Beach Cities Transit

Transit Services Study

Transit Services Study Final Report

December 2023



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ABBREVIATIONS

A&E	Architectural and Engineering
AHJ	Authorities Having Jurisdiction
AMC	Airport Metro Connector Station
APC	Automatic passenger counters
APM	Automated People Mover
AQMD	Air Quality Management District
AVL	Automatic vehicle location
AVTA	Antelope Valley Transit Authority
BCHD	Beach Cities Health District
BCT	Beach Cities Transit
BE	Battery electric
BEB	Battery electric bus
BESS	Backup energy storage system
BRT	Bus rapid transit
CARB	California Air Resources Board
CARES	Coronavirus Aid, Relief, and Economic Security Act
CBO	Community-based organization
CEQA	California Environmental Quality Act
CM	Construction Management
CMS	Charge Management System
CNG	Compressed natural gas
COA	Comprehensive Operational Analysis
CPUC	California Public Utilities Commission
CRRSAA	Coronavirus Response and Relief Supplemental Appropriations Act
CRT	Charge Ready Transport
CTSA	Consolidated Transportation Services Agency
CTTC	California Transit Training Consortium
DAR	Dial-A-Ride
DGS	Department of General Services
DSA	Division of the State Architect
EPA	Environmental Protection Agency
EV	Electric vehicle
FAP	Formula Allocation Procedure
FCEB	Hydrogen fuel cell electric bus
FTA	Federal Transit Administration
GHG	Greenhouse gas emissions
GVWR	Gross vehicle weight rating

HRS	Hydrogen refueling station
HQTA	High Quality Transit Area
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
ICE	Internal combustion engine
ICT	Innovative Clean Transit
KPI	Key performance indicator
LADOT	Los Angeles Department of Transportation
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LEHD	Longitudinal Employer-Household Dynamics
LEP	Limited English Proficiency
LRTP	Long Range Transportation Plan
MRCF	Measure R Regional Clean Fuel Bus Capital Fund
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NREL	National Renewable Energy Laboratory
NTD	National Transit Database
NTI	National Transit Institute
OCPP	Open Charge Point Protocol
OEHHA	Office of Environmental Health Hazard Assessment
OMF	Operations and maintenance facility
OTP	On-time performance
PPE	Personal Protective Equipment
PV	Photovoltaics
PVPTA	Palos Verdes Peninsula Transit Authority
RBTC	Redondo Beach Transit Center
RGAP	Ridership Growth Action Plan
RTOI	Residential Transit Orientation Index
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
RUHS	Redondo Union High School
SARTA	Stark Area Regional Transit Authority
SBCCOG	South Bay Cities Council of Governments
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SGR	State of Good Repair
SOC	State of charge
STA	State Transportation Assistance
TAP	Transit Access Pass
TDA	Transportation Development Act

TIRCP	Transit and Intercity Capital Rail Program
TNC	Transportation network company
TSP	Transit signal priority
TSS	Transit Services Study
TTC	Toronto Transit Commission
TTS	Torrance Transit System
UZA	Urbanized area
ZE	Zero-emission
ZEB	Zero-emission bus

1 EXECUTIVE SUMMARY

1.1 Background and Project Purpose

Beach Cities Transit (BCT) is the transit provider for the Beach Cities located in the South Bay of Los Angeles County. While BCT is operated by the City of Redondo Beach, it also provides service to Hermosa Beach, Manhattan Beach, El Segundo, and into Los Angeles to serve Los Angeles International Airport (LAX). BCT operates two fixed routes and the WAVE Dial-A-Ride (DAR) service, providing service to destinations throughout the South Bay and LAX. The WAVE serves qualifying residents (individuals who are 62+ or have a qualifying disability) of Redondo Beach and Hermosa Beach. BCT also connects with several other transit providers in the region including Metro (including rail connections at C Line stations), GTrans, Torrance Transit, and others.

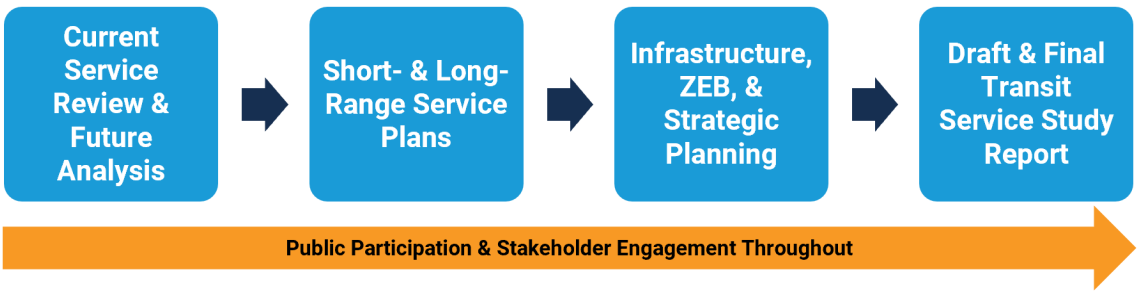
In February 2022, work commenced on the Transit Services Study (TSS) for BCT, which includes the first comprehensive overview of BCT services and BCT's operating environment since 2011 to guide future capital planning needs and service investments.

The TSS was broken down into three major components: service planning, zero-emission bus (ZEB) planning, and infrastructure and facility planning. An analysis of existing conditions and robust outreach and engagement throughout the project process helped to inform the recommendations presented in this report.

- Service Plan: details short-range service plans to guide service planning and provision with a five-year outlook, through FY2027-2028 and long-range service planning options based on anticipated developments and transportation projects in the South Bay. The service plan also includes supporting recommendations for BCT that outline strategies for improving the rider experience and enhancing public awareness of BCT.
- ZEB Plan: in response to the California Air Resources Board (CARB) Innovative Clean Transit (ICT) mandate, a ZEB rollout plan and strategy was developed to help BCT achieve a 100% ZEB fleet by 2040.
- Infrastructure and Facility Needs: to support BCT's sustained long-term operations and maintenance and accommodate the ZEB transition, infrastructure and facility needs were identified. This section details the need for a new Operations and Maintenance Facility (OMF) purpose-built for transit operations and maintenance as well as the required infrastructure to support a ZEB fleet.

The TSS project process is outlined in Figure 1-1.

Figure 1-1: Transit Services Study process



1.2 Summary of Existing Conditions

BCT serves the South Bay Region and Beach Cities, including Redondo Beach, Hermosa Beach, Manhattan Beach, El Segundo, and LAX through two fixed routes and the WAVE DAR service for seniors (62+) and persons with disabilities. BCT provides service through a fleet of 20 natural gas vehicles to a total service area population of over 180,000 people. Recently, BCT opened the new Redondo Beach Transit Center (RBTC) near the South Bay Galleria as a new multimodal regional transit hub.

BCT operates two fixed routes (102 and 109) with over 1,300 daily riders. Students account for ~19% of ridership on school days, predominately through the school tripper service provided to Redondo Union High School (RUHS) students.

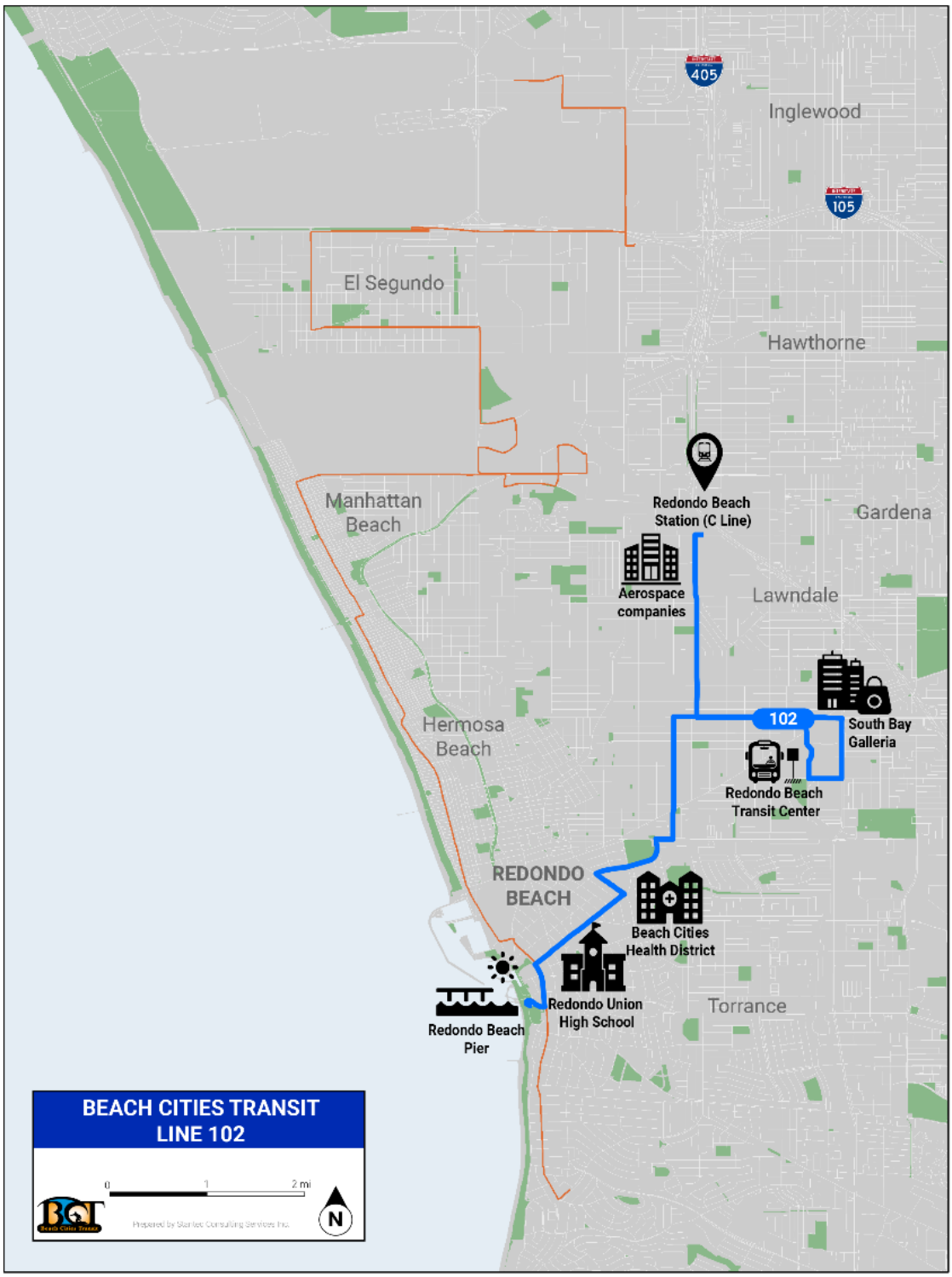
The WAVE operates in Redondo Beach, Hermosa Beach, and specific satellite locations throughout the South Bay (mostly medical facilities), providing curb-to-curb service to seniors and people with disabilities. The WAVE carries ~35 riders each day.

A market assessment and demographic analysis shows that BCT's service area is a diverse and fairly dense area of Los Angeles County. The large proportions of youth, seniors, and car-free households indicate a high potential propensity for transit use. However, the high median incomes and high car ownership rates, coupled with low percentages of workers commuting by transit show that while land use and demographic conditions could favor greater transit use, most residents rely heavily on private vehicle use for most journeys. The South Bay is projected to see modest population growth over the next 25 years with more significant growth in employment and jobs, specifically in El Segundo and Hermosa Beach. BCT's importance as a feeder service to regional transit could increase as it serves the growing commuter market. While projected population growth is expected to be less significant, pockets of Redondo Beach are expected to see population growth, specifically in South Redondo around Riviera Village and in North Redondo around the South Bay Galleria.

Line 102 provides service between the Redondo Beach Pier and Redondo Beach C Line Station as well as providing school tripper service to RUHS and serving the new RBTC (Figure 1-2).

- Line 102 operates on weekdays from 6am-9pm around every 40 minutes, Saturdays from 8am-9pm around every 30 minutes, and Sundays from 9am-7pm around every 40 minutes.
- Line 102 experiences ridership fluctuations depending on whether RUHS is in session or not, with 701 average daily weekday riders when school is in session and 516 average daily weekday riders when school is not in session.
- In the future, Line 102 could potentially be impacted by the C Line Extension and the South Bay Galleria Redevelopment. Both of these developments could impact and increase demand for Line 102 service.

Figure 1-2: Line 102



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Line 109 provides service between the Riviera Village and LAX, including multiple large employment centers in Manhattan Beach and El Segundo, and sees high passenger activity at C Line station connections, specifically the Douglas Station and Aviation Station (Figure 1-3).

- Line 109 operates on weekdays from 6am-10pm between every 40 and 55 minutes and on weekends from 6am-10pm every 60 minutes.
- This line does not experience seasonal ridership fluctuations due to students seen on Line 102 and instead experiences an average of 580 daily weekday riders.
- In the future, Line 109 will predominantly be impacted by changes happening at and around LAX, including the Automated People Mover (APM) and Airport Metro Connector Station (AMC).

Figure 1-3: Line 109

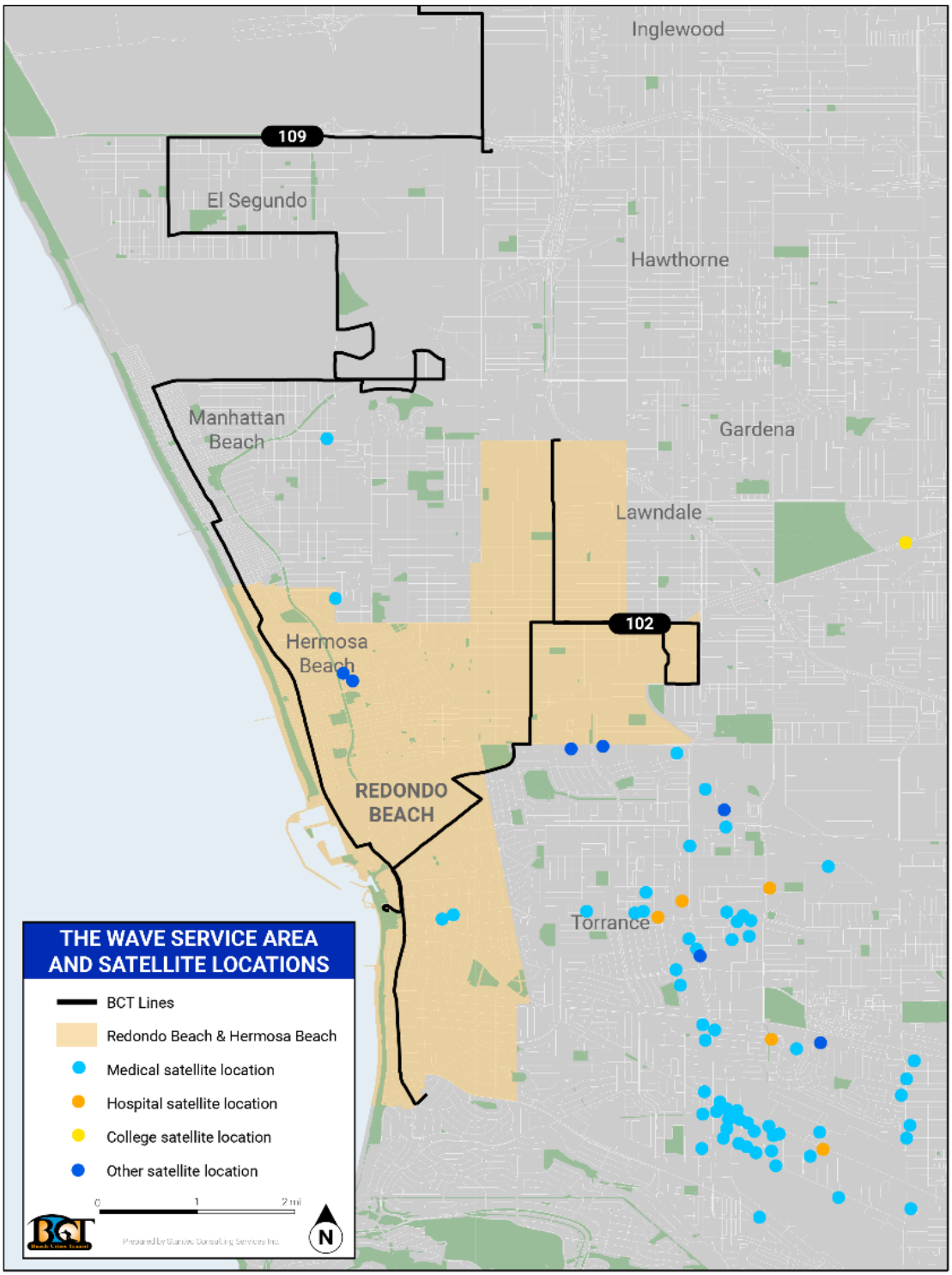


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The WAVE DAR provides service to seniors and those with disabilities, providing service within Redondo Beach, Hermosa Beach, and specific satellite locations (Figure 1-4).

- The WAVE operates on weekdays from 6am-8:30pm and weekends from 8am-8:30pm.
- Currently, the WAVE is experiencing around 35 daily passenger trips, compared to 51 daily trips pre-COVID.
- Seventy-five percent of trips begin and end in Redondo Beach, with 10% of trips beginning and ending in Hermosa Beach, and 15% of trips beginning and ending at a satellite location.

Figure 1-4: The WAVE Service Area and Satellite Locations



1.3 Summary of Engagement and Stakeholder Outreach

Public outreach and stakeholder engagement was conducted through a variety of different methods throughout the life of the project. Engagement activities and outreach methods are summarized in Table 1-1.

Table 1-1: Summary of Engagement Activities and Outreach Methods

Engagement Activities	Outreach Methods
• Community survey for riders, non-riders, and WAVE riders • 7 pop-ups or city engagements across the Beach Cities • 3 community focus groups • Technical Working Group meeting with key stakeholders • Pop-up booth at Redondo Beach Springfest 2023 in leu of Public Meeting	• Redondo Beach website • Project website • BCT Twitter, retweeted by other transit agencies and Beach Cities • Onboard BCT buses • RUHS student e-blast • Easy Reader 4-week full-page ad and digital ads • Community Services Instagram ads • Community Service email list • Direct emails to 109 city partners

Major findings from each engagement activity are summarized below.

1.3.1 Survey

A total of 280 completed and validated surveys were analyzed (of 295 collected surveys) among riders, non-riders, and WAVE riders. South Bay communities gave feedback on and were informed about BCT services. Highlights from this process include conclusions regarding areas of improvement and continued success.

Information or the lack thereof was a theme across demographics and transit preferences. BCT ensures that information about its services is available through a variety of different sources and mediums, including on the BCT website, through Twitter, onboard buses, at bus stops, and local senior centers and other community centers. A repeated theme across survey results and from engagement is a sentiment that people do not have adequate information about BCT services, which signals a need to explore strategies that can connect people with information and raise public awareness about where information can be found. Insights regarding information availability include:

- Real-time apps were widely used by BCT riders and often their only source of information about service notifications.
- Bus stop improvements pointed to the desire for more and better information about the routes and system as a whole when at a bus stop.
- Among non-riders, access to more information was the biggest factor that would increase their use of transit. While BCT provides information through a variety of sources, these comments suggest that non-riders are unaware of where to find the information.

Community members would generally like to see more frequent buses that run later into the evenings. Later trips were particularly desired on the weekends with supporting discussion about access to bars, restaurants, and entertainment. Additionally, there was a desire for more frequent bus service.

Community members who utilize WAVE services provided a smaller portion of feedback but did provide a clear perspective on where improvements in the service were needed. Core aspects of the service are where clients are most dissatisfied including service registration, scheduling, pick-up/drop-off times, and reliability. Once a rider is aboard the service, they are generally very satisfied with the service quality.

1.3.2 Pop-Ups

A total of seven pop-up events were held across the Beach Cities. Three were organized by JCL Consulting (Douglas C Line Station, Redondo Beach Farmers Market, and Redondo Beach Senior Open House at Perry Park) with the remaining four in-person outreach events (Manhattan Beach Senior Fair, Redondo Beach Senior Open House at Veterans Park, Hermosa Beach Farmers Market, and the El Segundo Farmers Market) completed by City staff. Events were organized to promote the BCT Survey as well as collect comments from the public. A total of 206 comment cards were received.

Major themes heard during the pop-ups include:

- A general lack of information and awareness about BCT services. Non-riders noted that they are interested in learning more about BCT, but there is a lack of information about where stops are and what destinations they can reach using BCT.
- Riders requested more frequent service.
- Riders requested more and better bus stop amenities, particularly shade, benches, shelters, and lighting.
- Older adults are very open to participating in mobility training for greater independence and improved quality of life.

1.3.3 Focus Groups

Focus group #1 was geared toward businesses, employees, and commuters. Attendees included community members, and representatives from the Los Angeles World Airports Rideshare Program, South Bay Workforce Investment Board, and LA Metro. Notable discussion points included:

- The South Bay Workforce Investment Board occasionally supports its clients with bus passes, but these are usually for Metro services. The representative noted that Redondo Beach clients use transit and interest has been increasing in the past couple of years particularly due to gas prices.
- Beach access was identified by multiple participants as a priority, noting the congestion and challenge of parking at piers.
- Frequency and consistency were identified as challenges.
- The addition of an east-west bus service designed to facilitate access to recreational areas was identified. Service along Manhattan Beach Blvd could improve beach access for North Redondo Beach and Manhattan Beach residents with stops at Polliwog Park and Redondo Beach Performing Arts Center.

Focus Group #2 sought engagement from seniors, students, parents, and caregivers. It was attended by five community members, two representatives from Torrance Transit, and two representatives from the City of Redondo Beach Senior and Family Services.

- Line 109 traverses a large area, providing connections between Riviera Village and Manhattan Beach but does not provide service across Redondo Beach; the opinion provided was BCT should prioritize Redondo Beach residents in service provision.

- The northern section of Line 109 was identified as too circuitous, and Metro Line 232 is the preferred route returning from LAX as it is more direct, and riders can reach their destination in less time.

- A respondent noted that the branding of BCT services does not stand out or excite people. The white vehicles were compared to 'service vehicles' and contrasted to Santa Monica Big Blue Bus and LA Metro Micro vans in El Segundo, both of which have distinct branding that sticks out in the community and looks like vehicles for public transit.

- Senior and Family Services from the City of Redondo Beach provided insight into residents' feelings towards the WAVE. Since the onset of the COVID-19 pandemic, there has been an increase in inquiries about DAR services. Adult caregivers are more comfortable with their elderly parents taking the WAVE. Additionally, community members provided examples of how helpful WAVE services were to them personally. It was noted that while there is information about BCT and the WAVE at senior centers, the information might not be up to date and may need to be updated regularly to make sure information is accurate.

- Draft service proposals included in the second focus group were alternatives to Line 109 to run through Redondo Beach Pier and streamline service along the northern portion of the route around Plaza El Segundo and Manhattan Village Mall. Responses to the addition of pier service were mixed; some supported this change whereas others expressed safety concerns of pier clientele. Streamlining Line 109 to eliminate detours in service was supported by participants.

Focus Group #3 targeted community-based, faith-based, and non-profit organizations. Attendees included three community members, the president of the South Bay Bicycling Coalition, and Hermosa Beach Council Member Justin Massey.

- Discussing WAVE services, a participant noted that although the WAVE is reliable, they had experienced issues with getting a return ride after booking a same-day trip.

- A Redondo Beach resident described a trip they often take to the Rivera Village. Taking Line 102 to Catalina, they hope for a successful transfer to Line 109 and on to their final destination. The return trip is more challenging because transferring from NB Line 109 to NB Line 102 is not properly timed, requiring a long wait for the next bus.

- Challenges on Line 109 north of Rosecrans were brought up with participants feeling that this section is 'unusable.' The participant suggested rerouting Line 109 to stay along the beach between Manhattan Beach and El Segundo.

- As part of the third focus group, draft service proposals discussed in the second focus group received similar feedback. Line 109 servicing the pier received mixed responses, some in support (like the participant who transfers from Line 102 to 109 while traveling to Riviera Village) while others did not like the idea. Streamlining of Line 109 at Rosecrans and PCH was supported.

1.3.4 Technical Working Group

A technical working group was held to discuss challenges and opportunities to improve mobility throughout the South Bay and Beach Cities. Attendees included representatives from Redondo Beach,

Manhattan Beach, Hermosa Beach, El Segundo, Torrance Transit, Metro, GTrans, and Palos Verdes Peninsula Transit Authority (PVPTA).

- Considerations for alternate routing of Line 102 were discussed to route trips leaving RBTC along Ripley past Adams Middle School. Ripley was determined to be a less desirable street for transit as it is a hilly residential collector.

- The proposed route realignment to Line 109 would no longer provide access to Plaza El Segundo as there is no stop along Sepulveda SB. The Metro representative provided insight on previous attempts by Metro to get a southbound stop along the west side of Sepulveda, across from Plaza El Segundo. Issues due to access to the oil refinery blocked the attempt. There was general support for this realignment.

- Service recommendations were proposed in this technical working group for Line 102 to take over the southern portion of Line 109 from the Redondo Beach Pier to Riviera Village, with Line 109 terminating at the pier. Discussion of dedicating additional red curb was brought up as well as the operational importance of proper scheduling.

- The proposed addition of an east-west route focused on beach service was discussed with this group and was well-received.

- Outreach and marketing of WAVE services were discussed at length. It was identified that if senior populations are widely unaware of the WAVE, it is the responsibility of Beach City partners to engage their local populations.

- Considerations for expanding WAVE service to the general public as a late-night service were proposed and were well-received.

1.3.5 Redondo Beach Springfest

Final public engagement occurred on April 15, 2023, at the 40th Annual Springfest sponsored by the North Redondo Beach Business Association near the Performing Arts Center along Manhattan Beach Blvd in Redondo Beach. Community members were able to provide input on the recommendations by asking questions as well as show their preferences by placing color-coded dots on the display boards supporting or opposing each recommendation.

Summarized below is each recommendation and how it was received by the public.

- Recommendation A: reroute Line 109 to serve the LAX Automated People Mover and Airport Metro Connector Station in 2025 to provide a direct connection to LAX and other transit services at the new Connector Station. Out of 13 total reactions, 92% of responses support this recommendation.

- Recommendation B: straighten Line 109 along Rosecrans and Sepulveda around Manhattan Village Mall, to address rider requests for more direct service and a quicker travel time to LAX. This recommendation removes service to stops that see very few passenger boardings and still maintains access to The Pointe, Plaza El Segundo, and businesses along Rosecrans Ave. 100% of respondents at Springfest support this recommendation.

- Recommendation C: consider a new summer bus service along Manhattan Beach Blvd, between the Redondo Beach C Line Station and Manhattan Beach Pier. This fills in a gap in service left after Metro discontinued Line 126, addresses requests from the public to provide service along Manhattan Beach Blvd, and serves many entertainment and recreational destinations like

Polliwog Park and the Performing Arts Center. Reception from the public at Springfest was very supportive of this recommendation, with 27 total respondents, 100% of whom supported this recommendation.

- Recommendation D: extend Line 102 south from Redondo Beach Pier to Riviera Village and re-route Line 109 to terminate at the Pier, creating a new transfer hub at the Pier which enables easier transfers between Line 102 and Line 109 and Torrance Transit. This also provides easier access to the Pier and Veterans Park Senior Center from Line 109, creates a one-seat ride for South Redondo students, and improves access to the newly opened RBTC and South Bay Galleria. 100% of respondents at Springfest support this recommendation.

- Recommendation E: maintain the WAVE DAR services for Redondo Beach and Hermosa Beach with increased marketing and awareness (travel training) programs, as there were no substantial comments about the WAVE in previous outreach activities. The curb-to-curb system adequately services the cities. 59% of respondents support this recommendation.

1.4 Service Plan

Short-range service plans were developed for the five-year planning period. Recommended service plans for fixed route and WAVE services are summarized below.

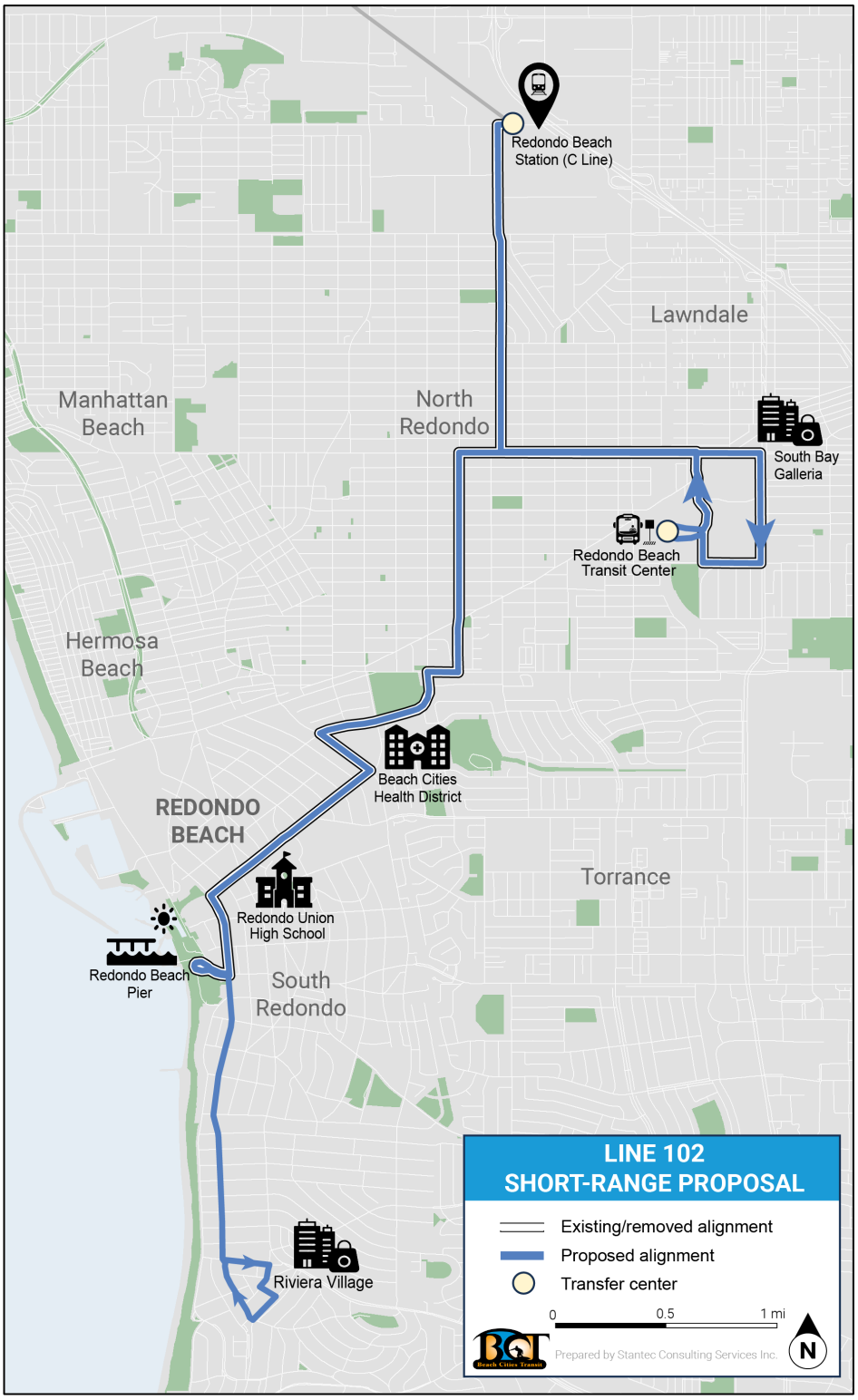
Line 102 recommendations are summarized below and shown in Figure 1-5.

- FY24-25 (Plan Year 2): decrease weekday headways from current headways to around every 33 minutes for most of the day to provide more frequent service after service became less frequent to serve the RBTC.

- FY24-25 (Plan Year 2): extend Line 102 from its current terminus at the Pier to Riviera Village. This will create a new transfer hub at the Pier, create a one-seat ride for South Redondo students, and improve access to the Redondo Beach Transit Center and South Bay Galleria.

- FY25-26 (Plan Year 3): increase Sunday service levels so that they match Saturday service levels, meaning that Sunday service would now operate around every 40 minutes from 8am-9pm. Post-pandemic weekend ridership on Line 102 has exceeded pre-pandemic ridership levels.

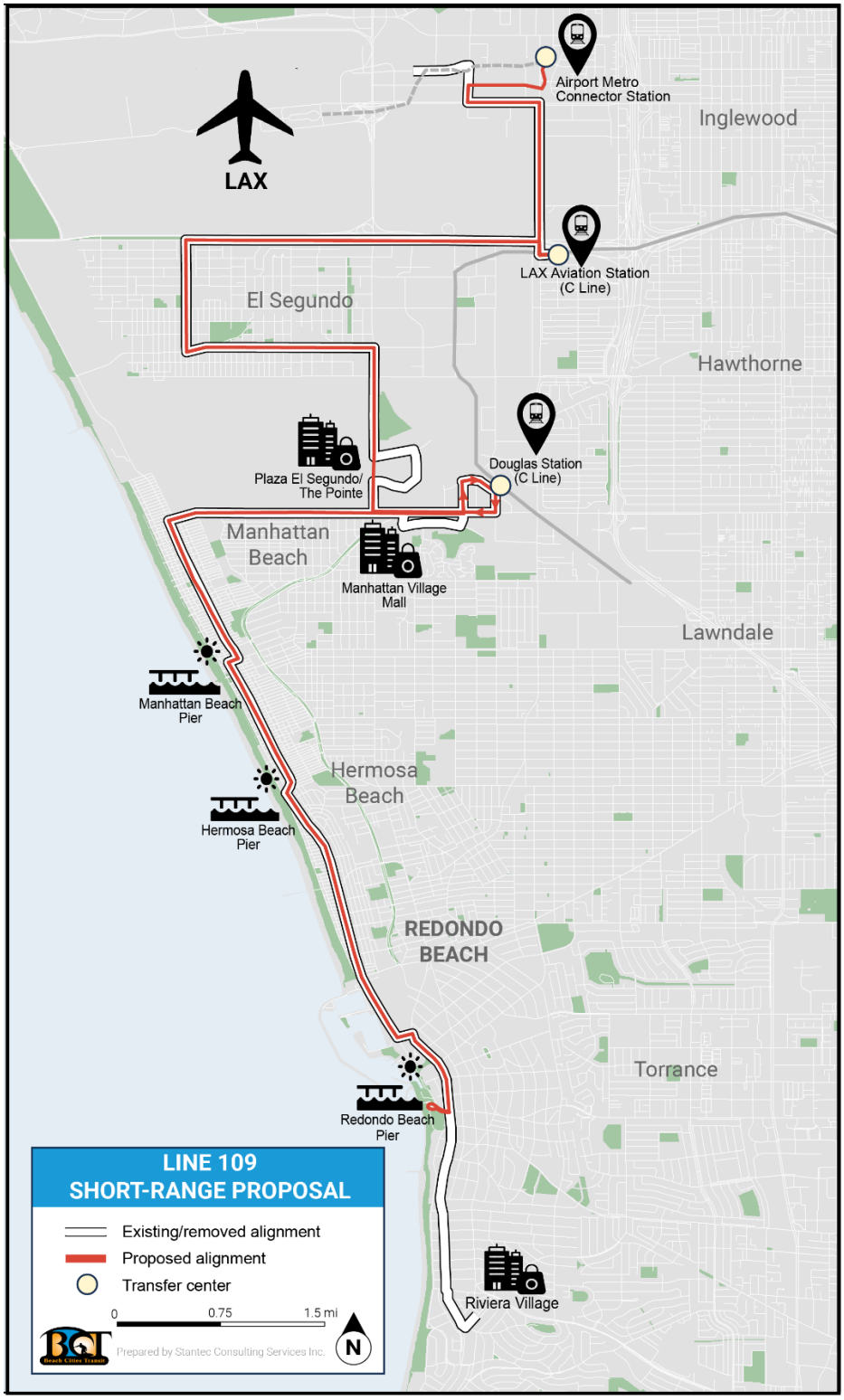
Figure 1-5: Line 102 Recommended Changes



Line 109 recommendations are summarized below and shown in Figure 1-6.

- FY23-24 (Plan Year 1): re-route Line 109 around Manhattan Village Mall and Plaza El Segundo to provide more direct service, reduce travel time, and eliminate stops with very low ridership that are not pedestrian-friendly.
- FY24-25 (Plan Year 2): adjust routing around LAX to serve the AMC to provide a direct connection to LAX APM and other transit operators at the AMC.
- FY24-25 (Plan Year 2): terminate Line 109 at the Pier and extend Line 102 south from the Pier to Riviera Village to enable easier transfers, provide easier access to the Pier and Veterans Park Senior Center, and better reflect travel patterns in South Redondo.
- FY26-27 (Plan Year 4): improve weekday AM and PM peak hour service to every 35 minutes to provide a better experience for riders who use Line 109 during peak hours.

Figure 1-6: Line 109 Recommended Changes

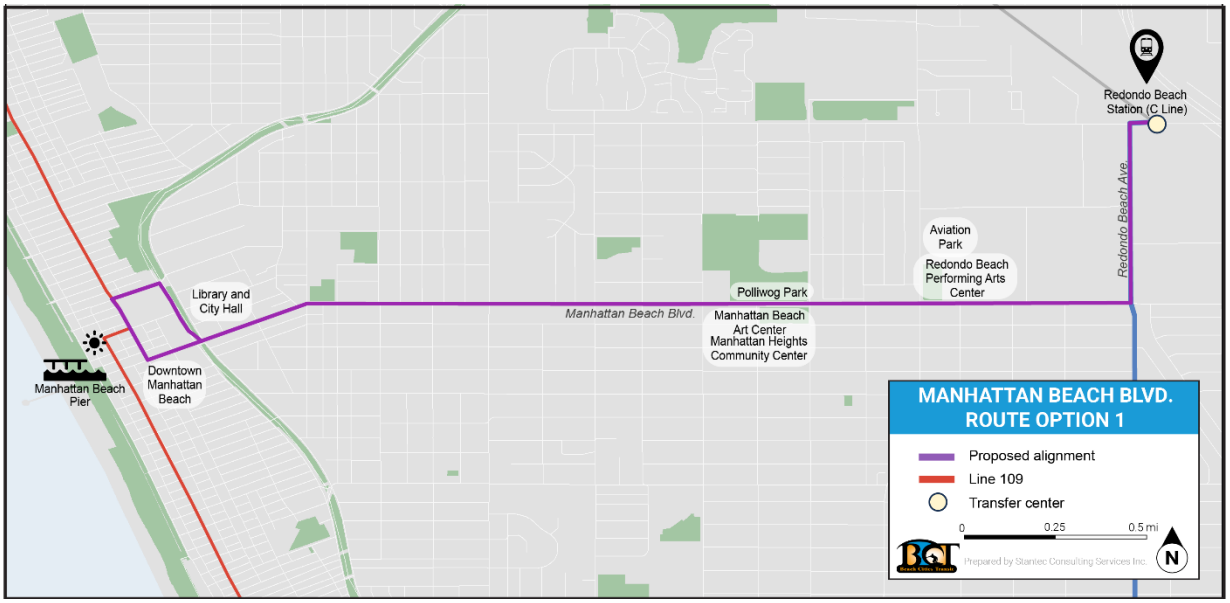


1.4.1 Manhattan Beach Blvd Link

Metro's discontinuation of Line 126 presents a service gap operating east-west along Manhattan Beach Blvd. Filling in this service gap received positive public feedback, and was expressed as a need in the survey results and at the outreach events. The recommended service plan proposes launching this service as a pilot during the summer months when RUHS is not in session in FY25-26 to reduce the operational and financial burden on BCT to operate.

The proposed service schedule is to operate Monday-Thursday from 8am-8pm every thirty minutes, and Friday-Sunday 10am-11pm every thirty minutes. The proposed route alignment is shown in Figure 1-7.

Figure 1-7: Proposed Manhattan Beach Blvd Link



1.4.2 The WAVE

Recommendations for the WAVE focus on opportunities to grow ridership and awareness, as summarized below.

- Outreach and Engagement:
    - Marketing and engagement Plan
    - Leverage organizational partnerships
    - Travel training
    - Promote group trips/social outings
- Technology Improvements
    - New scheduling and dispatching software
    - Opportunities to book trips in different ways (website, app)

- Enable WAVE vehicles to take TAP cards

In the long term, BCT can explore opportunities to open the service up to the general public.

1.4.3 Service Plan Summary

The five-year service plan is summarized in Table 1-2.

Table 1-2: Service Plan Summary

Plan year	1	2	3	4	5
Fiscal year	**FY23-24**	**FY24-25**	**FY25-26**	**FY26-27**	**FY27-28**
Line 102	Routing changes to absorb the portion of Line 109 between Redondo Beach Pier and Riviera Village (January 2024). Weekday service around every 33 minutes.	N/A	Alter the Sunday service schedule to match the Saturday service schedule.	N/A	N/A
Line 109	Routing changes to straighten out alignment around Plaza El Segundo and Manhattan Village Mall, and terminate line at Redondo Beach Pier (January 2024).	Implement routing changes to serve the Airport Metro Connector and Automated People Mover at LAX.	N/A	Implement 35-min weekday service during AM and PM peaks.	N/A
Manhattan Beach Blvd Link	Lead time for additional planning, outreach, etc.	N/A	Launch new line during summer months when school trippers are not in service.	Continue to monitor performance and adjust schedules as necessary, and begin to collect data to determine whether this service should be expanded year-round	
The WAVE	Various strategies to increase ridership among senior and disabled populations.				

1.5 Zero-Emission Bus Plan

CARB's ICT mandate requires that small transit agencies (including BCT) submit a Council-approved ZEB Rollout Plan by June 30, 2023, and begin purchasing ZEBs in 2026, with a goal of 100% transition by 2040. The regulation provides exemptions for agencies based on a lack of feasible vehicle alternatives, challenging terrain, operating profiles that aren't feasible with ZE alternatives, and other challenges. The purpose of this component of the TSS is to develop a CARB-compliant zero-emission rollout plan in response to the ICT Regulation and a transition plan and strategy for BCT's goal of a 100% ZE fleet.

Predictive power and energy modeling was completed to understand the optimal ZEB fleet for BCT. Through this modeling and other considerations, it was determined that battery-electric buses (BEBs) are the preferred technology choice for BCT over hydrogen fuel cell electric buses, as BCT can largely transition its current fleet to BEBs in a 1:1 manner. Transitioning to a BEB fleet will also help reduce BCT's greenhouse gas footprint by 87%.

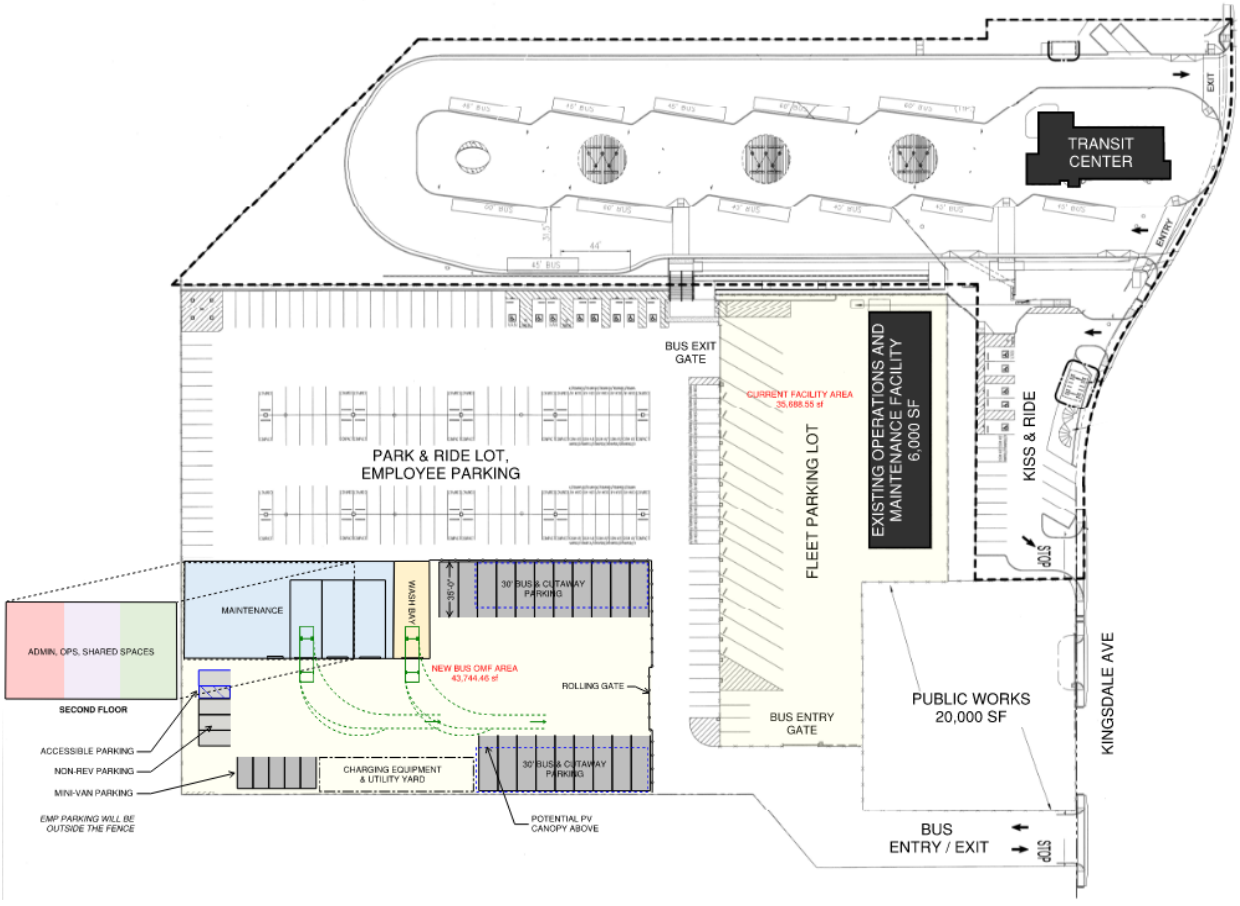
A fleet replacement plan and infrastructure phasing schedule was developed so that BCT will achieve a 100% ZEB fleet by 2040, with the first BEB purchase in 2029. This timeline is required to accommodate necessary infrastructure modifications and construction of a new facility.

A power demand model and charging profile was developed to understand power and charging requirements for BCT's future BEB fleet. The charging profile utilizes in-depot overnight charging and avoids charging during peak hours to minimize energy costs. The charging profile shows a maximum power capacity of ~700 kW seen during the overnight refueling window.

1.5.1 Infrastructure and Facility Needs

Analysis of BCT's OMF shows that it is too small to sustain BCT's long-term operations and transition to ZEBs and needs replacement. Space needs programming shows that the current facility is about 6,000 sq. ft. undersized for current operations. A conceptual master plan was developed for BCT's new facility that will accommodate the slight fleet growth resulting from the recommended service plan and BEB operations and maintenance. The plan is shown in Figure 1-8.

Figure 1-8: Conceptual Master Plan for New Operations & Maintenance Facility



Charging equipment, electrical utility improvements, and other infrastructure required to support ZEBs is detailed in the full report. Future planning and design needs are summarized below and phased to align with the delivery of the first BEB in 2030.

- 2024: Environmental (CEQA and NEPA) clearances
- 2026: Architectural and Engineering (A&E) services
- 2027: Construction Management (CM) services
- 2028: Commence facility construction
- 2030: Facility construction complete in time for the first BEB

1.5.2 Coordinated Implementation Plan

To help guide the City through the implementation of the service plan, ZEB plan, and facility construction, a coordinated implementation plan is provided below that integrates all aspects of the TSS project.

Table 1-3: Coordinated Implementation Plan, 2024-2040 [1]

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
2024	Bus Facility	Procure professional environmental support services for CEQA and NEPA clearances for the new OMF by the end of 2024.	BCT, Redondo Beach City Council	BCT should assume the CEQA and NEPA processes will take about 12 to 18 months in total. Design of the new facility can commence following CEQA clearance (about 6 - 9 months).
	Fleet Procurement	Fleet Procurement: 1 CNG bus (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $533,000
	Service Planning/ Operations	-Line 102: routing changes to absorb the portion of Line 109 between Redondo Beach Pier and Riviera Village. -Line 109: routing changes to straighten alignment around Plaza El Segundo and Manhattan Village Mall, and terminate the line at Redondo Beach Pier. One month prior to routing changes, install signs at any stops that will be closed stating the stop will no longer be in service and providing information on the new closest stops. -Manhattan Beach Blvd Line: assess conditions and placement of Metro Line 126 bus stops and identify needs in coordination with the City of Manhattan Beach for stops within their jurisdiction. This process should incorporate Transit Amenities	BCT, Redondo Beach Police Department (Parking Enforcement), Torrance Transit, other relevant City departments, Manhattan Beach	-BCT coordinate with Torrance Transit regarding routing changes around the Pier to ensure that schedules are coordinated to facilitate seamless transfers. -BCT coordinate with relevant City departments to ensure sufficient space for buses is provided at the Pier, including coordinating with Parking Enforcement to mitigate potential issues of illegal parking preventing BCT vehicles from accessing the space. -One month prior to service changes, BCT should conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT work with other City departments (such as the Department of Community

[1] Estimated capital costs in 2023$. Information on capital cost sources provided in Appendix C: Financial Considerations Inputs and Assumptions and Appendix D: Cost Estimates.

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
		Policies as outlined in BCT's Title VI Program. -At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).		Development, Community Services Department, etc.) to expand outreach capabilities. -Update the BCT website as service changes are implemented. -Update BCT maps and schedules as service changes are implemented.
2025	Fleet Procurement	Fleet Procurement: 3 CNG buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,632,000
	Service Planning/ Operations	-Line 102: increase weekday service to every 33 minutes all-day -Line 109: implement routing changes to serve the Airport Metro Connector Station and Automated People Mover at LAX -At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).	BCT, other relevant City departments, Manhattan Beach	-BCT examine schedules of other operators that will be serving the Airport Metro Connector Station to understand if schedules can be better coordinated to facilitate transfers. -BCT work in coordination with Manhattan Beach to install the required bus stop infrastructure for stops within Manhattan Beach city limits. -One month prior to service changes, BCT conducts robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -Update the BCT website as service changes are implemented. -Update BCT maps and schedules as service changes are implemented.
2026	Bus Facility	Procure professional A&E services for the design of the new facility and site improvements at the beginning of 2026.	BCT, Redondo Beach City Council	Design process should begin with detailed programming and master planning tasks to resume and validate the proposed space needs program and conceptual master plan. Design and permitting for the new facility can be expected to take about 12 to 18 months but can commence following project approval from CEQA.
	Service Planning/ Operations	-Line 102: Sunday service schedule improved to match Saturday schedule (all-day service around every 40 minutes). -Manhattan Beach Blvd Line: finalize the installation of bus stop infrastructure, conduct dry runs and operator training on the new route, and launch service in summer 2026. -At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on	BCT, Transportation Concepts, other relevant City departments, and relevant stakeholders to help promote the launch of the Manhattan Beach Blvd service (Manhattan Beach Department of Parks and Recreation, Manhattan Beach Chamber of Commerce, Redondo Beach Performing Arts Center,	-Transportation Concepts/O&M Contractor execute dry runs of the Manhattan Beach Blvd alignment to confirm run time and develop schedules, complete runcutting, and paddles. -BCT work with various stakeholders in the months leading up to the launch to continue to advertise the service. After service launch, collect data on ridership and performance as well as public feedback on rider satisfaction.

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
		proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).	Downtown Manhattan Beach Business + Professional Association, etc.)	-One month prior to service changes, BCT conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -Update the BCT website as service changes are implemented. -Update BCT maps and schedules as service changes are implemented.
2027	Bus Facility	-Issue for bid and award mid-2027: Construction Management Services for the new Bus OMF (or use City on-call contracts or other means to procure CM services.) -Issue for bid and award mid to end of 2027: Construction contract for the new Bus OMF.	BCT, Redondo Beach City Council	Procure CM services first to aid in the solicitation of general contractors for the construction of the new BMF.
	Fleet Procurement	Fleet Procurement: 2 CNG buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,135,123
	Service Planning/ Operations	Line 109: implement 35-minute weekday service during AM and PM peaks (7-9am and 4-6pm) Manhattan Beach Blvd Line: continue to monitor performance and adjust schedules as necessary. Begin to collect data to determine whether service should be expanded year-round. BCT should do this on a continuous basis.	BCT, other relevant City departments	-One month prior to service changes, BCT conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -Update the BCT website as service changes are implemented. -Update BCT maps and schedules as service changes are implemented.
2028	Bus Facility	In early 2028, begin construction on new Bus OMF.	BCT	Estimate construction period 18 months from award of contract to final commissioning of the facility. The City should allow for contingency in the schedule for unexpected delays, etc. so that facility can be opened in time for arrival of the first electric vehicles.
	Fleet Procurement	Fleet Procurement: 1 CNG van	BCT, Redondo Beach City Council	Estimated capital cost: $63,320
2029	Bus Facility - ZEB	If the program is still active, apply for participation in the SCE Charge Ready Transport Program for charging infrastructure installation. Vehicles must arrive on site within 18 months from the time the application was submitted.	BCT, SCE	Application will need to be coordinated with new OMF design and construction.

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft) 4 BE vans	BCT, Redondo Beach City Council	Estimated capital cost: $1,871,781
2030	Bus Facility	New Bus OMF to be completed. BCT to move contractor and operations into new facility.	BCT	OMF will need to be completed and commissioned prior to arrival of first BEB in order to allow for installation of charging equipment and coordination with SCE if utilizing SCE's Charge Ready Transport program (if the program is still available in the future).
	Fleet Procurement - ZEB	Fleet Procurement: 3 BE cutaways	BCT, Redondo Beach City Council	Estimated capital cost: $870,651
2031	Bus Facility	Demolition of existing bus maintenance facility and realignment of the park-and-ride parking lot.	BCT	The City may choose alternative approach to expanding park-and-ride lot, but it can be assumed that the existing facility will not be suitable for long term use by other functions. The existing building is well beyond its useful life in 2023.
2032	N/A	N/A	N/A	N/A
2033	N/A	N/A	N/A	N/A
2034	Fleet Procurement - ZEB	Fleet Procurement: 8 BE buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $8,443,000
2035	ZEB Deployment	Battery replacement for one 30 ft bus	BCT	No additional cost; cost included in vehicle purchase price extended warranty.
2036	N/A	N/A	N/A	N/A
2037	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft) 1 BE van	BCT, Redondo Beach City Council	Estimated capital cost: $1,372,000
2038	Fleet Procurement - ZEB	Fleet Procurement: 4 BE buses (30 ft) 4 BE vans	BCT, Redondo Beach City Council	Estimated capital cost: $5,589,000
2039	Fleet Procurement - ZEB	Fleet Procurement: 3 BE cutaways	BCT, Redondo Beach City Council	Estimated capital cost: $1,024,000
2040	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,178,000
	ZEB Deployment	Battery replacement for eight 30 ft buses	BCT	No additional cost; cost included in vehicle purchase price extended warranty.

1.5.3 Financial Considerations

Operating cost estimates for the five-year service plan are presented in Table 1-4. Main considerations include:

- Assumes BCT will continue to utilize a contractor for operations and maintenance of fixed route and WAVE services.
- The City will issue a new RFP for service for a new contract period to begin July 2026 (Plan Year 4). After that, it is anticipated that costs and associated wages will be higher subject to the RFP process.

- Results in a 32% increase in costs and a 23% increase in service between Plan Year 1 and Plan Year 5.

Table 1-4: Operating Cost Estimates for Five-Year Service Plan

Plan Year	Year 1	Year 2	Year 3	Year 4	Year 5
Fiscal Year	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**
Fixed Monthly Rate	$103,502	$108,574	$114,002	$121,982	$130,521
Fixed Hourly Rate	$48.57	$50.95	$53.50	$57.24	$61.25
Annual Revenue Hours	**47,186**	**47,186**	**49,560**	**50,319**	**50,319**
Total Operating Cost	$3,533,848	$3,707,007	$4,019,360	$4,344,162	$4,648,253

Major capital costs include bus procurements through 2040 and costs related to the new facility construction and ZEB infrastructure. With regard to infrastructure costs, Stantec's cost estimator Jacobus and Yuang, Inc. developed rough order of magnitude cost estimates based on the facility plans. Table 1-5 provides a summary view of the expected costs. Based on the high-level cost estimate, we estimate that BCT could spend $31.7 million on facility upgrades between 2023 and 2028.

Table 1-5: Total Opinion of Probable Cost with Escalation Plus Equipment Cost and Soft Costs

Site Costs	
Site Demolition	$450,351
Park & Ride Lot/Employee Parking	$604,309
OMF Sitework	$8,153,797
Admin-Ops & Maintenance Facility	$9,139,965
Escalation	$3,957,755
Equipment Costs	
Maintenance/Bus Wash Equipment	$1,000,000
Escalation	$423,843
Soft Costs	
Architectural/Engineering Fees	$3,559,503
Environmental Consulting (CEQA/NEPA)	$177,975
Construction Contingency	$1,186,501
Construction Management	$1,898,402
Surveys, etc.	$1,186,501
Total Opinion of Probable Cost with Escalation, Equipment, and Soft Costs	**$31,738,902**

Estimated costs for bus procurement are presented in Table 1-6.

Table 1-6: Estimated Costs for Bus Procurements

Year (FY)	Bus Procurements	Estimated Cost (2023$)
23-24	1 CNG Bus	$533,000
24-25	3 CNG Buses	$1,632,000
26-27	2 CNG Buses	$1,135,000
27-28	1 CNG Van	$63,300
28-29	1 BE Bus	$1,872,000

	4 BE Vans	
29-30	3 BE Cutaways	$870,700
33-34	8 BE Buses	$8,442,800
36-37	1 BE Bus 1 BE Van	$1,371,600
37-38	4 BE Buses 4 BE Vans	$5,588,800
38-39	3 BE Cutaways	$1,023,500
39-40	1 BE Bus	$1,178,400

Finally, a financial plan summary for the five-year service planning period is presented in Table 1-7.

Table 1-7: Financial Plan Summary

Plan Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Fiscal Year	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**
Total Operating Cost	$3,533,848	$3,707,007	$4,019,360	$4,344,162	$4,648,253
Total Capital Costs	$532,569	$1,631,890	$-	$1,135,123	$63,320
Total	$4,066,417	$5,338,897	$4,019,360	$5,479,285	$4,711,573

2 INTRODUCTION AND BACKGROUND

2.1 Overview

Beach Cities Transit (BCT) is the transit provider for the Beach Cities located in the South Bay of Los Angeles County. While BCT is operated by the City of Redondo Beach, it also provides service to Hermosa Beach, Manhattan Beach, El Segundo, and into Los Angeles to serve Los Angeles International Airport (LAX). BCT operates two fixed routes and the WAVE Dial-A-Ride (DAR) service, providing service to destinations throughout the South Bay and LAX. The WAVE serves qualifying residents of Redondo Beach and Hermosa Beach. BCT also connects with several other transit providers in the region including Metro (including rail connections at C Line stations), GTrans, Torrance Transit, and others (Figure 2-1).

Figure 2-1: BCT Routes with South Bay Connections



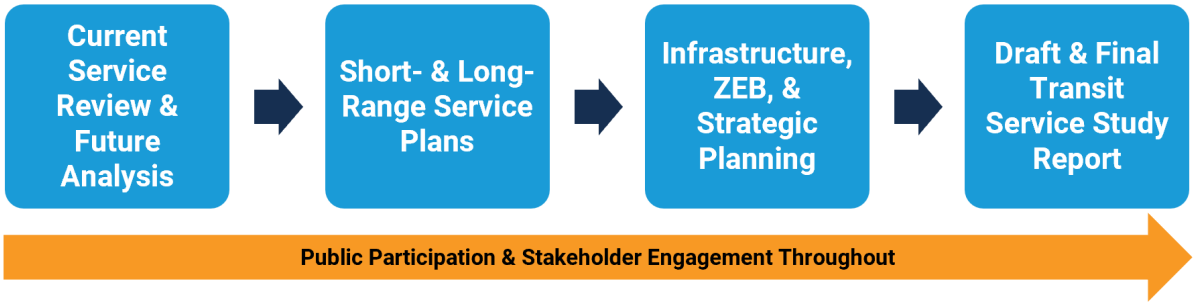
TSS 1 provided a comprehensive review of BCT's existing conditions, including existing conditions of the fleet and operations for the ZEB analysis and current operations and maintenance facility.

TSS 2 detailed short- and long-range service plans that will guide transit service planning and service provision through FY27-28 for the short-term and long-range planning recommendations. These service plans were designed based on the goals and visions established in TSS 2, and also include supporting recommendations that can improve service and the customer experience in ways indirectly related to providing service. Many of the changes presented in the service plan are in response to a changing transportation landscape in the South Bay and look at ways to make BCT a more attractive option for residents and visitors.

TSS 3 addresses the infrastructure needed to achieve the short- and long-range transit service recommendations presented in TSS 2, as well as the acquisition and implementation of zero-emission buses (ZEBs) to satisfy the Innovative Clean Transit (ICT) mandate set by the California Air Resources Board (CARB), including the required infrastructure upgrades and improvements needed to support a ZEB fleet.

This report compiles TSS 1-3, along with an overall financial plan and summary of public and stakeholder outreach conducted during the course of the planning process (Figure 2-2).

Figure 2-2: Transit Services Study Process



3 EXISTING CONDITIONS REVIEW – SERVICE PLANNING

3.1 Background Document Review

This section reviews key literature and planning and policy documents to provide current and future insights into BCT and the South Bay region, and importantly, to understand the larger regional planning framework in which BCT operates and understand how past BCT initiatives and other agency initiatives can impact this strategic planning process.

3.1.1 Beach Cities Transit Comprehensive Operational Analysis (2011)

Offering a look at BCT performance and position within the transit-rich South Bay, the 2011 COA combined performance reviews of BCT routes, an on-board survey, and partner roundtable to develop recommended service plans for each route.

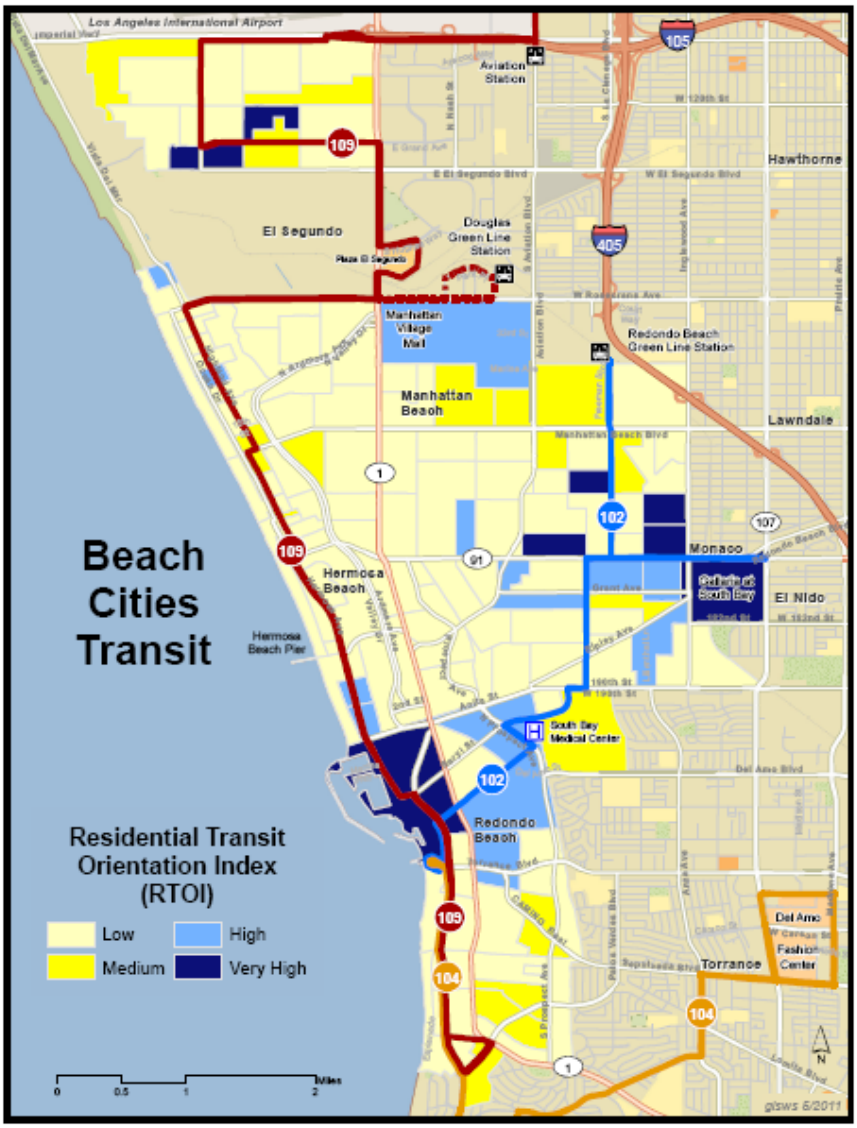
- Route Profiles: the three routes operated by BCT (Line 102, 104, 109) had an average productivity of 13.1 riders per hour with $3.36 the average cost per passenger. Line 102 was found to be the most productive with Line 109 the second, and Line 104 the least with an extremely low passengers per hour. Ridership was found to be 60% lower on weekends. Line 109 had the highest weekend ridership but Line 102 had the highest productivity.

- On-board Survey: conducted January 15-20, 2011, the onboard survey found a very high level of passenger satisfaction for BCT. Operator courtesy, personal safety, and cleanliness were the highest-rated items. Passengers were least satisfied with frequency and reliability. Riders largely use BCT for work and school trips and have incomes under $25,000. More frequent buses and improved reliability were the most desired system improvements.

- Latent and Future Demand: using demographic characteristics, neighborhoods with a high propensity for transit use were identified with a GIS-based analytical tool, Residential Transit Orientation Index (RTOI). In addition, the study team identified transit service needs and unmet markets based on survey results and field observations.

Figure 3-1 shows those neighborhoods with a high propensity for transit (darker blue colors). Line 102 serves many of the areas with high RTOI including those near Artesia Boulevard and Vail Avenue as well as neighborhoods with very high RTOI adjacent to the Galleria at South Bay. Line 109 serves neighborhoods with very high RTOI north of Redondo Beach Pier and pockets in El Segundo along Grand Avenue near downtown. The Manhattan Village Mall with high RTOI is served by Line 109 northbound.

Figure 3-1: Residential Transit Orientation Index (RTOI) for BCT service area



- Partner Roundtable: on March 28, 2011, City of Redondo Beach, El Segundo, Manhattan Beach, and Transportation Concepts (BCT contracted operator) discussed perceived issues and potential solutions. Areas of concern from El Segundo and Manhattan Beach: how routes serve residents of their cities, marketing of the BCT, signage at bus stops, and recent declines in ridership. Manhattan Beach also raised the idea of direct service to Manhattan Village Mall. On-time performance in the afternoons was raised as an issue by Transportation Concepts.

- Recommended Service Plan: Towards the overall goal of “providing transit service that will attract additional ridership in a cost-efficient and cost-effective matter” recommended strategies included:

  - Improving Poor Performance – Line 102 (20 boardings per hour) and Line 109 (10 boardings per hour) were reasonably productive lines whereas Line 104 had 4.1 boardings per hour, indicating low productivity and opportunity for discontinuation. The elimination of Line 104 was implemented.

  - Schedules - Define consistent, realistic schedules for each line. Minimize route deviations by operating via a single route path as much as possible. Where possible, use clockface headways (which result in the bus arriving at a given stop at the same time each hour) to make schedules more understandable for riders and potential riders.

  - Consistent Service Patterns - Provide direct connections to major trip generators and activity centers. Recommended that those major trip generators, Galleria on Line 102 and Douglas C (Green) Line Station for Line 109, be served on both northbound and southbound trips. The recommendation was followed with both lines currently serving their respective major trip generator traveling north and sound bound.

  - Addressing Overcrowding – Bus platooning was recommended to address overcrowding along Line 102 for school-related trips. Despite implementing this recommendation with three buses on Line 102 within five minutes of each other, overcrowding is sometimes an issue on school trippers and BCT staff must actively regulate boardings to minimize overcrowding issues.

  - More Frequent Service versus New Lines – Not identified as a significant issue for BCT, the recommendation leaned towards frequency improvements over new routes.

  - Requests for New Service – Manhattan Village Mall along Line 109 was the only identified request for service. Assessment of additional service was based on ridership potential, operational feasibility, and cost. The addition of service to Manhattan Village Mall was implemented by routing Line 109 eastbound along Park View Ave.

- Line 102

  - Recommended adding running time to improve the reliability of service.

  - Recommended to add a bus to operate 30-minute headways with service to Galleria at South Bay in both directions. This recommendation was implemented.

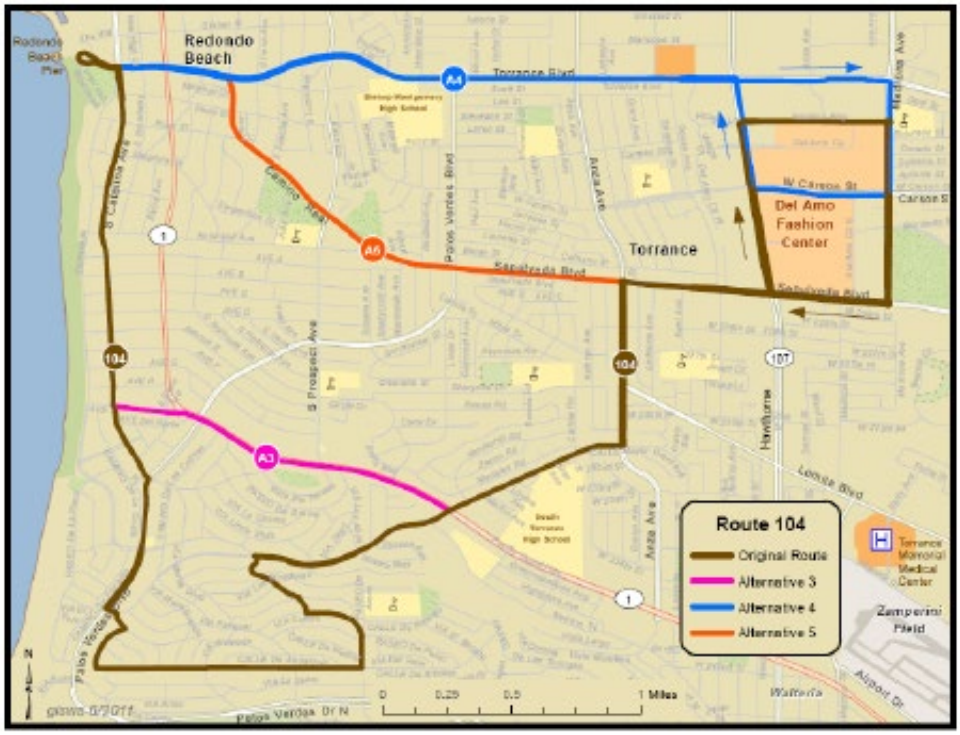
  - Vail Avenue, centrally located within Redondo Beach has stops at nearly every intersection, slowing down buses. It was recommended that Inglewood Avenue or Aviation Boulevard north of Artesia Boulevard be utilized for improved schedule adherence. As Line 102 still operates along Vail Avenue, this recommendation was not implemented.

- Line 104 – operating in low transit propensity neighborhoods, primary issues include low ridership and productivity.

  - Recommended to discontinue Line 104 to reallocate resources to Line 102, this was followed as Line 104 no longer operates.

  - Several options (illustrated in Figure 3-2) for rerouting Line 104 were assessed as alternatives to improve productivity including coordination with Torrance Line 7 which was ultimately impossible due to timing connections. Eliminating Line 104 was recommended.

Figure 3-2: Route Alternatives for Currently Discontinued BCT Line 104



- Line 109 – BCT's second most productive route, Line 109 connects Redondo Beach, Hermosa Beach, Manhattan Beach, and El Segundo with weekday headways of 45-minutes and 60-minutes on weekends.
    - Recommended adjustment to running times for improved reliability of service with continued 45-minute headways.
    - Improve access to Douglas Station was recommended with service in both directions. This recommendation was implemented.
    - The addition of two buses was recommended to improve headways to 30-minutes. This recommendation was not implemented, and Line 109 still operates with a 45-minute headway.
    - Due to lower-than-expected passenger activity at LAX City Bus Center, it was recommended to truncate Line 109 at Aviation C Line Station. Despite the potential to achieve 30-minute headways with the addition of only one bus, this was not implemented, and Line 109 still runs to LAX City Bus Center.

3.1.2 Analysis of WAVE Dial-A-Ride Services (2011)

In 2010, the firm Transportation Concepts assumed operations of the WAVE DAR service. Alongside the COA of the BCT system, a focused analysis of the WAVE was conducted in 2011 to uncover potential improvement strategies. The WAVE analysis looked at appropriate total annual vehicle service hours, the efficiency of WAVE scheduling and operations, and how the service could be

improved. This analysis included a review of contract requirements and a Trip Ticket Analysis for two service days, Monday, November 9, 2010, and Tuesday, December 14, 2010.

- The review of contract documents found the three performance standard measures failed to encourage increased ridership and productivity. WAVE provided 57 trips to 52 passengers with 8 cancelations/no-shows on sample day 11-9-10 and 44 trips to 40 passengers with 5 cancelations/no-shows on sample day 12-14-10. A total of 16,887 trips were provided in 2010 with Thursday the most productive day. More appropriate productivity measures were recommended such as Passenger Trips Per Vehicle Revenue Hour.

- Trip ticket analysis found data recording to be lacking and recommended improved data recording by reinforcing the importance of complete, accurate, and legible data recording. Additionally, there was little evidence of shared rides from the two sample days. To improve system productivity, exploring service and fare policies to promote multiple riders from the same origin/destination was recommended.

- Analysis of vehicles in service by hour on Monday 11-9-2010 found a peak of 4 vehicles in service between 11:45 am and 12:30 pm with vehicle revenue hours ranging from 2.75 to 3.25. Service capacity saw steady increases until the midday peak before a sharp decrease at 1 pm and leveling off through the afternoon. Notable peaks in passengers are seen at 9 am, and 4 pm – 5 pm with strong ridership between 11 am and 2 pm. Service capacity and demand were mismatched with inconsistent and highly variable availability.

- Saturday and Sunday mornings from 6-8 am were underutilized as well as Sunday through Thursday 8:30-9:00 pm. Friday and Saturday, 8:30-10:00 pm, were also underutilized. This recommendation resulted in the current WAVE schedule. In addition, the contracted 7,260 annual service hours were not recommended to change.

- The reservation system was identified as relying too heavily on the individual capabilities of the dispatchers. Reservation recommendations included separating reservations and dispatch responsibilities during the peak morning period along with an improved computer system.

- Marketing and public information recommendations included a rebranding to align with the BCT brand, updating the WAVE brochure, and developing a website as a central source for WAVE information. The recommendation to rebrand The WAVE to BCT DAR was not followed but it is assumed the brochure has been updated and the City of Redondo Beach's website does now host the primary source of BCT and WAVE information.

3.1.3 City of Redondo Beach Title VI Program Plan (2021)

This document, among other things, describes BCT's Title VI policy as mandated by the Federal Transit Administration (FTA). It provides a procedure for informing riders of their Title VI/Civil Rights and procedures for lodging complaints. The service area's Limited-English Proficiency (LEP) plan requires that materials and engagement consider Spanish speakers; other spoken languages fall below the minimum threshold.

Furthermore, the document provides systemwide service standards and policies:

- Vehicle load – should not exceed 1.0, that is, seated capacity.

- Vehicle headway – Line 102, 30 minutes Monday through Saturday with no standard for 8 am to 10 am; 40-minute headway 8 am to 10 am Saturday and Sunday. Line 109, 45-minute headway Monday through Friday and 60-minute Saturday and Sunday.

- On-time performance – 90% of all measured stops to be on time for fixed-route and WAVE Dial-a-Ride. The definition of a late trip is more than five minutes after the scheduled time for a fixed route. WAVE Dial-a-Ride on-time performance is a pick-up between 15 minutes before and 15 minutes after the scheduled pick-up time.

- Service availability – 44% of the service area population is within ¼ mile of a BCT route.

- Distribution of amenities – on local fixed routes, bus stops will be placed no more than ¼ mile apart. Bus stops within the City of Redondo Beach will include trash receptacles where there is sufficient space to accommodate ADA clearance requirements, seating/benches at bus stops with an average daily boarding of 5 or more passengers, and passenger shelter with an average daily boarding of 5 or more passengers will be considered. Bus schedule information will be considered at bus stops with an average daily boarding of 10 or more passengers.

- Vehicle assignments – based on operating requirements of each route and state of repair.

Importantly, this document specifies the thresholds that constitute a major service change that would trigger a Title VI-Service Equity analysis:

- Any increase in fares.

- Reduction in total system vehicle service hours of 25% or more of the total service miles or hours provided.

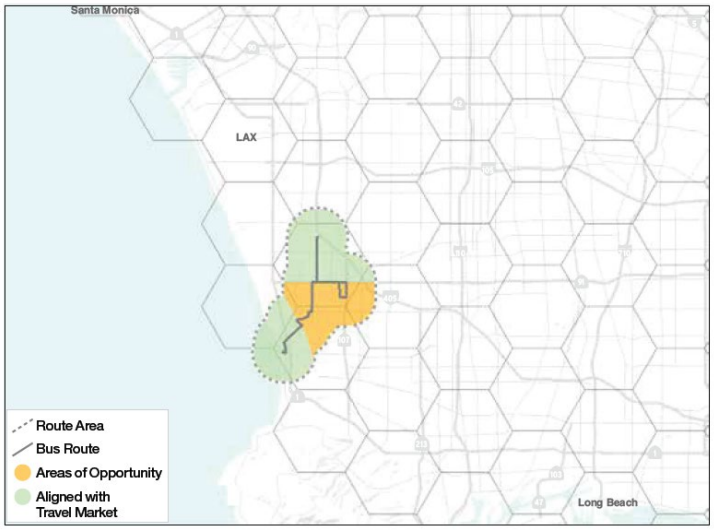
- Modifications to a route that exceeds 25% of the total inbound and outbound trip mileage of a route.

3.1.4 Los Angeles County Ridership Growth Action Plan (2018)

To address the decline in ridership since 2015 experienced by transit agencies across the Los Angeles region, a regional task force of agencies in LA County (Los Angeles County Municipal Operators Association) developed the Ridership Growth Action Plan (RGAP). Different segments across the county are identified as subregions like the South Bay and have unique recommendations in their action plans.

Recommendations from RGAP focus on serving areas with high potential for ridership growth along main corridors with dense residential and employment locations. Based on StreetLight data, the Line 102 segment from Redondo Union High School to South Bay Galleria represents an area of opportunity where the travel market aligns well with the route. The estimated percentage of travel around Line 102 showed that 47% of travel destinations were near the route. Connecting regional rail service, micromobility could serve as first-last mile alternatives.

Figure 3-3: Areas of Opportunity around Line 102 [2]



Regional connections could be better served by a corridor-focused, coordinated subregional network. Coordination with subregional partners to focus on serving major centers frequently and making transit travel time competitive with autos where possible. For BCT trips, Metro monthly, EZ Passes were used for 19% of trips, and TAP adoption was estimated at 11%. BCT National Transit Database (NTD) data from 2019 showed 407,272 unlinked trips and 43,220 total TAP uses in 12 months.

3.1.5 Redondo Beach Triennial Reviews (FY20.16-2018 and FY2019)

The Transportation Development Act (TDA) triennial performance review was conducted for FY16 through FY18 to ensure BCT compliance with TDA requirements, the status of prior audit recommendations, uncover performance trends and perform a detailed functional review.

The robust audit found that BCT complied with all TDA requirements that are applicable. Of the prior recommendations, the first recommendation for the implementation of marketing plan strategies was addressed by the creation of a full-time position and a part-time position to execute a comprehensive marketing program. The second recommendation to conduct an annual rider survey and community non-rider survey was substituted for a 100% daily onboard ridership count.

Some key observations from the audit include:

- Operating costs increased system-wide by 16.5%
- Operating costs increased per hour by 16.4% systemwide. Cost per passenger also increased by 28.8% due to operating cost increases compounded by ridership decrease.
- Overall ridership decreased by 9.6%.
- Farebox recovery ratio decreased by 18.4%.

[2] Data source: RGAP (2018)

- Administrative costs per vehicle service hour increased by 63.8% in alignment with the prior review recommendations to “implement marketing plan strategies.”

There were no suggestions for improvement.

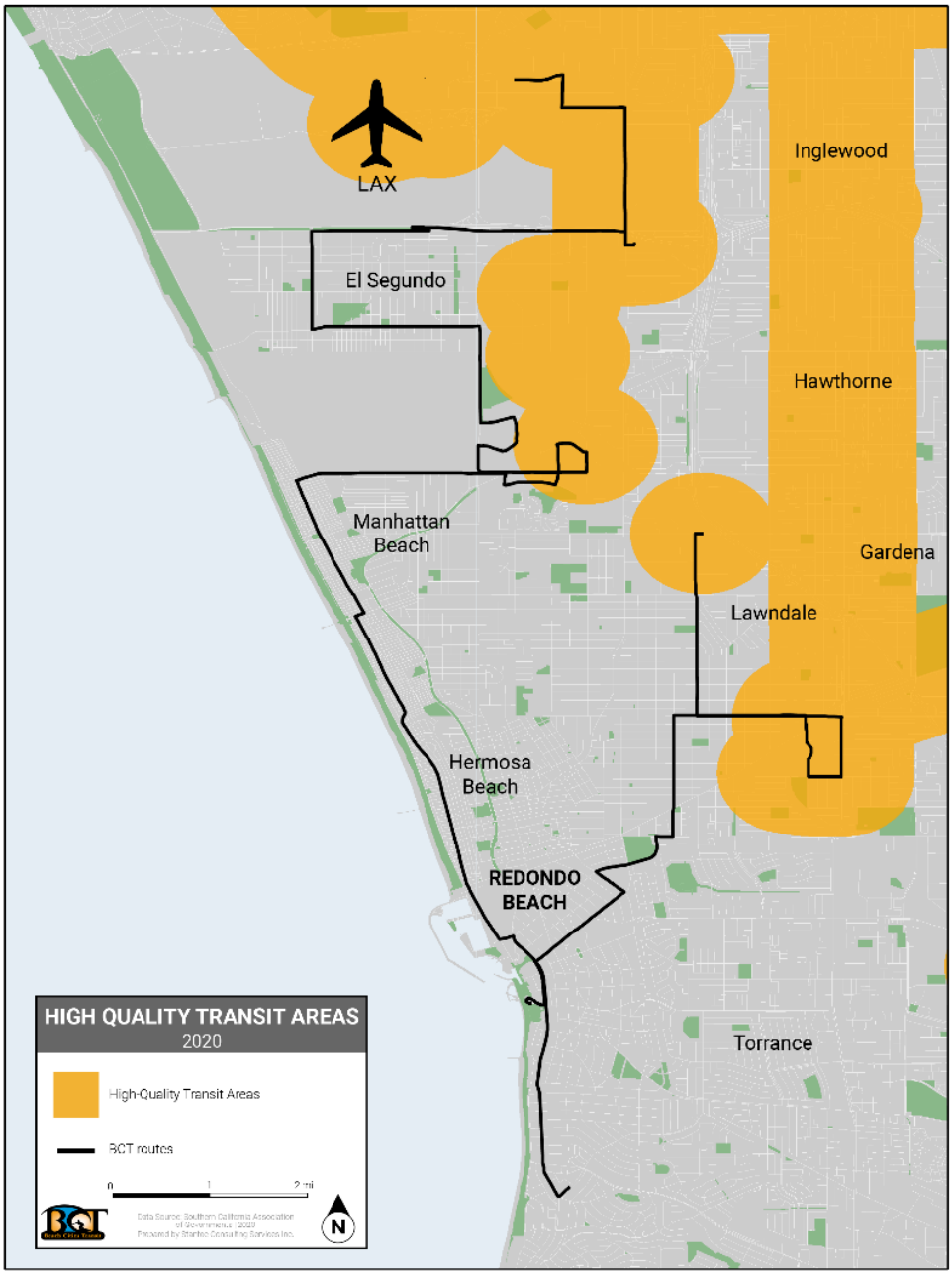
The FTA’s Triennial Review of FY2019 focused on compliance in 21 areas and found no deficiencies. As a Municipal Transit operator, BCT received formula 5307 funds for five projects from the FTA from 2012 to 2018. Notable projects include $720,000 in 2018 for the 2017 Replacement Transit Vehicle Procurement and $1.2 million in 2017 from the South Bay Cities Council of Governments (SBCCOG) Regional Funding for the South Bay Regional Intermodal Transit Center.

3.1.6 Connect SoCal (SCAG 2020-2045 RTP/SCS)

The Connect SoCal 2045 vision seeks to connect the built environment with transportation systems through policies, projects, and programs. Increasing mobility options through land use and transportation strategies, Connect SoCal will help achieve greenhouse gas reduction targets in addition to significant benefits to livability. A long-range transportation plan, Connect SoCal is Southern California Association of Governments (SCAG) 2020-2040 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

The plan identifies High-Quality Transit Areas (HQTAs), which are defined as areas within one half-mile of a well-serviced transit stop or a transit corridor with 15-minute or less service frequency during peak commute hours. HQTAs in the BCT service area is outlined in Figure 3-4. HQTAs intersect with both BCT lines, specifically where they connect to other transit lines such as the Metro C Line and the South Bay Galleria.

Figure 3-4: SCAG-defined High-Quality Transit Areas in BCT Service Area (2020) [3]



[3] Data source: SCAG GIS Open Data Portal (https://gisdata-scag.opendata.arcgis.com/datasets/43e6fef395d041c09deaeb369a513ca1)

3.1.7 LA Metro 2020 Long-Range Transit Plan

Metro's long-range transportation plan (LRTP) looks at reducing congestion and improving mobility across the region with consideration to shifts brought on by the COVID-19 pandemic. The LRTP provides a 30-year outline of Metro's approach to mobility in the region.

Rail corridors are an important part of connecting the South Coast region. Several projects are under construction and planned that would impact the connectivity of the South Bay to the larger LA Metro service area. Those projects are broadly broken up into two categories, LAX-related projects under construction and planned projects connecting to the BCT service area.

- Extending from the existing E Line at Crenshaw 8.5 miles southwest to the C Line, the Crenshaw/LAX Track Project opened to Westchester/Veterans in 2022. This project will expand rail coverage in the City of Inglewood and Leimert Park, connecting the Crenshaw neighborhood to LAX. In addition to the expansion, the Crenshaw/LAX Track Enhancement Project (estimated to open in 2024) will put the line fully underground when adjacent to LAX runways. In addition to rail projects, the Automated People Mover at LAX will connect LA Metro service directly to LAX.

- Airport Metro Connector 96th Street Transit Station [4] – Initial construction began on the AMC in June 2021 with forecasted completion in 2024. Situated on the currently under-construction Crenshaw/LAX K Line, the AMC will provide a connection to LAX via the Automated People Mover as part of the Landside Access Modernization Program. BCT Line 109 currently runs to the LAX Bus Center but would likely provide service to the AMC 96th Street Transit station. Currently running along Aviation Blvd to Century Blvd, Line 109 does not pass construction of the AMC but has been affected by associated traffic.

- Estimated to open in 2030, the C Line Extension to Torrance will enhance rail service in the South Bay. This project is still in the Environmental Impact Review (EIR) process with two alternatives being considered. Both C Line extension routes continue from the Redondo Beach C (Green) Line station and end at Torrance Transit Center. Alternative 1 would use the Metro-owned Right of Way (ROW), traversing a section of the BCT service area and stop at the Redondo Beach Transit Center (RBTC). It would provide ridership and expanded connectivity as well as construction impacts. Along Hawthorne Blvd, Alternative 2 would touch the BCT service area at a stop at South Bay Galleria. Construction impacts on BCT service would be less severe and the station would still be served by BCT [5].

Beyond transit improvements, planned freeway improvements to the ExpressLanes Strategic Network affecting the South Bay are:

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[4] Airport Metro Connector - LA Metro

[5] The operating plans for the K Line and C Line are currently in flux, where future operating plans could result in the future K Line continuing south from its currently-planned terminus to operate on the C Line between the Mariposa and Redondo Beach stations, eventually extending further down to Torrance with the C Line operating in an east-west direction only between Aviation/LAX and Norwalk. The Metro Board has instructed staff to conduct outreach and develop an updated Crenshaw/LAX Line operating plan recommendation that would be approved before the AMC station opens. This operating plan is important to consider but does not change the locations of current and future Metro rail stations that BCT interacts with.

- I-405, I-110, I-105, and SR-91 Ramp and Interchange Improvements (South Bay) – Estimated to open in 2039
- I-405/I-110 Int. HOV Connect Ramps & Interchange Improvements – Estimated to open in 2044
- I-110 ExpressLanes Ext South 10 I-405/I-110 Interchange – Estimated to open in 2046
- I-405 South Bay Curve Improvements – Estimated to open in 2047

3.1.8 LA Metro NextGen Bus Study

In 2018, Metro launched a bus network redesign study called NextGen to better align bus service with the needs of current and future customers. Goals for this plan included increasing the number of frequent bus lines, 10-minute headways for 80% of current bus riders, improved service span to an all-day, 7-day-a-week service, ¼-mile walk to a bus stop for 99% of current riders, and overall creating a more comfortable and safer waiting environment. Metro has focused on attracting more ridership during off-peak hours, as an analysis of travel patterns revealed large travel volumes during the midday—potential ridership for transit to capture by focusing on frequent service to better serve shorter trips.

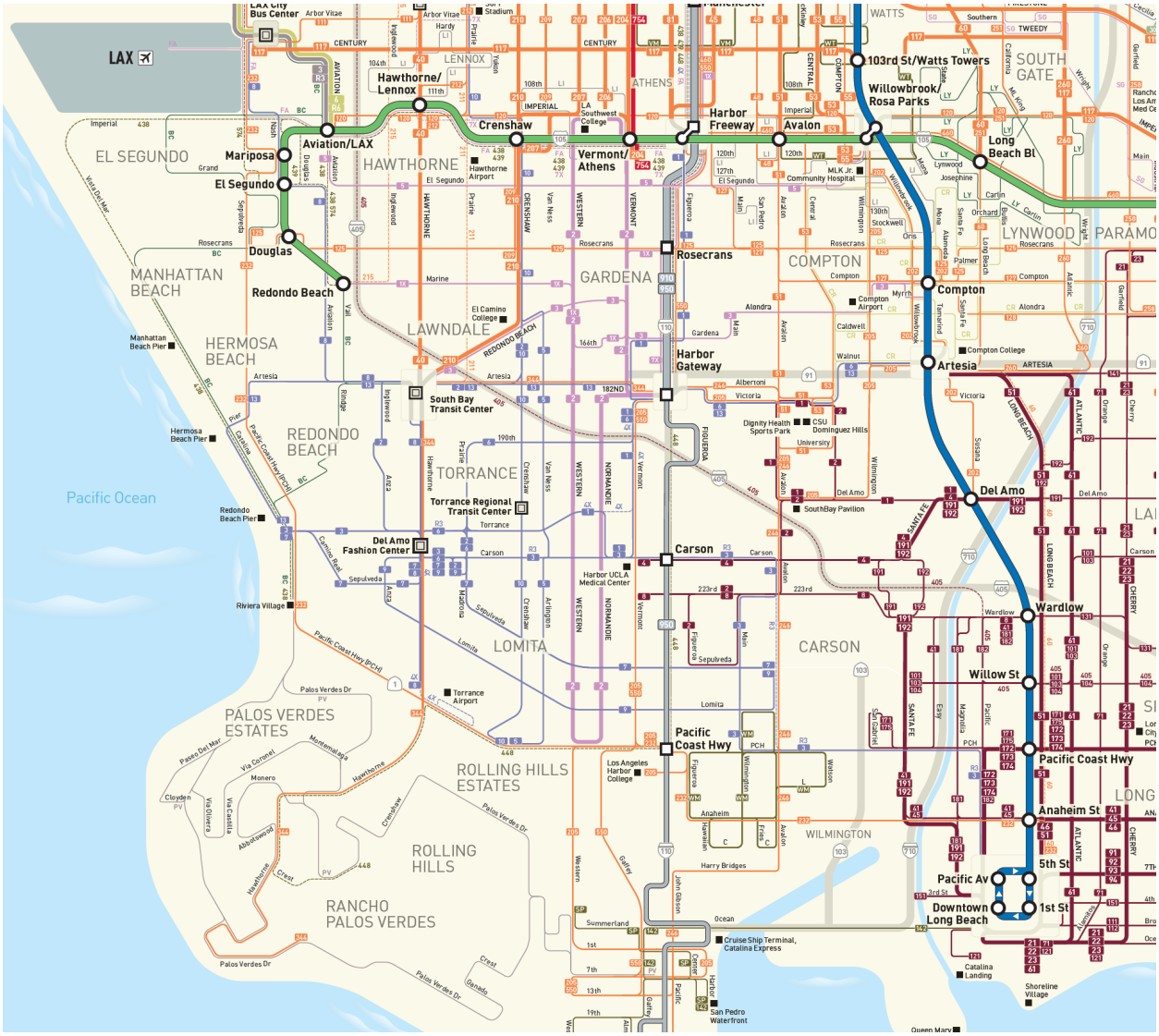
In the South Bay, service changes introduced by the NextGen Bus Study are summarized below:

Table 3-1: NextGen Bus Study changes and potential impacts to BCT

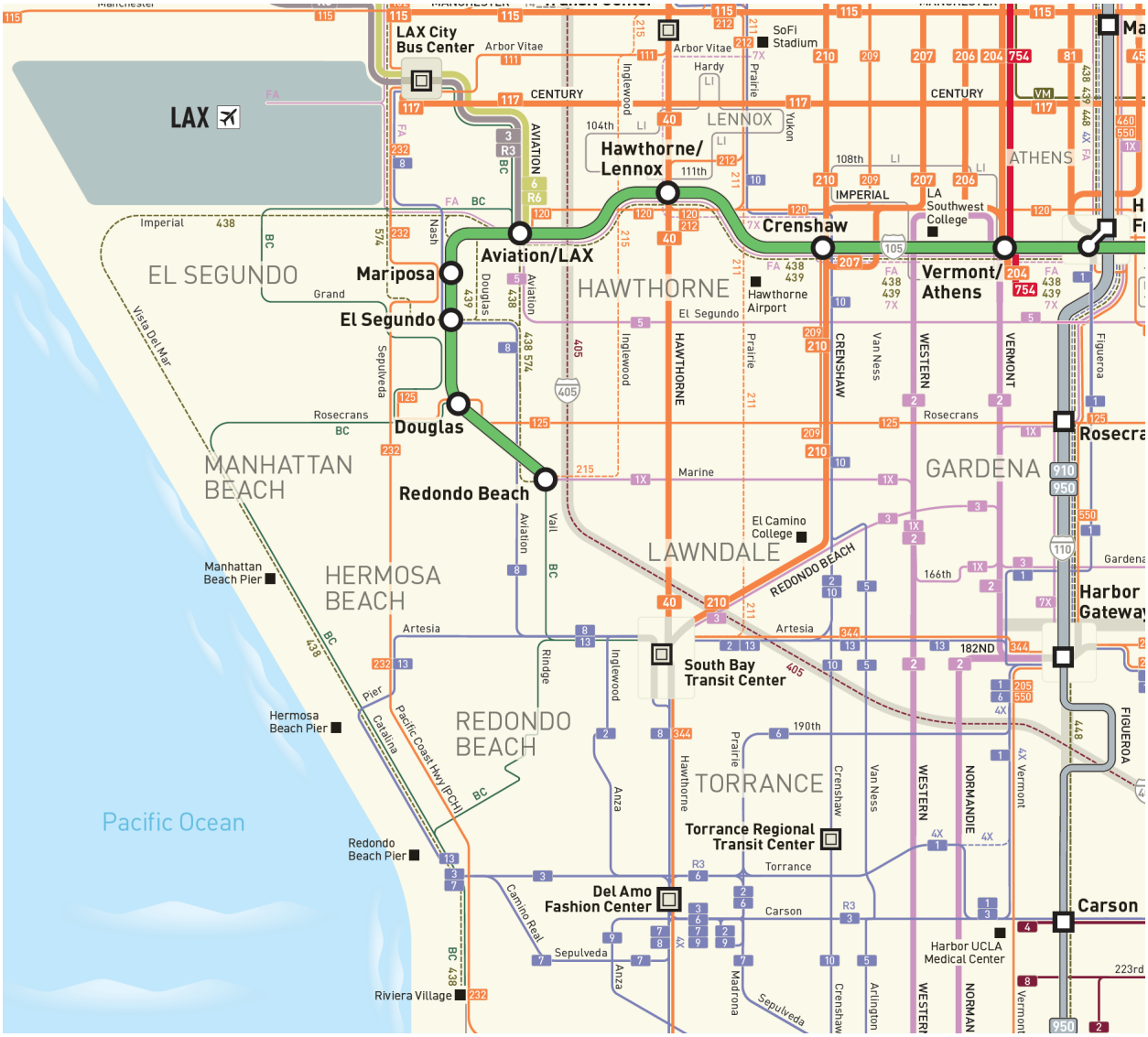
Metro Line	NextGen Change	Potential Impact to BCT
40/740 – ML King Jr – Crenshaw – Hawthorne	More frequent service Merging of lines 40 and 740	Potential increased demand on Line 102 at the RBTC
125 – Rosecrans	More frequent service Later service on Sundays	Potential increased demand on Line 109 along Rosecrans
126 – Manhattan Beach	Discontinued	No service along Manhattan Beach Blvd, potentially lower demand on 109. Also potential opportunity for providing service east-west connecting to Manhattan Beach Pier
130 – Artesia	Minor routing changes near the 110-Fwy Long Beach Transit began operation of Line 141 from Artesia Station east to Los Cerritos Center Torrance Transit operates 13 from Artesia Station west to Hermosa Beach	Likely minimal to no impacts
210 – Crenshaw/ Line 710 – Crenshaw Rapid	More frequent service Line 710 merged with Line 210 (Torrance Transit Line 2 replaces the 210 segment along Crenshaw Bl and Artesia Bl south of El Camino College)	Potential increased demand on Line 102 at the RBTC
211 – Prairie – Inglewood/ 212 – La Brea/ 215 – Prairie – Inglewood	More frequent service All-day, all-week service	Minimal impacts but potential increases in transfers at Redondo Beach Station and RBTC
344 – Hawthorne – Palos Verdes Harbor Gateway	More frequent service	Potential impacts on transfers at South Bay Galleria
625 – LAX C Line Shuttle	Discontinued Metro Micro introduced for LAX/Inglewood	Potential increased demand on Line 109 along Imperial Hwy

Metro slowly began rolling out new services in fall 2020, and as of spring 2023, all changes have been implemented but operator shortages have hampered Metro's ability to deliver on the frequencies recommended by the NextGen plan. Figure 3-5 provides an overview of all regional services in the South Bay (top) and more specifically in the Beach Cities (bottom).

Figure 3-5: Metro and Regional Services in the South Bay (top) and the Beach Cities (bottom) [6]



[6] Data source: LA Metro (https://www.dropbox.com/s/1nm4urcsi1tldnp/22-2104_web_MSysMap3_SoBayGateway_35x17_DCR.pdf?dl=0)



3.1.9 Vision 2028 (LA Metro Strategic Plan)

Addressing the complex patchwork of transportation agencies across the region, Vision 2028 lays out a plan for increasing prosperity through removing mobility barriers, swift and easy mobility through LA, and accommodating more trips through a variety of mobility options. Vision 2028 is Metro's 10-year strategic plan to reduce congestion and greenhouse gas emissions throughout the region.

Seeking to "double the percent usage of transportation modes other than solo driving, including taking transit, walking, biking, sharing rides, and carpooling" [7] Metro has outlined five goals to reshape LA County by 2028.

[7] LA Metro Vision 2028

1. Provide high-quality mobility options that enable people to spend less time traveling;
2. Deliver outstanding trip experiences for all users of the transportation system;
3. Enhance communities and lives through mobility and access to opportunity;
4. Transform LA County through regional collaboration and national leadership; and
5. Provide responsive, accountable, and trustworthy governance within the Metro organization.

Metro's goals impact BCT directly through transit provider partnerships and specific initiatives that integrate with BCT operations. Metro's goal 4 seeks to work with organizations across the transportation environment to implement holistic strategies in land-use policies to advance the mobility goals within LA County. Through resource sharing and co-investment, Metro wants to share in the risk and reward of partnerships that advance mobility in the region. Part of this partnership takes the form of incentivizing Metro funding program recipients to support initiatives that advance mobility goals of the transportation network.

3.1.10 Torrance Transit Tomorrow COA

Providing transit services across the South Bay, Torrance Transit spans multiple jurisdictions including those served by BCT. BCT and Torrance Transit interface at the South Bay Galleria, RBTC, Redondo Beach Pier, and LAX Bus Center as well as several other less prominent points.

Included in the comprehensive operational analysis that is the Torrance Transit Tomorrow Plan are six phases of service changes to guide the agency through a six-year plan. Those changes that impact or relate to BCT are listed below along with their specific impact on BCT. Potential changes BCT could consider in response to these will be fleshed out in TSS 2.

Phase 1 – planned implementation year 2020

- Rapid 3: Addition of Rapid 3 running from Downtown Long Beach to the Redondo Beach Transit Center along Hawthorne Blvd
    - Impact on BCT: Rapid 3 would increase service to connections to BCT Line 102 at RBTC.
    - Current Conditions: Rapid 3 service was implemented in June 2023 without service to South Bay Galleria. Rapid 3 aligns with Line 3 along most sections, but not all, and terminates service at the Torrance Transit Center.
- Line 7: Shorten Line 7 to terminate at Del Amo Fashion Center whereas the current route runs along Sepulveda Blvd and Camino Real to terminate at Redondo Beach Pier.
    - Impact on BCT: Service available from Redondo Beach Pier directly to Del Amo Fashion Center would change from Line 7 to the proposed Line 13.
    - Current Conditions: Modification of Line 7 has not yet been implemented.

Phase 2 – planned implementation year 2021

- Line 3: Rerouting of Line 3 from terminating at Redondo Beach Pier to the Redondo Beach Transit Center. This realignment would avoid duplication from the addition of Line 13.
    - Impact on BCT: Modified Line 3 will increase service along Hawthorne Blvd with an extension from Del Amo Fashion Center to South Bay Galleria and would increase connections to Line 102.
    - Current Conditions: Realignment of Line 3 has been implemented with service Line 3 service terminating at Redondo Beach Pier.

- Line 13: The addition of Line 13 provides service from Metro A (Blue) Line Artesia Station along Artesia Blvd to Hermosa Beach, down Hermosa Ave, and currently terminates near Redondo Beach Pier. Outlined service changes include Line 13 continuing east from Redondo Beach Pier along Torrance Blvd to terminate at the Del Amo Fashion Center. This route replaces eliminated sections of Metro Line 130.
    - Impact on BCT: Service duplication of BCT Line 102 occurs along Artesia Blvd near the South Bay Galleria and of Line 109 between Gould Ave/Artesia Blvd to Redondo Beach Pier. Line 13 will provide direct service along Artesia Blvd from Manhattan Beach/Hermosa Beach West, with connections to BCT services at South Bay Galleria. Proposed additions to Line 13 would replace sections of Torrance Line 3, maintaining service from Del Amo Fashion Center to Redondo Beach Pier along Torrance Blvd
    - Current Conditions: Line 13 currently does not run to South Bay Galleria along Torrance Blvd and instead starts/terminates at Redondo Beach Pier.

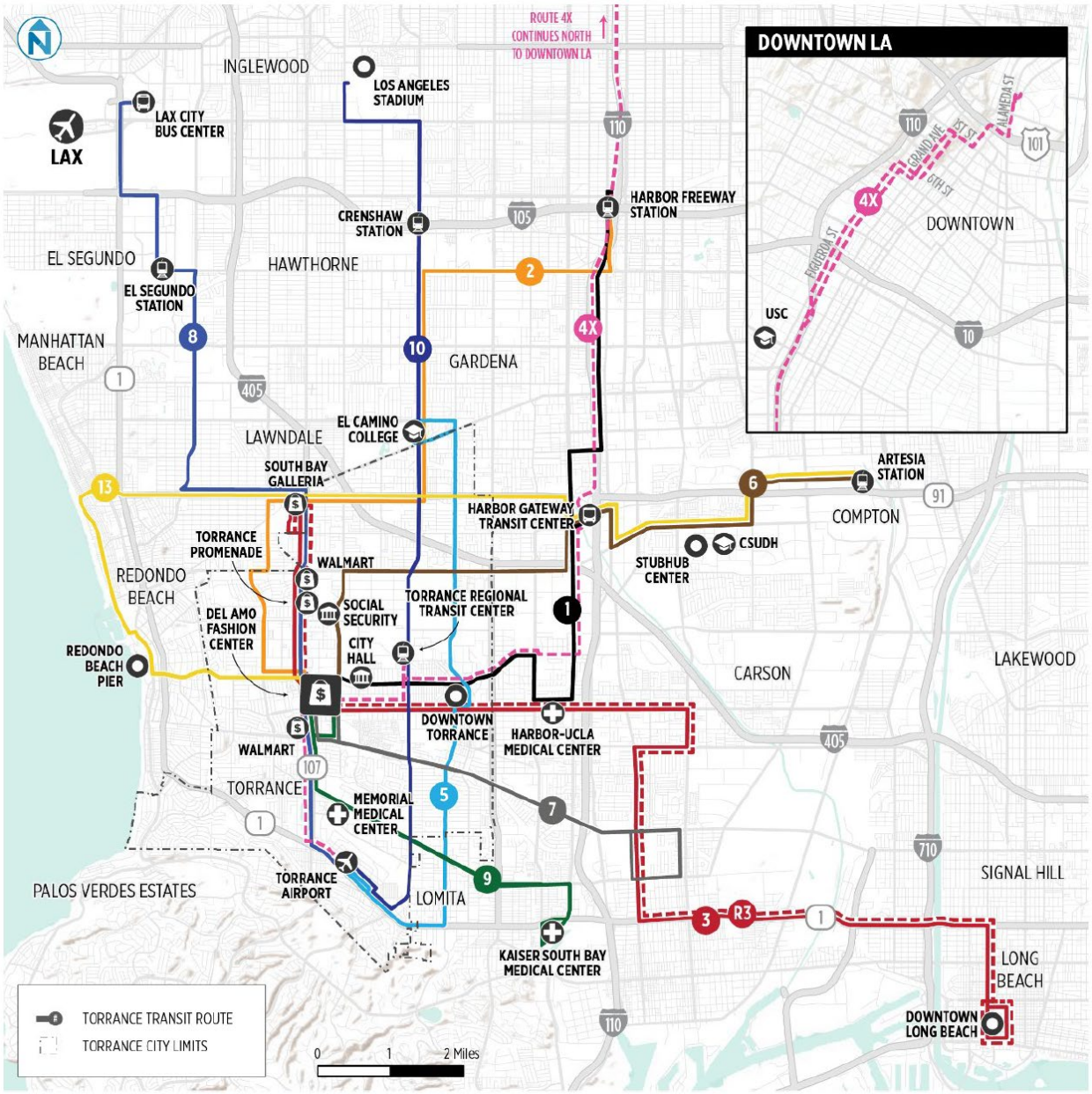
Phases 3-6 do not include route changes, instead focusing on improved frequency network-wide and the extension of service hours by approximately 57,500 hours over three phases. It is unclear if Torrance Transit intends to implement all service changes outlined in the Torrance Transit Tomorrow Service Plan or if as of June 2023, all changes have been implemented.

Long-term implications to BCT include regional connectivity and limited service duplication while enhancing transfers and connections. BCT should consider timed transfers with Torrance Transit, as changes to service frequency may impact riders making connections from one service to another. While serving different markets and destinations, the planned expansion of Line 13 will duplicate sections of BCT Line 109 service between the Hermosa Beach Pier and the Redondo Beach Pier.

BCT's proximity to Torrance Transit provides insight into transit utilization in the area.

- Torrance Transit has fare policies and rates that are in line with those of BCT.
- Torrance Transit has yet to complete a ZEB transition plan and highlighted the need for a comprehensive regional plan for the South Bay.

Figure 3-6: Torrance Transit Phase 2 route map [8]



[8] Data source: https://transit.torranceca.gov/home/showpublisheddocument/61806/637371705858170000

3.1.11 GTrans Line-by-Line Analysis and Transit Service Plan

In 2018-2019, the City of Gardena's municipal public transit agency, GTrans, conducted a line-by-line analysis to develop service proposals to improve service, attract more ridership, and better align with future developments in the South Bay—many of which will also impact BCT.

The result of the study was a series of recommendations and phased service plans, with the following main highlights:

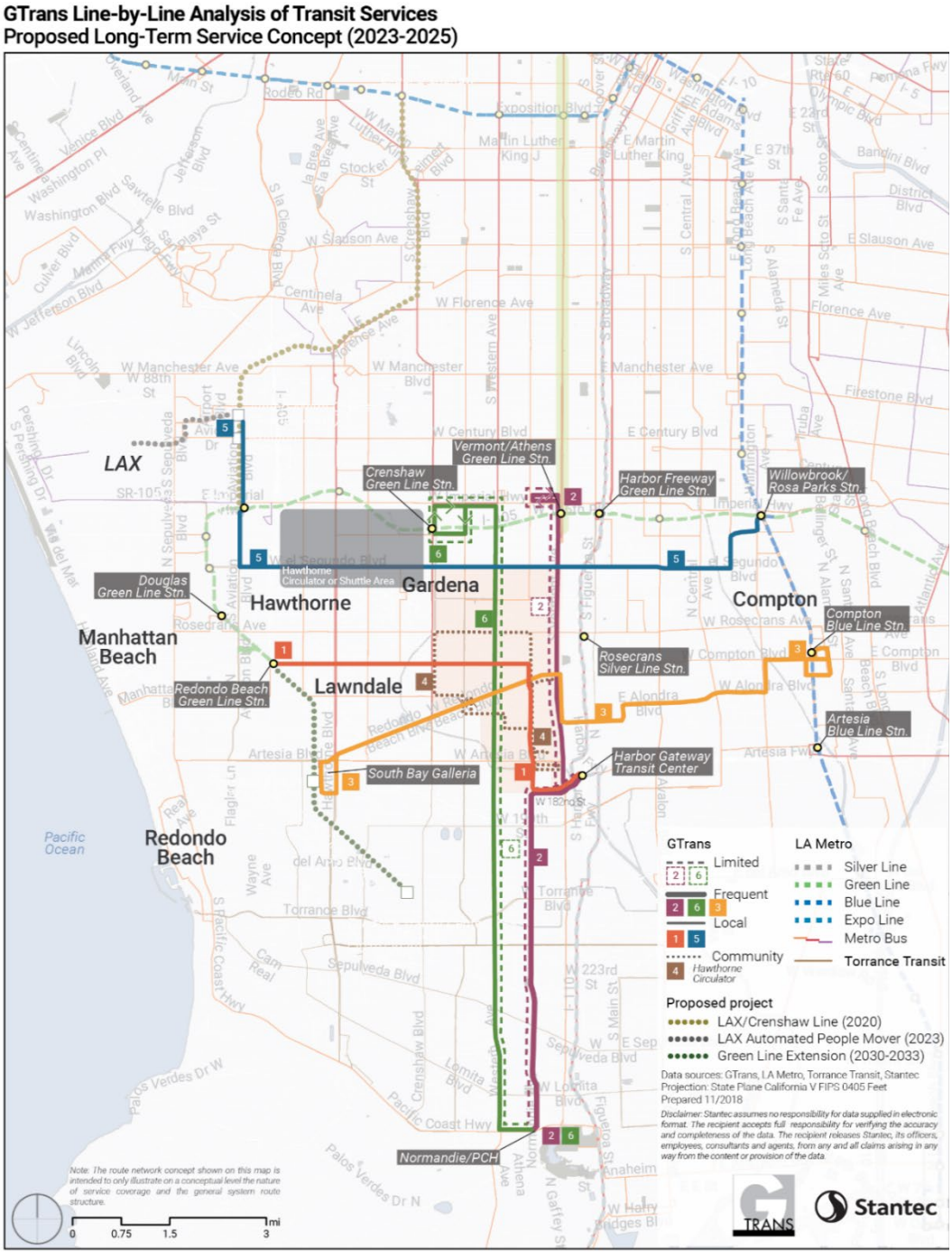
- Eliminating downtown service on Line 1X given its low productivity and existing services to downtown Los Angeles
- The splitting of Line 2 from a loop into two separate routes to improve operations and reliability, as well as create a new connection at the Crenshaw C Line Station
- Increasing frequency on lines 2 and 3
- Continue serving Aviation Station on Line 5, while extending the alignment to also serve the future People Mover station.

Other recommendations included examining the potential for redesigning Line 4 to divert trips away from the dial-a-ride service, as well as exploring microtransit for service between Gardena and Hawthorne.

The implementation of these recommendations was put on hold due to the COVID-19 pandemic, but as of 2022, GTrans has started to adjust their system, including increasing frequency on Line 2 and implementing a game day shuttle service from the Harbor Gateway Transit Center to the new SoFi Stadium.

The potential impacts to BCT of the GTrans study are generally limited to the impacts of potential Line 3 improvements with connections at the South Bay Galleria and the RBTC.

Figure 3-7: GTrans Service Concept 2023-2025 [9]



[9] Data source: GTrans Line-by-Line Analysis and Transit Service Plan

3.2 Market Assessment

Different demographics and population characteristics can display different propensities for transit use. For example, urban areas with high population density tend to have a population with a higher transit mode share than sparsely populated low-density suburban or rural areas where land uses are isolated and spread out. Other indicators, such as income and vehicle ownership, can also shape transit demand.

Essentially, transit ridership is typically strong in areas that display a high population density, employment density, a compact mix of land uses, and certain socioeconomic characteristics that historically translate to a high degree of reliance on transit, such as large student populations and zero-vehicle households. These and other demographics are explored below to analyze the existing transit markets in the South Bay region, and how these markets can influence transit demand in the future.

Table 3-2 provides a comparative demographic overview of Redondo Beach, Hermosa Beach, Manhattan Beach, El Segundo, and Los Angeles County.

- Whereas Los Angeles County saw a slight population increase between 2014 and 2019, all of the Beach Cities saw small population decreases; essentially, the population of the BCT service area remained steady over the past five years.
- The population of the Beach Cities also skews slightly older than the county average, particularly with a higher proportion of people between 35 and 64. Manhattan Beach has the oldest average age of 44, and El Segundo comes closest to the county average with an average age of 37.3.
- Of the Beach Cities, Redondo Beach has the highest percentage of youths, which contributes to strong student ridership on BCT's Line 102. As explored later in this section and throughout this report, youth population density is high along the Line 102 alignment and into North Redondo.
- The median household income in all of the Beach Cities is also significantly higher than the county, particularly in Manhattan Beach and Hermosa Beach.
- Transit mode share for the Beach Cities is very low compared to the county average. Redondo Beach has the highest transit mode share of the Beach Cities with 1.7% of workers taking transit to work.
- The Beach Cities is an area of high job density with a mix of different job sectors. The majority of people working in the South Bay commute from outside of the city that they work in, and the majority of people living in the Beach Cities commute to another city to work.
- Overall, Beach Cities residents are more likely to be older, have a higher median household income, are more likely to be white (non-Hispanic or Latino), have two or more vehicles available in the household, and are less likely to take public transit to work than the county or state average.

Table 3-2: Selected demographic characteristics [10]

DEMOGRAPHIC CHARACTERISTICS	Redondo Beach		Hermosa Beach		Manhattan Beach		El Segundo		Los Angeles County	
	Number	%	Number	%	Number	%	Number	%	Number	%
Total population (2019)	67,423		19,539		35,500		16,731		10,081,570	
Total population (2014)	67,511		19,725		35,534		16,839		9,974,203	
Population change (2014 – 2019)	-88	-0.1%	-186	-0.9%	-34	-0.1%	-108	-0.6%	107,367	1.1%
AGE										
14 and younger	12,609	18.7%	2,993	15.3%	7,618	21.5%	3,417	20.4%	1,835,169	18.2%
15-34	14,845	22.0%	5,255	26.9%	5,941	16.7%	4,228	25.3%	2,982,752	29.6%
35-64	31,056	46.1%	8,877	45.4%	15,931	44.9%	7,329	43.8%	3,927,671	39.0%
65 and older	8,913	13.2%	2,414	12.4%	6,010	16.9%	1,757	10.5%	1,335,978	13.3%
Median Age	40.7		39.3		44		37.3		36.5	
MODE TO WORK										
Automobile (drove alone)	29,006	78.9%	8,914	75.6%	12,276	78.2%	7,213	79.6%	3,560,442	74.0%
Automobile (carpool/passenger)	2,022	5.5%	507	4.3%	1,005	6.4%	489	5.4%	457,084	9.5%
Public Transit	625	1.7%	141	1.2%	141	0.9%	127	1.4%	279,062	5.8%
Walk or bike	1,213	3.3%	531	4.5%	408	2.6%	480	5.3%	168,399	3.5%
Other means	515	1.4%	224	1.9%	188	1.2%	154	1.7%	76,983	1.6%
Work from Home (Telework)	3,382	9.2%	1,474	12.5%	1,664	10.6%	607	6.7%	269,439	5.6%
Mean travel time to work (minutes)	31.1		35.0		32.5		25.5		31.8	
VEHICLE AVAILABILITY										
No vehicle available	441	1.2%	413	3.5%	235	1.5%	118	1.3%	186,571	3.9%
1 vehicle available	7,423	20.2%	2,629	22.3%	2,400	15.3%	1,892	20.9%	1,023,748	21.4%
2 vehicles available	18,668	50.8%	6,190	52.5%	8,017	51.1%	4,392	48.5%	1,798,734	37.6%
3 or more vehicles available	10,216	27.8%	2,559	21.7%	5,036	32.1%	2,644	29.2%	1,779,599	37.2%
HOUSEHOLD INCOME										
Number of households	27,663		8,956		13,427		6,417		3,316,795	
Median household income	$113,499		$136,702		$153,023		$109,577		$68,044	
RACE AND ETHNICITY										
White Alone (not Hispanic or Latino)	40,679	60.3%	15,235	78.0%	26,018	73.3%	10,375	62.0%	2,641,770	26.2%
Hispanic or Latino (of any race)	10,771	16.0%	1,831	9.4%	2,838	8.0%	2,709	16.2%	4,888,434	48.5%
Black or African American	2,111	3.1%	192	1.0%	155	0.4%	626	3.7%	790,252	7.8%
American Indian and Alaska Native	183	0.3%	119	0.6%	64	0.2%	0	0.0%	20,831	0.2%
Asian	9,101	13.5%	1,013	5.2%	4,763	13.4%	1,701	10.2%	1,454,769	14.4%
Native Hawaiian and Pacific Islander	63	0.1%	0	0.0%	34	0.1%	9	0.1%	24,597	0.2%
Other / two or more	4,515	6.7%	1,149	5.9%	1,628	4.6%	1,311	7.8%	260,917	2.6%

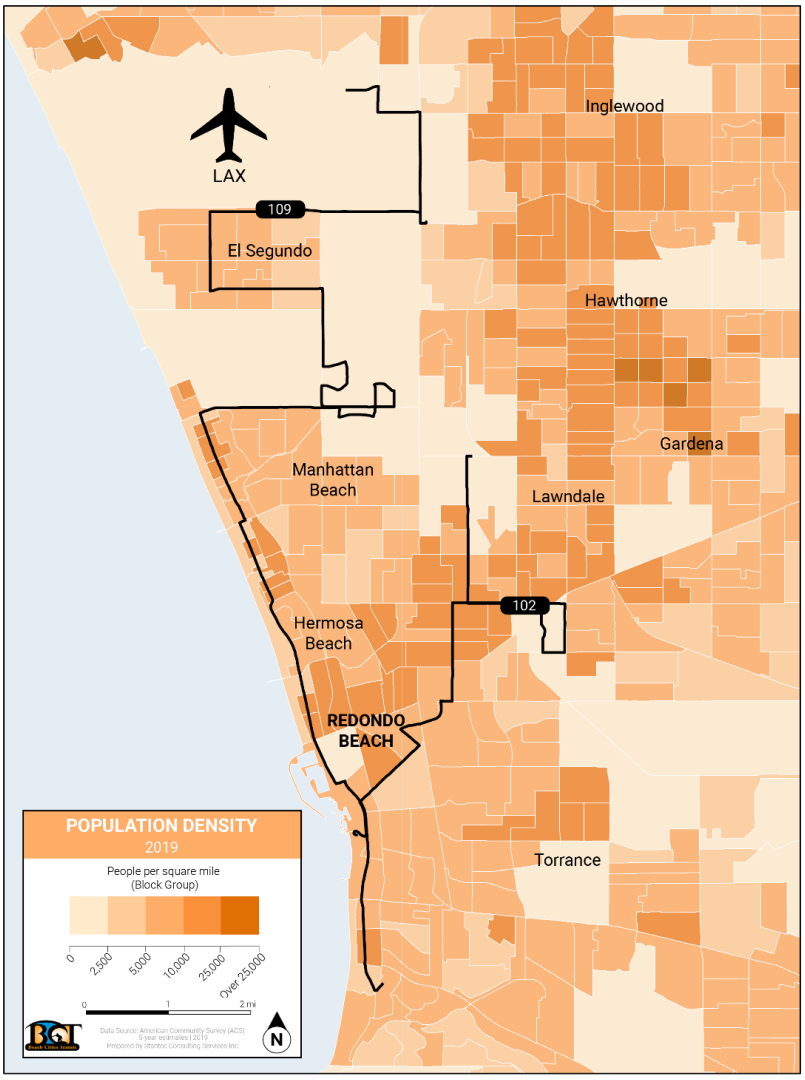
[10] Data sources: 2019 ACS 5-year estimates, 2014 ACS 5-year estimates.

3.2.1 Population Density

Population density is a major driver of transit use in any area; a high-density urban area will have a larger transit market than a lower-density suburban or rural area. Figure 3-8 shows the population density of the South Bay and Beach Cities Transit service area. The densest parts of the service area are within the City of Redondo Beach and small pockets of Hermosa Beach and Manhattan Beach; however, the South Bay Cities are not as dense as parts of the surrounding area such as Inglewood, Gardena, Hawthorne, and Los Angeles. Parts of the service area with very low population densities include LAX and some industrial areas (such as the El Segundo Chevron Refinery).

An estimated 77,000 people live within ¼ mile of BCT lines, and 136,400 live within ½ mile of BCT lines.

Figure 3-8: Population density (2019) [11]



[11] Data source: 2019 ACS 5-year estimates

3.2.2 Employment Density

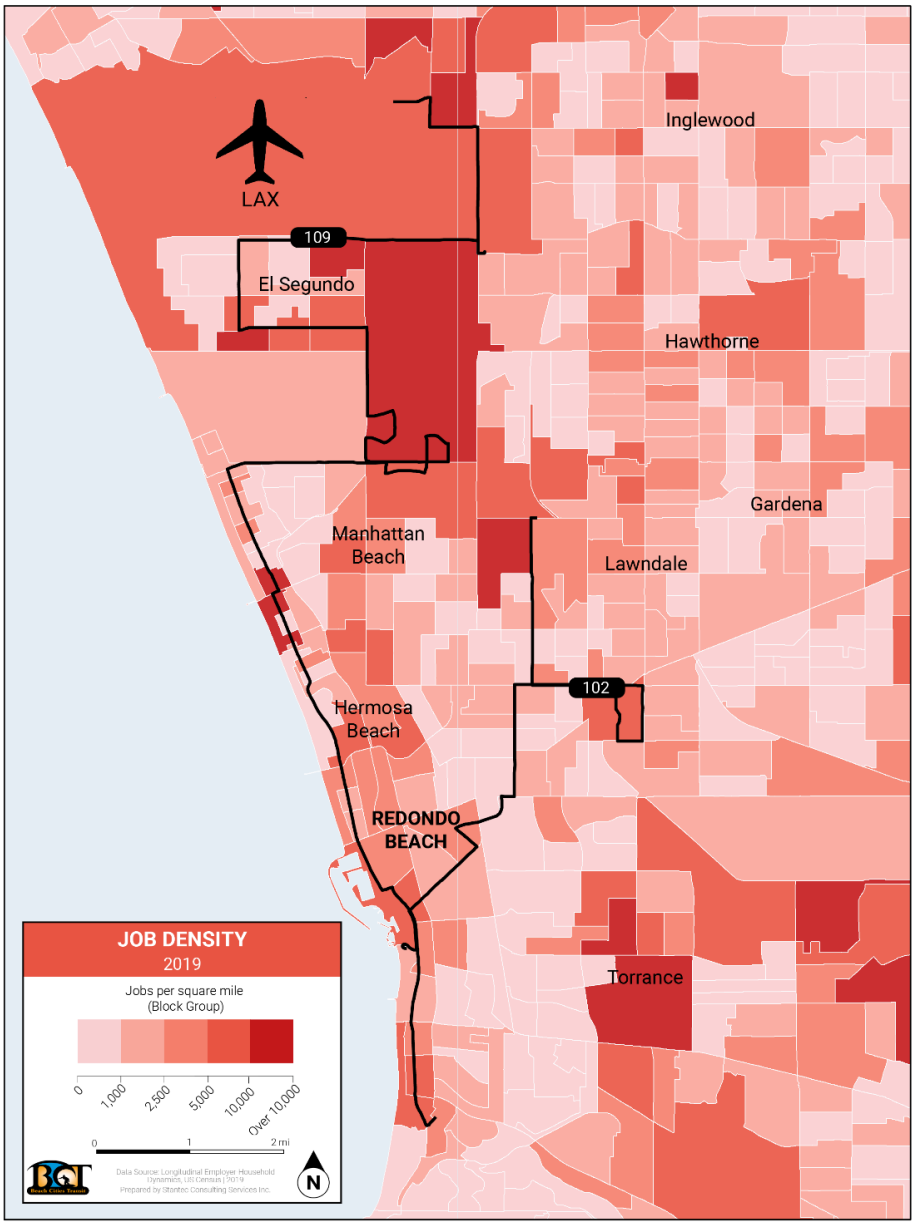
In the same way that population density is a strong indicator of transit use, employment density is also vital to the creation and maintenance of an effective transit network by providing access to jobs. Figure 3-9 shows the density of all jobs in BCT's service area. areas of high job density include LAX, South Bay Galleria, and multiple large retail centers and business parks.

Within El Segundo, Line 109 serves multiple employment centers such as the Pointe/Plaza El Segundo and concentrations of aerospace-sector jobs such as the Los Angeles Air Force Base, Northrop Grumman, and Raytheon Space and Airborne Systems. The Space Park business park in Redondo Beach near the Redondo Beach C Line station is served by Line 102.

Within the South Bay cities, there are high concentrations of retail and hospitality-focused jobs. Retail employment centers include the Manhattan Village Mall in Manhattan Beach and Riviera Village in Redondo Beach, both served by Line 109 and the South Bay Galleria served by Line 102.

An estimated 71,400 people work within ¼ mile of BCT lines, and 112,300 work within one-half mile of BCT lines.

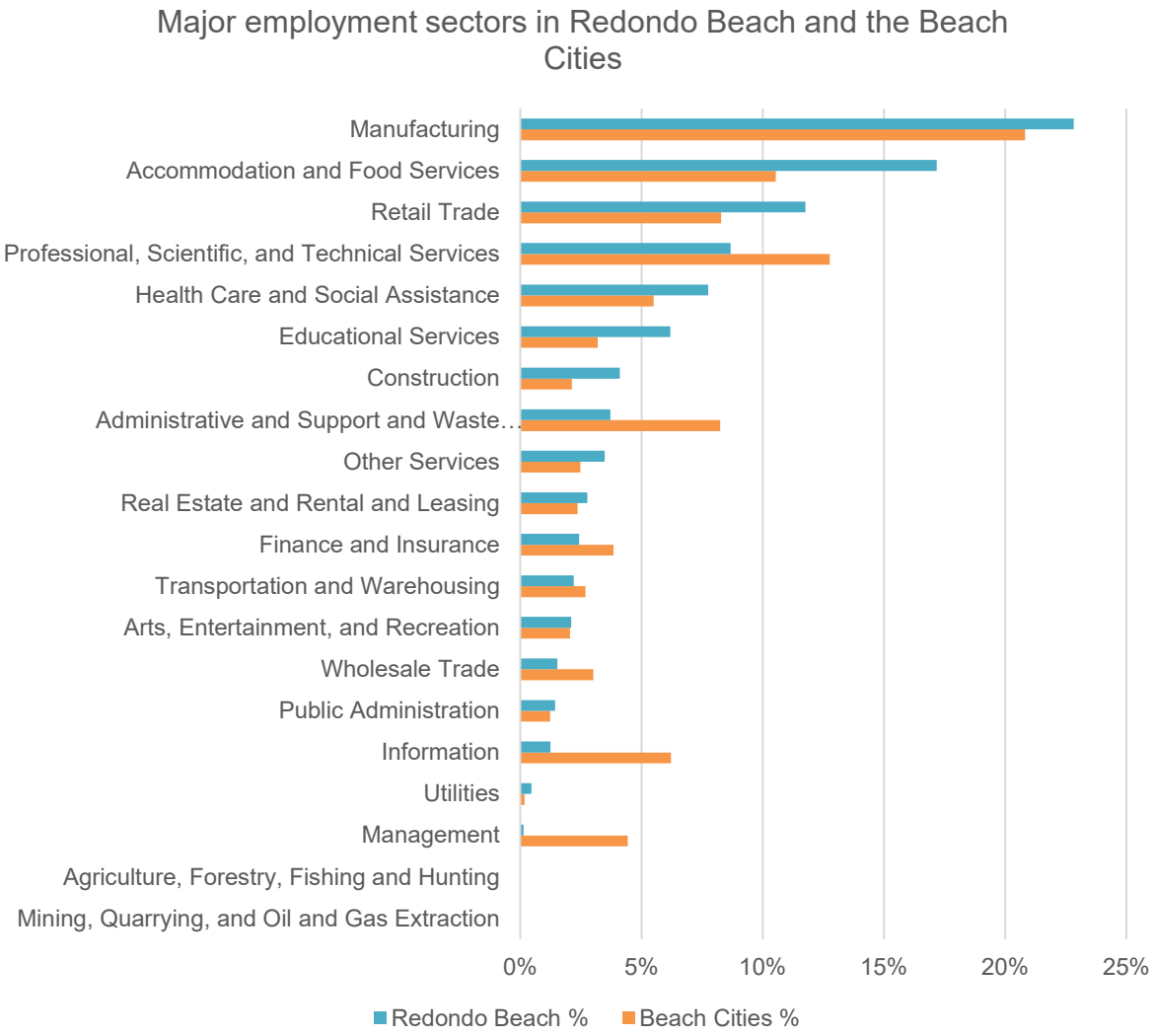
Figure 3-9: Job Density (2019) [12]



Major sectors in which workers are employed within Redondo Beach or the Beach Cities as classified by the North American Industry Classification System (NAICS) is presented in Figure 3-10. Within Redondo Beach and the Beach Cities, the major employment sectors include manufacturing, accommodation and food service, retail trade, and professional, scientific, and technical services. This aligns with earlier observations that major sources of jobs and economic activity within the Beach Cities are focused on retail/hospitality as well as aviation/aerospace-related jobs.

[12] Data source: https://onthemap.ces.census.gov/

Figure 3-10: Major Employment Sectors in Redondo Beach and the Beach Cities (Data source: NAICS) [13] [14]

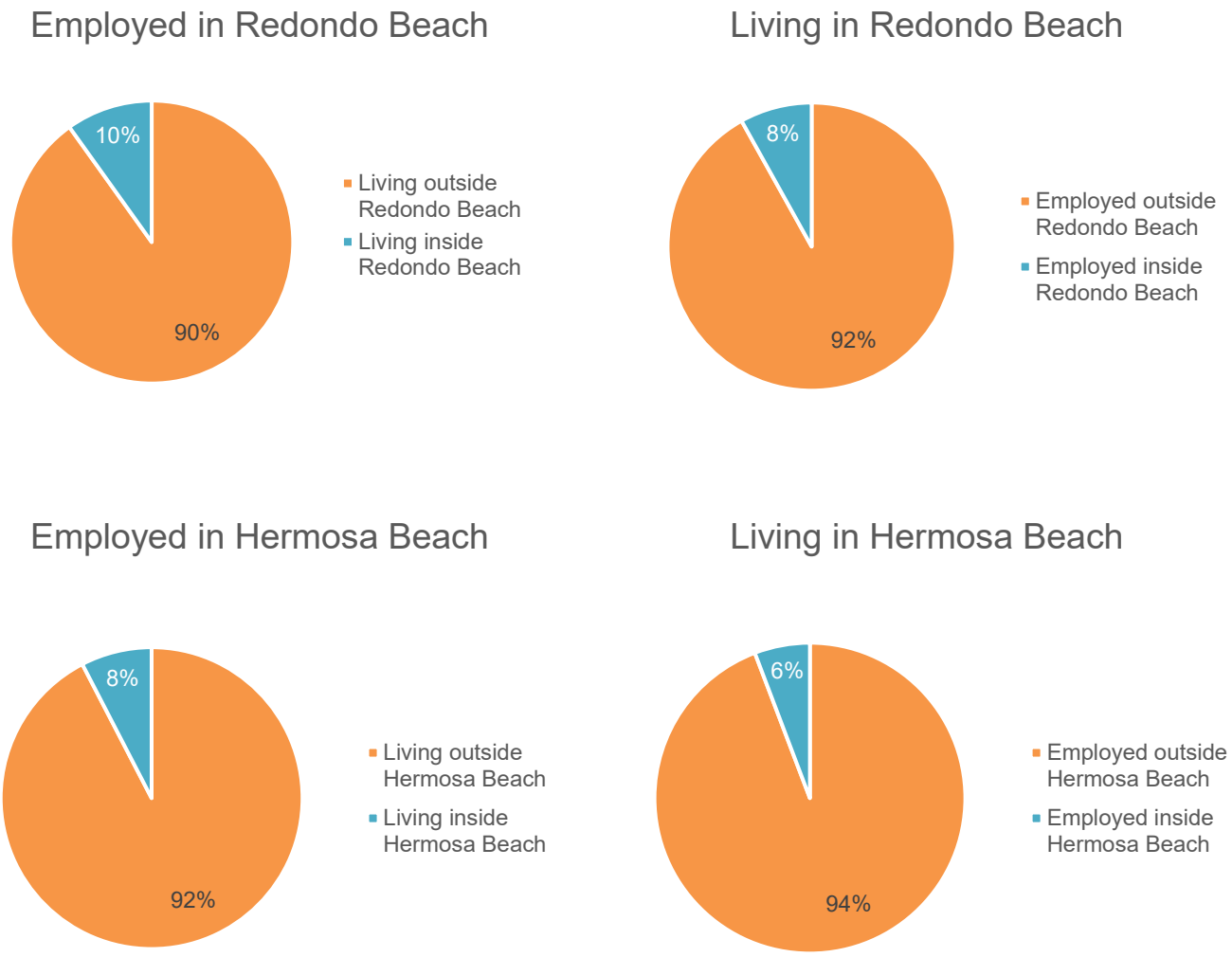


The US Census Longitudinal Employer-Household Dynamics (LEHD) collects data on the inflow and outflow of commute patterns that can show how many people working in a specified area also live in that area and how many people living in the area commute outside the area to work. Figure 3-11 shows that the vast majority of workers employed in the South Bay Cities do not live in the South Bay cities, and the majority of workers living in the South Bay cities work elsewhere. El Segundo has the most workers in the South Bay cities, with over 73,000 jobs as reported by the US Census. El Segundo also has the highest percentage of workers who work and live in El Segundo, with 20% of workers living in El Segundo also working in the city. This shows that the majority of people who work in South Bay cities commute from outside of that city, presenting an opportunity to capture more commute trips, potentially with BCT acting as a first/last mile connector between Metro rail services and the worker's final destination.

[13] Data source: https://onthemap.ces.census.gov/
[14] Beach Cities refers to Redondo Beach, Manhattan Beach, Hermosa Beach, and El Segundo

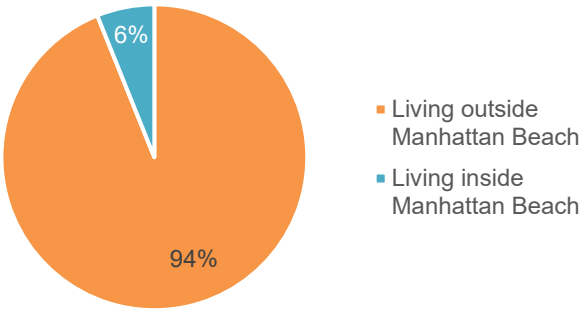
The top home locations for workers who work in the Beach Cities include Los Angeles (20.7%), Torrance (6.6%), Redondo Beach (5.8%), Long Beach (3.3%), and Hawthorne (2.6%) [15].

Figure 3-11: LEHD Inflow-Outflow (2019) [16]

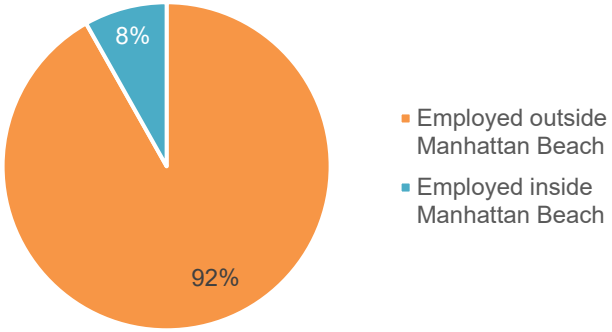


[15] Data source: https://onthemap.ces.census.gov/
[16] Data source: https://onthemap.ces.census.gov/

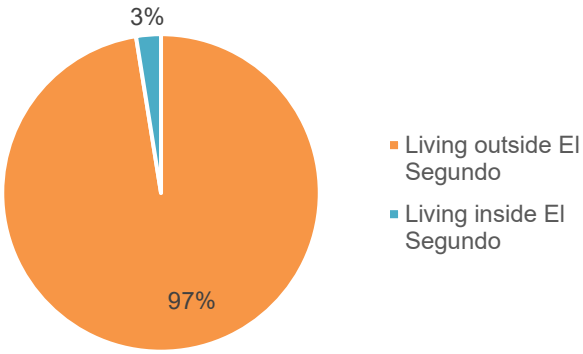
Employed in Manhattan Beach



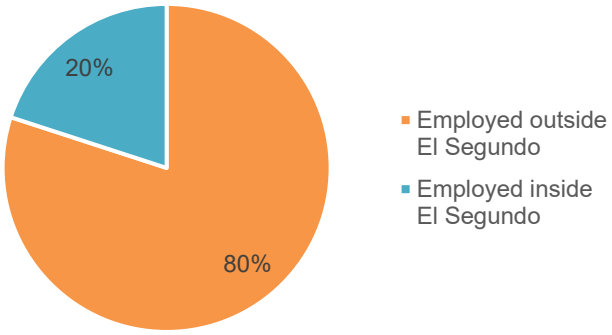
Living in Manhattan Beach



Employed in El Segundo



Living in El Segundo

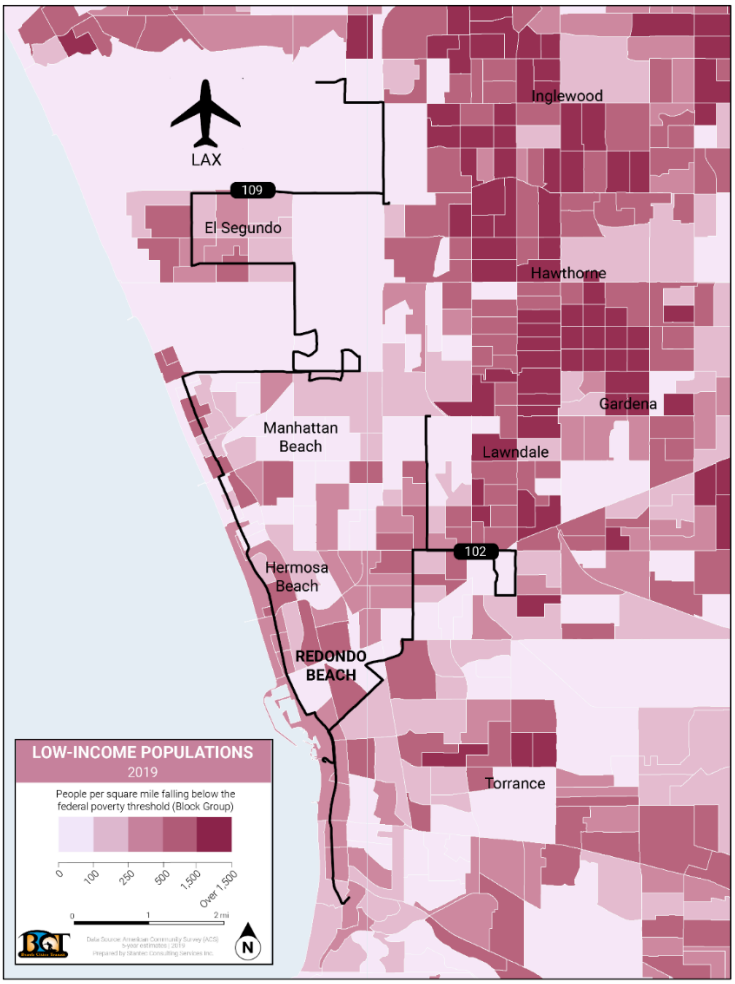


3.2.3 Low-Income Populations and Median Household Income

Low-income populations are more likely to use transit than those with higher household incomes [17]. Research notes that it is important for transit agencies to make transit as competitive as possible in the areas of pricing and service quality. The density of low-income populations (defined as people per square mile whose annual household income falls below the federal poverty level) in the BCT service area is shown in Figure 3-12. While some low-income populations are within Redondo Beach, Hermosa Beach, Manhattan Beach, and El Segundo, there is a higher density of low-income populations in Torrance, Gardena, Lawndale, Hawthorne, and Inglewood, showing that compared to surrounding communities, there are fewer low-income populations in the Beach Cities.

An estimated 8,305 low-income people live within ¼ mile of BCT lines, and 13,580 low-income people live within ½ mile of BCT lines.

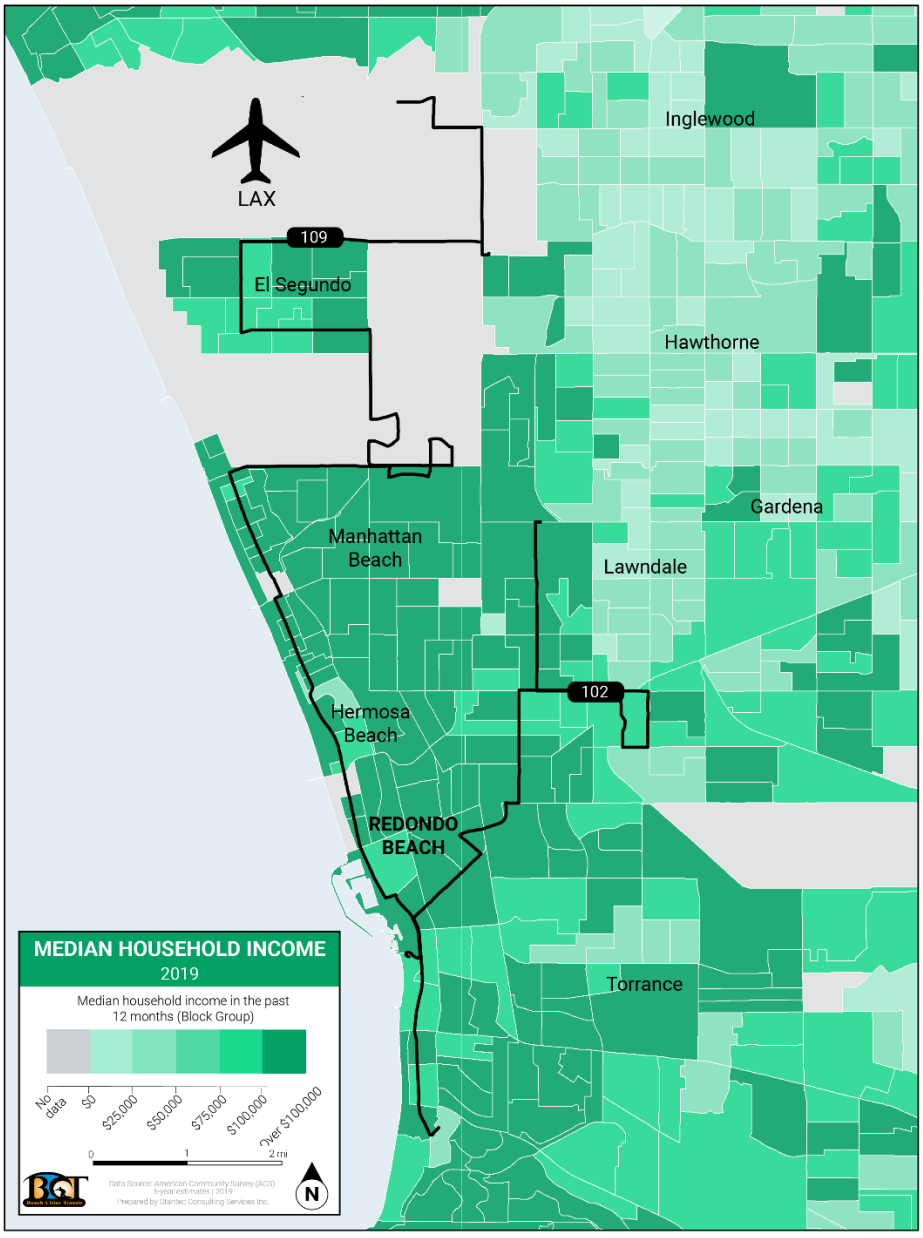
Figure 3-12: Low-income Populations (2019) [18]



[17] https://nap.nationalacademies.org/catalog/23175/elements-needed-to-create-high-ridership-transit-systems
[18] Data source: 2019 ACS 5-year estimates

Figure 3-13 shows the median household income, which reiterates the higher median household incomes found in Redondo Beach and the other South Bay Cities shown in Table 3-1. Overall, median household incomes are highest in El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, and Torrance, and lower in Inglewood, Gardena, Hawthorne, and Lawndale.

Figure 3-13: Median Household Income (2019) [19]

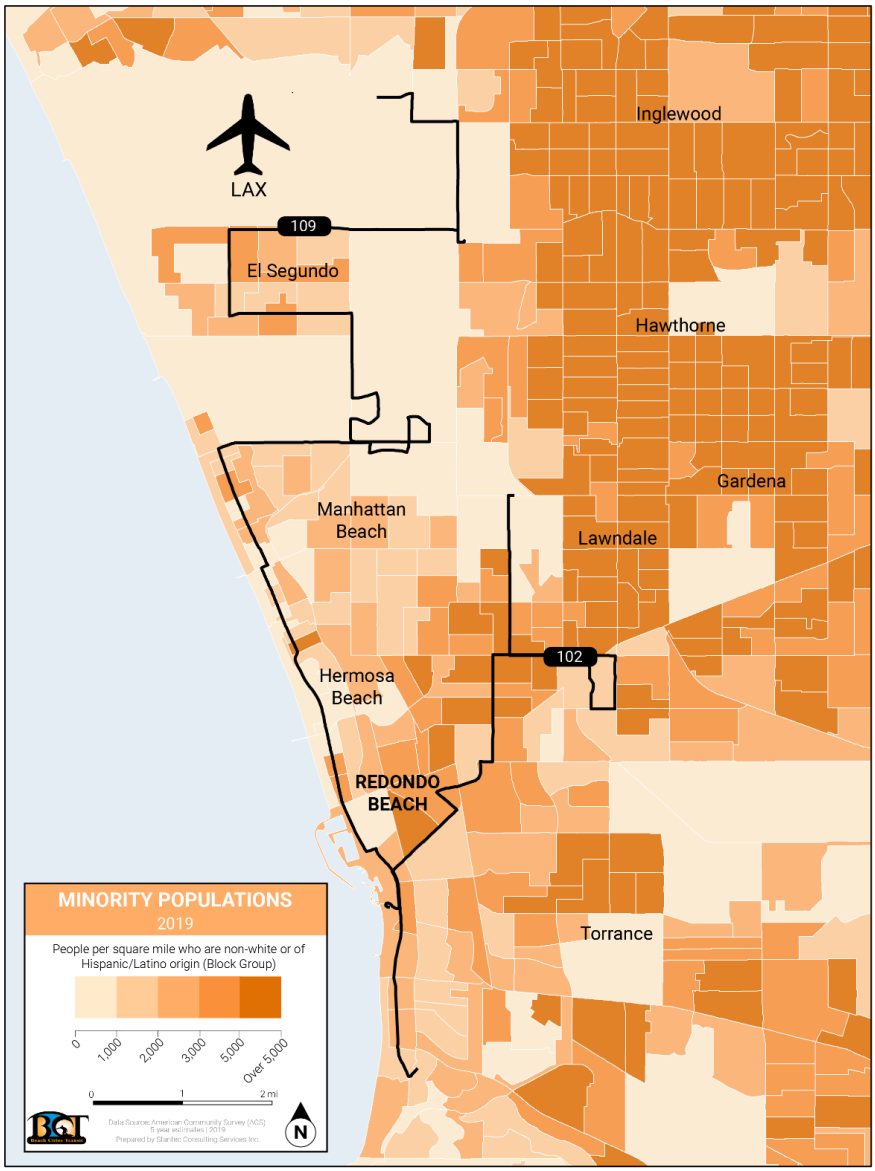


[19] Data source: 2019 ACS 5-year estimates

3.2.4 Minority Populations

Research suggests that minority and recent immigrant populations are more likely to take transit and are less likely to own a personal vehicle [20]. Figure 3-14 shows the population density of all those who are non-white or of Hispanic or Latino origin. While the entire service area is diverse, minority populations are more concentrated in Inglewood, Hawthorne, Gardena, and Lawndale, as well as pockets of Redondo Beach and Torrance.

Figure 3-14: Minority Population Density (2019) [21]

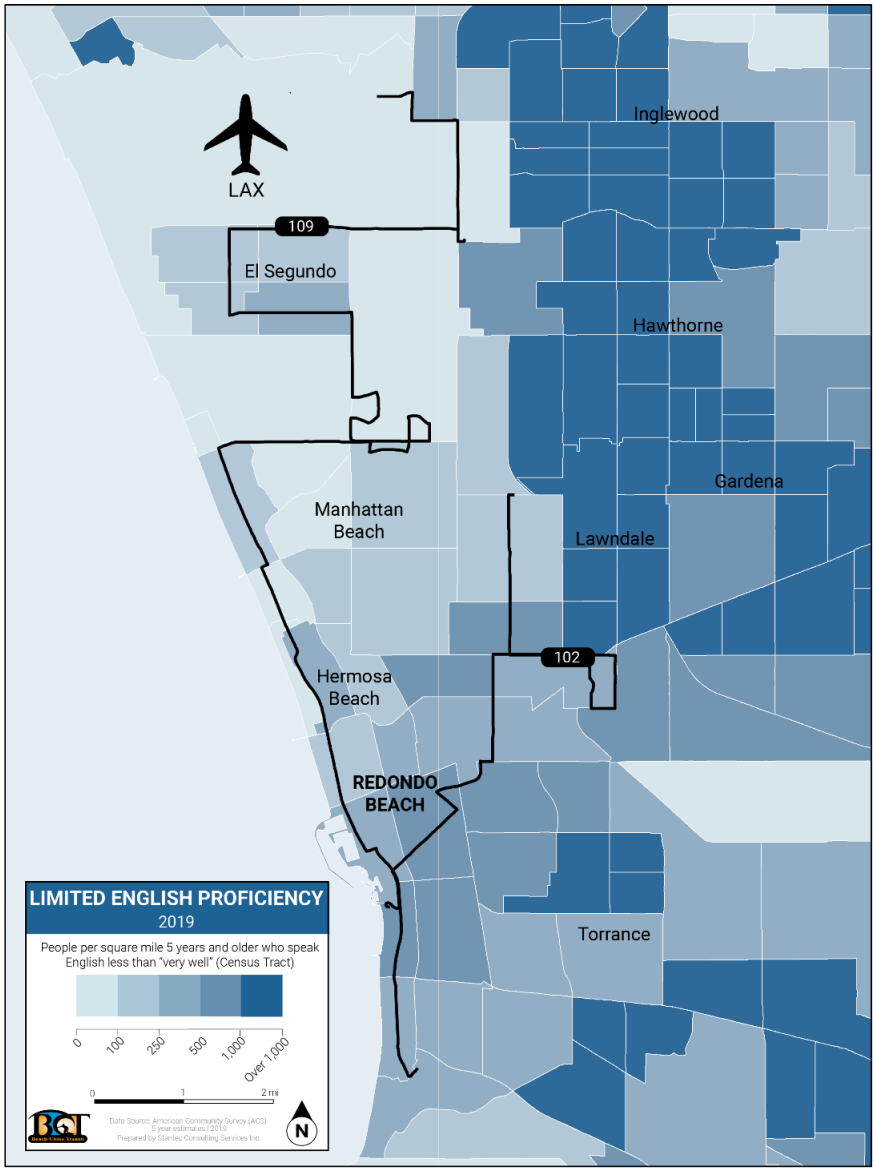


[20] https://nap.nationalacademies.org/catalog/23175/elements-needed-to-create-high-ridership-transit-systems
[21] Data source: 2019 ACS 5-year estimates

3.2.5 Limited English Proficiency Households

It is important to understand where LEP households are throughout the service area so that informational materials can be produced in the correct languages. Section 3.1.2 states that BCT's LEP plan only needs to consider Spanish speakers when preparing outreach materials as required under Title VI. The density of LEP households tends to mirror the patterns seen in the density of minority populations, with more LEP households in the communities east of El Segundo and fewer in El Segundo, Manhattan Beach, Hermosa Beach, and Redondo Beach.

Figure 3-15: Limited English Proficiency Households (2019) [22]

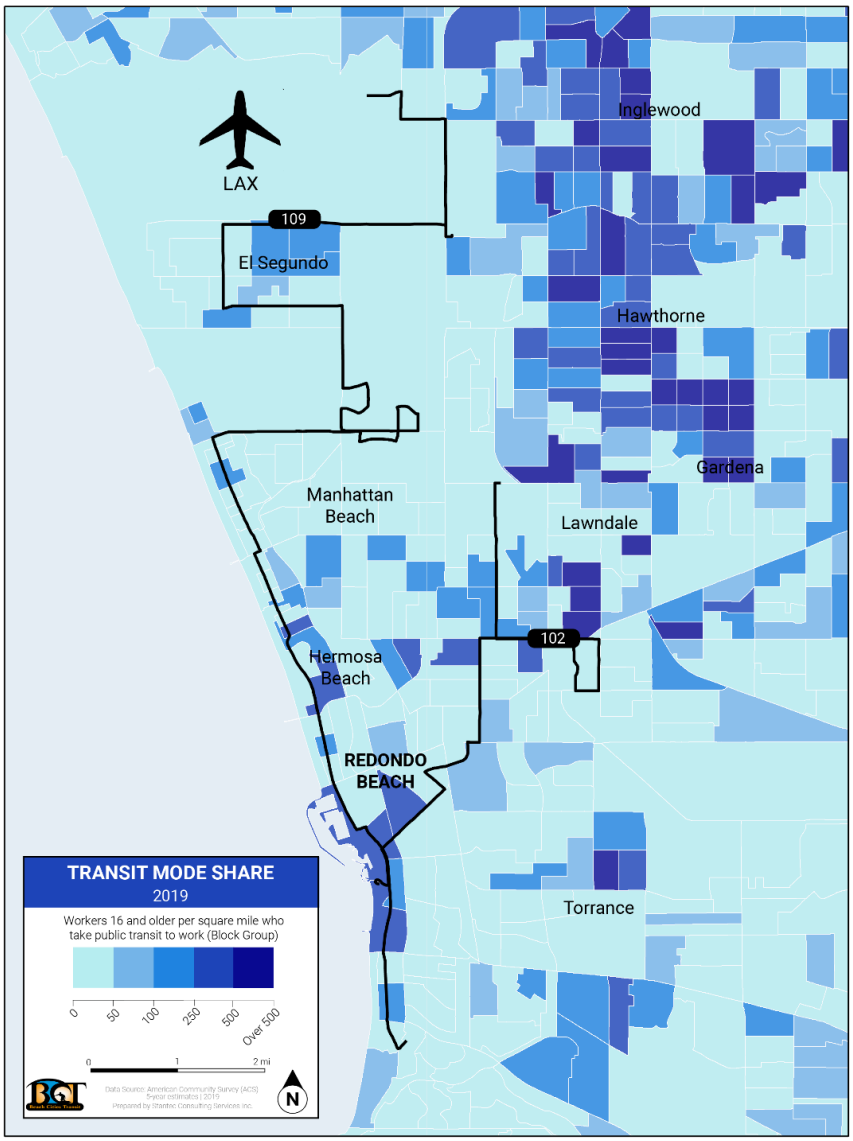


[22] Data source: 2019 ACS 5-year estimates

3.2.6 Transit Mode Share

Transit mode share refers to the percentage of people who commute to work using public transit. While the percentage of workers who take transit to work in Redondo Beach and the South Bay is lower than both the county and the state average and the transit mode share is higher in the communities of Inglewood, Hawthorne, Gardena, and Lawndale, there are pockets of relatively high transit mode share in both Redondo Beach and El Segundo. As a transit-aware demographic, workers who commute via transit (even with different agencies) present opportunities for BCT to take advantage of for non-work, weekend, or recreational trips.

Figure 3-16: Transit Mode Share (2019) [23]

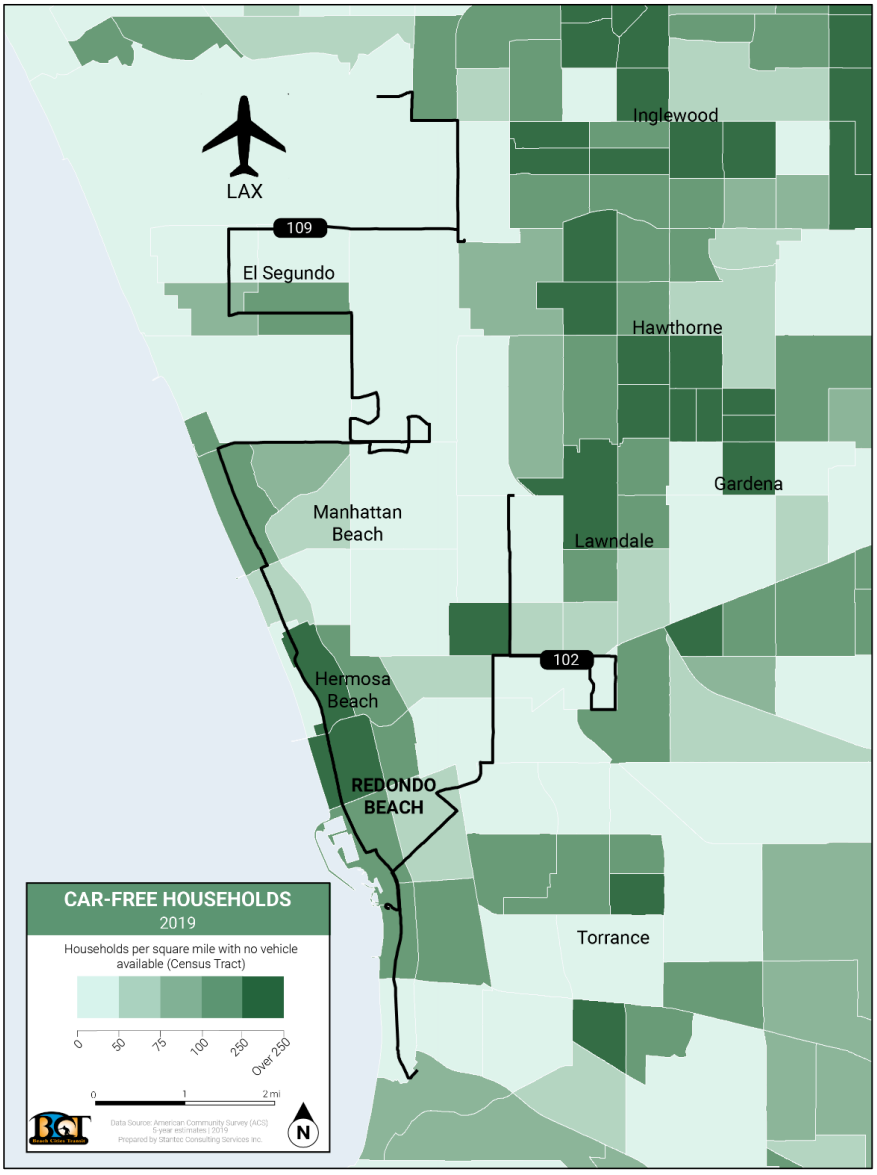


[23] Data source: 2019 ACS 5-year estimates

3.2.7 Car-Free Households

Car-free households are typically a key market segment for transit agencies, as targeting these populations with education and outreach can increase their transit use. Car-free households loosely reflect the patterns of transit mode share for commuting. Two census tracts in Redondo Beach/Hermosa Beach show car-free households make up at least 20% of all households; these areas hold potential for more transit riders as these households may not have another way to get around. Not identified within car-free households, young people represent an important demographic with limited car access and are considered in Section 3.2.9.

Figure 3-17: Car-free Households (2019) [24]



[24] Data source: 2019 ACS 5-year estimates

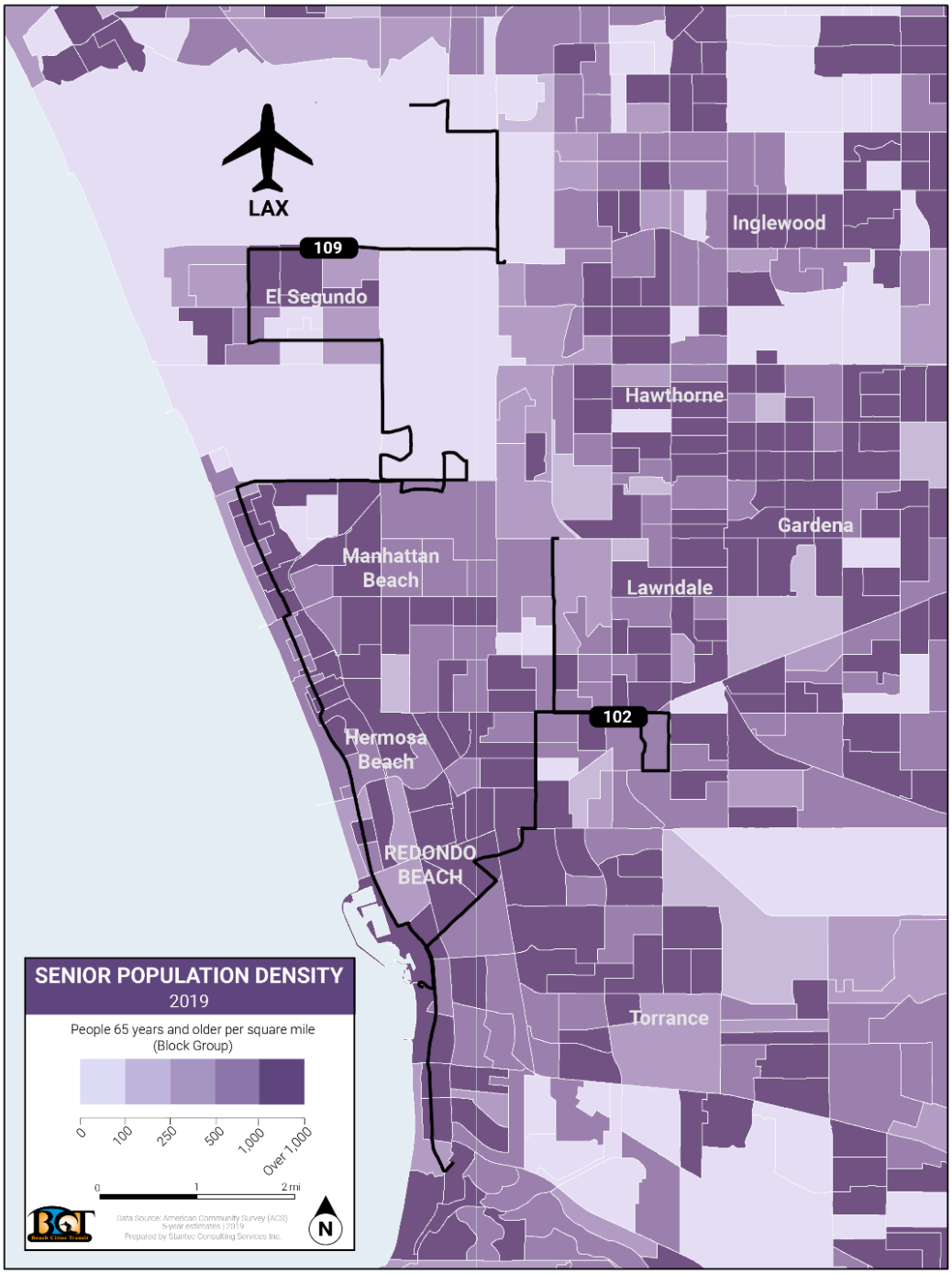
3.2.8 Senior Population

Senior populations may have limited mobility and may not be able to drive, but still need to get around and be able to access transportation resources and options. Seniors are an important population who ride transit services, whether through fixed-route, paratransit, or a combination of both. High concentrations of seniors exist throughout all of BCT's routes and service area, specifically within the South Bay Cities, as well as in Gardena and Lawndale.

Further, there are a number of designated senior housing complexes in Redondo Beach and Hermosa Beach that are too far away from BCT fixed route service to likely be accessible to seniors (such as Heritage Pointe and Cresta Mobile Park in Redondo Beach and Marineland Mobile Home Park and Sunrise of Hermosa Beach in Hermosa Beach).

As the population continues to age, it will be important to continue to understand where senior populations are most concentrated, and where these are in relation to BCT services. Surveying of WAVE users (primarily residents 62 and older) showed that accessing medical and healthcare services was a primary use for dial-a-ride service. Additionally, grocery shopping or other shopping errands and visiting family or friends were reasons this population uses demand response transit. The WAVE will continue to be a vital program for senior housing complexes located further away from fixed route services, as well as for seniors who are unable to use the fixed route system.

Figure 3-18: Senior Population Density (2019) [25]



[25] Data source: 2019 ACS 5-year estimates

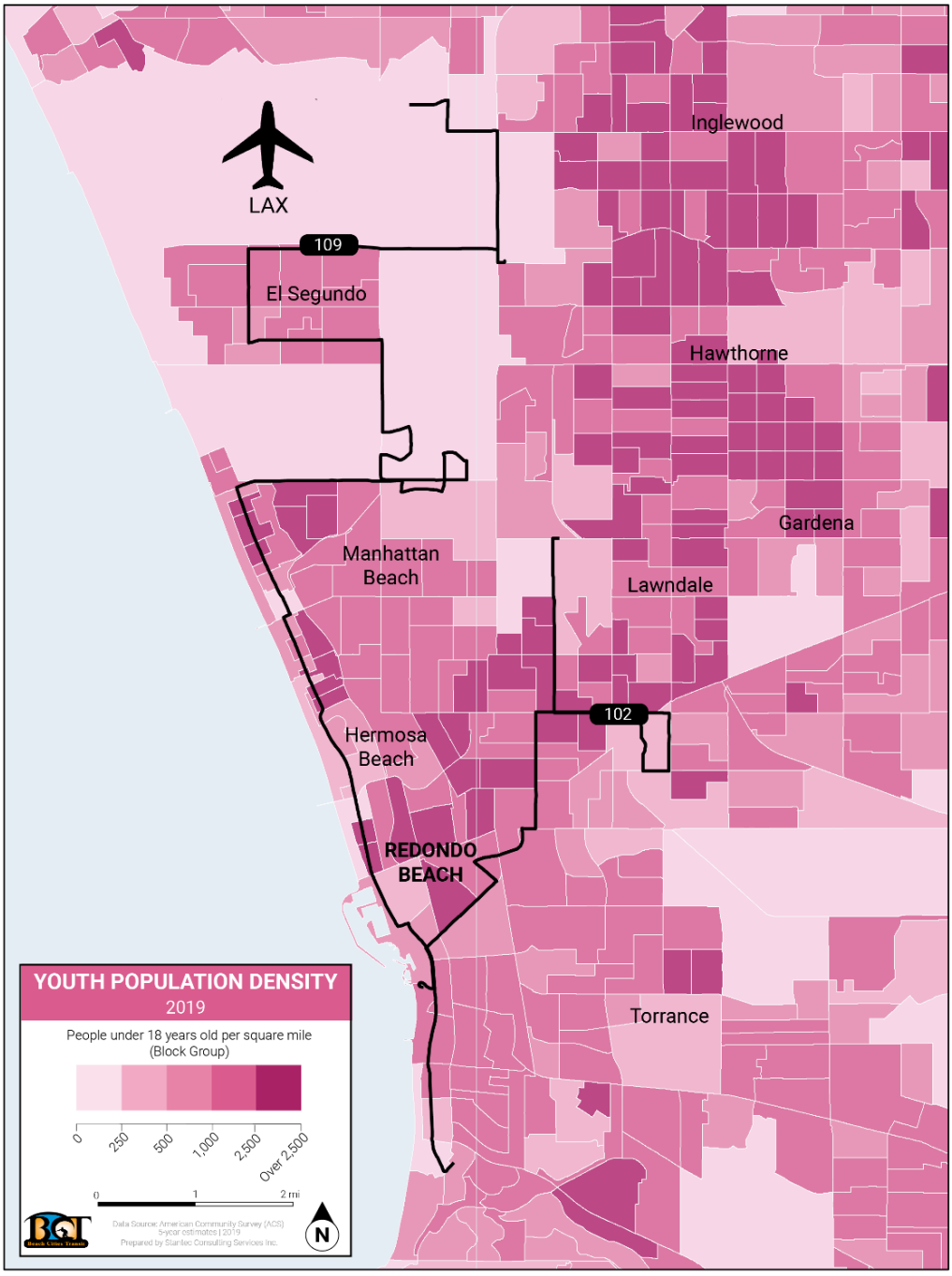
3.2.9 Youth Population

The youth population is another important population to serve, as BCT knows from experience with Line 102 and supplemental school trippers; a large portion of BCT's ridership are high school students traveling to and from school. When youths take transit from a young age, it is an opportunity to create lifelong transit riders through a positive experience riding transit. There is a higher density of youths in Redondo Beach than in the other South Bay Cities, as well as a high density throughout Inglewood, Hawthorne, and Gardena.

The high proportion of youths in Redondo Beach contributes to high youth ridership on the Line 102 school trippers. As explained in greater detail in Section 3.3.2.2, when school is in session, student passes can make up over 45% of Line 102 trips, and more than 10% of trips during the summer months when school is out of session. High youth/student ridership on Line 102 makes sense beyond the provision of school trippers, as Line 102 serves North Redondo Beach, a neighborhood with the highest density of youths in the city. Additionally, Line 102 is the only transit directly serving Redondo Beach schools as Metro 232 only operates along PCH.

The factors described above, and the anecdotal evidence young people are pushing off car ownership and driving less generally, indicate this population is a priority for transit ridership. Considering students use BCT now, this could translate into the perception of transit as a viable means of daily transportation. The high cost of car ownership paired with high-quality experiences on BCT could encourage young people to continue using transit (regardless of the transit agency) as they progress into driving age.

Figure 3-19: Youth Population Density (2019) [26]



[26] Data source: 2019 ACS 5-year estimates

3.2.10 CalEnviroScreen Disadvantaged Communities

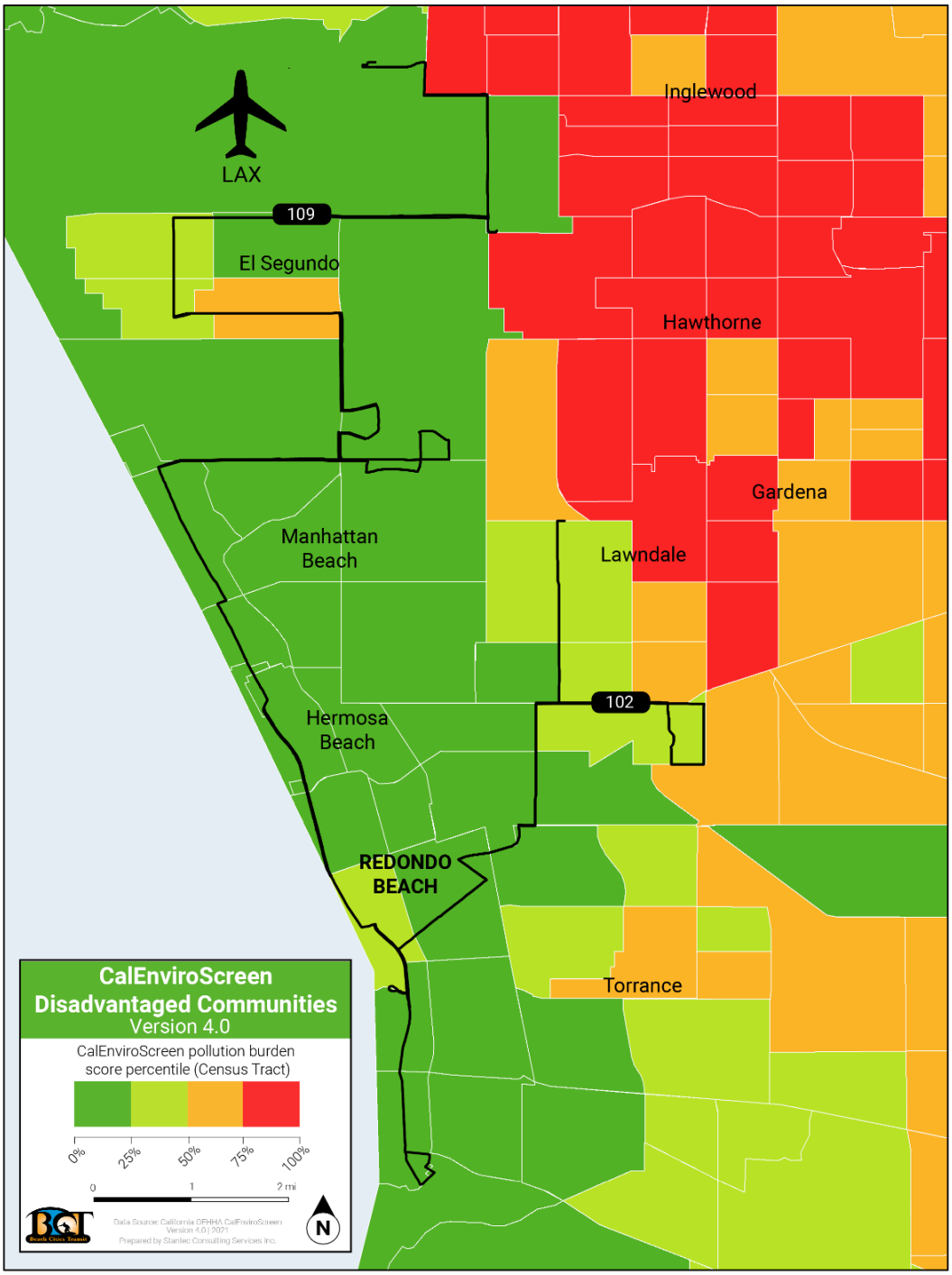
CalEnviroScreen is a mapping tool that is developed by the Office of Environmental Health Hazard Assessment (OEHHA) at the request of the California Environmental Protection Agency (CalEPA) to identify California's most pollution-burdened and vulnerable communities based on geographic, socioeconomic, public health, and environmental hazard criteria.

The identification of disadvantaged communities is important as providing more sustainable transportation options to these areas can help improve the community's public health and lessen the pollution burden, but the identification is also required in the development of the ZEB Plan, based on the CARB ICT regulation (discussed in greater detail in Section 5.1). The ICT requires the identification of disadvantaged communities and if any exist in the service area, the agency should strive to prioritize ZEB deployment in these areas. This analysis focuses on identifying route alignments that run through or adjacent to CalEnviroScreen-identified disadvantaged communities to prioritize ZEB deployment to lessen the pollution burden in these areas.

CalEnviroScreen evaluates the burden of pollution from multiple sources in communities while accounting for potential vulnerability to the adverse effects of pollution to identify disadvantaged communities from a wide variety of factors to comprehensively assess the overall health of communities, down to the census tract level. Specifically, CalEnviroScreen identifies disadvantaged communities as census tracts that scored in the top 25% based on the factors used by CalEnviroScreen to assess pollution burden and vulnerability.

The identification of disadvantaged communities is important as providing more sustainable transportation options to these areas can help improve the community's public health and lessen the pollution burden, but the identification is also required by the CARB ICT regulation (discussed in greater detail in Section 5.1). The ICT requires the identification of disadvantaged communities and if any exist in the service area, the agency should strive to prioritize ZEB deployment in these areas. Figure 3-20 shows that there is a very low pollution burden in Redondo Beach and the South Bay; however, Line 102 runs adjacent to two disadvantaged communities in the Lawndale and Torrance areas. Based on this information, BCT should strive to deploy ZEBs first on Line 102 to satisfy the ICT mandate.

Figure 3-20: CalEnviroScreen Disadvantaged Communities (2021) [27]



[27] Data source: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

3.2.11 Street Design and Walkability

The walkability of an area can have a direct impact on a resident's choice to use (or not to use) transit. The street design and walkability of a neighborhood can dictate the ease of access to the bus stop by various different modes, such as walking, biking, or use of a mobility device. An area that is both dense and walkable can host a number of destinations and land uses in close proximity, making these areas good candidates for successful transit service. BCT serves a diverse service area with varying levels of walkability and different street designs (Figure 3-21).

Figure 3-21: Different Street Designs in BCT's service area [28]



Manhattan Beach; dense and walkable, land uses in close proximity.



El Segundo; dense with low walkability, land uses are separated.

Figure 3-21 shows examples of different street designs and different levels of walkability in BCT's service area. The picture on the left shows an area of Manhattan Beach that is both dense and walkable. The area also hosts a number of different uses, including residential and commercial/retail uses. On the other hand, the image on the right shows a neighborhood in El Segundo. While the houses are close together, they are predominately single-family detached houses and the insular nature of the street network, highlighted by the presence of cul-de-sacs that reduce neighborhood connectivity, making it inconvenient to reach the main streets where transit is likely to run. Land uses are also separate, with commercial uses concentrated outside of the residential neighborhood. Even within the areas of the BCT service area that promote walking and active transportation by having a mix of land uses, issues persist such as narrow streets and sidewalks that impact BCT's ability to provide passenger amenities at bus stops. Narrow and substandard sidewalks provide insufficient space to provide amenities and a pleasant waiting environment at bus stops. This is especially the case in the areas of Redondo Beach were Line 102 provides services and the areas of El Segundo, Hermosa Beach, and Manhattan Beach that Line 109 runs through.

Narrow rights-of-way also impact BCT operations; on-street parking and busy, narrow streets sometimes create difficulties for BCT buses to fully access bus stops, as the bus cannot always access the curb due to parked cars or other obstacles. Narrow streets and sharp turns also impact bus size: BCT cannot

[28] Data source: Google Maps

operate larger buses through these areas to accommodate the tight turning radii required by the street network, limiting the street choices for a bus route alignment.

According to SCAG, Class I, II, and III bikeways currently exist in much of BCT's service area. Bike lanes help to facilitate the use of active transportation, and biking can also help to bolster transit use, as biking can be used for the first and last mile of trips taken predominantly with transit. All BCT buses are equipped with bike racks. Where bike lanes are not present, bikes can sometimes share the right-of-way with vehicle traffic, including buses, which can potentially cause issues with bus speeds and safety conflicts.

While the street, sidewalk, and active transportation infrastructure of the BCT service area can pose challenges for BCT bus operations due to narrow sidewalks and narrow, busy streets, continuing to encourage active transportation use is important to complement transit use. This would include advocating for more protected bike lanes to enable both bikes and buses to operate safely.

3.2.12 Demographic Projections

After reviewing existing market conditions, we used SCAG projections to review future conditions and better understand how the BCT service area will change in terms of population and job growth over the next 25 years. As this plan is intended to develop both short- and long-range service plans for BCT, it is important to understand how the demographic makeup will change so that BCT is prepared to serve the area as effectively as possible in the future. For example, new areas of high population or job density that are currently not being served by BCT may become important to consider serving in the future, or areas that will see population or job growth that are already being served may warrant more frequent service if they become sufficiently dense.

As part of each RTP/SCS planning period, SCAG develops regional growth forecasts which represent the most likely growth scenario for the region in the future and projects major growth indicators for population, households, and employment [29]. The current regional forecasting is projected from 2020 to 2045 and is documented at the transportation analysis zone level. The following subsections outline the population and employment projections for the South Bay region through 2045.

[29] https://scag.ca.gov/regional-forecasting

3.2.12.1 *Population Projections*

Figure 3-22: Projected Population Change, 2020-2045 [30]

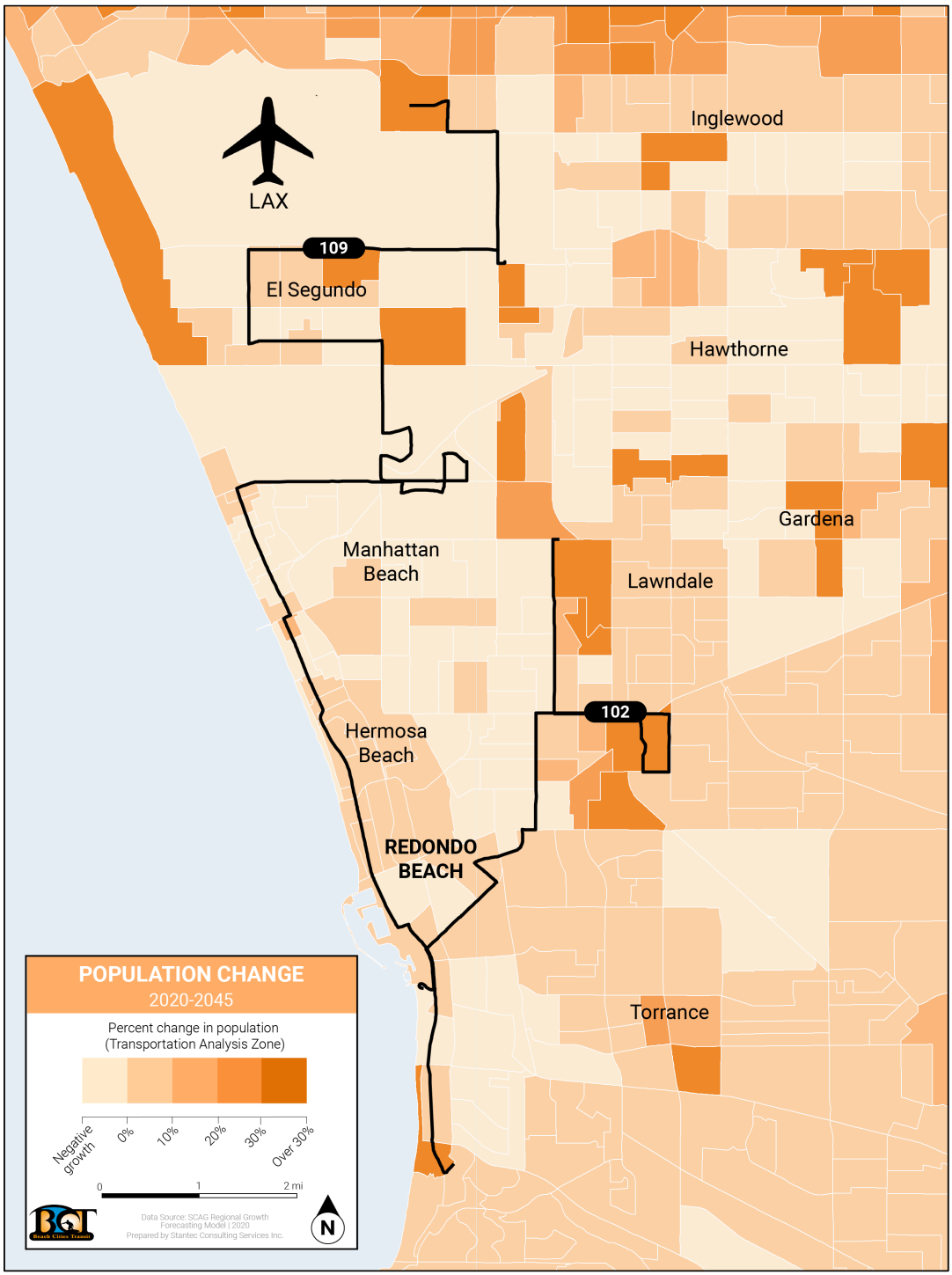


Figure 3-22 shows that:

- Over the next 25 years, much of the South Bay will either remain steady in terms of population or see a small amount of growth (0-10%).
- The parts of the South Bay that will experience the most population growth include south Redondo Beach near Palos Verdes and Riviera Village, Torrance, the area around the South Bay Galleria, El Segundo, and pockets of Lawndale, Gardena, and Inglewood.

[30] Data source: https://scag.ca.gov/regional-forecasting

3.2.12.2 *Employment Projections*

Figure 3-23: Projected Employment Change, 2020-2045 [31]

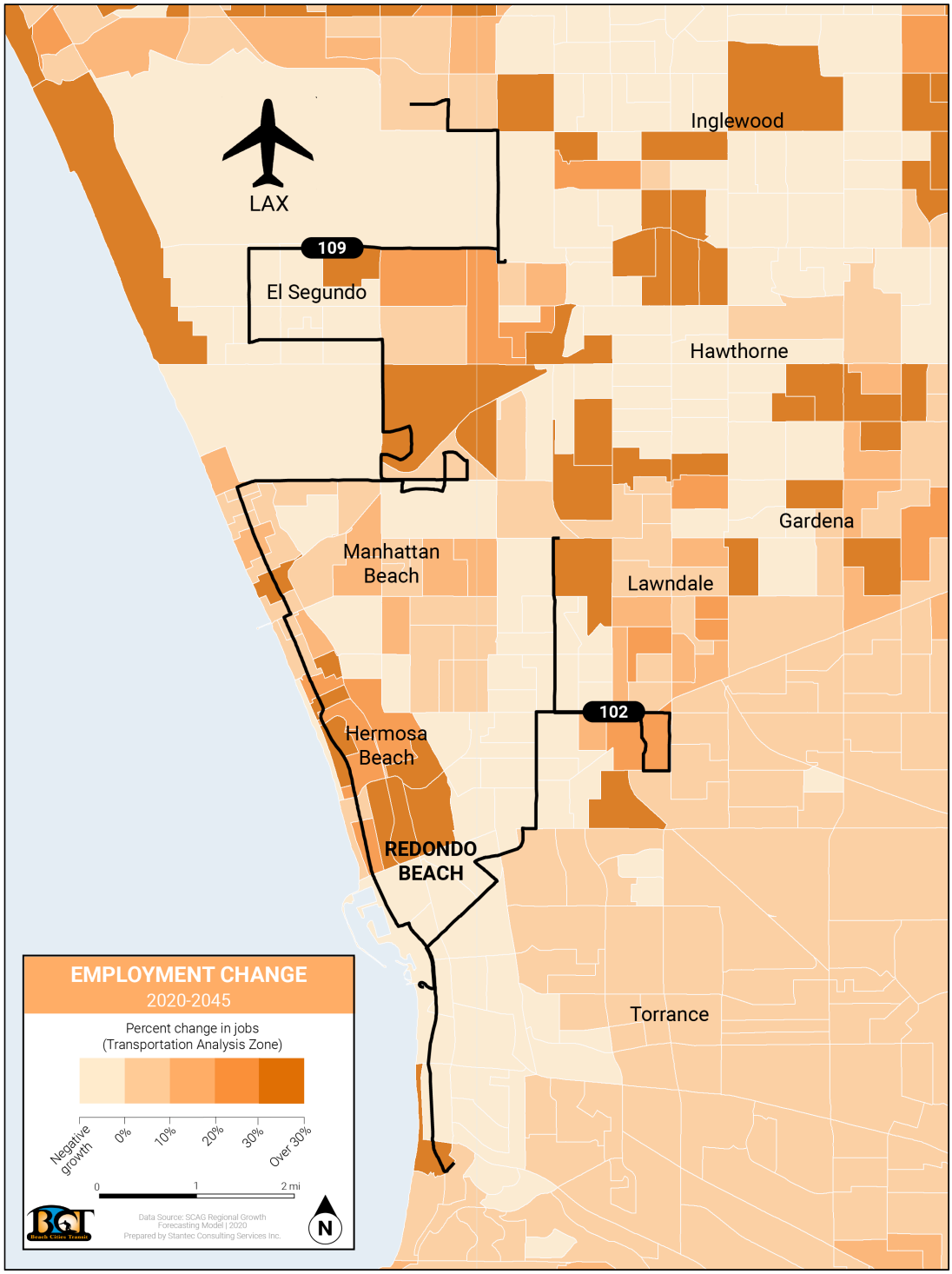


Figure 3-23 shows the following:

- Overall, more employment growth is expected in the BCT service area and South Bay Cities than population growth.
- Areas of significant employment growth tend to mirror areas of population growth, specifically the areas around the South Bay Galleria and the northern terminus of Line 102 – these areas with a combination of job and population density may have a higher transit propensity in the future and be important markets to serve. Portions of El Segundo that already have a high job density where Line 109 travels through are also expected to see significant job growth.
- Within the South Bay cities, Hermosa Beach and El Segundo are expected to see significant job growth, with some job growth seen in Manhattan Beach and Redondo Beach as well.

3.2.13 Summary and Implications

The South Bay and Beach Cities are a diverse and fairly dense area of Los Angeles County. The large proportions of youth, seniors, and car-free households indicate a high potential propensity for transit use. However, the high median incomes and high car ownership rates, coupled with low percentages of workers commuting by transit show that while land use and demographic conditions could favor greater transit use, most residents rely heavily on private vehicle use for most journeys; simply put, parking is free or low-cost and with abundant public parking facilities, most households own two or more cars, making driving easy and preferable to waiting for infrequent buses.

There could be an opportunity for BCT to capture more local trips due to the high proportion of car-free households in parts of Redondo Beach. Understanding why people do not currently take transit, and what could convince them to take transit, will be important in creating a more attractive service for the community.

High job density and multiple large employment centers show potential for more commute trips completed by transit, but too many workers may be commuting from outside the BCT service area for BCT to capture these trips. Strengthening connections to regional transit at rail stations and RBTC, and connecting to new regional transit lines as rail stations are constructed in the coming decades could be one opportunity to capture more of these trips. Improving outreach to large employment centers to develop new riders can also help to capture additional commuting trips.

The South Bay is projected to see modest population growth over the next 25 years with more significant growth in employment and jobs, specifically in El Segundo and Hermosa Beach. BCT's importance as a feeder service to regional transit could increase as it serves the growing commuter market. While projected population growth is expected to be less significant, pockets of Redondo Beach are expected to see population growth, specifically in South Redondo around Riviera Village and in North Redondo around the South Bay Galleria.

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3.3 Transit Service Analysis

3.3.1 Service Overview

BCT currently operates two fixed routes (lines 102 and 109) and DAR WAVE service to seniors (62+) and those with disabilities living in Redondo Beach and Hermosa Beach to anywhere within the two cities or a qualifying satellite location.

BCT services have changed over time since operation began in 2005, with temporary service changes between 2020-2021 due to the COVID-19 pandemic. Table 3-3 summarizes major service changes BCT has seen over time.

Table 3-3: BCT Service Changes, 2005-2021 [32]

Date	Service Change
2005	BCT service starts with three lines: 102, 104, and 109.
FY2012	Line 104 was cancelled and lines 102 and 109 were revised based on recommendations from the COA completed in 2011 (see Section 3.1.1).
March 15, 2020	Line 102 School Trippers suspended in accordance with school closures.
March 16, 2020	Temporary suspension of fare collection and BCT bus pass sales. Fare collection was reinstated in October 2022.
March 23, 2020 – November 15, 2020	Temporary service changes in effect: WAVE: operated holiday schedule on weekdays and weekends, from 8 am-5 pm with last trip taken at 4 pm Line 102: • Weekday: operated modified regular weekday schedule (suspension of last run leaving Redondo Beach Pier and last run leaving Redondo Beach C Line station) • Saturday: operated modified Saturday schedule (suspension of last two runs leaving Redondo Beach Pier and last two runs leaving Redondo Beach C Line station) • Sunday: regular Sunday schedule Line 109: • Weekday: operated modified Saturday/Sunday schedule (suspension of last two runs leaving Riviera Village and last run leaving LAX Bus Center)

[32] Data source: City of Redondo Beach

Date	Service Change
	• Saturday and Sunday: operated modified Saturday and Sunday schedule (suspension of last two runs leaving Riviera Village and last run leaving LAX Bus Center)
November 16, 2020	Reinstatement of Line 109 regular weekday service (with suspension of last two NB trips and last SB trip); weekend service operating with suspension of last two NB trips and last SB trip).
March 29, 2021	Reinstatement of School Trippers due to students returning to classroom.
July 5, 2021	Reinstatement of full weekday and weekend service schedule for lines 102 and 109, and WAVE.

3.3.1.1 *Regional Transit Landscape*

BCT is one player in the larger regional landscape of transit providers who provide service to the South Bay. While BCT provides local service to specific markets in Redondo Beach and the South Bay, it also connects with other services, for instance, at the Metro C Line Redondo Beach and other stations. Other services, such as LADOT Commuter Express Route 438, also provide service within Redondo Beach with some route alignment overlap with Line 109, but the two routes serve different purposes (with the Commuter Express targeting commuters traveling to large employment centers in downtown Los Angeles targeting longer-distance commute trips, and Line 109 serves more local trips. Commuter Express Route 438 also only operates during weekdays with directional service geared toward specific commute trips) and thus is not considered overlap or service duplication. In fact, Commuter Express Route 438 improves regional connectivity as BCT line 102 riders can transfer to the 438 short line that starts from the Redondo Beach Rail Station at Marine Avenue.

In addition to BCT, three other municipal operators provide local service within the South Bay. To gain a full understanding of where BCT sits within the larger regional transit landscape, partner transit providers and their services in the South Bay are summarized in Table 3-4 and shown in Figure 3-24.

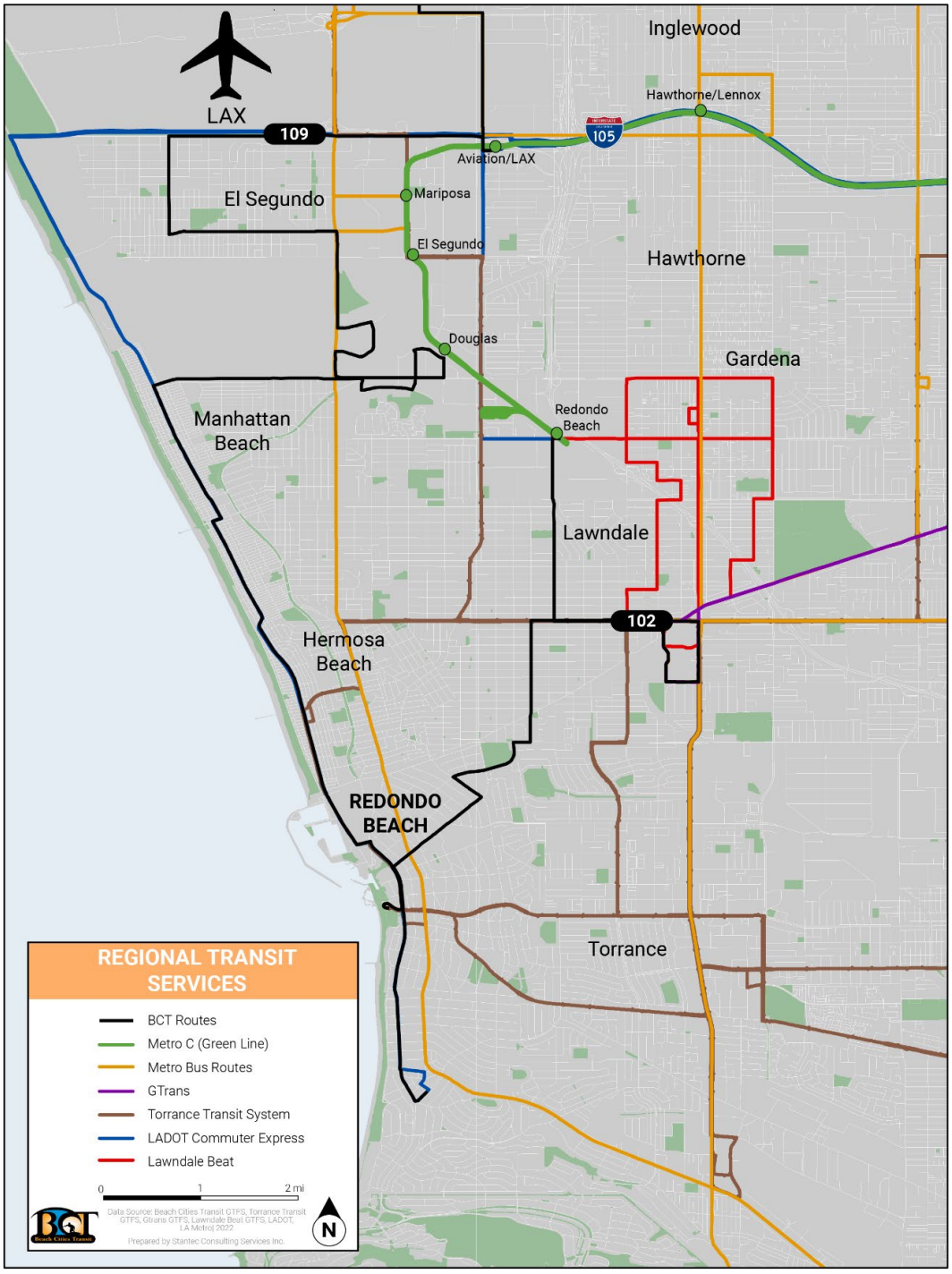
Table 3-4: Other Transit Providers in South Bay

Other providers operating in the South Bay	Agency description	Services provided in the BCT service area
LA Metro	The Los Angeles County Metropolitan Transportation Authority (branded as Metro) is the largest countywide transit operator, providing heavy rail, light rail, bus rapid transit (BRT), and fixed-route bus service throughout the county (in addition to other programs such as Metro Bikeshare and Metro Micro, a microtransit program as a rail station feeder.	Metro provides multiple services in the BCT service area: • Metro C Line runs between Redondo Beach and Norwalk in the median of the 105 freeway. Metro is currently in the process of extending the C Line to Torrance. The rail extension project is currently in the environmental review process. • The main Metro bus routes operating in the service area include lines 40, 210, 211, 232, and 344
GTrans	Municipal transit agency based in Gardena, providing service around the South Bay via six fixed routes as well as DAR service for elderly and disabled residents of Gardena, Hawthorne, Alondra Park, and Del Aire.	Line 3 provides service seven days a week between the RBTC (including the South Bay Galleria) and Compton via Redondo Beach Blvd and Alondra Blvd Line 3 provides additional service on school days to Bishop Montgomery High School in Torrance.
Torrance Transit System (TTS)	TTS is a municipal transit agency based in Torrance, providing service throughout the South Bay. Torrance provides a dial-a-taxi program for senior and disabled residents.	TTS operates the following lines in the BCT service area: • Line 2 between the Del Amo Fashion Center and Harbor Freeway Station (connecting with BCT at RBTC and South Bay Galleria)

Other providers operating in the South Bay	Agency description	Services provided in the BCT service area
		• Line 3 between Redondo Beach Pier and Long Beach • Line 7 between Redondo Beach Pier and Carson • Line 8 between Torrance and the LAX Transit Center (connecting with BCT at LAX Transit Center and South Bay Galleria) • Line 13 between Redondo Beach Pier and Artesia Station (also connecting with BCT at South Bay Galleria)
LADOT	LADOT provides two types of bus transit: DASH, for local neighborhood trips and to connect to other regional transit services, and Commuter Express, geared towards commuters traveling longer distances throughout LA and connecting different areas to major employment centers.	Commuter Express Route 438 with weekday AM service from Redondo Beach to Downtown Los Angeles and PM service from Downtown Los Angeles to Redondo Beach. The 438 has a shortline route from the Metro C Line Redondo Beach station. The route also serves Hermosa Beach, Manhattan Beach, and El Segundo.
Lawndale Beat	The Lawndale Beat is a municipal transit operator providing service via one fixed route to major destinations in and around Lawndale.	Lawndale Beat transportation services were reinstated in May 2023. Both residential and express fixed routes provide service in the South Bay, connecting with BCT at the RBTC and South Bay Galleria.
El Segundo	The City of El Segundo provides a variety of special transportation services including lunchtime shuttles, and a beach shuttle. El Segundo's shuttle services are currently suspended. Their Senior & Disabled Dial-A-Ride services are subsidized Lyft rides to qualifying city residents,	El Segundo provides lunchtime shuttles and beach shuttles to city residents and visitors. The lunchtime shuttle is a free service that transports riders from the business side of El Segundo to downtown El Segundo for lunch. The shuttle runs on a continuous loop to 17 corporate and downtown El Segundo locations, Monday-Friday from 11:45 am-2 pm. The beach shuttle operates during ESUSD spring and summer breaks, Monday-Saturday from 11 am-4:30 pm. The shuttle runs on a continuous loop through residential El Segundo and El Porto Beach. Both shuttle services are currently suspended.
LA Access Services	Access Services is the Consolidated Transportation Services Agency (CTSA) for Los Angeles County that administers the countywide Coordination Paratransit	Redondo Beach is located in Access' Southern Region and is an Access member agency. Access fares are one-way and based on the distance traveled, with trips up to 19.9 miles costing $2.75 and

Other providers operating in the South Bay	Agency description	Services provided in the BCT service area
	Plan on behalf of the county's 46 public fixed route operators and provides complementary ADA paratransit services on behalf of the public fixed route operators to certain individuals with disabilities and their Care Attendants.	trips 20 miles or more costing $3.50. These fares are more expensive than WAVE fares but also allow for longer-distance travel outside of the WAVE service area. Access clients ride free on BCT with their Access card.

Figure 3-24: Regional Transit Services in the BCT Service Area [33]



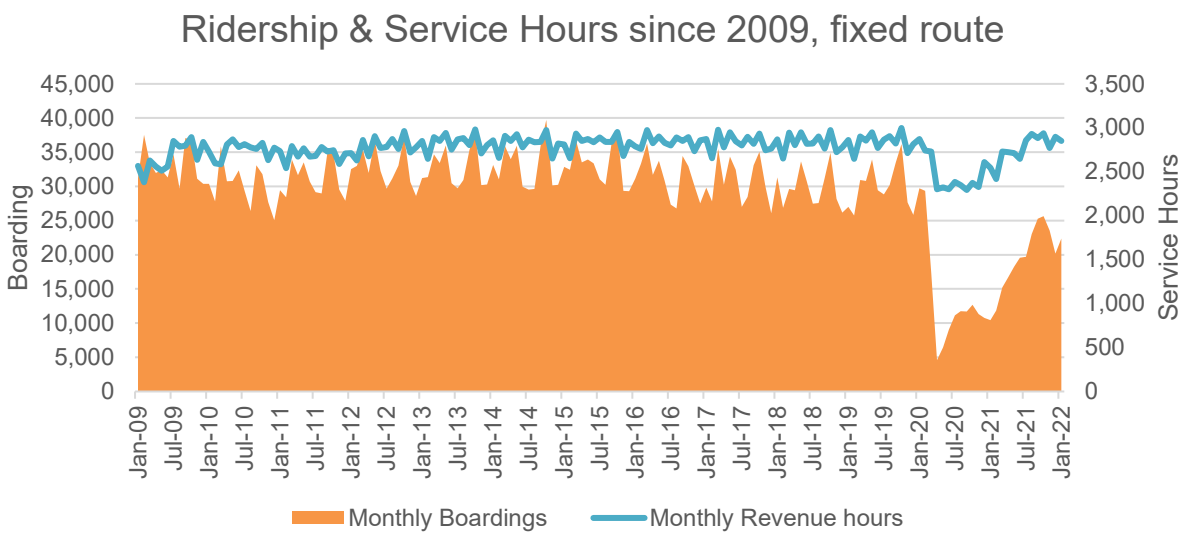
[33] Data sources: https://developer.metro.net/gis-data/, GTFS

3.3.2 Fixed Route Review

This section will explore BCT's existing fixed-route service and identify areas that are performing well as well as strengths and weaknesses within the system [34].

BCT carried approximately 373,000 unlinked passenger trips in 2019 (as reported to NTD) across its fixed-route system comprised of Lines 102 and 109 with school tripper services on Line 102. Monthly boardings across BCT fixed-route services show seasonal trends with ridership highs in the fall and lows in the summer, strongly driven by Line 102 student ridership during the school year (Figure 3-25).

Figure 3-25: Historical Ridership and Service Hours on Fixed Route Services [35]



Ridership peaked in 2015 at 415,259 annual unlinked passenger boardings but began to slump in 2017 by a rate of 5% year-over-year. The biggest pre-COVID drop occurred between FY16-17 and FY17-18 when ridership dropped on average by 3% year-over-year. This aligns with national trends seen in declining transit ridership that coincides with the rise of ride-hailing services like Lyft and Uber. At the peak of ridership in 2015, fixed-route ridership accounted for 96% of all ridership on BCT services. Similar to other agencies, between February and April of 2020, BCT saw an 84% decrease in total ridership. Despite continued rebounding in recovery, ridership remains roughly 30% below pre-COVID (2019) levels.

One new development to note is real-time arrival information. The City of Redondo Beach launched BCT's real-time information bus arrival time tracking system in October 2020. This real-time information is available on the BCT Real-Time webpage, Google Maps, and other third-party mobility apps (such as the Transit and Moovit apps). Each bus stop has a corresponding ID number, and riders can check live arrivals through native smartphone apps, via text messaging, or via a phone call. This enables riders to

[34] Unless otherwise indicated, data were collected and analyzed for two time periods. First, we collected pre-pandemic data from August 2019 through February 2020 to analyze pre-pandemic conditions. Second, we collected the most recent data available from August 2021 through February 2022 to analyze the trends during the recovery phase of the pandemic. We chose these time periods to not only compare between pre-pandemic and recent trends, but also to explore seasonal performance given the strong ridership dependence on students riding transit during the school year.
[35] Data source: NTD

reduce their wait times at bus stops and improves trip planning and the overall passenger experience; it also reduces the need to develop and install printed timetables at bus stops.

Table 3-5 summarizes key performance measures including ridership, revenue hours and miles, and fares collected, including productivity measures of ridership per revenue hour, farebox recovery per passenger, and on-time performance (OTP).

- Before the pandemic, BCT ridership was split between Line 102 (51%) and Line 109 (49%) with almost 20% more revenue hours operating on Line 109.
- Despite similar overall ridership on both lines, Line 102 has greater productivity (carries more riders per revenue hour during the school year due to high school student ridership) than Line 109.
- The farebox recovery ratio of Line 109 is 8% higher than Line 102.
- Line 102 sees better OTP than Line 109 as it travels through residential areas with fewer traffic or construction conditions, and is a shorter route. Line 109 is affected by traffic congestion traveling along the heavily trafficked streets of Hermosa and Manhattan Beach. Ongoing construction delays affect Line 109 OTP due to the multi-year construction of the LAX People Mover, Metro K Rail Line, and Airport Metro Connection projects.

Table 3-5: Summary Report for BCT, August 2019 – February 2020 [36]

	Total Passengers	Total Revenue Hours	Revenue Miles	Ridership/ Rev Hour	Collected Fares	Farebox Recovery per Passenger	On-Time Percentage
102	106,769	8,113	82,896	13.16	$44,299	$0.41	96.67%
109	105,617	11,750	142,553	8.99	$52,650	$0.50	86.58%
Total	212,386	19,863	225,449	10.69	$96,949	$0.46	91.63%

Figure 3-26 provides a look at the average number of boardings on Lines 102 and 109 between August 2019 and February 2020, just prior to the pandemic.

- The distinct seasonality includes ridership highs in October 2019 of 1,423 average weekday passengers to December 2019 lows of 1,034 average weekday passengers.
- Weekend ridership is somewhat more consistent year-round, with average Saturday ridership between 433-600 riders, and average Sunday ridership between 270-387 riders.

[36] Data source: City of Redondo Beach

Figure 3-26: Average Daily Boardings across BCT Fixed Route Services [37]

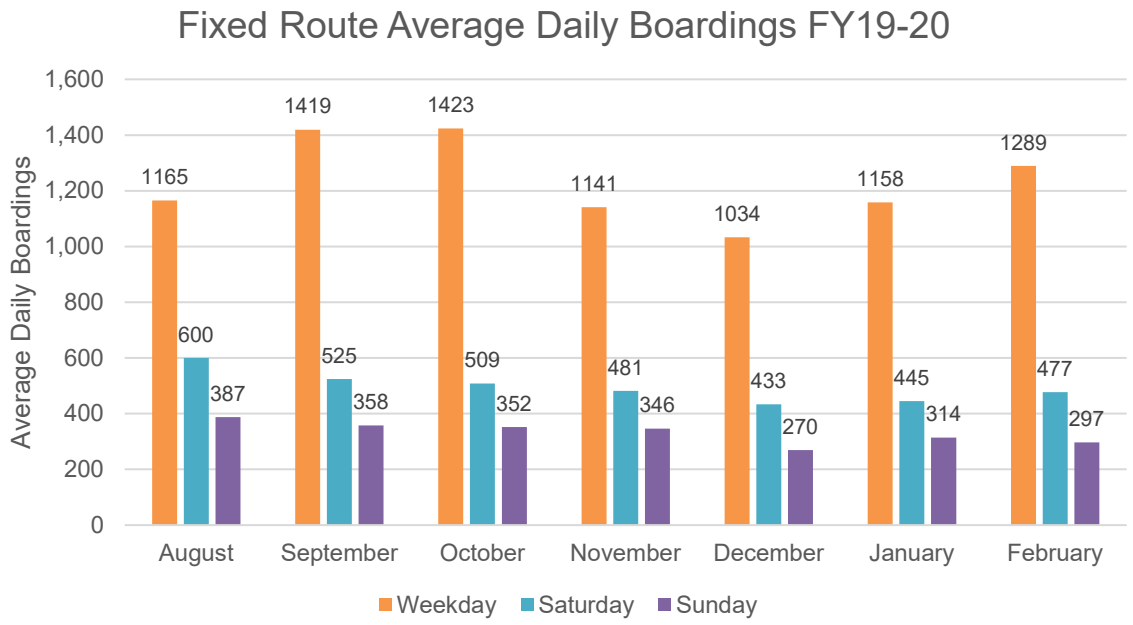
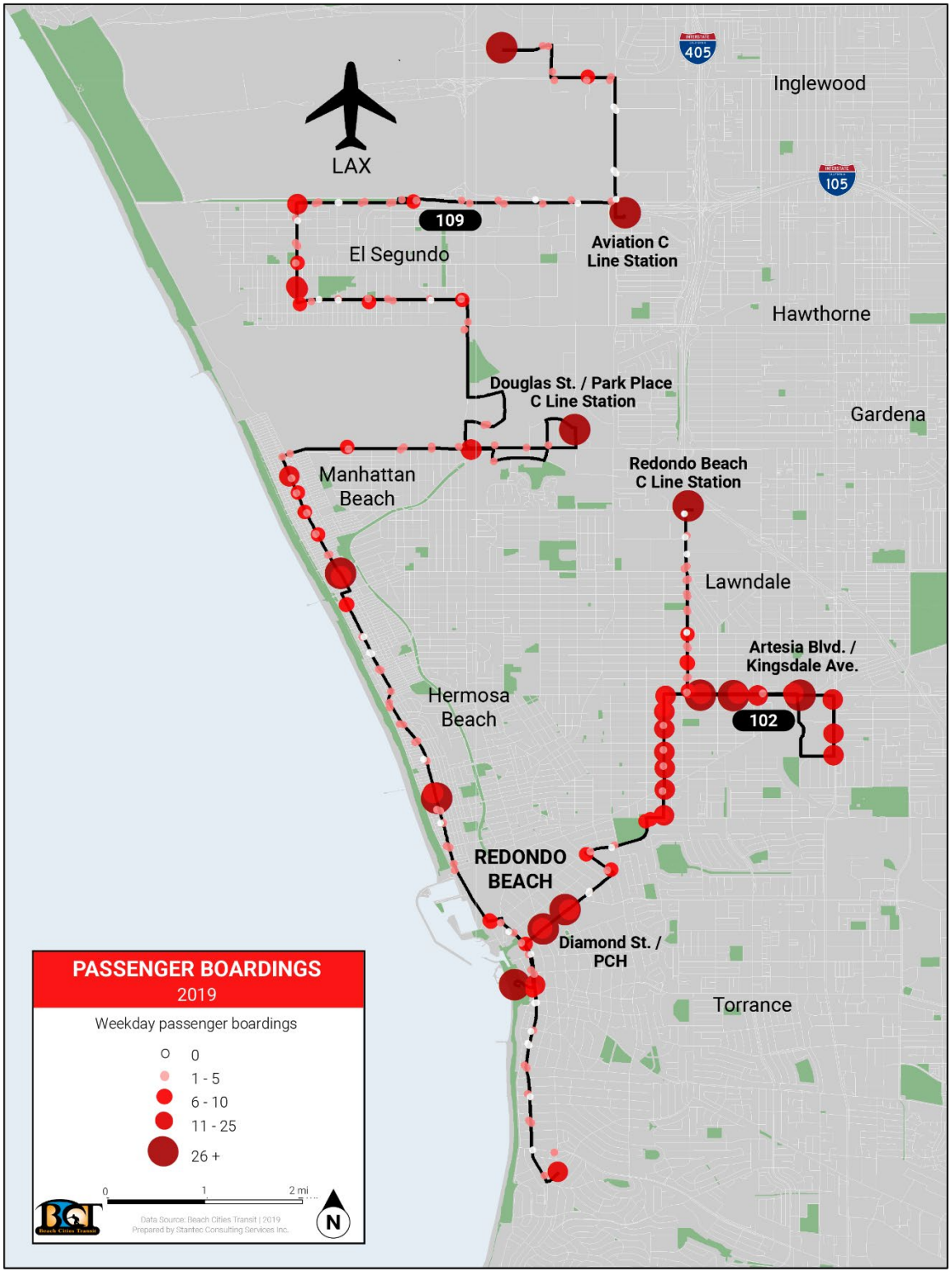


Figure 3-27 (below) shows stop-level weekday passenger activity. The data was manually collected by BCT from February-April 2019 with the map showing the sum of all boardings for all weekdays when data was collected during that period.

- Stops that saw 50 or more boardings during this time include the Aviation C Line Station, Redondo Beach C (Green) Line Station, Douglas St. / Park Place (Douglas C Line Station), Artesia Blvd / Kingsdale Ave at South Bay Galleria, and Diamond St. / PCH.
- Of the 208 stops in BCT's system, 87 (or 42%) saw zero passenger boardings during the collection period.
- Connections to C (Green) Line stations see high passenger boardings, indicating that many BCT riders use BCT to connect to the Metro Rail system, or may transfer to other transit services that also serve those rail stations.

[37] Data source: City of Redondo Beach

Figure 3-27: Stop-level Passenger Activity [38]

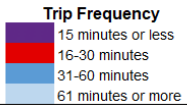


3.3.2.1 *Service Span and Frequency*

Figure 3-28 shows graphically the frequency and service span scheduled for weekdays, Saturdays, and Sundays for March 2023.

Figure 3-28: Service span and frequency, March 2023 [39]

WEEKDAY / Line	6:00 AM	6:30 AM	7:00 AM	7:30 AM	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:00 AM	10:30 AM	11:00 AM	11:30 AM	12:00 PM	12:30 PM	1:00 PM	1:30 PM	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM	5:00 PM	5:30 PM	6:00 PM	6:30 PM	7:00 PM	7:30 PM	8:00 PM	8:30 PM	9:00 PM	9:30 PM	10:00 PM
102 Monday	30	40	40	40	40	5	40	40	40	40	40	40	40	40	40	40	40	40	40	5	40	40	40	40	40	40	40	40					
102 Tues-Thurs	30	40	5	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	5	40	40	40	40	40	40	40	40					
102 Saturday					40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40					
102 Sunday							50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50							
109 Weekday	30	55	55	45	40	40	45	50	50	45	45	40	40	45	70	45	45	40	40	50	50	50	45	40	40	45	50	50	45	45	45	45	
109 Weekend	60	60	70	70	70	55	55	50	50	55	55	50	50	60	60	95	95	55	55	60	60	60	65	65	55	60	60	60	60	60	60	60	60



Line 102 operates more frequently than Line 109. On weekdays, Line 102 operates every 40 minutes from 6 am to 9 pm; however, on school days, school trippers are added to the schedule increasing Line 102 frequencies during morning and afternoon rush hours. As discussed further below, school trippers run later on Mondays due to schools starting later.

On Saturdays, Line 102 operates every 40 minutes for the majority of the day and Sunday headways are 50 minutes.

Line 109 operates between 6am and 10pm on weekdays. Beyond early weekday mornings when Line 109 operates every 30 minutes, Line 109 has headways between 40-70 minutes on weekdays.

On weekends, Line 109 operates generally with hourly headways between 6am and 10:15pm.

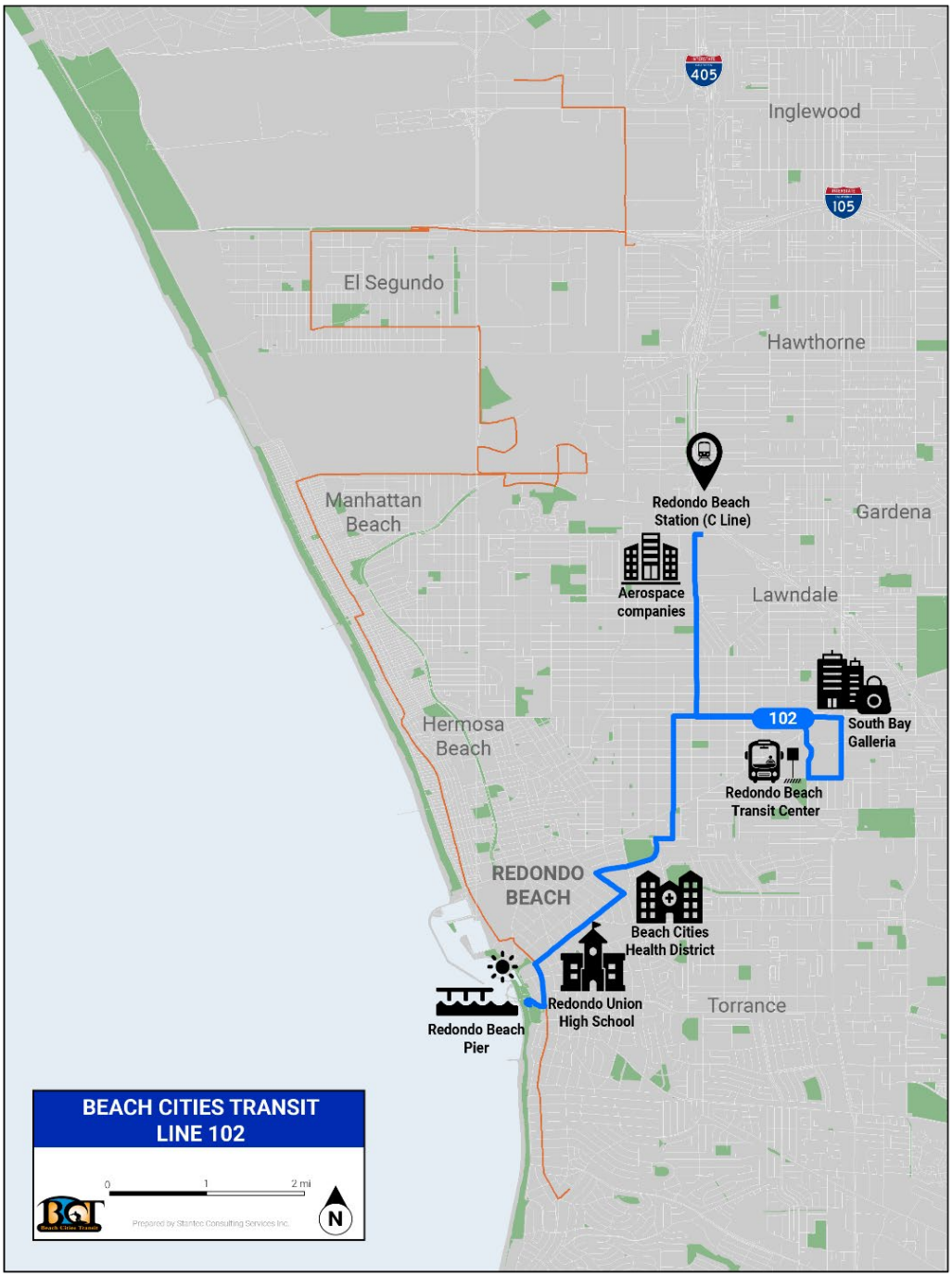
3.3.2.2 *Line 102*

Line 102 provides service from Redondo Beach Pier through the heart of South Redondo Beach and up into North Redondo Beach. Line 102 ends its run at the Redondo Beach C (Green) Line Station, the terminus of the Metro C Line. Major stops include Diamond Street/Redondo Union High School, particularly for school trippers on weekday afternoons and South Bay Galleria/Marketplace provides connections to Metro, Torrance Transit, and GTrans (Figure 3-29). However, the new RBTC opened in January 2023 and is now a major transfer point for all services. The additional running time for service to RBTC resulted in a headway of 40 minutes, rather than the previous 30-minute headways. The resultant implication is that to restore headways to 30 minutes, additional buses and revenue hours will need to be added to the route.

Line 102 seasonally operates three school trippers in the morning and afternoons to serve Redondo Union High School (RUHS) which accounts for a large portion of ridership on the system. New California State Law required schools to start later in the 2022-23 school year. RUHS starts at 9:25 am on Mondays and 8:30 am Tuesday-Friday, with class out at 3:30 pm instead of 3:00 pm. The impacts of the changes meant that BCT needed to adjust tripper times and have different tripper schedules for different bell times.

[38] Data source: City of Redondo Beach
[39] Data source: City of Redondo Beach

Figure 3-29: Line 102 with Major Trip Generators



The following subsections explore Line 102 in terms of performance, productivity, and reliability.

3.3.2.2.1 Performance and Productivity

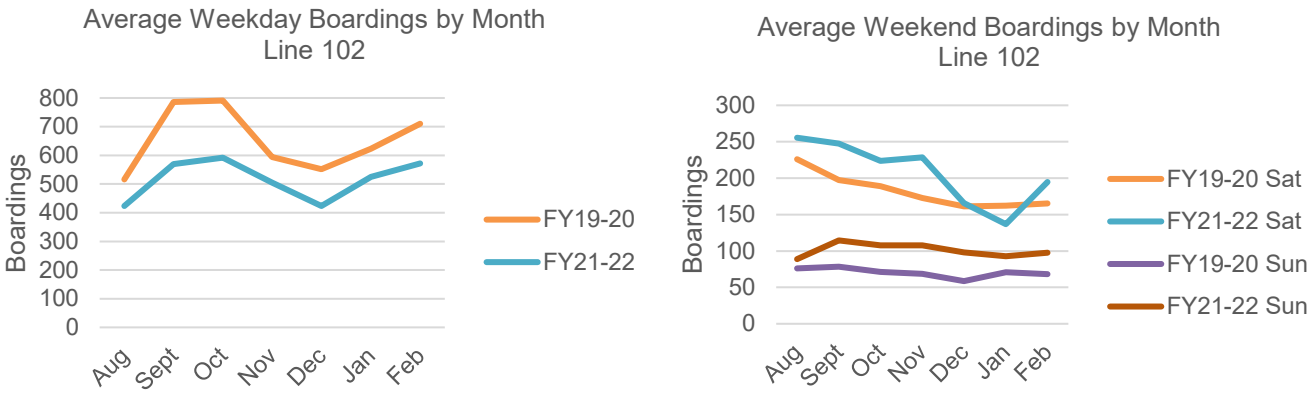
Heavily influenced by school activity, Line 102 weekday ridership ebbs and flows as school is in and out of session with peak ridership in October with 791 average weekday riders in FY19-20. On weekdays

during fall 2019 when school is in session, average ridership increases from 516 average weekday riders in August to the October high, then drops back down in December to 551 average weekday riders.

Weekend ridership is its strongest in the summer months providing 37% of all Line 102 boardings with an average of 226 Saturday riders and 76 Sunday riders in August of FY19-20.

Compared with pre-COVID ridership, ridership from August 2021 through February 2022 mirrored the seasonal trends, however, weekday ridership was on average ~25% less.

Figure 3-30: Daily average Boardings for Line 102 [40]



Weekend ridership does not clearly show the seasonal shifts from student riders, instead, there is a steady slump from the August 2021 weekend high of 256 Saturday riders. Interestingly, FY21-22 ridership has rebounded to outpace pre-pandemic weekend ridership with an average weekend fall (September – November) ridership of 233 Saturday riders and 110 Sunday riders.

Despite higher ridership in general during FY21-22, Saturday ridership appears to be very sensitive to conditions regarding COVID-19 within the community. During the surge of the Omicron variant in December and January of FY21-22, Saturday ridership dropped below that of the same time in FY19-20 to 137 Saturday riders in January 2022.

[40] Data source: City of Redondo Beach

Figure 3-31: Line 102 Productivity as Measured by Revenue Hours and Passenger Boardings [41]

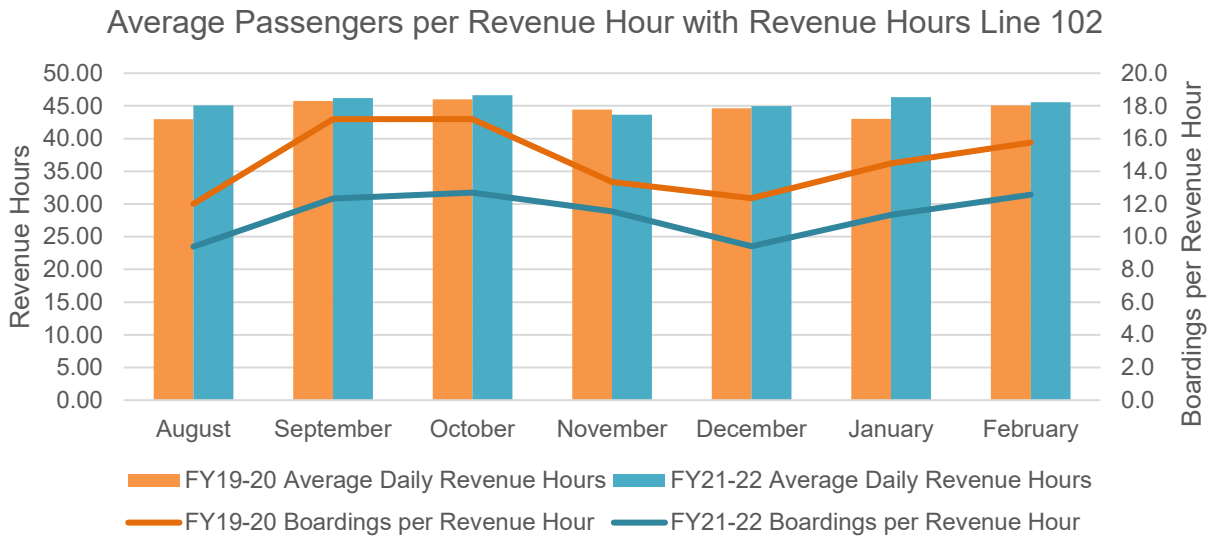


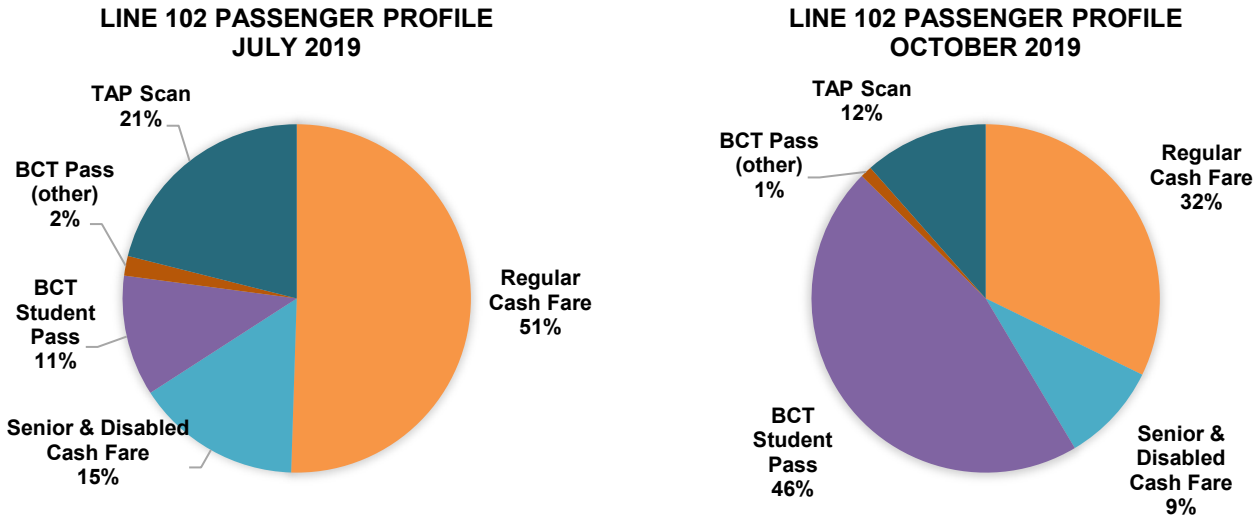
Figure 3-31 compares average daily revenue hours (service provided) to boardings per revenue hour.

- Revenue hours fluctuate slightly by month, mainly due to school trippers schedules. BCT operated an average of 43 revenue hours on Line 102 in August 2019 which increased to 46 in October 2019.
- Despite providing more revenue hours in most of FY21-22, BCT, like many other public transit systems, is still recovering from COVID-19 impacts with boardings per revenue hour still lower than in the previous year. October 2019 saw 17.2 boardings per revenue hour, but October 2021 saw only 12.7 boardings per revenue hour.
- FY21-22 weekend boardings generally outpaced pre-pandemic levels. Saturday productivity in FY21-22 saw an average of 6.6 boardings per revenue hour, up over 1 passenger per hour from the FY19-20 average of 5.4. Average productivity on Sundays in FY21-22 was significantly higher with an average of 7.7 passengers per revenue hour compared to 5.5 in FY19-20.

Figure 3-32 compares the passenger profiles (based on fare data) for Line 102 between July and October 2019 to understand differences in rider categories when school is in and out of session. Consistent with transit trends, ridership decreases during the winter holidays.

[41] Data source: City of Redondo Beach

Figure 3-32: Line 102 Passenger Fare Profile by Month, July and October 2019 [42]

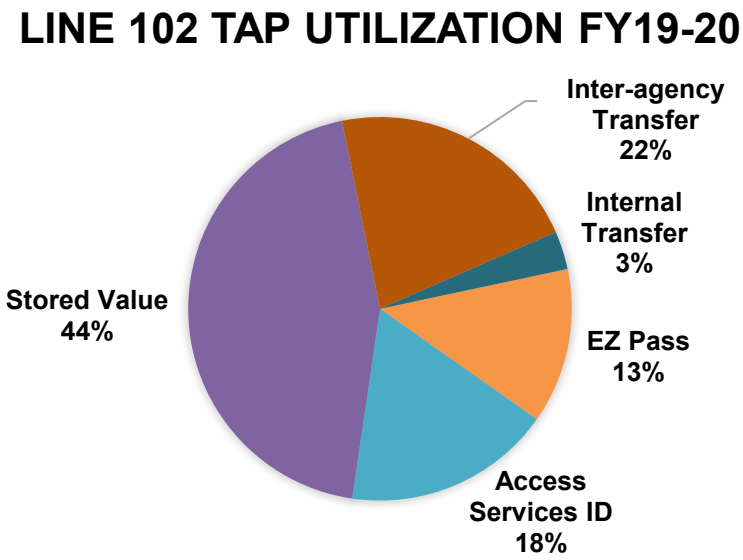


- A stark example of how school trippers impact Line 102 ridership is seen through the breakdown of ridership by fare category. Apart from the 75% increase in total boardings during the fall (19,224 boardings in October 2019) compared to the summer (10,961 boardings in July 2019), the ridership share for students increased by 35% in the fall.
- A high percentage of fares comes from the Regular Cash fare category, making up 51% of ridership when school is not in session.
- TAP card utilization makes up a significant portion of the overall ridership with 21% in July 2019 and 11% in October, diluted by the influx of student riders.

Figure 3-33 provides a breakdown of the different fares paid with a TAP card for FY19-20. Stored Value is the largest share with 44% but transfers from other agencies (22% Inter-agency transfers) and Access Services with 18% of taps are notable categories.

[42] Data source: City of Redondo Beach

Figure 3-33: Breakdown of TAP Utilization on Line 102 [43]



3.3.2.2.2 On-Time Performance (Service Reliability)

OTP is an important metric for service quality and reliability and the ability of riders to trust and depend on transit. According to BCT's Title VI program, BCT's definition of "on-time" is defined as a bus "arriving at a bus stop zero minutes early and no more than 5 (five) minutes after the scheduled time." The BCT standard for OTP states that 90% of all measured stops shall be on time.

BCT measures OTP manually based on the public-facing timepoints in Figure 3-34 for Line 102. BCT provided Stantec with route-level OTP for each day between August and February 2019/2020 and 2020/2021.

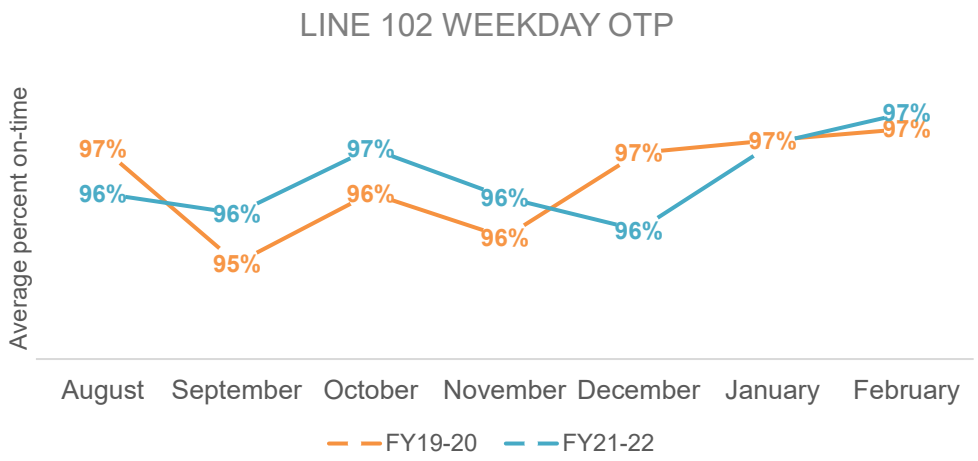
Figure 3-34: Line 102 OTP Timepoints



OTP was analyzed by day type and averaged over a month. Figure 3-35 displays the average OTP by month for weekdays, pre-COVID (August 2019 – February 2020), and during the recovery phase (August 2021 – February 2022). Line 102 consistently meets and exceeds the 90% standard for OTP; Line 102 achieves OTP consistently between 95% and 97% of trips in both FY19-20 and FY21-22. FY21-22 saw slightly better OTP which may be due to fewer riders, less traffic congestion, and/or lack of fare collection.

[43] Data source: City of Redondo Beach

Figure 3-35: Line 102 Average Weekday On-Time Performance [44]



On weekends, Saturday OTP fluctuated between 94%-99% during FY19-20 and 96%-100% during FY 21-22; Sunday OTP fluctuated between 91%-100% during FY19-20 and 91%-100% during FY21-22. Sundays have outlying examples of lower-than-average performance with 91% OTP in August 2019 and February 2021. Weekend and weekday OTP are similar, consistently achieving a high level of OTP but showing outlying months of lower performance.

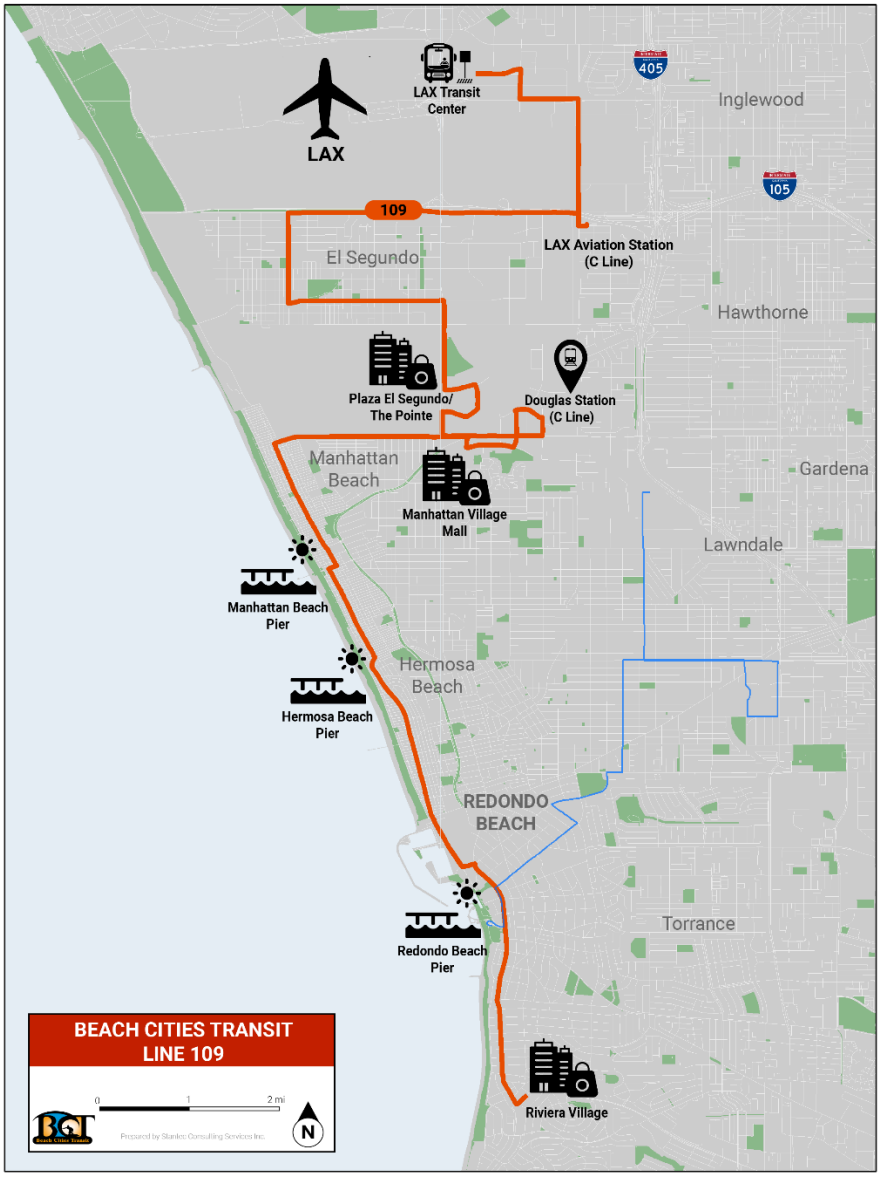
Stantec's ride-along observations, we noted that Line 102 increasingly deviates from its schedule as the day progresses. This was also noted by passengers as an inconvenience. The data captured by BCT and analyzed here does not provide insight into when buses start slowing down given the aggregated nature of the OTP data; collecting running times by trip and analyzing OTP at each timepoint could help diagnose operational challenges.

[44] Data source: City of Redondo Beach

3.3.2.3 *Line 109*

Line 109 traverses the beachfront of Redondo Beach along Catalina Avenue, Harbor Drive, Hermosa Avenue, and Manhattan Avenue through Hermosa Beach, and Manhattan Beach, and then travels through El Segundo on its way to LAX where the line ends at the LAX Bus Center. Figure 3-36 shows major trip generators and major destinations along this route including the three City Piers, shopping, dining, and tourist destinations of Riviera Village, Manhattan Village Mall, and Plaza El Segundo/The Point. Other prominent destinations include the Douglas and LAX Aviation Metro C Line Stations as well as the LAX Bus Center. Riders can transfer between lines 109 and 102 at Catalina and Emerald near the Redondo Beach Pier. Despite these major destinations, traversing the four cities in BCT's service area, Line 109 sees slightly less ridership than Line 102.

Figure 3-36: Line 109 with Major Trip Generators



3.3.2.3.1 Performance and Productivity

Line 109 followed a seasonal trend in both FY19-20 and FY21-22. High levels of ridership are seen in the fall months (September – November) of FY19-20 with an average daily ridership of 603 riders on weekdays, 318 riders on Saturdays, and 279 riders on Sundays. In the same time frame in FY21-22, the average daily ridership on weekdays was 419 riders, 288 riders on Saturdays, and 235 riders on Sundays.

Line 109 displays lower ridership in the winter months. December 2019 had an average weekday ridership of 482 passengers, a 12% decrease from the month before. In December 2021, ridership dropped by 17% to 340 average weekday passengers.

The change in passengers between October and January of FY19-20 was an 8% decrease whereas that period in FY21-22 saw an overall 2% increase in average weekday passengers. Like most other transit services, Line 109 continues to experience reduced ridership from the impacts of COVID-19.

Figure 3-37: Average Daily Boardings by Month on Line 109 [45]

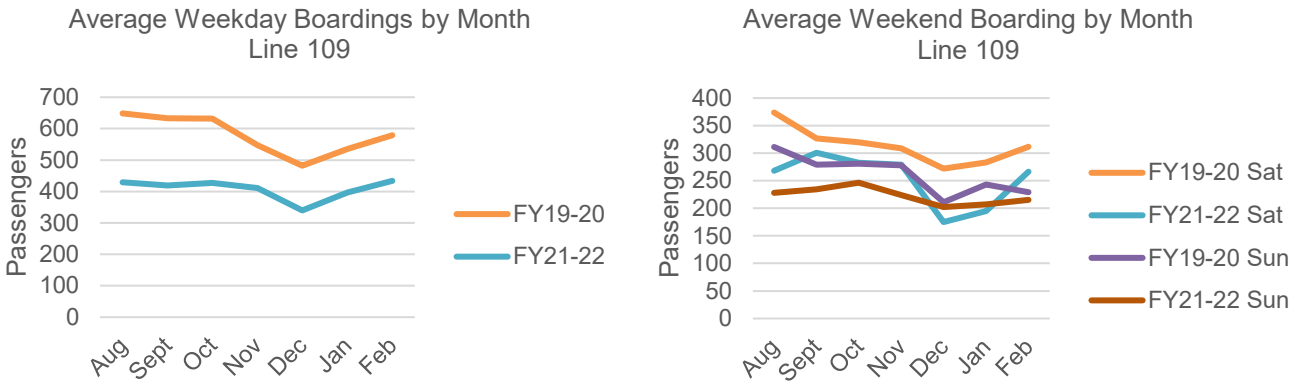


Figure 3-37 shows the seasonal shift in ridership between August and December. Average Saturday boardings in FY19-20 decreased 27% from 374 in August to 272 in December. In FY21-22 the change was a 35% decrease from 268 average Saturday boardings in August to 175 in December.

Average Sunday ridership in 2019 decreased by 32% from 331 boardings in August to 211 in December. For that same period in 2021, ridership decreased by 11% from 228 average Sunday boardings in August to 202 in December.

Figure 3-38 shows the average daily revenue hours compared to boardings per revenue hour.

- Weekday boardings per hour fluctuate from 10.7 in August 2019 to 8.4 in December 2019.
- August 2021 saw 7.1 boardings per hour decrease to 5.6 in December, but service hours were consistent for both months.
- November and January saw the fewest service hours provided; 56.7 in November and 57.5 in January.

[45] Data source: City of Redondo Beach

Figure 3-38: Line 109 Productivity as Measured by Revenue Hours and Passenger Boardings [46]

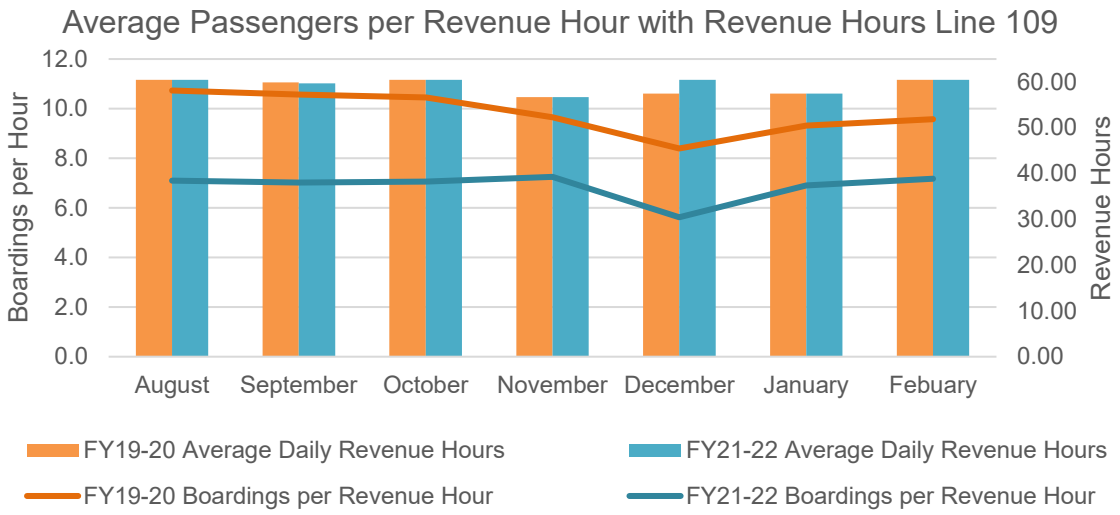
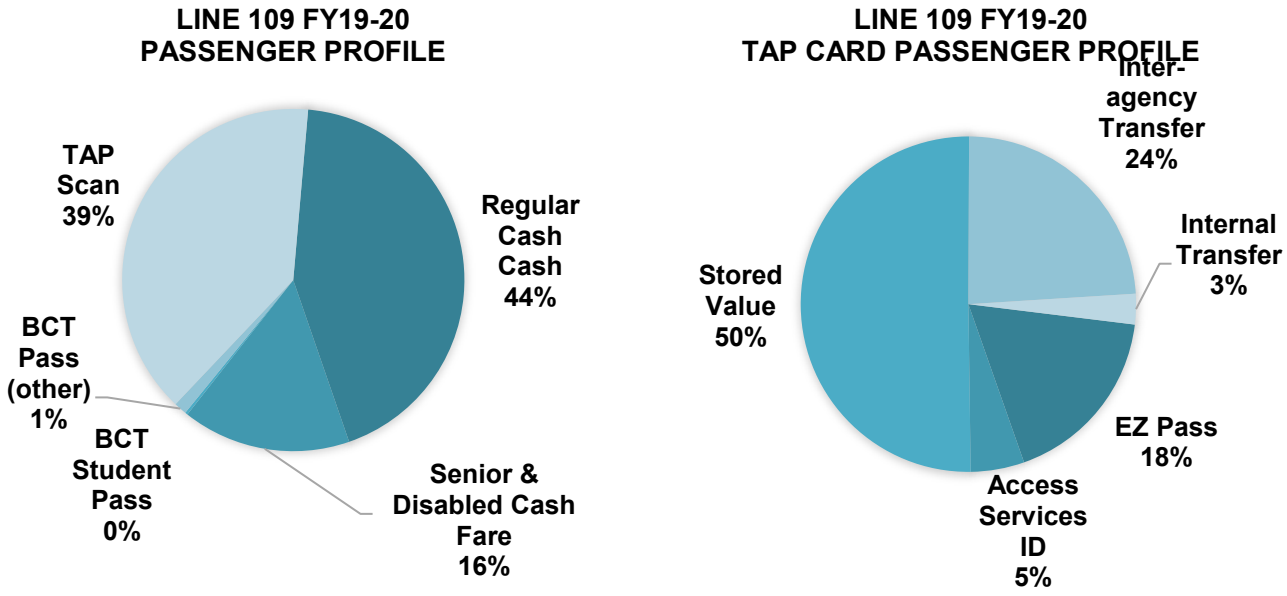


Figure 3-39 shows the passenger profile (based on fare data) for FY19-20 on the right and the detailed breakdown of TAP card scan data for that same period on the left.

- Most Line 109 passengers (58%) pay using cash, with Regular Cash Fares (42%) taking up most of the cash fares and Senior & Disabled Cash Fares (16%) representing a smaller portion.
- The other large segment of payment comes from TAP card (40%) utilization with 51% of TAP fares coming from Stored Value. Inter-Agency Transfers should be noted as representing almost a quarter (24%) of TAP scans, indicating utilization of connections at Aviation/LAX and Douglas Stations to the Metro C Line or other transit routes service the rail stations.
- Internal transfers account for a small (3%) portion of TAP card scans.
- Line 109 does not experience the same fall influx of students correlated to the school schedule, however, also sees a downturn in ridership during the holiday season.

[46] Data source: City of Redondo Beach

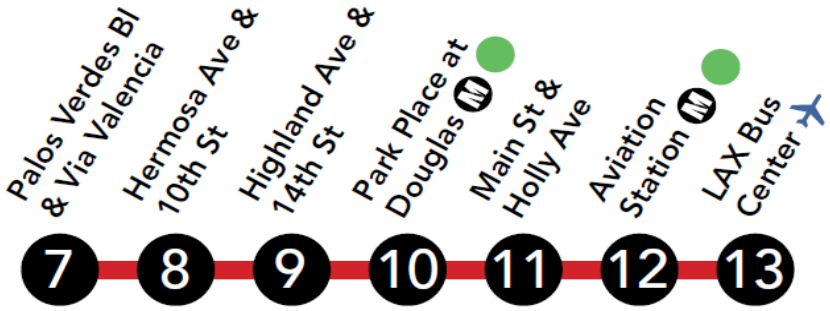
Figure 3-39: Line 109 Passenger Profile by Fare Category (left) and TAP Card Utilization by Category (right) [47]



3.3.2.3.2 On-Time Performance (Service Reliability)

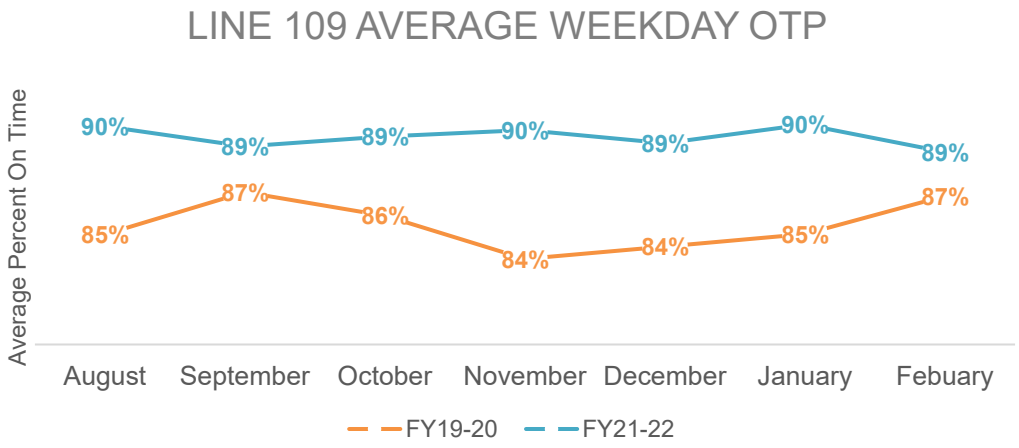
Line 109 is the longest route operated by BCT and navigates boulevards along the beach for much of the run. Traveling through sections of Hermosa Beach and Manhattan Beach, Line 109 has significant slowdowns as the route is on single lanes with high levels of vehicular, pedestrian, and cyclist traffic. Figure 3-40 provides a schematic of the timepoints along Line 109 used to measure OTP. In addition, several annual events throughout the year held by Redondo Beach, Hermosa Beach, Manhattan Beach, and El Segundo result in regular detours that deviate from the regular route.

Figure 3-40: Line 109 Measured Timepoints



[47] Data source: City of Redondo Beach

Figure 3-41: Line 109 Average OTP by Month [48]



OTP was analyzed by day type and averaged over the course of a month. Figure 3-41 displays the average OTP by month for weekdays, pre-COVID (August 2019 – February 2020), and during the recovery phase (August 2021 – February 2022). BCT occasionally meets its 90% standard for OTP for Line 109; the percentage of on-time trips was between 86% and 89% in FY19-20. FY21-22 saw slightly better OTP between 88% and 92% of trips on-time, which may be due to fewer riders and/or lack of fare collection.

On weekends, Saturday OTP fluctuated between 87%-96% during FY19-20 and 85%-98% during FY21-22; Sunday OTP fluctuated between 84%-94% during FY19-20 and 86%-96% during FY21-22. Weekends in FY19-20 achieved OTP on average 89% of the time whereas in FY21-22 it was achieved 90% of the time.

Along the northern portion of Line 109, construction from LAX AMP projects and the AMC Station severely impact traffic. Travel time and OTP could be expected to improve upon the completion of these projects, however, the high level of congestion in the LAX area, through the Beach Cities and will continue to impact OTP.

3.3.2.4 Summary of Fixed-Route Services

Providing fixed-route service in the South Bay, BCT lines 102 and 109 are unique routes that serve different populations. Both lines interface with each other and other transit providers with notable connections to the Metro C Line at Douglas, Aviation, and Redondo Beach Stations.

- Overall ridership has been decreasing from a high of 397,285 unlinked passenger trips in 2015 to 220,365 in 2021; approximately a 44% decrease. Line 102 provides important service to a high percentage of students (students represent 37% of Line 102) whereas Line 109 serves a broader population with much of the ridership using the line to transfer to Metro C Line stations.

- Seasonal trends are observed on both lines, but Line 102 has prominent seasonal shifts based on the school schedule with peak ridership in the fall months. FY19-20 ridership on Line 102 showed 12 boardings per revenue hour in August, compared to 17.2 in both September and

[48] Data source: City of Redondo Beach

October. Since August 2019, school has started in mid-August, so ridership is expected to continue to increase.

- Weekend ridership on Line 102 has rebounded to outpace pre-COVID levels. Boardings per revenue hour in FY21-22 were 21% higher on Saturdays. Peak boardings per revenue hour were 7.6 in August 2021 compared to 6.7 for that same month in 2019.

- Line 109 had more average weekday passengers, 648 in August 2019, compared to 519 on Line 102 in August 2019. Nonetheless, ridership on Line 102 is greater than on Line 109 in September and October; for example, Line 102 carried 19,224 passengers and Line 109 carried 16,962 passengers in October 2019.

- Generally, weekend ridership on Line 102 is about 20% of weekday ridership, whereas weekend ridership on Line 109 is about 50% of weekday ridership.

- Strong weekend ridership on Line 109 may be supported by increases in weekend service.

- High-performing stops included those at Metro C Line stations as well as stops at South Bay Galleria and RUHS. Of the 208 stops in BCT's system, 87 (or 42%) saw zero passenger boardings during the collection period.

- OTP is generally high and consistent with other transit services; OTP is better on Line 102 (97%) than on Line 109 (88%). Completion of construction near LAX is expected to improve Line 109 OTP. Riders can reduce their at-stop wait time through planning using the BCT real-time arrival information, which was launched in October 2020. Automatic vehicle location (AVL) installed on BCT buses provides real-time transit information on the BCT Real Time webpage, Google Maps, and other third-party mobility apps.

- Lines 102 and 109 have consistent (scheduled) headways for most parts of the weekday. Despite schedule adjustments effective July 1, 2022, there remains an opportunity to improve consistency on Line 102 by providing service from 12 to 3 pm on Sundays. Increasing frequency along Line 109 will be considered as a means of building on already strong ridership.

- State-mandated changes to high school start times affected school tripper time schedules starting with the 2022-23 school year. Monday mornings will run a different schedule than Tuesday through Friday.

- TAP utilization is relatively low across the system, particularly for Line 102 which sees a large portion of its ridership utilizing Student BCT Passes and elderly and/or disabled cash fares. Line 109 reports a much higher TAP utilization (14% Line 102, 39% Line 109) with 24% of those TAP fares coming from inter-agency transfers. BCT reinstated fare collection and BCT bus pass sales in October 2022.

The review of current fixed-route services provides insights, along with stakeholder feedback, into potential design and service changes. The identification of gaps in service, the delivery of service, or infrastructure present opportunities in the development of short- and long-range service plans.

- The RBTC opened in January 2023 with service on Line 102 as well as Metro lines 40, 210, 211, GTrans Line 3, and Torrance Line 2. BCT school trippers do not service the RBTC. Alternatives to maintain the current 30-minute headway will be explored in the service planning phase of the TSS.

- The anticipated opening of AMC presents opportunities to improve BCT service to LAX as well as create Westside connections that will be considered for potential alterations to Line 109.

Additionally, the northern section of Line 109 will be considered for route adjustments for more efficient service.

- Preliminary analysis of BCT bus stops showed an average distance between stops of 0.22 miles. Although BCT fixed-route service does not stop at non-requested stops, there is an opportunity for marginal time gains from balancing bus stops within the system.
- Long-term analysis around the Metro C Line extension will include route considerations for both extension alternatives as part of the service planning phase.
- The lack of east-west connectivity within the BCT service area represents an identified gap. Analysis of potential service adjustment includes but is not limited to, route adjustments and seasonal service.

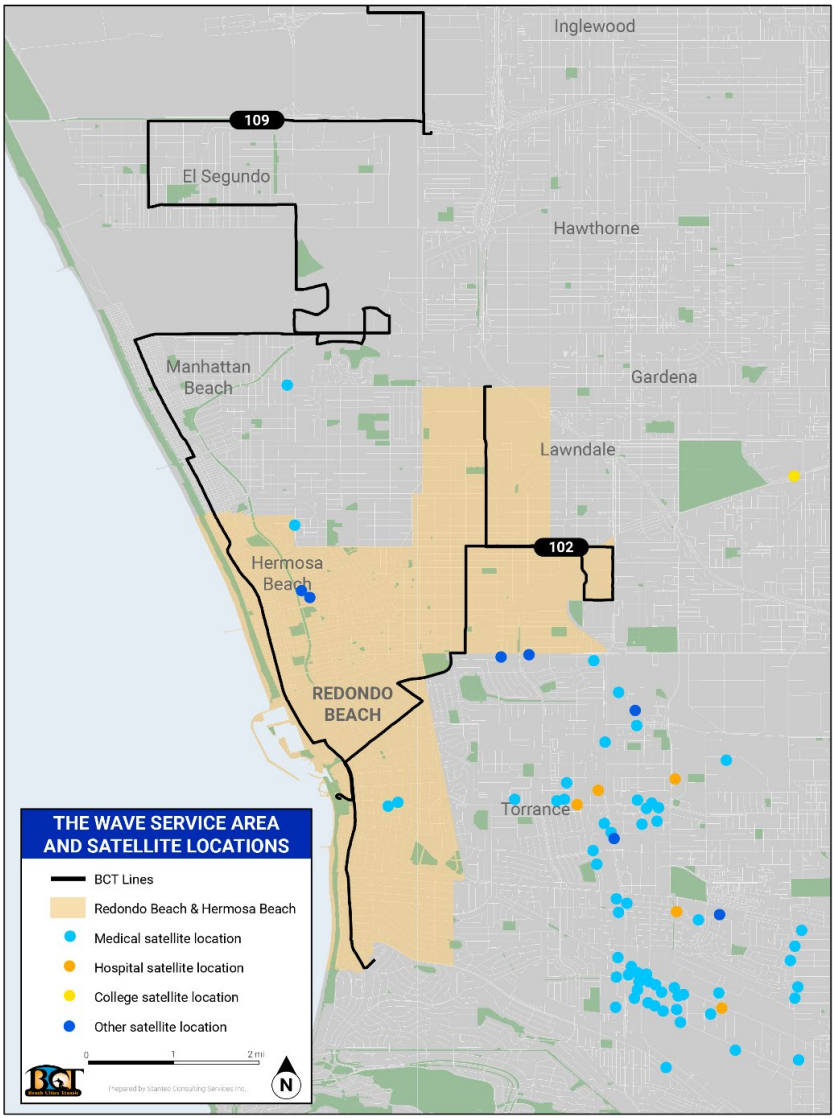
In addition to providing information for the development of a service plan, the fixed-route review also provides useful insights to guide stakeholder engagement, such as diving deeper into ridership patterns, rider satisfaction, and attempting barriers to use from the broader community.

3.3.3 The WAVE Review

3.3.3.1 Service Overview

Serving seniors 62+ and individuals with impairments or disabilities, the WAVE provides paratransit for trips originating or ending in Hermosa Beach, Redondo Beach, or designated satellite locations, primarily medical facilities in neighboring Torrance (the WAVE service area and satellite locations shown in Figure 3-42). Only residents of Redondo Beach or Hermosa Beach are eligible, and verification of eligibility is required to ride. Registration for a WAVE Identification Card is submitted via mail, email, or in person.

Figure 3-42: The WAVE Service Area and Satellite Locations [49]



[49] Data source: City of Redondo Beach

Operating Monday through Friday from 6:00am to 8:30pm and on weekends from 8:00am to 8:30pm, the WAVE fare is $1.00 for all trips. The discounted rate for groups of three or more qualifying individuals is $0.75 each. Through COVID-19 Relief Federal Funding, fare collection was suspended through October 2022. Trip scheduling is available by phone seven days a week from 6:00am to 8:30pm.

Trips offered by WAVE include:

- Same-day pickup scheduled within 30 minutes of the call time, depending on demand.
- Same-day trips scheduled within two hours of the call time, depending on demand.
- Reservation trips scheduled up to seven days in advance.
- Subscription trips scheduled for the same time, repeating daily or weekly trips.

Groups traveling with five or more people need to request a ride at least 24 hours in advance. Cancellations must be made at least two hours in advance of the scheduled trip time. Cancellations made less than two hours in advance of the trip are considered no-shows. The pickup window is three minutes after the vehicle arrives at the curbside and if the rider is not picked up by that time, it is considered a no-show.

On average, no-shows and cancellations make up 4% of all WAVE trips from August 2019 through February 2020. During that period, there was an average of 1.3 no-shows per day making up 4% of trips and in FY21-22 no shows made up 1% of all trips. Cancellations made up a smaller portion of uncompleted trips in FY19-20 at 1% of all trips, but slightly larger in FY21-22 with 2% of trips canceled. Patrons who accumulate three no-shows within 90 days may be subject to suspension of service.

Table 3-6 shows the breakdown of WAVE riders by category (June 2019), including the proportion of ambulatory passengers and passengers who use wheelchairs. The majority (87%) of trips are ambulatory. Wheelchairs and oversize wheelchairs constituted 11% of rides.

Table 3-6: WAVE Ridership by Ride Type [50]

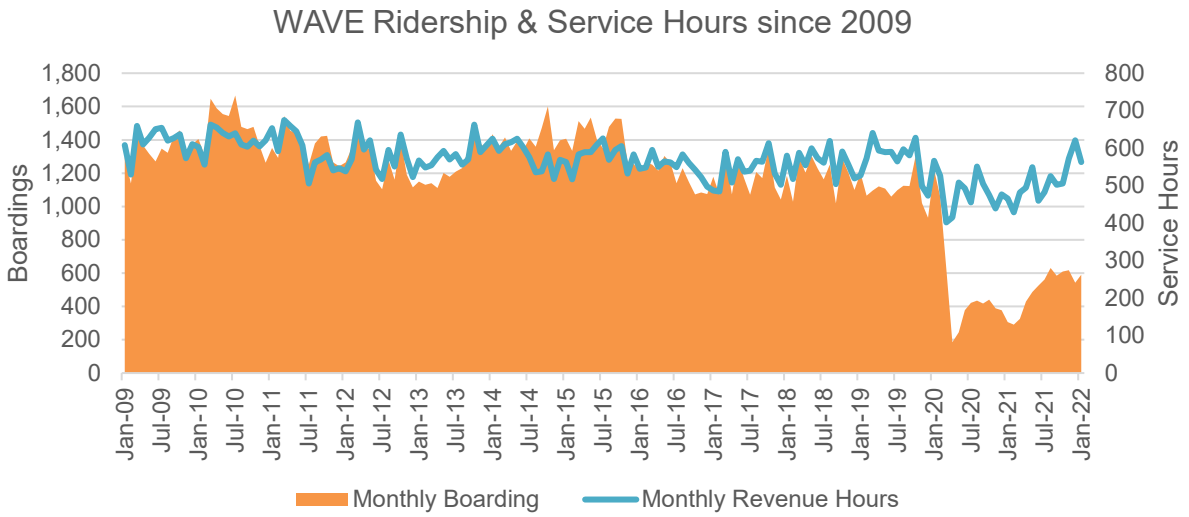
Rider type	Riders	Percent
Ambulatory	1,167	87%
Cab Only	22	2%
Oversize wheelchair	30	2%
Wheelchair	116	9%
Total	1,335	100%

3.3.3.2 Performance and Productivity

WAVE ridership has trended downward since its peak in 2010. Before the onset of the COVID-19 pandemic in 2020, ridership had hit its lowest point to date in December 2019 (Figure 3-43) at 933 monthly trips. Ridership in December of 2021 has only rebounded to 542 monthly trips, 58% of the 2019 low.

[50] Data source: City of Redondo Beach

Figure 3-43: The WAVE Ridership and Service Hours, 2009-2021 [51]



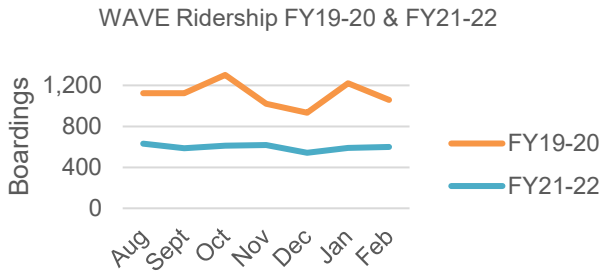
Boardings per hour and mile in FY21-22 have been well below those of FY19-20. NTD data in Table 3-7 shows that productivity remains half of what it was pre-COVID. The fall season (August – December) of 2019 had 1.98 boardings per revenue hour whereas for the same period in 2021, there were only 1.10 boardings per revenue hour.

Figure 3-44 shows monthly ridership trends for both FY19-20 and FY21-22. WAVE ridership in FY21-22 averaged 24 riders per weekday, seven on Saturdays, and 11 on Sundays. This is well below pre-pandemic levels that averaged 51 riders per weekday, 20 per Saturday, and 20 per Sunday.

Table 3-7: Boardings per Revenue Hour and Mile [52]

Year	Boardings per revenue hour	Boardings per revenue mile
2019 (Aug-Dec)	1.98	0.21
2020 (Jan-Feb)	2.12	0.23
2021 (Aug-Dec)	1.10	0.18
2022 (Jan-Feb)	1.06	0.17

Figure 3-44: WAVE Ridership



- Boardings per revenue hour in 2019 and early 2020 are close to, or over 2.0.
- Boardings per revenue hour dropped by approximately half in 2021 and 2022 compared to FY19-20.

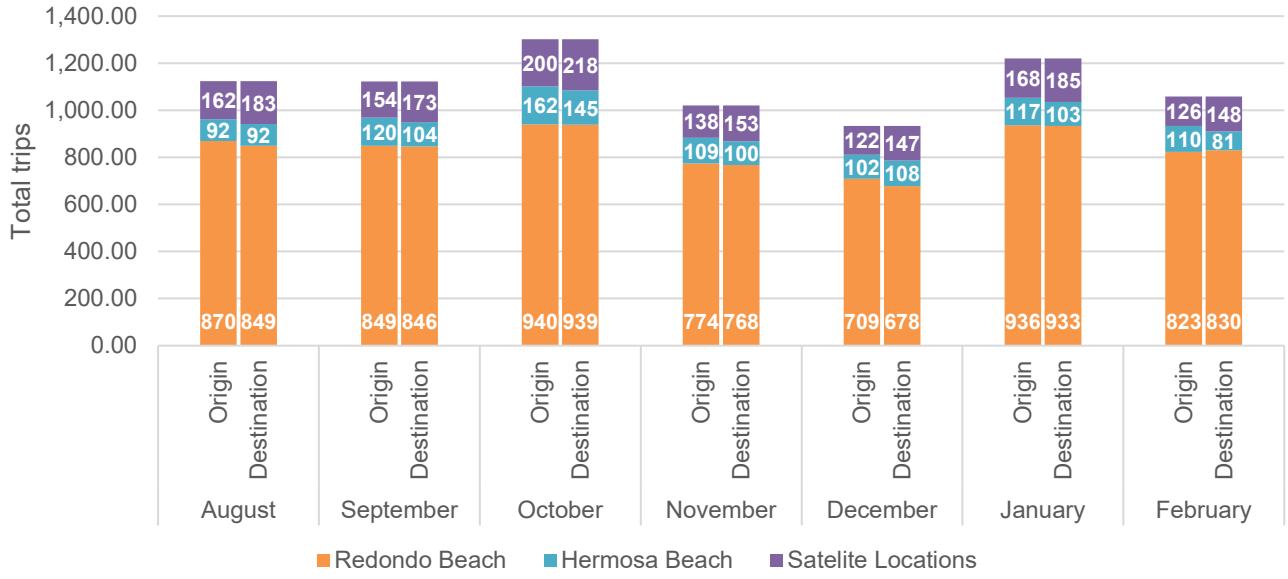
[51] Data source: NTD
[52] Data source: NTD (table, left) and City of Redondo Beach (graph, right)

- The seasonal trend was not as prominent in FY21-22 as Figure 3-44 shows, with ridership consistent throughout the analyzed year apart from a small downtick in December to an average daily boarding of 21 for weekdays, 7 for Saturdays, and 10 on Sundays.

The WAVE provides rides originating in Hermosa Beach or Redondo Beach as well as from satellite locations, primarily medical destinations.

- Figure 3-45 shows that approximately 75% of trips originate and end in Redondo Beach. Redondo Beach is the primary market for WAVE services with satellite destinations the next most popular use.
- Hermosa Beach accounts for 10% of trip origins as well as destinations.
- Satellite Locations represent 14% of origins and 15% of destinations.

Figure 3-45: Origin and Destinations from WAVE Trips in 2019 [53]



3.3.3.3 *On-Time Performance*

OTP for WAVE service is defined as a vehicle arriving at the pickup location 15 minutes before or after the scheduled time with an OTP goal of 90% of trips. OTP for WAVE pick-ups is measured every fifth day.

[53] Data source: City of Redondo Beach

Figure 3-46: WAVE OTP [54]

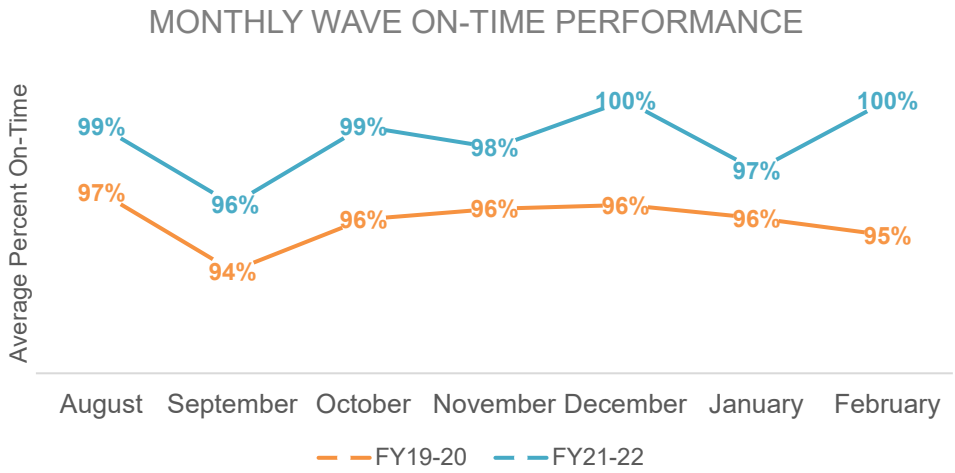


Figure 3-46 shows OTP for the WAVE for FY19-20 and FY21-22.

- In FY19-20 BCT performed well with 95% of recorded trips on-time, 4% of trips 0-5-minutes late, and only 1% of trips 6-10 minutes late.
- Throughout FY21-22 with fewer passengers, WAVE was able to achieve higher OTP than in FY19-21.
- Overall, OTP is high, and late trips are rare for WAVE service.

3.3.3.4 *Scheduling and Dispatching Procedures* [55]

The City of Redondo Beach entered into a new management agreement for the operation and maintenance of BCT fixed route and WAVE services with Transportation Concepts in May 2020. As the contracted operator, Transportation Concepts is responsible for scheduling and dispatching the WAVE service. Specifically related to scheduling and dispatching, Transportation Concepts is responsible for:

- Scheduling of all WAVE trips
- Dispatching of vehicles for all WAVE trips
- Providing training for scheduling and dispatching personnel

In the management agreement, Transportation Concepts outlines a systemic method to reserve, schedule, and dispatch trip requests including same-day trips and subscription reservations, and integrate all demands for service to efficiently maximize productivity. Transportation Concepts does this through an in-house scheduling and dispatching software called Simpli, which contains the following features:

- Client management system for registering new clients and editing client records

[54] Data source: City of Redondo Beach
[55] All information in this section comes from data from the City of Redondo Beach

- A trip-booking system to create new trips, edit existing trips, and set up subscription trips
- Computerized scheduling and dispatch software to optimize routes and productivity with live scheduling and real-time updates
- Mobile Data Terminal: each driver has a mobile tablet device with internet access so they can view their trips for the day, integrating driver and dispatcher communications so they can communicate in real-time about any schedule changes. the real-time manifests enable drivers to receive alerts as new trips, time changes, and cancellations are made in real time

In the management agreement, Transportation Concepts outlined the use of two full-time and two part-time dispatchers to provide coverage during hours of operation. The dispatcher on duty is responsible for communication and coordination with the vehicle operators, taking ride requests from passengers, and answering the customer line.

According to their dispatching procedures, when a customer calls to schedule a WAVE trip, the dispatcher should follow the following steps in setting up a ride:

- Ask for the customer's first and last name
- Ask where the customer is going
- Ask what time the customer wants to be picked up, or what time their appointment is
- The customer needs to book a ride at least an hour before their scheduled appointment time for any medical appointment
- The dispatcher will confirm if the location is in the WAVE service area or a satellite location
- The dispatcher will use Simpli Transport to look up the customer and schedule the trip

3.3.3.5 WAVE Customer Feedback

Transportation Concepts collects and tracks complaints and compliments received by customers, including the date, time, location, and nature of the comment, as well as what service the comment was regarding. Transportation Concepts follows up with customers regarding these comments when possible or necessary (for example, compliments to a specific bus operator do not require a follow-up). Between July 2019 and June 2020, three comments about the WAVE were received:

Table 3-8: WAVE Comments, July 2019-June 2020 [56]

Date	Comment type	Comment details
August 5, 2019	Compliment	WAVE customer called to let management know how grateful he is for the service. Stated that dispatchers and drivers provide a helpful and kind service.

[56] Data source: City of Redondo Beach (names have been removed and replaced with "WAVE customer")

Date	Comment type	Comment details
November 3, 2019	Complaint	Passenger stated the new DAR bus is unsafe and should be pulled from service. Passenger does not like having to walk up the ramp, and prefers to use a lift. Passenger recently had hip surgery.
March 6, 2020	Complaint	No show – bus was at the location. Bus arrived at 9:25 am for a 9:30 am pick-up. The driver waited until 9:35 am, WAVE customer was a no-show, so the driver departed.

Overall, the low number of comments received regarding the WAVE service is encouraging and implies that overall, WAVE customers are satisfied with the service as currently provided. This is echoed by the fact that one of the comments received was a compliment, meaning that service was so high quality that the passenger felt the need to go out of their way to compliment both drivers and dispatchers. Complaints were also investigated and dealt with, when applicable. Moreover, the nature of the two complaints were not material for potential changes—agencies across the US continue to deploy low-floor vehicles with ramps as a way to speed boardings compared to lifts, and a no-show policy is important for the efficient use of resources.

It is important for Transportation Concepts to continue to track and monitor comments received over time to ensure that customers remain highly satisfied with the service. Further, soliciting specific feedback on the WAVE through the public survey that is ongoing through summer 2022 as a part of this project is important to learn how the service can be improved further. The findings from the survey as well as other public and stakeholder engagement activities will be incorporated into service plans and recommendations for the WAVE in future stages of this project process.

3.3.3.6 *WAVE Summary*

Providing a vital service in and around Redondo Beach and Hermosa Beach, the WAVE operates dial-a-ride services for seniors 62+ and individuals with disabilities who are residents of Redondo Beach or Hermosa Beach. WAVE provided an average of 37 trips per day in FY19-20 and 20 in FY21-22.

- Since achieving peak ridership levels in 2010 with 17,761 annual trips, the WAVE has steadily declined in ridership to 5,913 annual trips in 2021.
- Despite providing roughly the same amount of average daily revenue hours (18.1 hours FY19-20, 18.2 hours FY21-22), WAVE ridership remains lower than what it was pre-COVID.
- The WAVE consistently achieves high OTP.
- Approximately 75% of all trips originate or end in Redondo Beach, 10% in Hermosa Beach, and 15% at satellite locations.
- Minimal comments and complaints are received from WAVE customers, showing that customers are overall satisfied with the service.
- WAVE ridership is consistent year-round and does not exhibit the seasonal fluctuations seen in BCT's fixed route services.

3.3.4 Ride-Alongs

One full day of ride-alongs were completed on April 7, 2022, to gain firsthand exposure to the BCT fixed-route system, observe system operations and ridership, and solicit informal feedback from bus operators and passengers. Major observations from the ride-alongs include:

Service Requests:

- It was noted that BCT has received some requests for later service Monday-Saturday due to missed trips on the Metro Line 232 later at night, leaving passengers stranded. Local passengers see BCT as a more reliable option compared to Metro, which is grappling with bus operator shortages.
- Requests included service along Redondo Beach Blvd, to Del Amo Fashion Center, and the nearest Walmart on Hawthorne.

Customer/Passenger Experience:

- While many bus stops have benches, many bus stops lack shade, and some stops lack any amenities creating an uncomfortable waiting environment.
- Buses are generally clean and well-maintained.
- Operators were observed to be helpful and friendly to passengers and helping them navigate the system whenever a passenger had questions.
- Sometimes, onboard announcements were not aligned with the next approaching stop and sometimes onboard announcements did not play at all. This was experienced on both lines.
- Some passengers noted that they were confused about which direction the bus was heading. Signage manually operated by the driver (located in the right corner of the bus windshield) was noted by passengers for its usefulness.

On-Time Performance:

- Minimal issues with OTP were noted on Line 109 throughout the day. Minimal OTP issues with Line 102 during the morning, but OTP suffered as the day went on with late arrivals observed in the afternoon. Waning OTP was attributed, in part, to construction in the LAX area.

Bus Operators:

- Overall bus operator satisfaction seems high, with many operators noting they have been with the company for over ten years. Some operators noted that there have been increasing issues with the unhoused population in recent years due to COVID-19 and the elimination of fare collection. Some operators noted issues with run times on Line 109 through El Segundo and Hermosa Beach. Passengers also noted that bus operators are friendly and helpful.

Observations Specific to Line 109:

- Line 109 became full (around 30 passengers onboard, no standees) during AM and PM peak commute trips to transport passengers to and from the Metro C Line stations. Line 102 was busiest during the school trippers where it experienced full seated capacity plus standees. No pass-bys or refusals were observed.

- Line 109 operates slowly through Hermosa Beach and Manhattan Beach, as the streets are narrow, one lane each way, and there are many cyclists and pedestrians. For example, the left turn at Highland Ave. and Manhattan Beach Blvd was very difficult for the bus to make as there is no dedicated left turn signal and a heavily used scramble crosswalk (see Figure 3-47).

Figure 3-47: Example Intersection



- The majority of passengers on Line 109 alighted at Metro C Line stations. Only one passenger was observed who took the line to LAX, though bus operators noted that there is more passenger activity to and from LAX in the summer when passengers are taking it as a direct way to reach hotels and resorts in the South Bay.

- While Line 109 provides service to LAX, there is no dedicated space to store luggage. The one passenger observed traveling to LAX had difficulty finding a place to place her luggage while she was onboard as the operator would not allow her to place it in the aisle as the aisle needed to remain clear.

3.3.5 Redondo Beach Transit Center

The City of Redondo Beach commenced construction on a new transit center in October 2020 and was completed in January 2023 (Figure 3-48). The RBTC is located at 1521 Kingsdale Ave in Redondo Beach south of Grant Ave and adjacent to the Target store. The RBTC replaces the old South Bay Transit Center adjacent to the South Bay Galleria. The $15 million project was funded, in part, by federal, and local transit dollars from the FTA, the LA Metro Call For Projects Funds, South Bay Subregional Measure R Funds, and City of Redondo Beach Proposition C Local Return Transit Funds.

Figure 3-48: RBTC Renderings [57]



[57] Data source: City of Redondo Beach

The RBTC is a modernized, multimodal transportation facility that serves five bus operators across 11 bus bays (Figure 3-49): BCT (Line 102), Torrance Transit (Line 3), GTrans (Line 3), Lawndale Transit, and LA Metro (lines 40, 210, and 211).

Figure 3-49: Redondo Beach Transit Center Bus Bay Schematic [58]



The RBTC includes a number of amenities, including a transit ticket vending machine, real-time passenger information services (planned), a passenger waiting area, public bathrooms, park-and-ride drop-off area with short-term parking for 13 vehicles, designated bicycle storage, pedestrian access with signalized crosswalks, transit operator facility with a breakroom, separate driver bathrooms, and security features including CCTV. The RBTC also has a parking lot with 320 parking spaces, including ADA spaces and spaces for EV charging.

Beginning in January 2023 when the transit center began operations, BCT made changes to Line 102 to accommodate serving the transit center and account for the additional run time which impacts the Line 102 schedule and frequencies. Line 102 school trippers do not stop at the transit center in order to maintain current tripper headways. The current new schedule increases headways from the current schedule, but BCT is actively exploring ways to maintain the current frequencies and minimize the impact on riders. Furthermore, as other transit partners serve the RBTC and redesign schedules, all transit partners should collaborate to align schedules as best as possible to minimize passenger transfer wait times.

[58] Data source: City of Redondo Beach

3.4 Financial Analysis

3.4.1 Fares

BCT collects fares in three forms: cash onboard, agency-issued passes, and Transit Access Pass (TAP) card payment. Regular non-transfer fare is one dollar ($1.00), and the seniors and people with disabilities fare is 50¢. For passengers transferring from other agencies to BCT using a TAP card to pay, the transfer fare is25¢. There is no charge for BCT-BCT transfers. Beginning March 19, 2020, BCT suspended fare collection which was reinstated October 2022. Fare utilization data comes from FY19-20, August to February data. Table 3-9 lists the type of fares accepted by BCT on fixed-route services. These include the onboard cash fare, BCT monthly passes, and fares paid with a TAP Card.

Table 3-9: Fare Category Description with Cost and Utilization [59]

Fare Type	Description	Cost	Usage [60]
Regular Cash Fares	Regular fare (not senior or disabled) paid in cash at boarding.	$1.00	37%
Senior & Disabled Cash Fares	62+ years, have a disability, or a Medicare card, and pay in cash.	$0.50	13%
BCT General Pass	Monthly passes are available for residents and non-residents.	Redondo Resident: $40/month Lawndale Resident: $20/month Non-resident: $40/month	<1%
BCT Student (K-12) Pass	Monthly passes for students.	Redondo Resident: $8/month Lawndale Resident: $8/month Non-resident: $20/month	19%
BCT Senior (62+) Pass	Monthly passes for seniors 62+ years.	Redondo Resident: $5/month Lawndale Resident: $5/month Non-resident: $10/month	1%
BCT Disabled Pass	Monthly passes for individuals with a disability and a Metro Disabled TAP ID, Medicare, or SSDI.	Redondo Resident: $5/month Lawndale Resident: $5/month Non-resident: $10/month	<1%
Free	Free rides are given to children (5 and under) but still counted as passengers.	Free	<1%

[59] Data source: City of Redondo Beach
[60] Usage based on operator collected fare data from MMR Invoices August 2019 through February 2020.

Fare Type	Description	Cost	Usage [60]
TAP Fare	Regular adult and student fare using stored value. Senior/Disabled fare using stored value	$1.00 $.50	30%

- Totaling 50% of all fares, cash payments represent the largest segment of payment forms. Along Line 102, cash fares account for 36% of payments which is only matched by BCT Student Pass utilization. Cash fares along Line 109 represent the second largest portion of payment at 42% of payment.
- Representing 13% of fares across the system, Senior & Disabled cash fares are widely utilized. Line 109 receives 14% of fares from the 50¢ fare and Line 102, 11%.
- BCT Monthly Passes (Resident/Lawndale/non-resident) – BCT offers a Monthly Bus Pass Subsidy program for eligible Redondo Beach (subsidized by the City) and Lawndale residents (subsidized by the City). This pass is underutilized, representing less than 1% of fares.
- The BCT Student Monthly Pass (not available on TAP) is heavily utilized on Line 102 accounting for 39% of ridership but almost entirely not represented on Line 109. The other three passes (General, Senior, and Disabled) can be loaded to a TAP card but are underutilized across both lines, representing 1% or less of all fares.
- Free fares represent just 1% of total ridership and account for children riding BCT.
- TAP is the regional fare card utilized throughout LA County. Utilization of TAP for fare payment is 30% across the BCT system but more heavily utilized on Line 109 where it represents 46% of fare categories.

The utilization of TAP Cards is further broken down in Table 3-10. Three types of cash fare (regular, student, and senior or disabled) are categorized under the Stored Value Category which is the most widely utilized TAP fare type. Inter-Agency Transfers also use Stored Value but are counted separately. Fares paid with an EZ Pass are reimbursed to the City by TAP at the average fare rate of 91¢ per ride. Riders using an Access Services ID to ride fixed-route services are not charged but Access Services reimburses the City 50¢ per ride.

Table 3-10: TAP Card Fares by Category [61]

TAP Type	Description	Cost	Usage [62]
EZ Pass	The EZ Pass provides unlimited rides and transfers on BCT and other agencies in the LA Metro area. Fare levels for routes and services are based on zone [63].	Redondo Resident: $90/month Non-resident: $110/month	17%

[61] Data source: LA Metro TAP Payment data
[62] Usage percentage based on TAP Payment data across the BCT system from August 2019 through February 2020.
[63] https://www.metro.net/riding/fares/ez-transit-pass/

TAP Type	Description	Cost	Usage [62]
Access Services ID (ASI)	Individuals with an Access Services ID (a TAP card) may use this card to board a BCT vehicle. The City of Redondo Beach is reimbursed by Access Services $0.50 for each passenger trip	$0.50, not paid by the rider, but reimbursed by Access Services to City	8%
Stored Value	All non-pass fares are collected with a TAP card.	$1.00 for regular and student, $0.50 for senior and disabled	51%
Inter-Agency Transfer	Trips originating from another service which include a transfer to a BCT service.	$0.25	24%

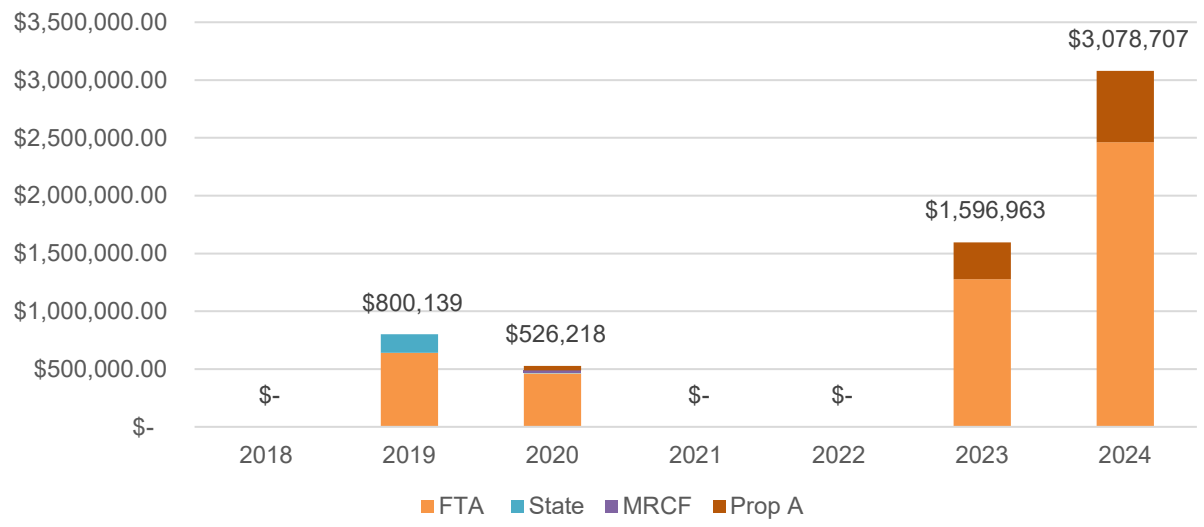
- EZ Passes represent a sizeable (17%) portion of TAP utilizations. Based on operator counts from August 2019 to February 2020, there is slightly higher (17%) EZ Pass utilization on Line 109 compared to Line 102 (13%). The City of Redondo Beach subsidizes the cost of the EZ Pass to its residents, which provides unlimited riding and transfers across Los Angeles County.
- ASI ID Card used via TAP card on fixed-route services represents 8% of all TAP transactions. ASI ID Cards account for 18% of TAP utilization on Line 102 compared to only 5% on Line 109 as reported by August 2019 to February 2020 operator counts.
- Stored Value fares including regular, student, and senior or disabled represent 51% of TAP utilization across Line 102 and 109. Operator counts show comparable utilization on both lines with 45% of Line 102 and 51% of Line 109 TAP transactions paid by Stored Value.
- Transfers from other systems to BCT include a 25¢ transfer fare and are only valid when using a TAP Card. Stored Value transfers to the BCT system represent about a quarter (24%) of TAP utilization. Line 102 and 109 have similar utilization of transfers from other systems based on operator counts, with 24% and 26% of respective TAP scans being transfers.

3.4.2 Capital Budget

The majority of BCT capital expenses relate to bus procurement and replacement of retirement-age buses. Historically, BCT has not had large capital budgets. A notable exception is the recently completed RBTC which was funded -in part- by federal (FTA) and local transit dollars including the LA Metro Call for Projects Funds, Subregional Measure M Funds, and City of Redondo Beach Proposition C Local Return Transit Funds. The RBTC is discussed in Section 3.3.5 and funding for the RBTC was not included in the below discussion of procurement.

Between 2018 and 2024, BCT received $6 million in capital funds during the procurement years. Figure 3-50 shows that most capital funds are Federal monies and account for 81% of the total period amount and, on average, 82% of annual capital funds. Local Return funding provides the remaining 19% which is divided into three distinct sources: State, Proposition A, and Measure R funds. State funding has not been allocated annually, with the exception of 2019 when $160,000 was awarded or 20% of that year's capital budget. Prop A funding provides an average of 12% across the period with significantly more (20%) in 2023 & 2024. Finally, Measure R Regional Clean Fuel Bus Capital Fund (MRCF) provided a small 5% portion of the annual 2020 procurement budget.

Figure 3-50: Capital Funding from 2018-24 [64]



While BCT leverages several sources for bus procurements, the FTA's 5307 – Urbanized Area Formula Grant provides the primary funding source, accounting for 81% of bus procurement costs. Table 3-11 outlines previous procurements as well as those currently planned.

Table 3-11: Vehicle Procurements from 2018-24

Year	Count	Vehicle	Service
2018	-	-	No procurement
2019	5	Cutaways	Demand Response

[64] Data source: Redondo Beach

Year	Count	Vehicle	Service
2020	3	Cutaways	Demand Response
2021	-	-	No procurement
2022	-	-	No procurement
2023	3	Buses	Fixed Route
2024	5	EZ Buses	Fixed Route

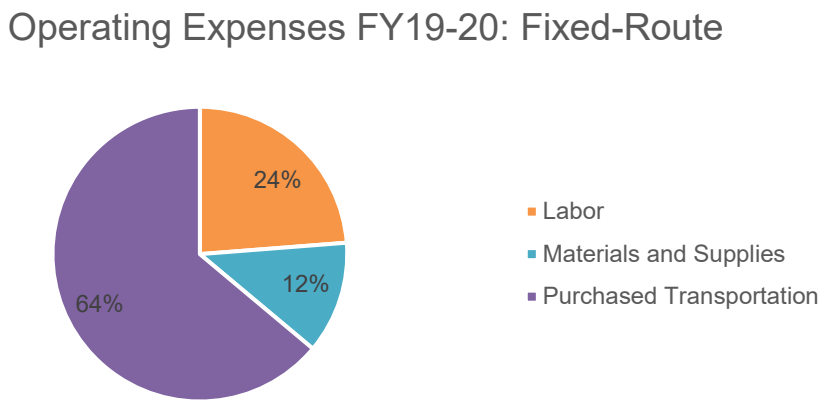
Procurement is an ongoing process with BCT anticipating the delivery of 3 buses in 2023 and 5 buses in 2024 as well as several more planned during the next few fiscal years (further outlined in Section 5.3). Considering the higher cost of BEBs, it is important to pursue programs focused on capital funding. Distributing significant monies, one-time grants like California's Transit and Intercity Capital Rail Program (TIRCP) or the Federal Low-No Grant offer funds that BCT can use to cover costs associated with procurement as well as charging infrastructure. A complete list of applicable grants and funding programs is provided in Section 11.5.

3.4.3 Operating

3.4.3.1 Operating Expenses

Operating expenses for BCT, like other transit agencies, are largely driven by labor related to operating and delivering transit service—bus operators and mechanics. Figure 3-51 shows the breakdown of BCT's operating expenses for 2019.

Figure 3-51: BCT Fixed-route Operating Expenses (FY2019-20, BCT Financial Reporting) [65]



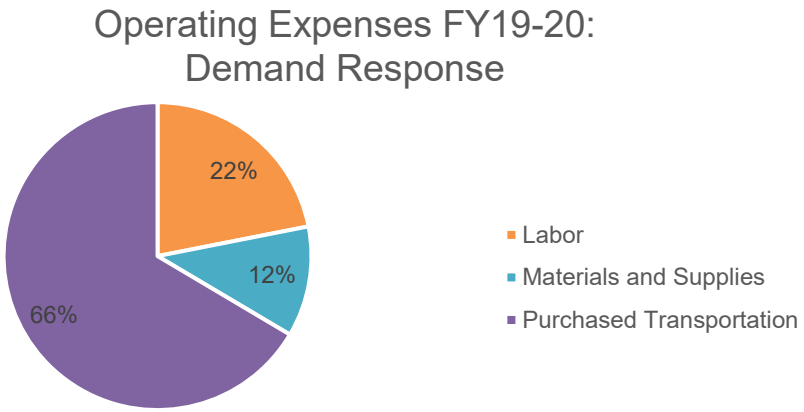
- The bulk of operating expenses (64%) from FY19-20 come from transit operations provided by Transportation Concepts, as well as COVID-19 maintenance expenses and miscellaneous expenses which include overhead costs. Labor (internal Redondo Beach staff) accounts for 24% of operating expenses which includes salaries and wages, fringe benefits, and other services (consultants, contractors, and maintenance). Materials and supplies account for 12% of BCT

[65] Data source: City of Redondo Beach

expenses and include fuel and lubricants, tires and tubes, and other materials, as well as utilities, and liability insurance.

- NTD data shows total operating expenses have steadily increased by 15% between 2016 and 2019, from $3.35 million to $3.85 million. For this same period, operating cost per passenger trip has increased by 28% from $7.20 to $9.19.

Figure 3-52: BCT Demand Response Operating Expenses (FY19-20, BCT Financial Reporting) [66]



- WAVE operating expense breakdown is similar to fixed-route expenses, with the exception that purchased transportation accounts for 2% more of expenses.
- WAVE operating expenses, as reported to NTD, have increased by 13% between 2016 and 2019. Costs per passenger trip have also been rising by 31% between 2016 and 2019 from $33.60 to $44.08 per passenger trip in 2019.

3.4.3.2 Operating Funding Sources

BCT typically receives operations funding from several state, and county transit sales tax revenue sources. Table 3-12 provides summary information about funding type, source, and description.

[66] Data source: City of Redondo Beach

Table 3-12: Funding Sources [67]

Type	Source	Description
Formula Allocation Procedure (FAP)	Local	Tax funding is allocated to Municipal transit operators. FAP is funded by the Los Angeles County Transit Sales Taxes of Propositions A and C and Measures R and M.
Transportation Development Act (TDA)	State	Statewide one-quarter cent sales tax is eligible for both capital and operating expenses. BCT only uses TDA for operating funds.
State Transportation Assistance (STA)	State	Funding is derived from the statewide sales tax on gasoline and diesel from the Transportation Planning and Development Account in the State Transportation Fund. Funds can be used for both capital and operating expenses. BCT uses STA for operating funds and occasionally bus capital.
SB1 State Transportation Assistance (STA)	State	Additional funds through increased vehicle gas taxes and registration fees to the STA allocations, BCT uses SB1 funds as operating funds.
Local Return sales tax revenues	Local	Local Return funds are derived from local sales taxes approved by Los Angeles County voters on Propositions A and C and Measures R and M in 1980, 1990, 2008, and 2016, respectively.
SB1 State of Good Repair (SGR)	State	An allocation of funding for SGR projects only. These are dedicated capital funds that BCT is currently using to fund capital improvements at the Transit Operations facility.
Federal COVID Relief	Federal	Temporary one-time Federal funds through the Coronavirus Response and Relief Supplemental Appropriations Act (CRRSAA) and Coronavirus Aid, Relief, and Economic Security (CARES) Act provided transit agencies funds for operational use to help mitigate the effects of the COVID-19 Pandemic for FY2020 through FY2023.

[67] Data source: City of Redondo Beach

Figure 3-53 shows the breakdown of operating funding sources between FY2018 and FY2022.

Figure 3-53: Operating Funding Sources

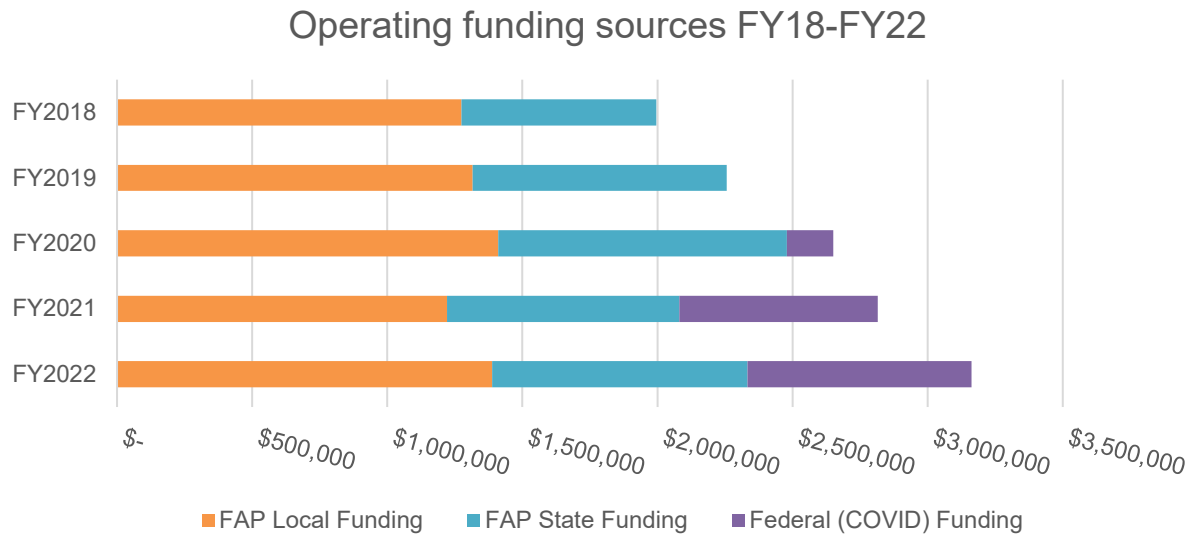


Table 3-13: Allocation of Operations Funds [68]

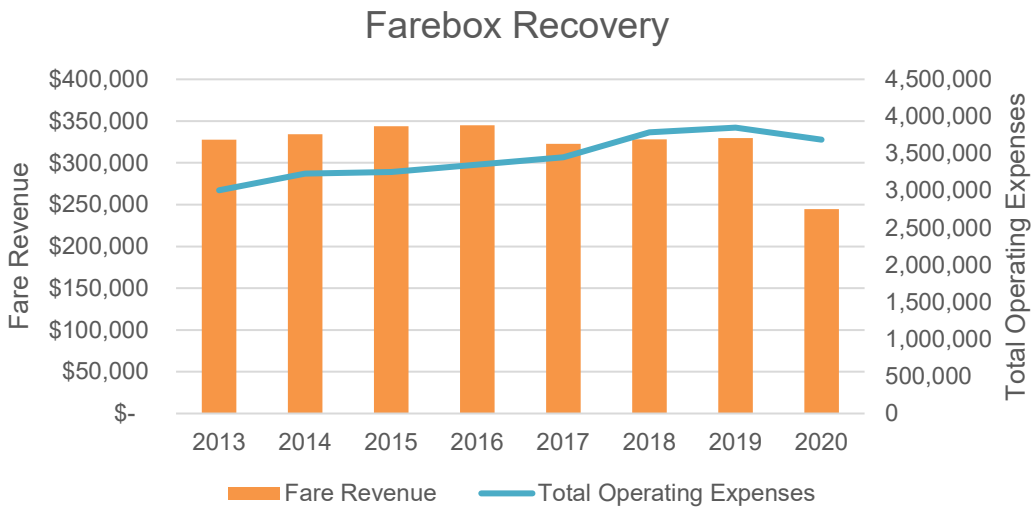
	FY2022	FY2021	FY2020	FY2019	FY2018
Fixed-Route Allocation	68%	67%	85%	91%	93%
Demand Response Allocation	6%	7%	9%	9%	7%
Federal (COVID) Funding	26%	26%	6%	N/A	N/A

- BCT's largest revenue source is local FAP funding. Pre-pandemic, over half (58%-64%) of total operating expenses came from local FAP funding, and the other portion (36%-42%) came from state FAP sources.
- Federal COVID-19 Relief Funds including funds from the CRSSAA and CARES Act provided supplemental funds in FY2020 and a quarter of BCT funding for operations in FY2021 and FY2022. ARPA funds will supplement operating expenses in FY2023. COVID-19 Relief funds are not ongoing funding.
- Table 3-12 shows most operating funds are allocated to fixed-route operations. Pre-pandemic fixed-route accounted for over 90% of funds. The supplemental COVID-19 Relief Funds were not directly allocated specifically to fixed-route or demand response but rather used for both operations.

Before the pandemic, BCT consistently had a farebox recovery ratio of approximately 10%. Fare revenue had been increasing slightly before 2017 but was stable through 2019. Figure 3-54 shows fare revenue fluctuating as operating expenses steadily grew between 2013 and 2020.

[68] Data source: City of Redondo Beach

Figure 3-54: Farebox Recovery and Operating Expenses (2016-20) [69]



- The pandemic and the resulting suspension of fare collection meant that farebox revenue—while on a slight upward trend since 2017—has plummeted. In 2019, BCT collected $329,572 in fares, while in 2020, it collected $244,491 through April, a 25% decrease. Hopefully, with rebounding ridership and the resumption of fare collection, farebox recovery will improve.

3.5 Futures Analysis

3.5.1 Future Developments

Long and short-term projects are planned that will impact the South Bay and the demand for BCT services. These projects include major new transit infrastructure from Metro such as Lines K and C extension as well as land developments like South Bay Galleria and mixed-use developments in Redondo Beach and El Segundo. The impacts BCT may experience from these projects range from local ridership and construction to major increases in transit options connecting the region. BCT should monitor the process of these projects as well as additional proposals that may change current projections.

3.5.1.1 Transportation Projects

Table 3-14 summarizes major transportation projects in the South Bay taking place over the next 15 years. The impact timeframe has been divided into either “short-term” or “long-term” to align with either the short- or long-range service plans that will be developed for BCT in the next deliverable.

[69] Data source: NTD

Table 3-14: Transportation projects in the South Bay

Project	Project Overview	Potential impact on BCT	Expected Delivery Year	Impact Timeframe
LAX Automated People Mover (APM) (Landside Access Modernization Program) [70]	The LAX APM is a 2.25-mile elevated guideway train system that will connect Metro's AMC to LAX, providing direct transit access to LAX. The APM is anticipated to become fully operational in 2023. The APM will be able to be reached via the future Crenshaw/LAX Line and the C Line. The APM will connect to bus transportation services at the AMC. Many transit agencies provide service to LAX, including BCT, LA Metro, Culver City Bus, Santa Monica BBB, GTrans, and others.	This new connection may result in increased demand for BCT Line 109	2023	Short-term
Airport Metro Connector [71]	The AMC station at Aviation Bl/96th Street will allow riders to connect from the LAX APM to the LA Metro rail system. The station is also planned to have a bus plaza served by BCT, LA Metro, Santa Monica BBB, Culver City Bus, Torrance Transit, and GTrans.	This new connection may result in increased demand for BCT Line 109	2024	Short-term
Crenshaw/LAX Transit Project (K Line) [72]	Provides a vital north-south link in the Metro rail system, enabling more people on the west side to travel to more destinations more quickly as well as providing rail connections to LAX and the APM via the AMC station.	Potentially more travelers using this line to connect to C Line to travel around Redondo Beach and the South Bay, which could increase demand for BCT services.	2022	Short-term
C Line Extension [73]	Metro plans to extend the C Line through the South Bay from Redondo Beach to Torrance. Metro is currently in the environmental review process, studying two potential route options through Redondo Beach, Lawndale, and Torrance. Metro anticipates C Line Extension	Demand for local transit in and around Redondo Beach and RBTC will likely increase due to the presence of the rail line Increased demand for BCT 102 may need to consider and plan for potential service	2030-2033	Long-term

[70] LAWA Official Site | Automated People Mover
[71] Airport Metro Connector - LA Metro
[72] Crenshaw/LAX Transit Project - LA Metro
[73] C Line (Green) Extension to Torrance - LA Metro

Project	Project Overview	Potential impact on BCT	Expected Delivery Year	Impact Timeframe
	opening between 2030 and 2033, with construction forecasted to begin in 2026 [74].	disruptions related to construction beginning in 2026 depending on the rail alignment.		
Vermont Transit Corridor South Bay Extension [75]	In the early planning stages, the Vermont Transit Corridor is evaluating transit alternatives from Hollywood Boulevard to 120th Street. As part of this study, an extension approximately 10 miles south from 120th Street to the Metro J Line (Silver) Pacific Coast Highway transitway station is also being evaluated. Currently, both BRT and rail concepts have been advanced into an environmental review.	Creating a direct north-south route from the South Bay to Los Angeles could increase demand for transit but this service would not connect directly to the BCT service area.	2028-2030	Long-term
Inglewood Transit Connector [76]	Spanning the first/last mile gap between SoFi Stadium and the Metro K Line, the Inglewood Transit Connect would connect at the Downtown Inglewood transit stop. The Inglewood Transit Connector is expected in 2028. The SoFi stadium, home to the Los Angeles Rams and Chargers as well as a concert and event venue, is part of Hollywood Park, which includes offices, condominiums, a movie theater, a hotel, restaurants, and an open-air shopping and entertainment complex [77]. Finally, the Intuit Dome, the future home of the Los Angeles Clippers, is currently under construction south of SoFi stadium and is expected to open in 2024 [78].	BCT would most likely not be impacted but may experience increased demand during special events, sports seasons, and the 2028 Summer Olympics. Overall demand to visit the Inglewood complex may also increase due to the number of amenities at the complex.	2028	Long-term

[74] The operating plans for the K Line and C Line are currently in flux, where future operating plans could result in the future K Line continuing south from its currently-planned terminus to operate on the C Line between the Mariposa and Redondo Beach stations, eventually extending further down to Torrance with the C Line operating in an east-west direction only between Aviation/LAX and Norwalk. The Metro Board has instructed staff to conduct outreach and develop an updated Crenshaw/LAX Line operating plan recommendation that would be approved before the AMC station opens. This operating plan is important to consider but does not change the locations of current and future Metro rail stations that BCT interacts with.

[75] Vermont Transit Corridor South Bay Extension Feasibility Study - LA Metro

[76] Inglewood Transit Connector Presentation (envisioninglewood.org)

[77] https://hollywoodparkca.com/en-us

[78] https://www.nba.com/news/clippers-break-ground-on-new-arena-in-inglewood

3.5.1.2 *Land Use and Development Projects*

Table 3-15 summarizes major land use and development projects in the South Bay taking place over the next 15 years.

Table 3-15: Land use and Development Projects in the South Bay

Project	Project Overview	Potential impact on BCT	Expected Delivery Year	Impact Timeframe
South Bay Galleria [79]	Redondo Beach City Council has approved conceptual plans for redevelopment which include more commercial space, a 150-room hotel, 300 apartments, and six acres of open space. 20% of residential units will be designated for middle- and low-income residents.	Redevelopment may increase demand along Line 102 and importantly, the inclusion of affordable housing may also increase demand for BCT services. A more detailed project timeline will help BCT to more accurately plan how to best respond to the redevelopment.	To open in phases, redevelopment of retail areas 2023-2024; residential set to open in mid-2025; hotel in 2026	Mid- to Long-term
PLANredondo [80]	The city's new general plan will shape land use and open space goals and policies that will act as the city's foundation for growth and development for the next 20-30 years. The City Council adopted the new land-use plan in May 2021.	This includes residential overlay areas in four parts of the city with higher density housing than other land use designations, including considerations for densities up to 45 dwelling units per acre.	Ongoing	Long-term
AES Redondo Beach [81]	Along Harbor Drive, the AES Power Plant has been permitted to continue operating through 2023. The 51-acre site was purchased by a developer who permitted the operating extension. Potential development could include an office campus, retail/commercial space, or hotel as well as some portion of the property as open space.	There is no immediate impact on BCT from AES. The future impact is unclear as the plant remains operating and no development plans submitted.	Unknown	Long-term

[79] City of Redondo Beach – South Bay Galleria
[80] City of Redondo Beach - PLANredondo
[81] California's Coastal Power Plants: Redondo Beach Generating Station(ca.gov)

Project	Project Overview	Potential impact on BCT	Expected Delivery Year	Impact Timeframe
Beach Cities Health District (BCHD) Healthy Living Campus [82]	Beach Cities Health District has proposed redevelopment of their 11-acre property at 514 North Prospect Avenue. The new development would provide residential Care for the Elderly with a reduction of the existing facility from 420 units to 217 units, including memory care [83].	The Project would result in a net decrease of 1,222 daily trips, which may decrease demand along Line 102 and for WAVE services.	2025 (tentative)	Short-term
100-132 N. Catalina Avenue Mixed-Use Development [84]	Proposed construction of 30 residential units with 3,000 sf of commercial space (an example is one (1) coffee shop with tasting space) by Beach City Capital at 100-132 North Catalina Avenue. The project includes the demolition of approximately 8,929 sq. ft. of existing buildings between 112 and 132 North Catalina Avenue.	The project is along BCT Lines 102 and 109 and may increase demand.	Denied by Redondo Beach City Council, a Revised plan is anticipated to be resubmitted.	Short-term
King Harbor Public Amenities Plan [85]	The City of Redondo Beach has commenced a planning effort to establish a holistic framework plan to improve and enhance various public amenities within the City's waterfront, King Harbor. The Plan was approved by the City Council in October 2022. The plan will include an implementation strategy that will consider how the plan will be implemented and funded throughout the planning and design process	BCT Lines 102 and 109 serve King Harbor and could result in increased demand.	100% Draft Plan submitted Sept. 2022; Community outreach in progress; implementation timeline unclear	Long-term
El Segundo Pacific Coast Commons [86]	In March 2022, the El Segundo City Council voted to approve a new mixed-use development comprised of a series of buildings located on the west side of the Pacific Coast Highway between Holly and Palms Ave. The properties are currently used as parking for neighboring hotels. The development is planned to consist of 263 apartments (with 32 designated as affordable), 11,252 square feet of ground-story retail, and parking for 792 vehicles.	Increased demand for Line 109 could result from this development. The proposed development is approximately a 500-ft walk from the nearest BCT bus stop on Grand Ave.	2025	Short-term

[82] The Campus | BCHD - Healthy Living (bchdcampus.org)
[83] https://www.bchdcampus.org/campus
[84] City of Redondo Beach - News Details
[85] King Harbor Amenities Plan | Redondo Beach (khamenitiesplan.com)
[86] El Segundo approves mixed-use project on Pacific Coast Highway | Urbanize LA

Project	Project Overview	Potential impact on BCT	Expected Delivery Year	Impact Timeframe
	Construction is expected to last for 34 months.			

Figure 3-55 provides a spatial analysis of the projects in Table 3-13 and Table 3-14 with estimated completion dates. Completion dates for the AES campus, King Harbor Public Amenities Plan, and Catalina Ave Mixed-Use Development are unknown at this time.

Figure 3-55: Future Transportation and Land Use and Development Projects in BCT Service Area



4 EXISTING CONDITIONS REVIEW – OPERATIONS AND MAINTENANCE FACILITY

This section provides a high-level overview of the existing conditions of the infrastructure and facilities at BCT's bus maintenance and operations facility (OMF). General guidance will also be provided on what facilities and infrastructure may be required and/or considered in the future master plan for a new OMF at the site. Any challenges to upgrading the existing facility for ZEB implementation are also discussed at a high level. These preliminary considerations will be built upon in greater detail at later stages in the form of the facilities master plan, as well as in the ZEB implementation plan with the assumption that a new facility will be provided by BCT on the same property as the existing OMF. The City has currently approved Future Subregional Measure R funding for a new OMF, planned to be allocated in FY25-26.

4.1 General Site Information

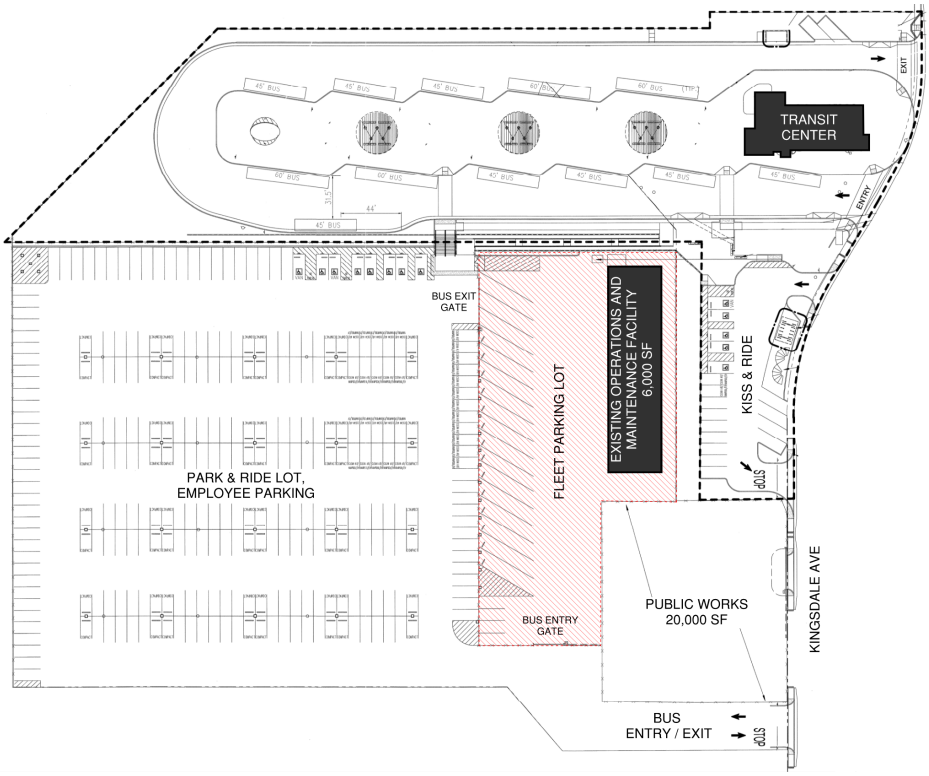
BCT's facility is located at 1519 Kingsdale Ave. in Redondo Beach (Figure 4-1 and Figure 4-2). The transit agency's OMF occupies a fenced area inside the City's larger property that includes the new transit center, kiss & ride, park & ride lot, and about 20,000 sq. ft. of space just south of the OMF that is currently used by the public works department. The total site area including these other functions is about 6.5 acres. See Figure 4-1 below for the location of OMF relative to other functions on the site.

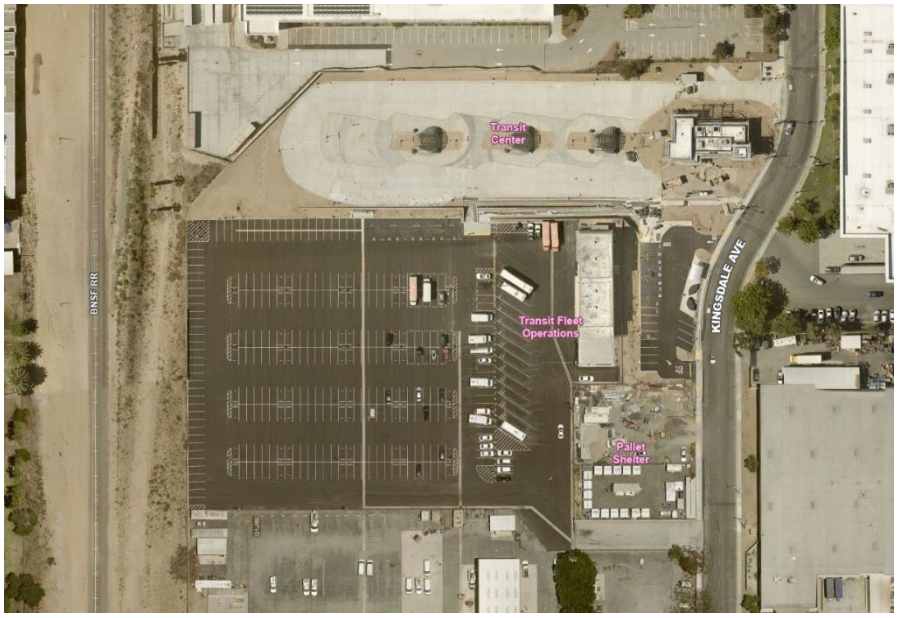
The OMF consists of a 6,000 sq. ft. single-story fleet maintenance building that houses vehicle maintenance and operations within the fenced area of approximately 36,000 sq. ft. (0.87 acres). This area only contains the fleet maintenance building and fleet parking, but not employee parking. The building and site do not contain administrative City spaces which are located at other City offices.

The facility also does not include fueling infrastructure of any kind since the fleet fuels at offsite CNG facilities, nor does it include a fixed vehicle wash since vehicles are currently washed by a third-party vendor.

Figure 4-1: Site Diagram of BCT Property (above) and Aerial View (below) [87]

The red hatched area represents current BCT operations and maintenance facility within the fenced portion of the property.





[87] Data source: City of Redondo Beach

Figure 4-2: Image of Parked BCT Bus and Fleet Maintenance Facility



4.1.1 Existing Building and Maintenance Equipment Review

4.1.1.1 Summary

A detailed building assessment is not part of this report since the existing facility is assumed in need of replacement in the future, but a high-level assessment of the condition and functional spaces was performed via a facility walk-through by Stantec and City staff on May 13, 2022.

The facility is currently occupied entirely by the City's transit operator with no onsite City staff spaces. The amount of space allocated for the four maintenance bays appears to be adequate for the City's current size of fleet but at only 40 feet deep, the building cannot accommodate a full-size 40-ft long transit bus. Even a 30-ft-long vehicle is too large for the building because a minimum of 6- to 8 ft should be provided at both ends of the vehicle to safely maneuver equipment and personnel around a vehicle with the bay doors closed. The building also does not meet the current needs for offices, locker rooms, and training spaces since dedicated space for these functions is not present in the facility. Only one toilet room exists in the building. It is in poor condition and does not meet most, if any, of today's accessibility standards. Adequate storage is also significantly lacking for all office and maintenance needs.

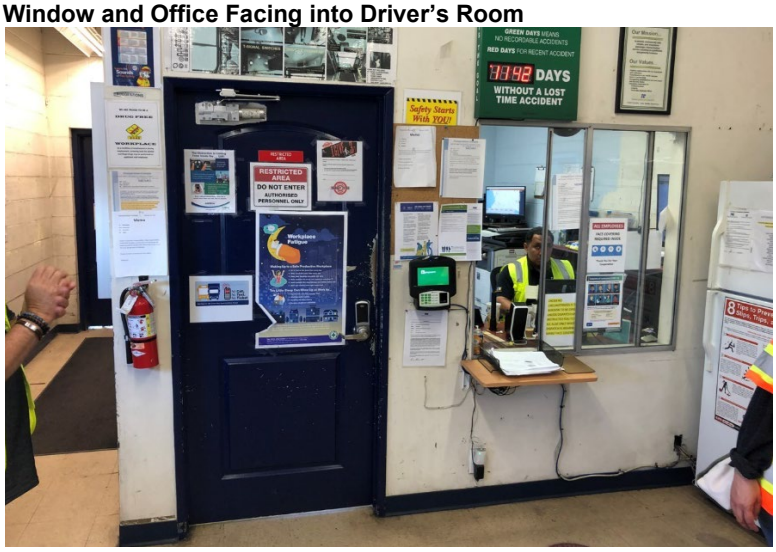
Maintenance equipment was also not specifically assessed but the shop was generally equipped with standard vehicle maintenance equipment, including mobile platform lifts, lube, and compressed air systems, tire racks, etc. Abandoned in-ground vehicle lifts are present in at least one maintenance bay which creates challenges with utilizing mobile lifts that need to roll on a flat floor.

Figure 4-3: Interior Maintenance Bays



The maintenance bays are not equipped with an overhead fall protection system typical of many transit facilities. Fall protection should be provided for any facility where accessing equipment or inspections are needed for the top of the vehicles.

Figure 4-4: Dispatch Window and Office Facing into Driver's Room



4.1.1.2 Facility Conditions

The bus parking lot and pavement are in excellent condition since these site improvements were included as a part of the larger transit center construction project.

The building is generally in poor condition primarily due to its age and relative to its current use. The facility was originally constructed for vehicle service but not for CNG vehicles or transit operations. The

building has been partially retrofitted to accommodate office and support spaces as needed but none are constructed to modern transit civic building standards for office or service/support spaces. Code-compliant building HVAC systems, particularly the exhaust and detection systems for CNG vehicles, are not in place.

Additionally, the building does not meet current accessibility standards. Since current improvements aren't being planned, the building does not require upgrades. If upgrades or improvements were to be considered for this building, the entire building would need to be upgraded if the construction value of any upgrades were to exceed the current DSA (Division of the State Architect) valuation threshold for building alterations, structural repairs, or additions to existing buildings. For 2022, this value is $182,172, so any improvements exceeding this value would also need to include accessibility improvements as outlined in Chapter 11B, Division 2 of California Building Code Part 2, Volume 1. In other words, the current OMF building has exceeded its useful life and needs replacement.

Figure 4-5: Ceiling Space and Fluid Reels Within Maintenance Bays



4.1.1.3 ZEB Implementation Considerations

Since the building is assumed to need to be entirely replaced, limited discussion is provided on the needed improvements to the actual building required to accommodate either type of ZEB technology. However, in addition to the building simply being too small, the need to upgrade the building exhaust systems, the costs and impacts to install a formal fall protection system, and new gas-detection systems for hydrogen fuel (if applicable) would be significant costs to be applied to a building generally not suitable for long term investment. The necessary tools and specialty diagnostic equipment would also be required for either type of ZEB vehicle, and would be implemented at the time staff are trained to service the particular vehicle technology.

For a facility considering the implementation of hydrogen fuel cell electric buses (FCEBs), a compliant gas-detection system (for any hydrogen leak) will be required at the maintenance garage that would operate and maintain FCEBs, as well as in any enclosed building that an FCEB would enter. These systems are similar to those required at a facility with CNG buses and require similar ventilation requirements. These systems would need to be entirely new at the BCT facility since the equipment and systems are relatively new and could be adapted for hydrogen detection.

If battery-electric buses (BEBs) are implemented, then bus recharging equipment is recommended for use inside the building, in the event that a down bus is required to be charged or plugged in during service. These chargers would be lower-powered DC units, rated at 15-20 kW, and could be located inside or outside of the building so long as the dispensers are routed to the proper locations inside the maintenance bays to connect to the charging port(s) on the buses.

4.1.2 Vehicle Service Cycle

4.1.2.1 Summary

The property has one driveway for ingress and egress of vehicles on the south end of the property that connects to an access drive out to Kingsdale Avenue. The bus yard is separated from the remainder of the property with a fence and vehicle gates. Park & Ride lot users, employees, visitors, and deliveries utilize the same driveway off Kingsdale Ave. which mixes transit vehicles, staff, and public vehicles in common drive aisles.

Prior to returning to the facility, operators refuel the vehicles at an offsite card lock fueling facility. Operators return to the facility and pull vehicles up to the main entry door, and a supervisor pulls fares from the bus. Operators then park the vehicle. Vehicle washing is provided by a third-party vendor that utilizes a mobile system that captures and reuses the wash water.

Figure 4-6: Parked Buses in Newly Resurfaced Fleet Parking Area



4.1.2.1.1 ZEB Implementation Considerations

The current service cycle functions adequately for the size of BCT's operations and is suitable for transition to ZEB technologies since phasing will not cause significant impacts on ongoing operations. Since the current service cycle on-site is very limited, further consideration for optimization of the service

cycle during the course of ZEB implementation and future facility upgrades should be considered in the future master planning phases.

With the implementation of FCEBs, no changes to the service cycle would be required if the hydrogen fueling dispensers were to be located offsite similar to the current card lock facility. The primary impact on the facility will be the installation of a new gas detection and exhaust system in the existing building if it is not to be wholly replaced.

For BEBs, chargers and dispensers will need to be planned throughout the yard but are unlikely to change the current service cycle except that the fueling function would then happen onsite as opposed to offsite. If the current fleet parking configuration is to remain, careful planning for locations of charging dispensers will need to be considered, and charging cabinets/equipment will most likely need to be remotely located from the dispensers since the current parking layout is very constrained.

Since the agency currently fuels offsite, the phased installation of charging equipment should be relatively straightforward since there is no issue with making space for new infrastructure and equipment in the same location as current fueling equipment.

4.1.3 Electrical Service

Electrical power is supplied to the facility from an onsite Southern California Edison (SCE) pad-mounted transformer located near the northwest corner of the maintenance building. Utility electrical service is from the underground utility lines through the property.

4.1.3.1 Conditions and Preliminary ZEB Considerations

A detailed assessment of the electrical utility equipment and capacity is not included in this assessment but it can be reasonably assumed that the current utility serving the building will need to be upgraded for a new OMF building and any additional onsite ZEB fueling equipment.

The existing electrical system is likely not adequate to serve the loads that would result from the full build-out of the BEB chargers. BEB charger demands vary depending on the model, but power demands often exceed 200 kW per charger, and peak fleet charging demands greater than a megawatt are common even with charge management systems. The chargers would likely each require a new 480 V electrical feed with a new service from SCE. SCE has significant distribution lines along Kingsdale Ave. that could potentially feed a new service to the chargers.

If FCEBs were adopted and a hydrogen fueling system was installed onsite, this may also require a new electrical service from SCE to provide 480 V power to the hydrogen compressors and filling equipment. Additional analysis of the fueling cycles and hydrogen compressor operations will be required to confirm if the existing transformer will be sufficient or if additional service and transformation will be needed.

4.1.4 General Maintenance Facility Considerations

4.1.4.1 Fire Protection Considerations

With the implementation of both FCEBs and BEBs, fire protection and life-safety concerns can be significant. However, due to the relatively new advent of these technologies, building and fire protection codes have not specifically addressed many of these concerns. The National Fire Protection Association (NFPA) 855 ‘Standard for the Installation of Stationary Energy Storage Systems’ is a standard that can potentially be applied to BEB storage, but this particular standard is certainly overkill relative to the capacity of the batteries onboard buses and is more applicable for an indoor application/storage of battery systems. The need for enhanced fire protection systems has not been determined as a baseline

requirement for BEB implementation and would be left up to the discretion of the local fire marshal and the building officials. Early coordination with the local building authorities is highly recommended to understand their requirements and concerns.

4.1.4.2 Fall Protection and Safety Infrastructure Considerations

Safety is of paramount importance at all bus maintenance facilities and should be assessed at a very detailed level for any future facility modifications. A detailed safety assessment is outside the scope of this report, but assumptions can be made that fall protection systems in the interior maintenance bays should be a baseline requirement for vehicle maintenance facilities. This requirement will not be going away with the implementation of FCEBs or BEBs and may even increase due to battery packs being located on the roofs of vehicles. Regardless, equipment will likely continue to be located on the rooftop of vehicles, whether it be batteries, fuel tanks, or air conditioners, and therefore the demand for additional fall arrest systems may be required in the future based on the work performed at the facility.

5 EXISTING CONDITIONS REVIEW – ZERO-EMISSION BUS PLANNING

As part of the TSS, BCT is also developing a ZEB rollout plan to comply with State regulations requiring that a ZEB rollout plan be developed and submitted to CARB, as well as to guide strategic infrastructure deployment for the redevelopment of the operations and maintenance facility.

Several analyses of existing conditions related to the fleet and bus operations are summarized here that will inform the ZEB analysis and planning in later steps of the TSS.

5.1 ICT Regulation

CARB adopted the ICT regulation in December 2018, which requires all public bus transit agencies in the state to gradually transition to a complete ZEB fleet by 2040. This regulation is in accordance with preceding state policies SB 375 and SB 350. SB 375, the Sustainable Communities and Climate Protection Program, creates initiatives for the increased development of transit-oriented communities, better-connected transportation, and active transportation. Relatedly, SB 350 supports widespread transportation electrification through collaboration between CARB and the California Public Utilities Commission (CPUC).

ICT also states that transit agencies are required to produce a ZEB rollout plan that describes how the agency is planning to achieve a full transition to a zero-emission (ZE) fleet by 2040 as well as outlining reporting and record-keeping requirements. Specific elements required in the rollout plan include:

- A full explanation of how the agency will transition to ZEBs by 2040 without early retirement of conventional internal combustion engine buses
- Identification of the ZEB technology the agency intends to deploy (either BEBs or FCEBs)
- How the agency will deploy ZEBs in disadvantaged communities
- Identification of potential funding sources
- A training plan and schedule for ZEB operators and maintenance staff
- Schedules for bus purchase and lease options (including fuel type, number of buses, and bus type)
- Construction of associated facilities and infrastructure (including location, type of infrastructure, and timeline)

Small California transit agencies, such as BCT, are mandated to submit ZEB rollout plans by June 30, 2023, to CARB. ICT also outlines different ZEB purchase schedules that large and small agencies must adhere to. Beginning in 2021 and continuing annually through 2050, each transit agency will be required to provide a compliance report[88]. The initial report will outline the number of and information on active buses in the agency's fleet as of December 31, 2017. Subsequent reports must include transit agency information, information on each bus purchased, owned, operated, leased, or rented (including make, model, curb weight, engine and propulsion system, bus purchases, and any information on converted buses), ZE mobility option information (if applicable), and information on renewable fuel usage (including date purchased, fuel contract number, and effective date, if applicable).

Table 5-1 below outlines the ZEB purchase schedule for small transit agencies for heavy-duty transit vehicles. Specific vehicle types, such as motor coaches, cutaways, double-deckers, and 60-ft. vehicles, are exempt from this purchase schedule until 2026 or later (dependent on Altoona testing being

[88] https://ww2.arb.ca.gov/sites/default/files/2019-10/ictfro-Clean-Final_0.pdf

completed). Whereas large agencies are required to start purchasing ZEBs in 2023, small agencies are exempt until 2026, when 25% of new bus purchases must be ZE.

Table 5-1: ZEB Purchase Schedule (as a percentage of total new bus purchases for small transit agencies) for standard buses [89]

Year	Percentage
2026	25%
2027	25%
2028	25%
2029 and after	100%

ICT also outlines several flexibility options to comply with ZEB purchase requirements that transit agencies can take advantage of. These include receiving bonus credits for early ZEB purchases, ZE mobility options to encourage innovation, enhanced first/last mile connections and improved mobility, and the option to form a joint ZEB group, which entails transit agencies working together to collectively comply with ZEB purchase requirements and a joint ZEB rollout plan. Formation of joint ZEB groups is dependent on certain eligibility requirements (agencies must share infrastructure, be in the same air basin, air district, Metropolitan Planning Organization, or Regional Transportation Planning Organization).

The ZE mobility option outlined above specifically refers to a program that provides a ZE service, such as a shared mobility bicycle program or any service operated by the agency that includes ZE transportation, such as microtransit, demand-response service, or autonomous shuttles. The mobility option does not apply to larger buses or fixed-route transit services. Small transit agencies must achieve 180,000 zero-emission passenger miles per year to be eligible for a mobility credit. One mobility credit is the equivalent of having one ZEB in the fleet.

To account for circumstances beyond a transit agency's control that may impact their ability to comply with ICT regulations, the mandate laid out specific provisions for exemptions. Exemptions will be permitted for the following circumstances:

- If the required ZEB type is unavailable
- Daily mileage needs cannot be met
- Gradeability needs cannot be met
- Delays in infrastructure construction
- A financial emergency is declared by the transit agency
- In circumstances where incremental capital or electricity costs for charging cannot be offset after applying for all available funding and incentive opportunities.

Specifically, the ZEB rollout plan required to be submitted to CARB by mid-2023 must include the following components, broken down by CARB into nine sections.

- Section A: Transit agency information

[89] In this report, standard buses refer to 35-ft. or 40-ft. unless otherwise stated

- Section B: Rollout plan general information
- Section C: Technology portfolio
- Section D: Current bus fleet composition and future bus purchases
- Section E: Facilities and Infrastructure Modifications
- Section F: Providing service in disadvantaged communities
- Section G: Workforce training
- Section H: Potential Funding Sources
- Section I: Start-up and scale-up challenges

5.2 ZEB Background and Market Scan

To better provide context for the ZEB analysis, this section provides a summary of ZEB technologies, their applications, their challenges, and fleet availability. As a precursor to ZEB modeling and recommendations, the following background information aims to provide an overview of the options available when implementing ZEB technologies. While not all technologies reviewed will be applicable to BCT, a basic understanding of what is available and how the technologies work will support local expertise for informed decision-making on what will be the best fit for operations in the Beach Cities.

The last several years have seen a rapid deployment of low-emission and ZEB globally. This is primarily driven by an increasing regulatory push towards cleaner transportation, rapid advancements in bus and battery technologies, favorable fiscal incentives, and a maturing electric vehicle market ecosystem resulting in lower costs and reduced technological risks. Notwithstanding the significant advancements that have been made toward reducing the environmental footprint of diesel buses, there are many ZEB technologies available today and at various stages of market deployment that provide a cleaner alternative to diesel and CNG buses. Given various available funding programs, it is evident that the transit industry is being oriented to embrace ZEB technologies in the future.

Like many agencies in the Los Angeles region, BCT operates a fleet of CNG-fueled buses. Generally, these vehicles are known as 'low-emissions' particularly compared to diesel equivalents. Nonetheless, CNG vehicles still emit CO_2 and other greenhouse gases (GHGs), and the production of CNG fuel can lead to environmentally harmful byproducts like methane gas. Moreover, CARB's mandate requires a conversion of California transit fleets to fully ZEBs. Different configurations of BEBs and FCEBs are being considered today by transit agencies as a solution to replace fossil-based fuels with the goal of reducing criteria pollutant and greenhouse gas emissions (GHGs), as well as within California to comply with ICT regulations.

5.2.1 Battery-Electric Buses

BEBs function by using electricity stored in an onboard battery to propel the vehicle. The major internal component that dictates the vehicle's range is the battery size and capacity—the larger the battery, the longer the bus can operate on a single charge.

Increasing the battery size to maximize range creates some limitations. While a bigger battery generally increases the length of vehicle operation, it is also heavier. Together with passenger loads, the bus may become so heavy that the energy required to move the vehicle reduces its operating range. To create

buses that meet vehicle operating parameters, OEMs and agencies are trying to balance the trade-offs associated with vehicles that have larger, heavier batteries.

One way that OEMs have addressed these trade-offs is to build high-power on-route charging infrastructure. This allows them to extend the range of the BEBs by providing additional charges in short sessions at the time. With this infrastructure, buses can recharge during operating periods to extend their range. However, on-route charging is typically more expensive, as it typically occurs during electricity peak hours, and would need to be located at a City-owned location [90].

One key trade-off is the need for a bus service schedule that allows for sufficient time to recharge buses during periods of operation (5-10 minutes for every trip). This may have downstream impacts on fleet size, service frequency, operator labor, and operating and capital costs. The need to ensure that on-route chargers are functional can also restrict flexibility since BEBs need to be assigned specifically to blocks that operate on routes with charging equipment.

Depending on the battery of a BEB, these vehicles can be classified as follows:

- **Short-Range BEBs:** they can be equipped with smaller batteries (<300 kWh) that enable operating ranges of approximately 130 miles. The vehicles usually required supporting infrastructure along the routes to extend service.
- **Standard BEBs:** vehicles equipped with batteries between 440 kWh and 525 kWh for ranges of 180–210 mi. These vehicles can be operated with a single overnight charge or can also be paired with on-route charging infrastructure.
- **Long-Range BEBs:** vehicles with larger batteries (i.e., 660 kWh) for ranges up to 260 mi. These vehicles can be operated with a single overnight charge or can also be paired with on-route charging infrastructure.

Regardless of the battery size, the charging methodology can also be a way to classify BEBs:

- **Depot-charging only**: These buses are considered to only be charged in-depot at the end of their service day. The charging rate for this equipment is usually between 60 kW up to 150 kW. The charger configuration for these buses can be either using a plug-in or a pantograph connection.
- **On-route fast charging**: They are ideally recharged on-route as the battery depletes during operation using fast-charging equipment [91] that has power outputs higher than 300 kW and up to 600 kW. These buses oftentimes also require in-depot recharging. The charger configuration for these buses can only be a pantograph connection for the fast on-route charging but they could also have a plug-in connection for the depot-charging (low-power) equipment. However, this means additional costs and special orders to the OEMs since two connection configurations need to be added to the bus. Also, since charging would occur during peak- hours, electricity costs would be higher.

Table 5-2 lists transit BEB models currently available for US transit agencies. Transit agencies in the US have a broader selection of BEBs than FCEBs as the industry has historically favored BEBs. Reasons for

[90] As part of future reports, modeling will determine if on-route charging is needed. Should on-route charging be a determined as a critical need for the electrification of BCT's fleet, Stantec will identify locations suitable for implementing on-route chargers.
[91] Chargers often require electrical upgrades (like transformers and switchgears) which are discussed, as applicable to BCT, in TSS 3.

this include the relatively lower capital costs for BEBs versus FCEBs (especially for smaller-scale deployments) and the lack of readily available, reliable, and affordable hydrogen as a fuel source in most parts of the country.

Table 5-2: Non-exhaustive List of Available Transit BEBs, Battery Capacities, Range, and Fuel Economy.

OEM	Propulsion Type	Length(s) (ft) [92]	Battery Capacity (kWh)	OEM Stated Range (mi)	Fuel economy (kWh/mi) [93]
BYD	BEB – Long Range (with optional on-route charging)	30, 35, 40, 60	215-578	150-220	1.45-2.65
New Flyer	BEB – Fast Charge	35, 40, 60	160-320	55-115	2.78-2.86
New Flyer	BEB	35, 40, 60	311-466	135-22	2.08-2.33
Nova	BEB – Long Range	40	594	210-290	2.03-2.82
Proterra [94]	BEB – Long Range	35, 40	220-738	95-330 [95]	1.59-2.8 [96]
GreenPower	BEB	30, 35, 40	210-320	85-175	1.21-1.72
Gillig	BEB	40	450	180-200	1.80-2.20

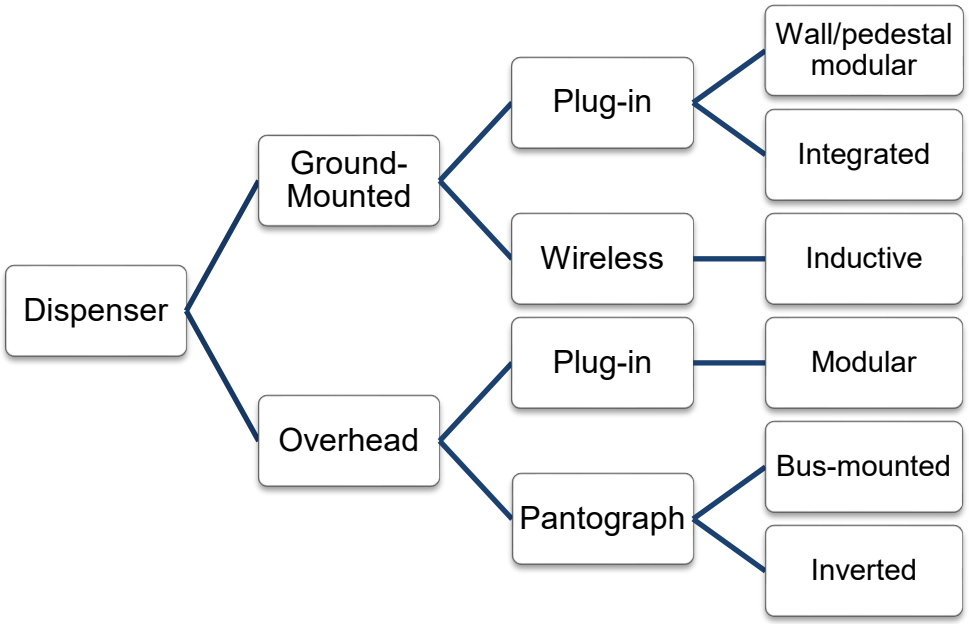
BEB charging equipment has two main components: the power cabinet and the dispenser, in addition to any supporting electrical equipment such as transformers and switchgear. The power cabinet can have different power rates, depending on the number of modules that are combined. The charger module is the inner power module for DC charging stations (piles) and converts AC energy into DC in order to charge vehicles. For example, a power cabinet can have one module of 60 kW or two modules for a total of 120 kW power rate. The charging equipment can be categorized based on power output as follows:

- Standard charging: between 60- to 150-kW power rates. Can be provided by any type of dispenser.
- Fast charging: for power rates above 300 kW and a maximum of 600 kW. Only pantographs can provide these high-power capacities.
- Centralized: new centralized solutions are grouping the charging modules in a single unit capable of distributing up to 3 MW among several modular dispensers. The dispensers connected to a centralized unit can be either plug-ins or pantographs.

[92] New Flyer has quoted prices of $920,000 to $1 million for 35-ft BEBs, $930,000 to $1.1 million for 40-ft BEBs, and $1.6-1.8 million for 60-ft BEBs. Proterra has quoted prices of $930,000 to $1.1 million for 35-ft BEBs, and $940,000 to $1.2 million for 40-ft buses.
[93] The fuel economy ranges quoted here are from OEMs. However, expected operational fuel economies will differ between agencies and communities based on topography, ridership, climate, and other factors.
[94] At the time of writing, the future of Proterra is uncertain as they move through Chapter 11 bankruptcy filings. Mention of Proterra is maintained as reference information.
[95] With Duopower drivetrain; https://www.proterra.com/vehicles/catalyst-electric-bus/range/
[96] With Duopower drivetrain; https://www.proterra.com/vehicles/catalyst-electric-bus/range/

There are three types of dispensers, which are the actual connection between the vehicle and the power cabinet, and those are 1) plug-in, 2) pantographs, and 3) wireless dispensers. However, different installation configurations of dispensers are also possible, creating the classification shown in Figure 5-1.

Figure 5-1: Dispenser installation configurations



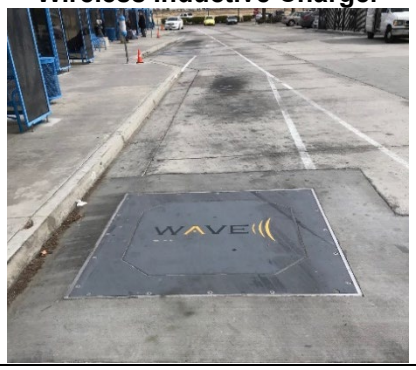
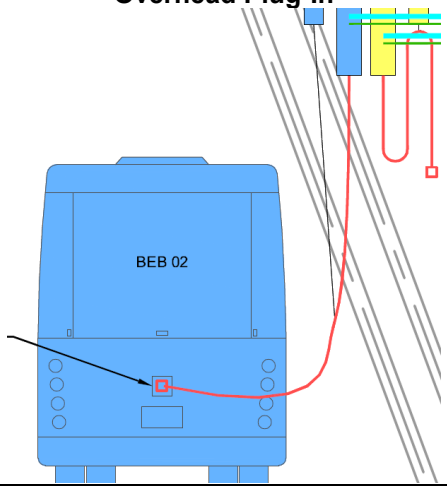
On a modular dispenser, one or more power cabinets can supply one or more dispensers. A modular dispenser can also be referred to as the “dispenser pedestal”. In contrast, an integrated dispenser has the power module and dispenser within the same cabinet, making it a single unit.

Wireless chargers occupy a small footprint and can be used on-route. While aesthetically more pleasing because no large external space is needed like for overhead chargers (they are built into the roadway), charging efficiency varies greater with bus alignment. Also, not all OEMs offer inductive charging and there is no interoperability among wireless charger providers.

For the overhead inverted pantograph configuration, a charging head is lowered onto a set of DC charging rails on the top of the BEB. All BEB manufacturers have aligned with universal high-power opportunity chargers from companies such as Siemens and ABB. Additionally, interoperability is currently being tested. Pantograph chargers can be installed on-route for fast charging or in the depot for overnight charging at lower power rates, depending on the power cabinet configurations.

Table 5-3 presents images and examples of the different dispenser installations and configurations.

Table 5-3: Examples of Dispenser Installation Configurations

<table>
<tr><th colspan="2">Ground-Mounted Dispensers</th></tr>
<tr><td>Modular Plug-in Dispenser
 
</td><td>Integrated Plug-in Dispenser
 
</td></tr>
<tr><td colspan="2">Wireless Inductive Charger
 
</td></tr>
<tr><th colspan="2">Overhead Dispensers</th></tr>
<tr><td>Overhead Plug-In
 
</td><td>Inverted Pantograph
 
</td></tr>
</table>

Because they require fewer alterations to a facility, plug-in chargers tend to cost less than overhead and inductive chargers in terms of purchase costs and installation. Nevertheless, plug-in chargers require more space compared to overhead and are subjected to increased wear and tear, relative to other charger types in a transit setting. Inductive chargers may not be suitable for depots with constrained space.

Regardless of the charger type utilized, electrical upgrades are often required to provide the electrical capacity needed for bus charging. These “before the meter” or provider-side upgrades can include a transformer (Figure 5-2) and switchgear. While an important space and easement consideration, provider-side upgrades are often paid for by the utility when using a program like Charge Ready Transport from SCE. Further discussion and technical specifications will be included in TSS #3.

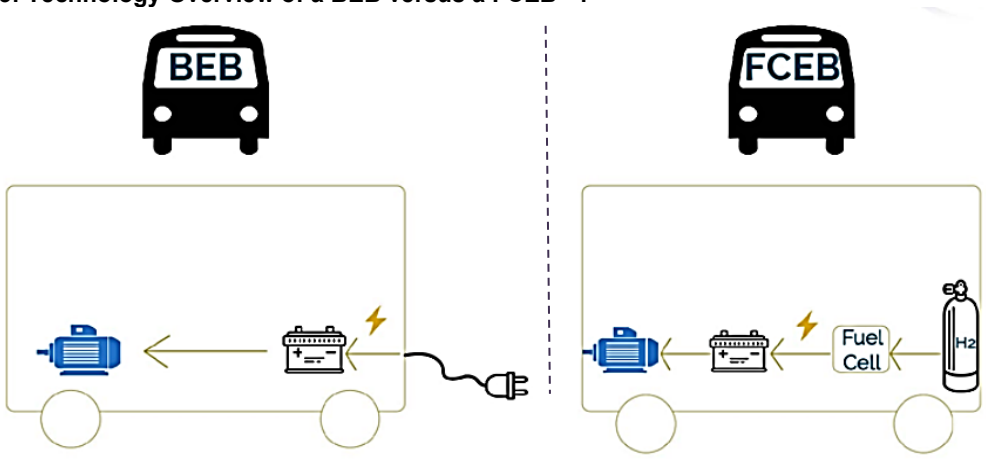
Figure 5-2: Upgraded Service Transformer from Roaring Forks Transportation Authority



5.2.2 Fuel Cell-Electric Buses

FCEBs are also electric buses, however, their energy is stored not only in onboard batteries, but hydrogen is also used as an energy carrier. Hydrogen in this sense works as any other fuel (e.g., gasoline, diesel, CNG, etc.), but instead of an ICE (reciprocating engine) to convert the energy into mechanical work, a fuel cell converts hydrogen’s internal energy into electricity. Figure 5-3 shows a technology comparison between BEBs and FCEBs to highlight how hydrogen is the source of energy for the FCEBs.

Figure 5-3: Technology Overview of a BEB versus a FCEB [97].



FCEBs can be fueled more traditionally and have a longer range. Due to the onboard power generator (the fuel cell), FCEBs are fueled similarly to CNG or diesel buses. The onboard energy source allows onboard electricity generation and therefore permits FCEBs to travel greater distances than BEBs, which need to recharge their batteries using an external charger. The range of FCEBs is between 240–325 mi, depending on the hydrogen tank size [98].

FCEBs provide operational advantages over BEBs including short refueling times, driving range comparable to fossil fuel buses, and reliable service in cold weather conditions.

Early deployments of this technology struggled to find economic benefits due to the high cost of hydrogen production and the expensive nature of FCEBs themselves. However, as hydrogen becomes more economical to produce and fuel cell prices drop, the economics for FCEB will improve especially for longer bus routes requiring faster re-fueling times. While FCEBs have been in the market for over 10 years, only a few manufacturer options are currently available in the US. Table 5-4 presents a list of a sample of available FCEB models and manufacturers in the US.

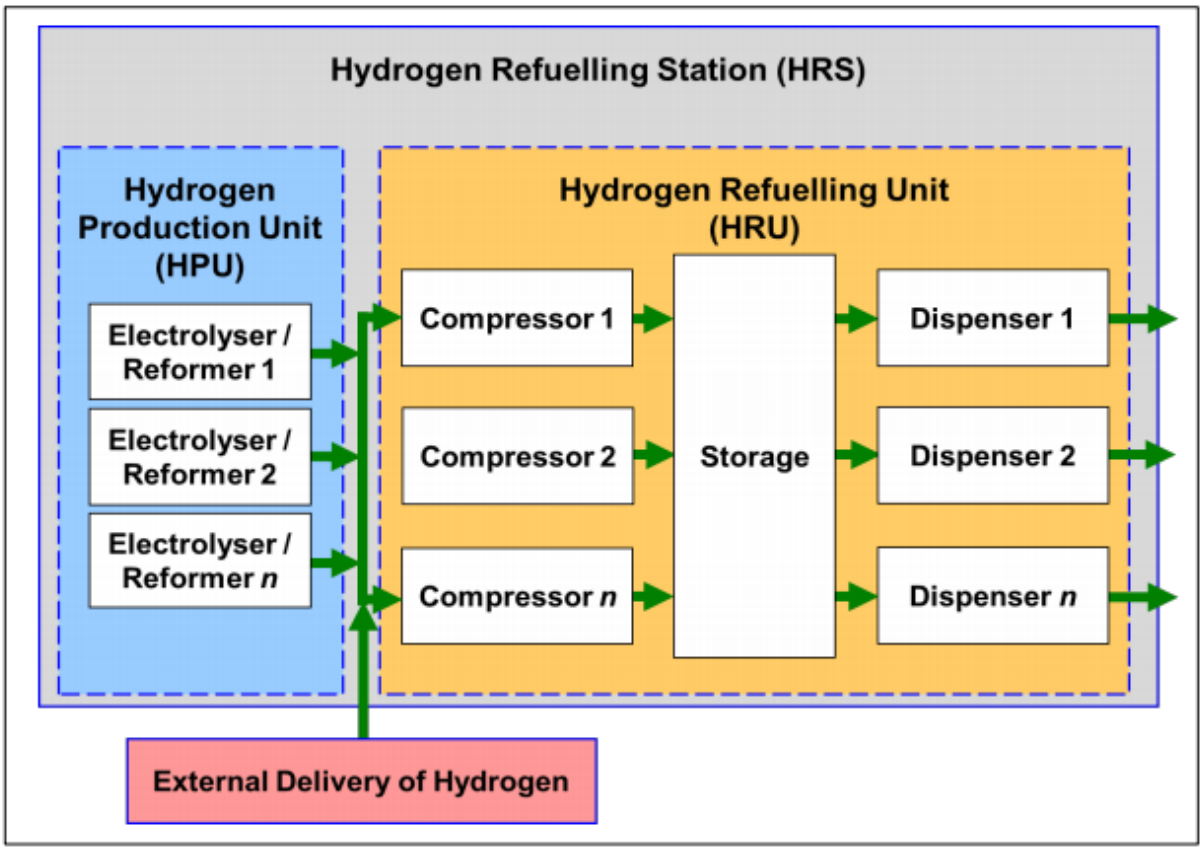
Table 5-4: Non-exhaustive List of Available Transit FCEBs, Battery Capacities, Range, and Fuel Economy

OEM	Propulsion Type	Length(s) (ft)	Fuel Cell Power	Battery Capacity (kWh)	Tank Size (kg)	OEM Stated Range (mi)	Fuel economy (mi/kg)
New Flyer [99]	FCEB	40, 60	160 kW rate motor power; 85 kW (net)	100, 150	37.5	>340	5.8 - 7
ElDorado National	FCEB	35, 40	160 kW rate motor power	11	60	>350	6.5 - 8

[97] Source: CTE
[98] Fuel economy of 6.8 mi/kg was assumed for example purposes only. Current hydrogen tank configurations are 37.5 kg and 50 kg capacity and assuming 95% tank consumption.
[99] New Flyer quoted purchase prices for 40-ft FCEB ~$1.01M and 60-ft FCEB ~$1.46M.

Hydrogen refueling station (HRS) is a term used to refer to the equipment required to transfer hydrogen from static storage tanks to onboard vehicle storage. The refueling process of an FCEB is similar to that of a CNG or diesel bus in that a hose is connected to the fuel gauge until the tank is full (the current standard for heavy-duty vehicles such as buses is 350 bar). This lower-pressure option of 350 bar is financially advantageous as the costs of the required storage vessels and HRSs are significantly lower for 350 bar fueling than for higher-pressure fueling options (e.g., 700 bar used in light-duty vehicles). Figure 5-4 below shows a generalized schematic of an HRS.

Figure 5-4: Generalized Schematic of a Hydrogen Infrastructure Facility [100]

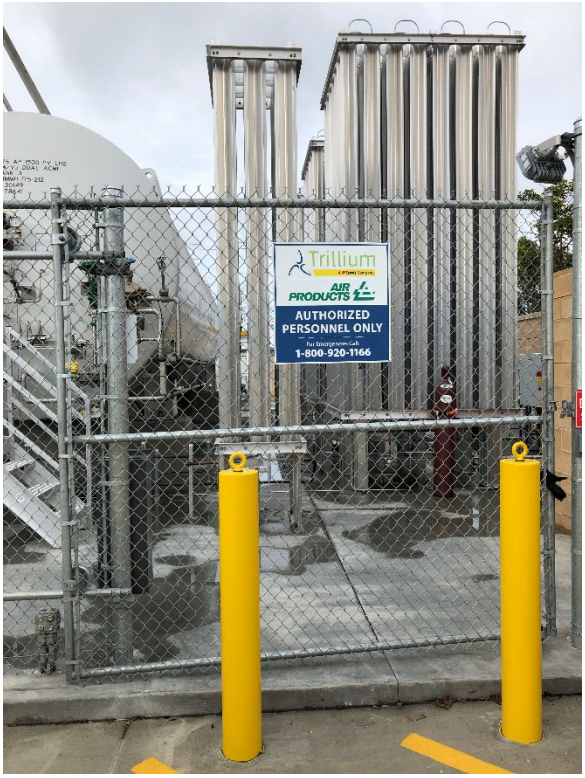


Hydrogen can be stored and transported as a liquid or as a compressed gas; however, hydrogen liquefaction is an energy-intensive process that can erode some of the cost benefits if used for low hydrogen demands. Onsite hydrogen fueling via an onsite HRS thus can be better justified financially for larger fleets.

[100] M. Faltenbacher, K. Stolzenburg, S. Eckert, and M. Gallmetzer, "JIVE-Joint Initiative for hydrogen Vehicles across Europe Deliverable 3.1 MEHRLIN-Models for Economic Hydrogen Refueling Infrastructure Activities 2.4, 3.1 and 3.2 Performance Assessment Handbook," 2018.

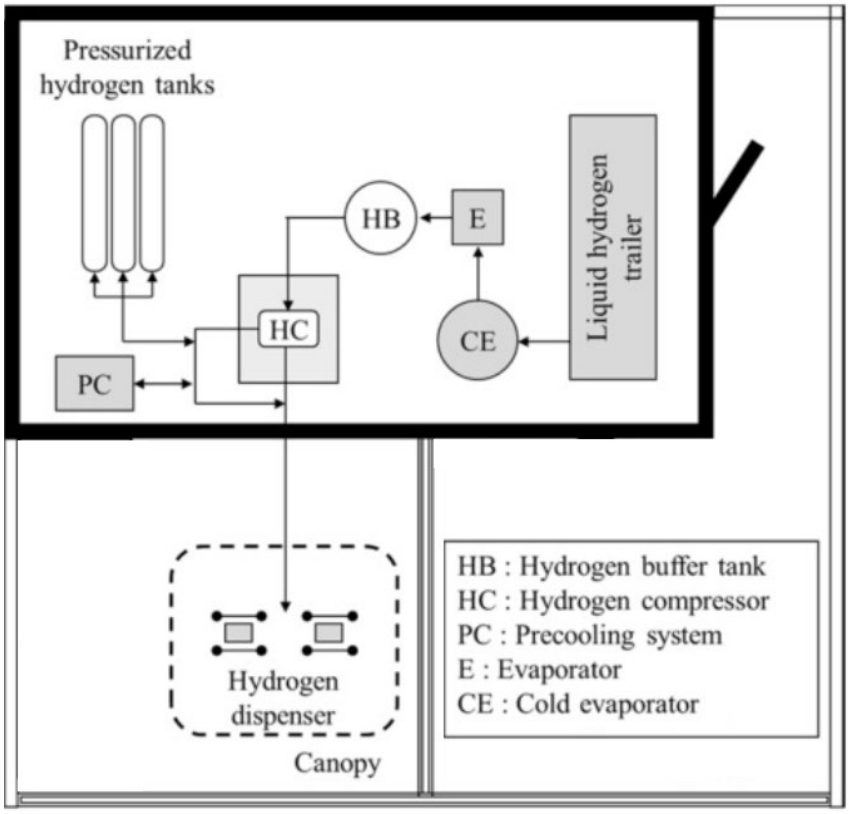
Figure 5-5: Liquid Hydrogen Fueling Station Equipment (storage tank, *left*, and vaporizer and compressor, *right*) at OCTA





If liquified hydrogen is selected as the delivery method, then the cold liquid (-430°F) will be stored in liquid hydrogen tanks (Figure 5-5) at between 50 and 150 PSI. Upon demand from the hydrogen dispensers, the liquid could then be pumped by triplex reciprocating pumps or compressors (3.94 kg/min. or 14.7 gal./min. at 5,000-6,000 PSI per pump) through vaporizers so that the hydrogen is warmed and becomes gaseous and near-atmospheric temperature. Finally, the gaseous hydrogen is routed through a chiller or other precooling system to increase its density, and then to the high-flow gas hydrogen dispensers, which will fill the buses to 350 bar (about 5,000 PSI). If no bus is connected to a dispenser or all buses are full, the gaseous hydrogen from the pumps and vaporizers are then directed to a buffer-storage array, as needed to allow the pumps to run during a typical 2.5-minute exchange time between sequential-bus fills. The buffer-accumulator both reduces the number of start-stop cycles of the pumps and also improves fueling speed and efficiency, as the accumulated gaseous hydrogen is then utilized at the start of the next dispensing cycle. Figure 5-6 presents the layout of a liquid hydrogen fueling station.

Figure 5-6: Layout of Liquid Hydrogen Refueling Station [101]



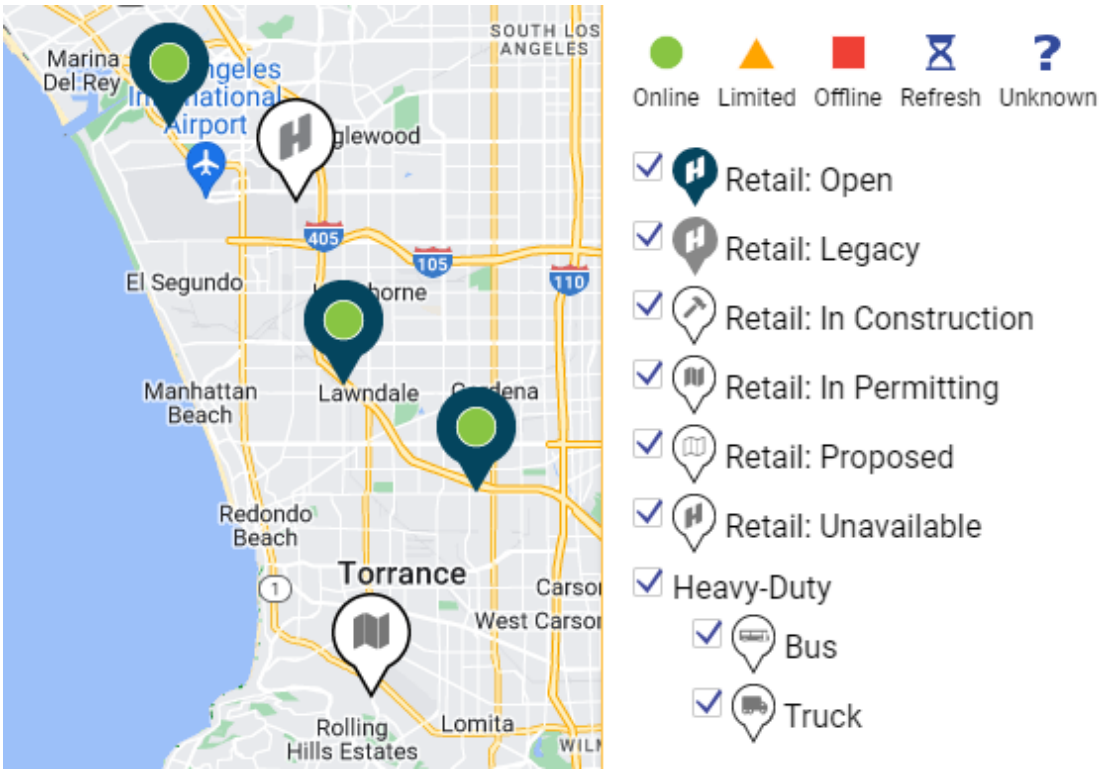
The footprint of hydrogen stations can usually be accommodated by the space designated for CNG refueling stations if this currently exists at the facility. The use of pumps for the hydrogen refueling station will likely increase the power requirements at each division when transitioning away from diesel. As such, an important consideration is the power and energy requirements for the pumps and related equipment for onsite hydrogen dispensation.

As mentioned above, hydrogen fueling is similar to that of CNG vehicles, and should BCT opt for FCEBs, off-site fueling could be explored as is currently done with CNG vehicles, as space constraints at the current site would make an onsite HRS challenging. Off-site fueling would require considerations for additional deadhead and time to fuel built into contracts with operators. The fueling of hydrogen is done in a gaseous state similar to that of CNG but would require additional safety training for fueling operators. Fueling times depend on the size of the tank and fueling technology, but generally range from 10-25 minutes; fueling speed is seen as an area with high potential for advancement.

Figure 5-7 shows current hydrogen fueling facilities in the South Bay, both online and under construction.

[101] Publication available at https://www.researchgate.net/figure/Layout-of-hybrid-station-with-gasoline-and-liquid-hydrogen-supply-systems-21_fig9_285044628

Figure 5-7: Hydrogen Fueling Facilities in the South Bay, Hydrogen Fuel Cell Partnership [102]



The South Bay has three public hydrogen fueling facilities online, as well as one proposed commercial hydrogen fueling station. It should be noted that the fueling station in Torrance on 190th St. operates from a pipeline source of 100% renewable hydrogen. This facility would provide uninterrupted fuel at 35/70 MPa whereas other stations source hydrogen via delivery, presenting potential for disruption. It should also be noted that unless the facility is purpose-built for heavy-duty vehicles, it is unlikely that the facility will have sufficient supply to fuel transit buses and the other vehicles used in BCT's fleet.

If, after modeling, it is determined that an FCEB fleet is the preferred option for BCT, these opportunities for offsite fueling will be explored in greater detail to determine if their daily supply of hydrogen is sufficient for BCT's needs.

5.2.3 ZE Cutaways and Vans

ZEBs were first developed in the standard (35-ft., 40-ft., and 60-ft.) bus sizes, but as transit agencies continue to transition their entire fleets to ZE, there is an increasing demand for ZE options for different bus sizes, including cutaways for demand response and paratransit services. Indeed, BCT operates cutaways for the WAVE service and generally operates smaller heavy-duty buses (30-ft.) for fixed-route service.

Some of the main challenges associated with cutaways for the ZEB market include their shorter design life and most of the smaller cutaway units are based on a van chassis from a major automotive manufacturer with a body mounted on it from the bus manufacturer. The power train is what comes with

[102] Stations Map | Hydrogen Fuel Cell Partnership (h2fcp.org)

the chassis and is not purpose-built for bus operation or layout. By comparison, the heavy-duty full-sized bus is built ground up with the power train components purchased, configured, and installed by the OEM. Perhaps most importantly, being smaller vehicles, there is less space for the ZE apparatus (batteries and/or fuel tanks) and passenger space may be affected if it cannot be accommodated on the roof of the vehicle. This also affects the overall weight of the vehicle; axle capacities are limited and the passenger load, which needs to make provision for battery/electric powered mobility aid devices, can be diminished by the weight of the ZE equipment, be it batteries or hydrogen cylinders, etc. If an insufficient amount of this equipment is installed, the operating range will be proportionately less.

Accessibility of many ZEB vehicles designed for DAR presents issues for customers with mobility challenges. Whereas BCT has transitioned all their DAR vehicles to ramp entrances, currently available ZEBs have step and lift entrances. High and narrow steps are difficult for senior and/or disabled passengers to navigate. It will be important for BCT to procure vehicles with easily accessible ramps.

Despite these challenges detailed above, there have been some products that are suited for transit bus applications at this point; however, the current product and technology state in North America is very much still evolving. A few examples are as follows:

- A Quebec, Canada firm, Lion Bus, has developed a line of electric conventional type C school buses. Evolving from this is a purpose-built small electric low-floor bus offered in both school bus and transit bus versions. It resembles a flat front type D school bus and is approximately 26-ft. with a capacity of up to 31 passengers. A 75-mile range is claimed with one battery but adding an optional second battery doubles the range [103].

- A third vehicle design from Holland is the UMS Mission bus (Figure 5-8). It starts with a stripped-down ProMaster chassis and uses an all-composite body with contemporary electrical componentry. A prototype unit in Canada is expected to undergo Canadian Motor Vehicle Safety Standards certification soon and then pursue US approvals [104].

[103] https://thelionelectric.com/en/products/electric_minibus
[104] https://urbanmobilitysystems.nl/solutions/mission/

Figure 5-8: UMS Mission Zero-Emission Cutaway Bus



- A partnership between Proterra and Optimal-EV announced in June 2020 the development of a battery electric low-floor cutaway bus for North American markets (Figure 5-9). The Proterra [105] battery system will feature 113 kWh of energy capacity with a range of up to 125 miles on one charge. According to the OEM, the vehicle can fully charge in two hours and does not have a reduced carrying capacity due to the onboard battery. The vehicle debuted at the American Public Transportation Association EXPO 2021 and became available for purchase beginning in 2021. Optimal-EV has noted that this is the first vehicle in a line of multiple ZEBs for a variety of applications [106].

[105] Considering Proterra's Chapter 11 bankruptcy filing, Optimal-EV may need to obtain an alternative battery system partner.
[106] https://www.metro-magazine.com/10122170/optimal-electric-vehicles-proterra-partner-to-produce-all-electric-low-floor-cut

Figure 5-9: Optimal-EV Low-Floor Cutaways Bus Using Proterra Battery System



Finally, US Hybrids has recently announced the production of a hydrogen fuel cell plug-in shuttle bus. The vehicle is 30' and features a capacity for up to 25 seats and is ADA-compatible. The vehicle has a hydrogen storage capacity of 9.78 kg of usable hydrogen with a 28.4 kWh battery. US Hybrids states a range of 125 miles with an additional 15 miles using the battery capacity. It is unclear when these will be on the market or what the estimated purchase price will be.

Table 5-5 provides an overview of current and emerging ZE cutaways on the North American market, including some of the vehicles discussed in greater detail above.

Table 5-5: Summary of Zero-Emission Cutaway Options

Lightning Systems E450 Shuttle Bus		
Chassis	Ford E450	
Wheelchair Access	Unknown	
Dimensions L x W x H roof	Unknown	
Seating Ambulatory (Wheelchair)	Varies	
Range	80-120 miles	
Battery size	86 kWh or 129 kWh	
LionM		
Chassis	OEM	
Wheelchair Access	Side Ramp	
Dimensions L x W x H roof	313" x 95" x 111"	
Seating Ambulatory (Wheelchair)	22 (6)	
Range	75-150 miles	
Battery size	160 kWh	

UMS Mission	
Chassis	ProMaster
Wheelchair Access	Side or Rear Ramp
Dimensions L x W x H roof	295” x 87” x 106”
Seating Ambulatory (Wheelchair)	16 (1)
Range	Unknown
Battery size	Unknown



Optimal-EV S1LF	
Chassis	Ford E450
Wheelchair Access	Side Ramp
Dimensions L x W x H roof	Unknown
Seating Ambulatory (Wheelchair)	12 (3)
Range	125 miles
Battery size	113 kWh



Phoenix Motorcars Zeus 400 Shuttle Bus	
Chassis	Ford E-series
Wheelchair Access	Rear lift
Dimensions L x W x H roof	Variable
Seating Ambulatory (Wheelchair)	23 (2)
Range	160 miles
Battery size	150 kWh



Overall, the current ZE cutaway market is more limited than the ZEB market for standard transit buses. While there are several battery-electric cutaways available, there are currently no hydrogen alternatives on the North American market (though there are smaller hydrogen vans discussed below). However, demand for ZE cutaways is increasing as transit agencies look to transition demand response and dial-a-ride fleets to ZE fleets, and the industry is responding by providing more options. It will be important to continue to monitor the market as new options become available that feature longer ranges as the technology continues to evolve, as well as more hydrogen options.

In addition to cutaways, there are also several smaller EV passenger vans on the market. Unlike cutaways, there are currently both battery-electric and hydrogen options for vans available on the US market, though there are more battery-electric options. So far, these ZE vans tend to be built on the Ford Transit passenger van platform.

Table 5-6: Zero-emission Vehicle Options for Paratransit use

Lightning Systems Transit Passenger Van		
Chassis	Ford Transit 3500	
Wheelchair Access	Unknown	
Dimensions L x W x H roof	Unknown	
Seating Ambulatory (Wheelchair)	15	
Range	60-120 miles	
Battery size	86 kWh – 105 kWh	
GreenPower EV STAR ADA		
Chassis	OEM	
Wheelchair Access	Side Lift	
Dimensions L x W x H roof	300” x 80” x 106”	
Seating Ambulatory (Wheelchair)	16 (2)	
Range	<150 miles	
Battery size	118 kWh	
US Hybrid Hydrogen Paratransit Van		
Chassis	Ford Transit 350 HD	
Wheelchair Access	Ramp (low-floor)	
Dimensions L x W x H roof	263” x unknown x 107”	
Seating Ambulatory (Wheelchair)	Multiple configurations, up to 3 wheelchairs	
Range	250 miles	
Battery size	40 kWh 12.8 kg of usable H2	

Lightning Systems has developed a range of new electric product offerings based on the Ford Transit and Ford E450 chassis. The company is also developing a larger bus based on the Ford F550 chassis. The range is between 60-120 miles depending on the vehicle configuration. The company is based in Colorado but has an office in San Diego to accommodate the demand within the California ZE vehicle market. The company also offers charging infrastructure and a data analytics platform to improve fleet operations. Their vehicles have been CARB-certified.

The Antelope Valley Transit Authority (AVTA) recently procured six of the GreenPower EV STAR ADA vehicles at a cost of $95,780 per vehicle. The cost is inclusive of the HVIP grants of $100,000 per vehicle, which these vehicles are eligible for as they are based on an OEM chassis. The cost is exclusive of sales tax and charging infrastructure. This vehicle is also Altoona-tested and Buy America-approved.

US Hybrid has recently produced a hydrogen passenger van for the Stark Area Regional Transit Authority (SARTA) in Ohio for use in their paratransit service. The vehicle has 250 miles of range utilizing 12.8 kg of usable hydrogen with a 40-kWh battery and the manufacturer reports an estimated fuel economy of 17-20 mi/kg. The vehicle can seat up to 15 ambulatory passengers or up to three wheelchairs and three ambulatory passengers with different seating configurations. The vehicles have a manufacturer’s suggested retail price of $220,000. US Hybrid has also reported developing four hydrogen paratransit vans for SunLine Transit with a range of up to 300 miles. The vehicles are not currently Altoona tested but testing is planned to be forthcoming.

5.3 Fleet Review

BCT's fleet is currently comprised of 20 vehicles used for WAVE and fixed route service, specifically, one 17' van and five 25' cutaways for WAVE service, and a combination of 25', 33' and 42' buses and cutaways for fixed route service, with the 42' bus utilized for school trippers on Line 102 where the extra capacity is required (Table 5-7). With the exception of the 42' bus, which has undergone refurbishment, all vehicles have gone into service between 2011 and 2020.

BCT currently has multiple bus procurements in progress to replace vehicles that have reached or are approaching the end of their useful lives [107]:

- Three 32' buses to replace 2011 El Dorados: approved by City Council in April 2021 and was put in service in January 2023.
- Five 32' buses to replace 2013 El Dorados: approved by City Council in December 2021 with an expected delivery date of July 2023.

BCT has future planned bus procurements:

- Order 40' replacement in FY2024 for a 30' bus, with estimated delivery in FY2025.
- Order 30' replacements for 2015 El Dorados in FY2025 with estimated delivery in FY2026.
- All cutaway replacement procurements will begin after 2028.
- BCT will likely begin acquiring ZEBs starting in 2030, to align with the ICT regulation, completion of a new OMF, and BCT's fleet management plan.

Table 5-7: BCT Fleet Composition [108]

Model year	Service year	Quantity	Make	Length (ft)	Fuel type	Service type
2003	2005	1	El Dorado	42	CNG	Fixed route
2011	2011	3	El Dorado	33	CNG	Fixed route
2013	2013	5	El Dorado	33	CNG	Fixed route
2015	2015	1	El Dorado	24.5	CNG	Fixed route
2015	2015	2	El Dorado	33	CNG	Fixed route
2019	2019	2	Ford	25	CNG	Fixed route
2014	2018	1	Mobility Ventures	17	CNG	WAVE
2019	2019	2	Ford	25	CNG	WAVE
2020	2020	3	Ford	25	CNG	WAVE

All of BCT's fleet uses CNG, and fueling currently occurs offsite at three different locations: the Redondo Beach Public Works yard, fuel station at LAX (for Line 109), and a fuel station in Torrance are used as a backup in case fueling at the Public Works yard is unavailable.

In order to effectively operate and maintain a ZEB fleet, the operating facility must be able to support the required infrastructure. Currently, the maintenance facility located at 1521 Kingsdale Blvd has exceeded its useful life and does not meet the basic needs required for administration, operation, bus and employee

[107] Data source: City of Redondo Beach
[108] Data source: City of Redondo Beach

parking, and maintenance of BCT and the BCT fleet, and the facility will need to be expanded to accommodate future ZEB fleet and related charging infrastructure. Following the identification of the preferred ZEB fleet composition, we will identify the required facility and infrastructure needs and modifications to support the ZEB fleet.

5.4 Operational Review

It is important to understand how BCT's vehicles are operated throughout the day, and specifically when these vehicles are in and out of service to understand constraints and opportunities in regard to potential charging schedules and to help inform preliminary energy and power requirements.

Vehicle requirements for a typical weekday [109] for fixed route services are shown in Figure 5-10.

Figure 5-10: Hourly Vehicles in Operation [110]

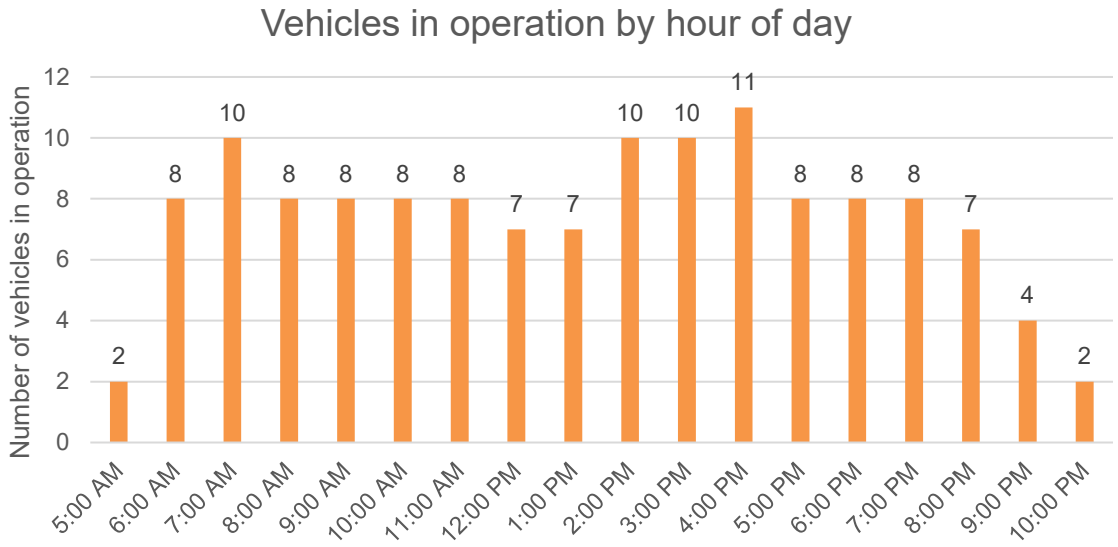


Figure 5-10 shows that peak vehicle requirements occur at 4 pm with 11 vehicles in operation. The majority of BCT's vehicles are in operation for most of the day, with the exception of a few vehicles that operate during the AM and PM only for Line 102 school tripper services. Typically, four vehicles operate on Line 109 and five operate on 102, with an additional three vehicles for trippers. Extra vehicles follow the trippers in the morning to pick up students after the bus meets capacity. According to NTD data, BCT has 20 vehicles available for maximum service and uses 14 vehicles in maximum service which equates to a 42% spare ratio [111].

BCT blocks its vehicles so that most vehicles complete an AM block and a PM block. In most cases, the vehicle immediately begins the PM block after completing the AM block, which would minimize the ability to return to the yard for midday charging. Because limited operating ranges are currently one of the main constraints of some ZEB technologies, it is important to first understand how long BCT's blocks are and

[109] A representative weekday of Thursday, October 3, 2019 was chosen to represent a full service schedule.
[110] Data source: City of Redondo Beach
[111] https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2020/90214.pdf

then to pivot to the vehicle level (according to the scheduled vehicle assignments for example service day chosen) to understand the distance vehicles travel on an average day.

Figure 5-11: Block Frequency by Daily Service Miles [112]

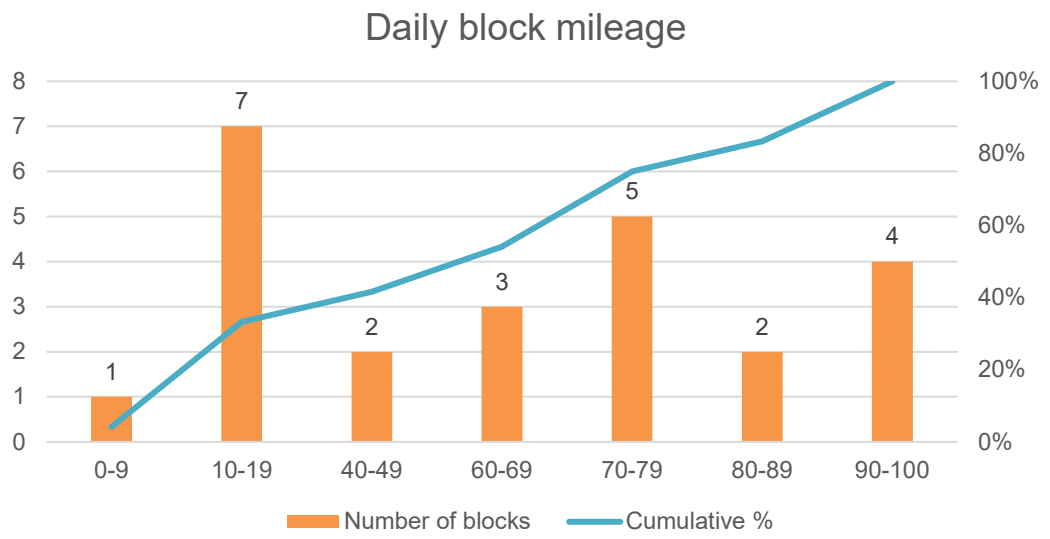


Figure 5-11 shows the distribution of blocks by distance (inclusive of revenue and deadhead miles) that BCT's fixed route vehicles are assigned to on an average Thursday. For example, one block is between zero and 10 miles, seven blocks are between 10 and 20 miles, and so forth. Given that the average operational range of a standard BEB is between 120 and 150 miles, all blocks are comfortably within current BEB ranges, with a maximum block length of 100 miles. However, we know that vehicles complete multiple blocks in a day, so block lengths must be combined at the vehicle assignment level to understand the full distances vehicles travel in a day.

[112] Data source: City of Redondo Beach

Figure 5-12: Vehicle Frequency by Daily Service Miles [113]

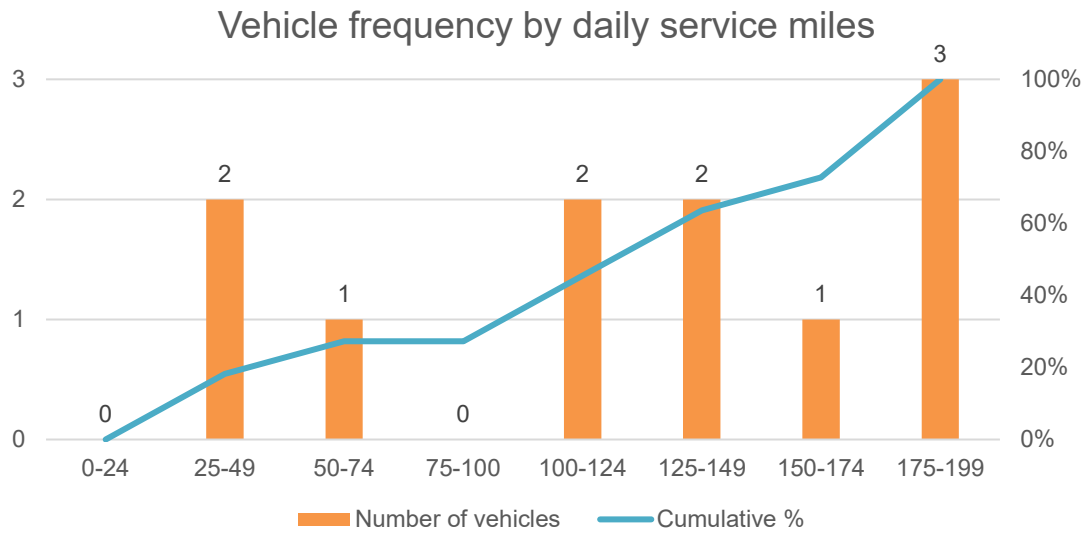
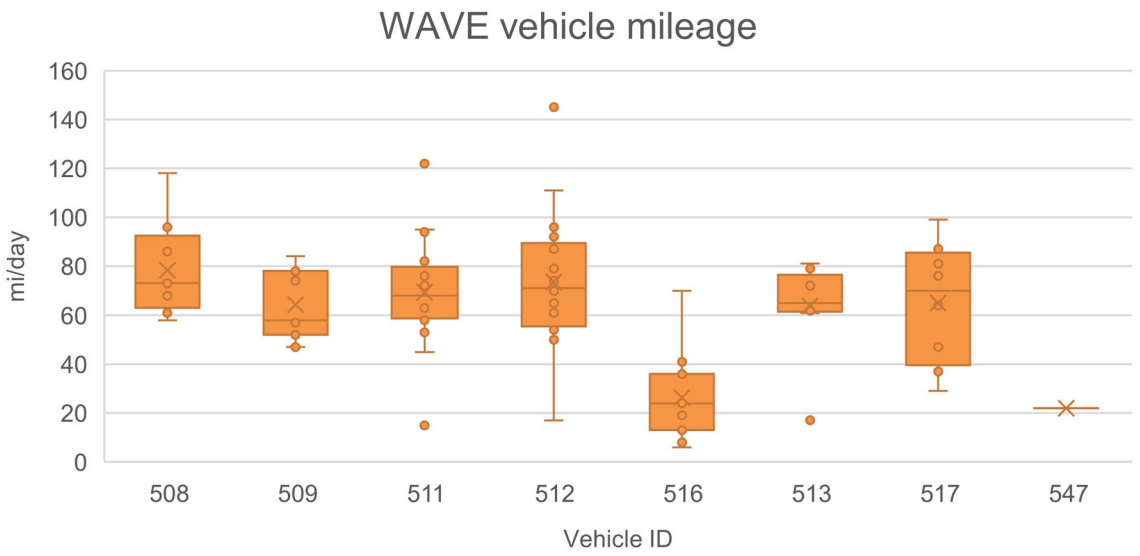


Figure 5-12 shows that when blocks are combined at the vehicle assignment level, vehicles can travel over 175 miles in a day; specifically, up to 179 miles. While this is still close to the current stated BEB range as discussed in Section 5.2, some reblocking may need to be completed to accommodate the current fixed route service with BEBs, ensuring that blocks are grouped in a way that daily service can be completed or there is sufficient time between blocks to recharge.

On average, four or five vehicles are used daily for WAVE operations. To capture the variability of the distance vehicles can travel in a day under demand response systems, daily miles traveled per vehicle were analyzed for weekdays in October 2019.

[113] Data source: City of Redondo Beach

Figure 5-13: Daily Mileage for WAVE Vehicles [114] [115]



The box and whisker plot in Figure 5-13 is designed to show the variation in daily vehicle mileage. Each vehicle entry in the plot shows different statistics regarding mileage per day: the minimum (bottom whisker), first quartile (bottom of the box), median (line within the box), third quartile (top of the box), and maximum (top whisker). Outliers are displayed as the dots above and below each entry (defined as number below the lower and upper limits as determined by the interquartile range) and the X in the middle of each box is the mean for that dataset.

While during the month of October, vehicles traveled an average of 64 miles a day, this varied between a minimum of six miles and a maximum of 145 miles. While there are some distances that may exceed the ranges of ZE cutaways currently on the market, the majority of daily WAVE service seems to be easily convertible to ZEBs based on this data alone.

5.5 Key Considerations for BCT's ZEB Transition

While a fuller analysis and development of recommendations and strategies will be delivered in a later phase of the TSS project, we note some key considerations and implications of the ZEB transition for BCT.

- BCT's fleet is small and unlikely to expand significantly in either size or vehicle type due to demand realities. Based on the vehicle types that BCT operates, BEB equivalents are more readily available than FCEB equivalents.

- BCT's maintenance and operations facility has limited space. If an FCEB fleet is envisioned, the lack of space makes shoehorning a hydrogen storage and fueling facility highly unlikely, and BCT would need to identify proper offsite fueling, similar to its current arrangement for CNG fueling. For a BEB, strategic placement of chargers and charging dispensers will be needed to minimize their footprints and space consumption.

[114] Vehicle 547 completed one day of service and traveled 22 miles on that day.
[115] Data source: City of Redondo Beach

- Charging infrastructure for BEBs includes before-the-meter and customer-side electrical upgrades that require significant investment and planning. Participation in utility-operated infrastructure programs, like Charge Ready Transport from SCE can help offset the majority of charging equipment costs including transformers and switchgear.

- BCT's operating range per vehicle approaches the current threshold of BEB vehicles and may require restructuring of blocks and vehicle assignments, but is within the threshold of FCEB vehicles.

- Regionally, most agencies with ZEB plans, including Metro and Long Beach Transit, are trending towards BEBs.

- BCT's major capital spending has been, historically, for bus replacements and has leveraged some federal funding and local sources. With the adoption of ZEBs, the larger capital outlays required will need not only increases in budget but also the exploration of competitive grant programs to cover these costs. It will be challenging to utilize Local Match for Federal funds as new and ongoing operations and capital expenses utilized on an annual basis for the new Transit Center erode Local Match funds. In addition to Proposition A, other Local Return funds should be utilized.

6 ENGAGEMENT AND STAKEHOLDER OUTREACH [116]

A variety of engagement activities took place between May and August 2022 to promote the study and encourage participation and feedback. During this time, an online survey was open for BCT riders, WAVE riders, and non-riders to understand community priorities in transit service provision and opportunities to craft a more attractive service. A variety of other events, including a combination of virtual and in-person events, were conducted to reach as wide an audience as possible.



In-person events included pop-ups throughout the BCT service area at transit hubs and community events such as farmer's markets and community fairs. These pop-ups were conducted to receive feedback on BCT, promote awareness of the study, and encourage survey participation.

Three virtual focus groups were held with targeted groups (such as businesses, employers, riders, senior services groups, WAVE riders, and community members) to gather in-depth feedback about the current strengths and opportunities of BCT services, and how services can be improved. A technical working group was held with representatives from Beach Cities municipalities and partner transit agencies operating in the region. A summary of all outreach activities conducted to date is found in Table 2.

Table 6-1: Details of Direct Engagement Activities

Date	Event	Engagement	Purpose
Friday 5/20/22	Manhattan Beach Senior Fair	7 comment cards	Promote the BCT survey and engage with Beach Cities residents.
Tuesday 7/12/22	Focus Group #1	5 attendees	Engage in a robust discussion with businesses, employees, and commuters.
Thursday 7/14/22	Pop-up: Douglas C Line Station	88 comment cards & reactions	Promote survey responses and engage with transit users.
Tuesday 7/19/22	Focus Group #2	7 attendees	Engage in a robust discussion with seniors, students, parents, and caregivers.
Wednesday 7/20/22	Redondo Beach Senior Open House @ Veterans Park	1 comment card	Promote the BCT Survey and engage with Beach Cities residents.
Thursday 7/21/22	Pop-up: Redondo Beach Farmers Market	74 comment cards & reactions	Promote the BCT Survey and engage with the Beach Cities residents.
Friday 7/22/22	Hermosa Beach Farmers Market	21 comment cards	Promote the BCT Survey and engage with Beach Cities residents.
Tuesday 7/26/22	Focus Group #3	8 attendees	Engage in a robust discussion with community-based, faith-based, and non-profit organizations.
Wednesday 7/27/22	Pop-up: Redondo Beach Senior Open House @ Perry Park	7 comment cards	Promote the BCT Survey and engage with Beach Cities residents.

[116] For more information please see Appendix A: Public Summary Outreach Report

Date	Event	Engagement	Purpose
Wednesday 8/10/22	Technical Working Group	14 attendees	Discuss proposed service recommendations with transit partners.
Thursday 8/11/22	El Segundo Farmers Market	8 comment cards	Promote the BCT Survey and engage with Beach Cities residents.
Saturday 4/15/23	Redondo Beach Springfest 2023 (in lieu of public meeting)	91 comments & reactions	Solicit public feedback to the final Recommendations

Advertising for the TSS and the accompanying survey included digital methods as well as traditional advertising. Interested parties were directed to the BCT Services Study website (via direct link or QR code) which provided information about the study and meeting details and was the host for the surveys. Digital promotion focused on direct emails (to 109 city partners, a Redondo Union High School student e-blast, and the Community Services email list), digital ads on Easy Reader throughout June, and Community Services Instagram ads with supporting tweets from the BCT Twitter account. Physical materials included advertising on BCT buses and a full-page ad in the Easy Reader during June.

Upon completion of the draft service plan and design of the recommendations, a subsequent outreach/consultation event will be conducted to inform stakeholders and the public about the proposed plan.

6.1 Survey

From June through August of 2022, an online survey was conducted to gather responses and insights from BCT riders of fixed-route and the WAVE dial-a-ride service, as well as from non-riders in the South Bay. Surveys were advertised in several ways, including digital media placements and direct emails to known stakeholders, as well as during eleven in-person engagement events across the South Bay.

Participants accessed the survey via a single link but were directed (through a logic tree) to one of three surveys that best suited their ridership profile; multiple surveys were also possible for people who ride both WAVE and fixed-route services. Of the 295 surveys collected, a total of 280 valid (completed) surveys were analyzed. Survey response counts are seen in Table 30. Slightly more than half of the respondents were BCT riders of the WAVE or fixed-route service, with the remaining respondents not BCT riders. Of the total rider responses, 143/154 or 93% were fixed-route and 7% were WAVE riders, which mirrors the breakdown of ridership across the two modes (97% of ridership in 2021 was on fixed-route, and 3% was on WAVE).

A detailed breakdown of all survey responses is provided in Appendix A: Full Survey Results.

Table 6-2: Survey Responses by Survey Type

Survey Type	Count	Percent of total surveys
Fixed-route rider survey responses	143	51%
WAVE survey responses	11	4%
Non-rider survey responses	126	45%
Total survey responses	280	100%
Total administered surveys	295 [117]	

[117] After validating survey response, not all surveys administered were included due to incomplete or partial responses. Of the 295 surveys administered, 15 were determined invalid for a total of 280 surveys included in analysis.

Overall respondent demographics skewed female (60%), white or Caucasian (63%), and over 35 years old with under 35 (Under 18, 18-24, and 25-34) making up only 21% of respondents. Respondents overwhelmingly indicated household incomes greater than $75,000 with only 15% indicating a household income below $75,000. This largely aligns with the demographics of the overall service area, where the majority of South Bay residents are over 35 years of age (with a median age of 40), 66% of residents identifying as white or Caucasian, and median household income above $75,000 (specifically $125,000).

6.1.1 Survey Takeaways

Collecting over 280 detailed opinions from the Transit Services Study Survey, and many more in-person and virtual impressions, South Bay communities gave feedback on and were informed about BCT services. Highlights from this process include conclusions regarding areas of improvement and continued success.

Information or the lack thereof was a theme across demographics and transit preferences. BCT ensures that information about its services is available through a variety of different sources and mediums, including on the BCT website, through Twitter, onboard buses, at bus stops, and at local senior centers and other community centers. A repeated theme across survey results and from engagement is a sentiment that people do not have adequate information about BCT services, which signals a need to explore strategies that can connect people with information and raise public awareness about where information can be found. Insights regarding information availability include:

- Real-time apps were widely used by BCT riders and often their only source of information pertaining to service notifications.
- Bus stop improvements pointed to the desire for more and better information about the routes and system as a whole when at a bus stop.
- Among non-riders, access to more information was the biggest factor that would increase their use of transit. While BCT provides information through a variety of sources, these comments suggest that non-riders are unaware of where to find the information. Strategies to address this are discussed in greater detail in Section 7.3.4.

Those without access to a vehicle are more likely to take the bus. While this is to be expected, it bares pointing out that all non-riders indicated they had access to vehicles, whereas 12% of riders did not have access. BCT provides essential services to South Bay community members. Additionally, WAVE users (all who had access to a vehicle) indicated they used transit only when unable to drive due to an injury or some other reason.

Community members would generally like to see more frequent buses that run later into the evenings. Later trips were particularly desired on the weekends with supporting discussion about access to bars, restaurants, and entertainment. Additionally, there was a desire for more frequent bus service.

Community members who utilize WAVE services provided a smaller portion of feedback but did provide a clear perspective on where improvements in the service were needed. Core aspects of the service are where clients are most dissatisfied including service registration, scheduling, pick-up/drop-off times, and reliability. Once a rider is aboard the service, they are generally very satisfied with the service quality.

Overall, while BCT provides services that are valued and perceived as high quality by its riders, gaps are still present. Addressing the need for connecting the general public to information sources as well as riders will go a long way in reinforcing BCT's services. This coupled with service modifications and improvements to better suit the desires of current riders could heighten the overall profile of BCT.

6.2 Pop-Ups

A total of seven pop-up events were held across the Beach Cities. Three were organized by JCL Consulting (Douglas C Line Station, Redondo Beach Farmers Market, and Redondo Beach Senior Open House at Perry Park) with the remaining four in-person outreach events (Manhattan Beach Senior Fair, Redondo Beach Senior Open House at Veterans Park, Hermosa Beach Farmers Market, and the El Segundo Farmers Market) completed by City staff. Events were organized to promote the BCT Survey as well as collect comments from the public. A total of 206 comment cards were received.



Major themes heard during the pop-ups include:



- A general lack of information and awareness about BCT services. Non-riders noted that they are interested in learning more about BCT, but there is a lack of information about where stops are and what destinations they can reach using BCT.
- Riders requested more frequent service.
- Riders requested more and better bus stop amenities, particularly shade, benches, shelters, and lighting.
- Older adults are very open to participating in mobility training for greater independence and improved quality of life.

6.3 Focus Groups

Three virtual focus groups were held to solicit feedback from different groups and populations throughout the Beach Cities community. Focus groups were designed to gain a more nuanced understanding of how South Bay community members and stakeholders interact with BCT services. Focus groups were broken down into three sections: introductions and an overview of the project, an overview of the BCT services with preliminary survey results, and an in-depth discussion of participants' experiences and opinions regarding BCT.

Discussions were initiated with a series of response-provoking questions tailored to the stakeholders of the different sessions. As part of this discussion, JCL staff engaged with participants, asking clarifying questions and furthering the discussion. Utilizing feedback from focus groups and discussions with BCT staff, service plan proposals were developed by Stantec, and incorporated into subsequent focus groups as questions to solicit preliminary feedback. Participants were asked to provide opinions on proposed service changes, helping to refine service proposals for BCT's fixed route and WAVE services.

Focus group #1 was geared toward businesses, employees, and commuters and was held on Tuesday, July 12, 2022. Attendees included community members, and representatives from Los Angeles World Airports Rideshare Program, South Bay Workforce Investment Board, and LA Metro. Notable discussion points included:

- The South Bay Workforce Investment Board occasionally supports its clients with bus passes, but these are usually for Metro services. The representative noted that Redondo Beach clients use transit and interest has been increasing in the past couple of years particularly due to gas prices.

- Beach access was identified by multiple participants as a priority, noting the congestion and challenge of parking at piers.

- Frequency and consistency were identified as challenges with one participant noting the service gap on Line 102 on Sunday afternoons.

- The addition of an east-west bus service designed to facilitate access to recreational areas was identified. Service along Manhattan Beach Blvd could improve beach access for North Redondo Beach and Manhattan Beach residents with stops at Polliwog Park and Redondo Beach Performing Arts Center.

Focus Group #2, held on Tuesday, July 19, 2022, sought engagement from seniors, students, parents, and caregivers. It was attended by five community members, two representatives from Torrance Transit, and two representatives from the City of Redondo Beach Senior and Family Services.

- Line 109 traverses a large area, providing connections between Riviera Village and Manhattan Beach but does not provide service across Redondo Beach; the opinion provided was BCT should prioritize Redondo Beach residents in service provision.

- The northern section of Line 109 was identified as too circuitous, and Metro Line 232 is the preferred route returning from LAX as it is more direct, and riders can reach their destination in less time.

- A respondent noted that the branding of BCT services does not stand out or excite people. The white vehicles were compared to 'service vehicles' and contrasted to Santa Monica Big Blue Bus and LA Metro Micro vans in El Segundo, both of which have distinct branding that sticks out in the community and clearly look like vehicles for public transit.

- Senior and Family Services from the City of Redondo Beach provided insight into residents' feelings towards the WAVE. Since the onset of the COVID-19 pandemic, there has been an increase in inquiries about DAR services. Adult caregivers are more comfortable with their elderly parents taking the WAVE. Additionally, community members provided examples of how helpful WAVE services were to them personally. It was noted that while there is information about BCT and the WAVE at senior centers, the information might not be up to date and may need to be updated on a regular basis to make sure information is accurate.

- Draft service proposals included in the second focus group were alternatives to Line 109 to run through Redondo Beach Pier and streamline service along the northern portion of the route around Plaza El Segundo and Manhattan Village Mall. Responses to the addition of pier service were mixed; some supported this change whereas others expressed safety concerns of pier clientele. Streamlining Line 109 to eliminate detours in service was supported by participants.

Focus Group #3 was held on Tuesday, July 26, 2022, and targeted community-based, faith-based, and non-profit organizations. Attendees included three community members, the president of the South Bay Bicycling Coalition, and Hermosa Beach Council Member Justin Massey.

- Discussing WAVE services, a participant noted that although the WAVE is reliable, they had experienced issues with getting a return ride after booking a same-day trip.

- A Redondo Beach resident described a trip they often take to the Rivera Village. Taking Line 102 to Catalina, they hope for a successful transfer to Line 109 and on to their final destination. The return trip is more challenging because transferring from NB Line 109 to NB Line 102 is not properly timed, requiring a long wait for the next bus.

- Challenges on Line 109 north of Rosecrans were brought up with participants feeling that this section is 'unusable.' The participant suggested rerouting Line 109 to stay along the beach between Manhattan Beach and El Segundo.

- As part of the third focus group, draft service proposals discussed in the second focus group received similar feedback. Line 109 servicing the pier received mixed responses, some in support (like the participant who transfers from Line 102 to 109 while traveling to Riviera Village) while others did not like the idea. Streamlining of Line 109 at Rosecrans and PCH was supported.

6.4 Technical Working Group

A technical working group was held to discuss challenges and opportunities to improve mobility throughout the South Bay and Beach Cities. Held virtually on Wednesday, August 8, 2022, attendees included representatives from Redondo Beach, Manhattan Beach, Hermosa Beach, El Segundo, Torrance Transit, Metro, GTrans, and Palos Verdes Peninsula Transit Authority (PVPTA). Redondo Beach Council Member Christian Horvath also participated. A summary of the discussion grouped by discussion topic is presented below.

Fixed route key discussions

- Considerations for alternate routing of Line 102 were discussed to route trips leaving RBTC along Ripley past Adams Middle School. Ripley was determined to not be an ideal street for transit as it is a hilly residential collector. The Redondo Beach Council Member did indicate support for the proposal and support from constituents in that area.

- The proposed route realignment to Line 109 would no longer provide access to Plaza El Segundo as there is no stop along Sepulveda SB. The Metro representative provided insight on previous attempts by Metro to get a southbound stop along the west side of Sepulveda, across from Plaza El Segundo. Issues due to access to the oil refinery blocked the attempt. There was general support for this realignment considering ridership levels and the benefits of streamlining the overall route, with the general consensus being that the positives of streamlining the route outweigh the negatives of removing these underutilized stops.

- Additional context for the origins of the Line 109 detour along Rosecrans was provided by the Manhattan Beach representative. Originally requested to provide direct service to the Manhattan Village Mall and near the senior community on Parkview Ave, there was a consensus that the streamlining and elimination of this detour was warranted.

- Service recommendations for Line 102 to take over the southern portion of Line 109 from the Redondo Beach Pier to Riviera Village, with Line 109 terminating at the pier were proposed in this technical working group. The representative from Torrance Transit shared their operational experiences with multiple buses serving the pier. Due to limited curb space at the pier, Torrance Transit experiences challenges with Lines 3 and 7 buses needing to maneuver within the limited space. Discussion of dedicating additional red curb was brought up as well as the operational importance of proper scheduling. Further explanation of this service change can be found in Section 5.1.2.

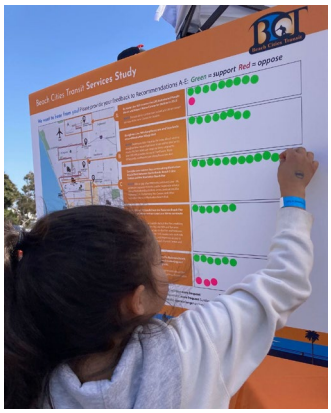
- The proposed addition of an east-west route focused on beach service was discussed with this group. Generally well received, the idea of a pilot with the potential for a permanent route was discussed. The service recommendation for this route can be found in Section 5.4.

WAVE key discussions

- Outreach and marketing of WAVE services were discussed at length in this working group. It was identified that if senior populations are widely unaware of the WAVE, it is the responsibility of Beach City partners to engage their local populations. Uncertainty of key partnerships between BCT/WAVE and organizations like Beach Cities Health District to promote LA Metro's On the Move Riders Program was brought up. Discussion of outreach and engagement with WAVE-eligible residents can be found in Section 5.3.1 with further elaboration in Section 6.4.

- Considerations for expanding WAVE service to the general public as a late-night service were proposed. A representative from Hermosa Beach noted that an on-demand service would likely be popular on nights and weekends in downtown Hermosa Beach as a way to get home safely after a night out. The representative from PVPTA pointed out that evening service could avoid the challenges other all-day on-demand services have run into with high demand from students after school. Further discussion of WAVE service considerations can be found in Section 5.3.2.

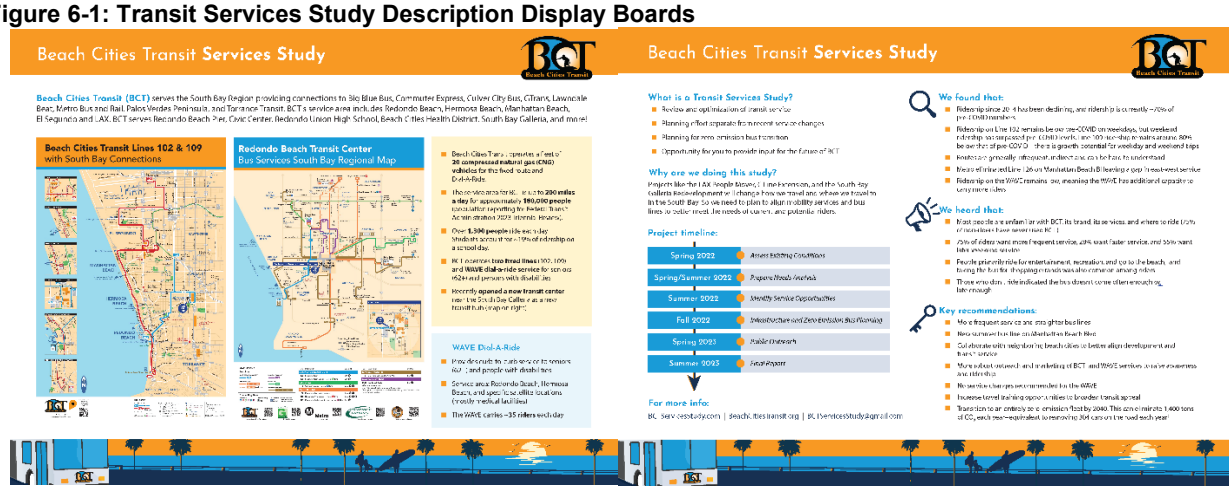
6.5 Redondo Beach Springfest



The final public engagement occurred on April 15, 2023, at the 40th Annual Springfest put on by the North Redondo Beach Business Association near the Performing Arts Center along Manhattan Beach Blvd in Redondo Beach. Three display boards (Figure 6-1 and Figure 6-2) displayed information regarding BCT services, an overview of the Transit Services Study with findings and recommendations, and a map-based explanation of the primary service changes.

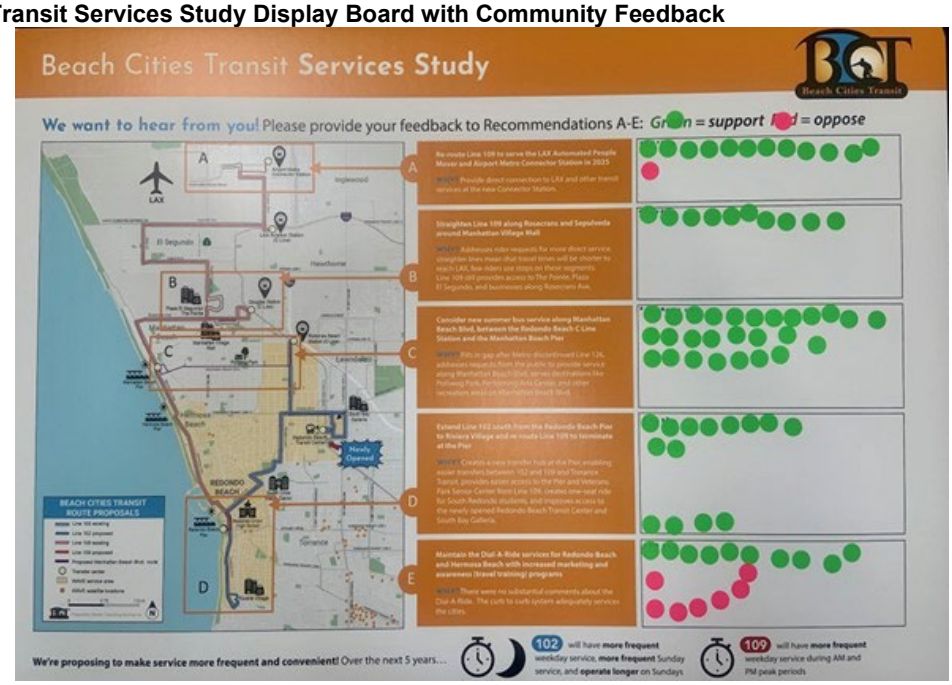
Generally, to notify stakeholders of the opportunity for public engagement or online comment, notifications were sent via eblast and posted to Twitter. In-person, to incentivize participation and engagement with display boards, the pop-up booth included a prize wheel and a "selfie" photo station, offering fun giveaways to festival goers.

Figure 6-1: Transit Services Study Description Display Boards



Community members were able to provide input on the recommendations by asking questions as well as show their preferences by placing color-coded dots on the display boards supporting or opposing each recommendation. Stakeholders were supportive of the recommendations with most dots in Figure 6-2 green, indicating support.

Figure 6-2: Transit Services Study Display Board with Community Feedback



Each recommendation and how it was received by the public is summarized below.

- Recommendation A: reroute Line 109 to serve the LAX Automated People Mover and Airport Metro Connector Station in 2025 to provide a direct connection to LAX and other transit services at the new Connector Station. **Out of 13 total reactions, 92% of responses support this recommendation**.

- Recommendation B: straighten Line 109 along Rosecrans and Sepulveda around Manhattan Village Mall, to address rider requests for more direct service and a quicker travel time to LAX. This recommendation removes service to stops that see very few passenger boardings and still maintains access to The Pointe, Plaza El Segundo, and businesses along Rosecrans Ave. **100% of respondents at Springfest support this recommendation.**

- Recommendation C: consider a new summer bus service along Manhattan Beach Blvd, between the Redondo Beach C Line Station and Manhattan Beach Pier. This fills in a gap in service left after Metro discontinued Line 126, addresses requests from the public to provide service along Manhattan Beach Blvd, and serves many entertainment and recreational destinations like Polliwog Park and the Performing Arts Center. **Reception from the public at Springfest was very supportive of this recommendation, with 27 total respondents, 100% of whom supported this recommendation.**

- Recommendation D: extend Line 102 south from Redondo Beach Pier to Riviera Village and re-route Line 109 to terminate at the Pier, creating a new transfer hub at the Pier which enables easier transfers between Line 102 and Line 109 and Torrance Transit. This also provides easier access to the Pier and Veterans Park Senior Center from Line 109, creates a one-seat ride for South Redondo students, and improves access to the newly opened RBTC and South Bay Galleria. **100% of respondents at Springfest support this recommendation.**

- Recommendation E: maintain the WAVE DAR services for Redondo Beach and Hermosa Beach with increased marketing and awareness (travel training) programs, as there were no substantial comments about the WAVE in previous outreach activities. The curb-to-curb system adequately services the cities. **59% of respondents support this recommendation.**

A total of 91 written comments and reactions were captured at the final public event. Most of these comments were unrelated to the specific service proposals, and major themes are summarized in the last section of Appendix A: Public Outreach Summary Report. Several hundred more visitors were exposed to BCT's services and anticipated improvements. Final recommendations were posted to the project website for public comment. Overall, these responses show a high level of support and excitement for implementing the proposed recommendations, while reactions to Recommendation E present an opportunity for more targeted outreach regarding the WAVE to understand specifically why there is more opposition to this recommendation compared to the other recommendations.

7 SERVICE CONCEPTS DEVELOPMENT

7.1 Goals and Objectives

By assessing feedback from community and stakeholder outreach, our analysis of existing conditions, and through workshops with City of Redondo Beach staff, goals have been identified that will shape the service plans and create a unified future vision for BCT services in both the short- and long-term. Within each goal, more specific objectives and action items have been identified that will help to achieve these goals, including both short- and Long-range service options and supporting recommendations that help to achieve these goals and improve the overall customer experience.

BCT will provide transit service that:

- **Aligns and grows with changes in the South Bay and prepares BCT for the future,**
- **Enhances regional connectivity,**
- **Grows ridership, and**
- **Increases the public awareness of BCT.**

These goals, along with specific objectives and action items, are presented in Table 7-1.

Table 7-1: BCT Goals and Actions

Goal	Description	Action Items	Details
Goal 1	Align and grow with changes in the South Bay and Prepare for the Future	1A. Adjust routes and service levels strategically over time to respond to changes, growth, and demand	Detailed in the Service Plan section, BCT should adjust routes and service levels strategically over five-year short-range planning period.
		1B. Consider future land use developments and transportation projects	Similar to the motivation for this current study, BCT should continue to monitor new transportation projects and land use developments in the South Bay and provide service appropriately.
		1C. Build a more data-driven approach	Acquire APC across the BCT fleet to more accurately track stop-level passenger activity and make more data-driven decisions regarding service. Consider using planning softwares to assist with planning and data analysis.
		1D. Plan for zero-emission buses	Develop a CARB-compliant ZEB Rollout Plan and begin to implement the plan and transition the fleet. This also involves the construction of a new operations and maintenance facility, as BCT's current operations and maintenance building is undersized and in need of replacement to sustain the agency's operation. A new facility purpose-built for transit operations and maintenance functions, as well as outfitted to support battery-electric buses, is required for BCT to be able to continue to serve the South Bay in the long-term.
		1E. Work with other transit agencies to establish transit priority measures	Work with other transit operators in the South Bay to begin building support for transit priority measures and develop an understanding of what priority measures are viable in the South Bay.
		1F. Consider future rebranding with ZEB transition	Consider the viability of a future bus rebranding effort to help BCT stand out and grow public awareness.
Goal	**Description**	**Action Items**	**Details**
Goal 2	Enhance regional connectivity	2A. Work with transit partners to align schedules and improve customer trips	Work with transit partners to align schedules and improve customer trips. When introducing new services, ensure service schedules are aligned to facilitate transfers.
		2B. Continue to service transit hubs	Ensure transit hubs in the South Bay are served by BCT to facilitate more regional travel. When introducing new services, ensure existing transit hubs are served. Explore serving new transit hubs as they are established.
		2C. Increase TAP usage	Increase promotion of TAP to collect more detailed passenger data, which can be used to inform future service changes. TAP usage reduces the time it takes to board the bus, and can speed up trips. Greater TAP card adoption can enable easier regional travel, as the card can be used across all transit operators in the South Bay.
Goal	**Description**	**Action Items**	**Details**
Goal 3	Focus on growing BCT ridership	3A. Strengthen existing services and explore potential new routes	Strengthen existing services, such as adjusting frequencies and service span, strategically over time to grow ridership and make BCT service more attractive. Explore potential new routes that fill gaps in service that are currently not being served by any transit operator.
		3B. Explore opportunities to grow ridership and efficiency of the WAVE	Explore various strategies to grow WAVE ridership among senior and disabled populations and make the service more efficient.
		3C. Expand service design guidelines	Develop more detailed service guidelines extending beyond the Title VI program; fine-tuning them to provide a strong rationale for service provision and associated service levels. Additional metrics to track performance, such as passenger boardings per revenue hour, can help guide and inform future service changes.
		3D. Improve bus stops	As staffing capabilities allow, continue to maintain and update BCT's bus stop inventory. Explore opportunities to improve bus stops as BCT is able to. Continue to advocate for improved bus stops at stops outside of BCT's jurisdiction.
Goal	**Description**	**Action Items**	**Details**
Goal 4	Increase public awareness of BCT	4A. Develop a strategic marketing plan	Develop a strategic marketing plan to increase public awareness of BCT. This includes implementing the other action items listed under this goal.
		4B. Strengthen digital communications	Expand BCT's digital presence to reach a wider audience.
		4C. Explore marketing opportunities for local events and businesses	Explore partnerships with local events and businesses for marketing and public awareness. Advertise how to use BCT to get to South Bay events and destinations on social media and through online outlets.
		4D. Outreach to targeted communities	Conduct targeted outreach to specific communities to grow ridership, such as among senior and disabled communities to grow WAVE ridership.

Goal 1 is related to the many transportation, land use, and development projects that are underway in the South Bay. Over the next decade, the South Bay will see many large-scale transportation projects such as the extension of the Metro C Line to Torrance, the opening of the Automated People Mover at LAX, and the new Airport Metro Connector station at LAX, along with land use and development projects like the South Bay Galleria redevelopment. This goal also addresses other ways that BCT can set itself up for long-term success, such as through planning for zero emission buses, construction of a new operations and maintenance facility to set BCT up for long-term success, and exploring the viability of regional partnerships to implement transit priority measures.

Goal 2, enhance regional connectivity, speaks to BCT's role as one of many transit operators in the South Bay. The Los Angeles region is made up of a patchwork of different municipal operators, along with Metro providing regional bus and rail services. As such, BCT needs to continue to work with other operators to make sure that service coverage is maximized, and duplication is minimized. To further enhance regional connectivity, it is important that BCT continues to serve local transit hubs and make sure that transfers between BCT and other services are well-timed to facilitate interagency transfers.

Goal 3 action items include strengthening existing services and exploring new routes, exploring opportunities to grow WAVE ridership, expanding existing service design guidelines, and improving the customer experience at bus stops. Like all agencies across North America, BCT saw ridership decline during COVID-19. While ridership is rebounding and continues to grow, it is important for BCT to explore other ways to grow ridership and improve the customer experience.

Goal 4 focuses on strategies to increase public awareness of BCT, including maintaining and implementing a strategic marketing plan and strategies to grow community awareness, such as through strengthening digital communications, enhanced outreach to target communities, and partnerships with local businesses and events to advertise BCT. A major theme heard throughout the public engagement process was a general lack of awareness of BCT services, or some knowledge of BCT but not enough to feel comfortable using the service. A major opportunity for BCT is to grow public awareness to position BCT as an important and valued community service.

7.2 Service Plans

In the following sections, service plans for each line or service are proposed. The service plans are presented across three timelines: immediate service plan (to be implemented between fall 2022 and the beginning of 2023), short-range service plan (to be implemented over a five-year timeframe beginning in FY23-24), and long-range service planning options to be implemented past the five-year planning timeframe.

The recommended service plan for each line considers the major issues driving changes in each line; not only the transportation, land use, and development projects that the line needs to respond to and serve, but also other service changes that can make BCT more efficient and attractive stemming from the technical analysis and public and stakeholder feedback. Each service plan also considers the other transit operators in the area to avoid or minimize service duplication when possible and ensures that each line has a distinct purpose.

To improve ridership and attract more non-riders to use the service, service expansion (in terms of more frequent service and addition of new services) is considered. Acknowledging that more service means more operating resources, the operational considerations for implementing the recommended service plans have also been analyzed. We understand that transit agencies operate with limited resources, so expansions of service have been strategically phased in over time to incrementally improve service levels in a more realistic manner.

7.2.1 Line 102

Service provided by Line 102 spans the City of Redondo Beach from the Redondo Beach Pier to the South Bay Galleria and north to the Redondo Beach C Line Station with notable stops at RUHS, Beach Cities Health District, and major aerospace industry parks. Line 102 connects with Line 109 at Catalina/Emerald, just before its terminus at the Redondo Beach Pier.

Weekday ridership along Line 102 remains approximately 21% below pre-pandemic levels [118], but weekend service has shown ridership numbers 29% higher than the 2019 average. During the school year, most riders are students (46%), and cash fare is the predominant fare type when school is not in session. Providing school tripper service to RUHS, students are a major source of ridership along Line 102. State-mandated changes to middle and high school bell schedules starting fall 2022 required adjustments to the school tripper service provided by BCT.

Opened in early 2023, the RBTC provides improved connections and services to transit riders in the South Bay. The addition of a stop at RBTC will improve Line 102 connections with Torrance Transit, GTrans, and Metro Bus. However, the operational impact of serving the RBTC adds approximately 10 minutes to each trip (entering the transit center, aligning at a bus bay, dwelling for passenger activity, and exiting the transit center). The opening of RBTC is the first of several major developments that will affect this line including the South Bay Galleria Redevelopment, and, in the long-term, the Metro C Line Extension, with an expected opening between 2030 and 2033.

7.2.1.1 Immediate Service Plan

The adjustments to school tripper service stem from a California State Law [119] mandating that high schools cannot start before 8:30am. At RUHS, this translates to a two-schedule system with Monday classes starting at 9:25am and an 8:30am start Tuesday-Friday; classes end at 3:30pm every school day.

BCT has adjusted their school tripper schedule to reflect this change including two different schedules for Mondays and Tuesday-Friday with three school tripper runs every five minutes at morning and afternoon bells. Monday runs start at 8:25am, arriving at RUHS at 9:07am and Tuesday-Friday runs start at 7:20am and arrive at the Diamond & PCH stop at 8:02am (Figure 7-1 & Figure 7-2).

[118] Data source: City of Redondo Beach
[119] SB328, 2019

Figure 7-1: School tripper Schedule Starting Fall 2022, Monday Only [120]

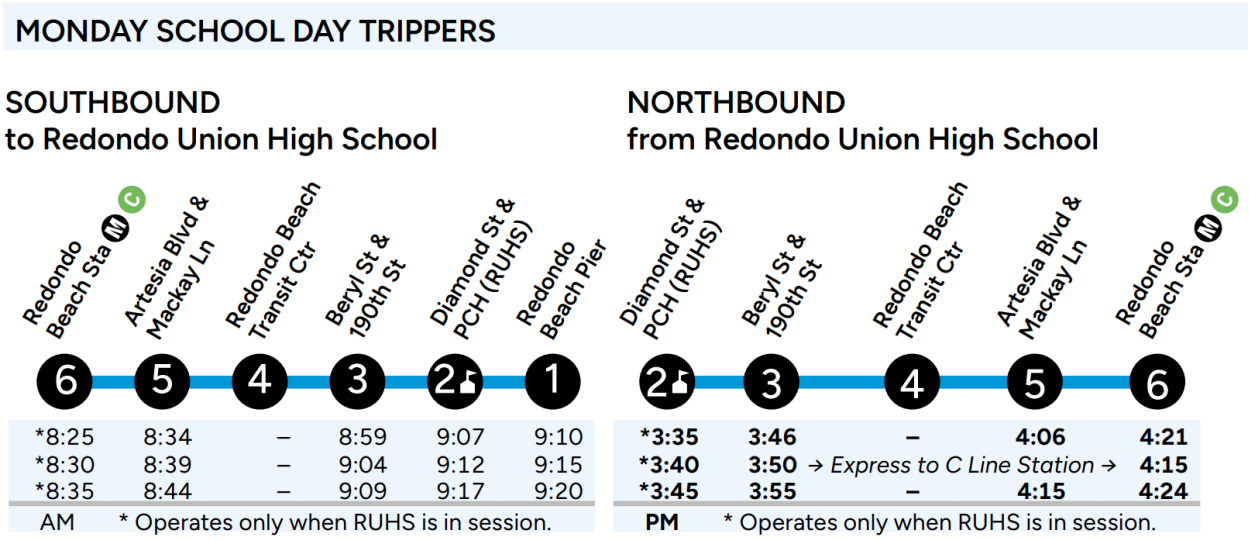
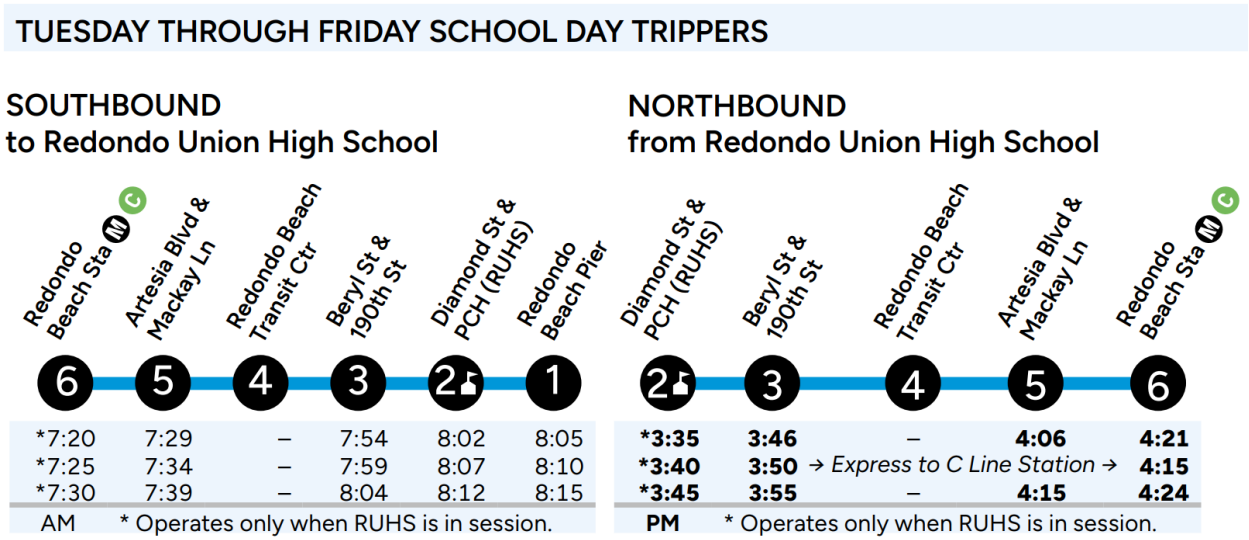


Figure 7-2: School tripper Schedule Starting Fall 2022, Tuesday-Friday [121]



Afternoon school tripper service is the same every school day with buses leaving Diamond and PCH at a five-minute frequency starting at 3:35pm, except for minimum school days, where after-school trippers start earlier. To maintain headways and reduce total travel times, school trippers **will not** stop at the RBTC.

The opening of the RBTC is a major project that will also affect Line 102 operations in the immediate timeframe. The RBTC is a modernized, multimodal transportation facility that will house five bus operators across eleven bus bays (Figure 7-3): BCT (Line 102), Torrance Transit (Line 3), GTrans (Line 3),

[120] Source: https://www.redondo.org/civicax/filebank/blobdload.aspx?t=41381.28&BlobID=42046
[121] Source: https://www.redondo.org/civicax/filebank/blobdload.aspx?t=41381.28&BlobID=42046

Lawndale Beat, and Metro (lines 40, 210, and 211). Located at 1521 Kingsdale Ave in Redondo Beach, RBTC replaces the old South Bay Transit Center adjacent to the South Bay Galleria.

Figure 7-3: Redondo Beach Transit Center Bus Bay Schematic [122]



To maintain a 30-minute frequency during weekdays, the following changes to Line 102 were considered:

- Eliminating the loop around the South Bay Galleria to provide service only to the RBTC. This alignment would have Line 102 (for both directions) turning onto Kingsdale Ave. from Artesia Blvd and eliminating service along Hawthorne Blvd and 182nd St. This adjustment would consolidate service and connections at the RBTC but ignore the productive Hawthorne/Artesia stop as well as the free-standing shops on the south portion of that block. Additionally, site plans for the South Bay Galleria Redevelopment show the bulk of housing located on the corner of Artesia Blvd and Hawthorne Blvd with limited access to bus services under this considered alignment. Ultimately, the loop along Hawthorne Blvd provides necessary access to transit services and is important to maintain. Thus, removing this portion was not considered viable.

- Adjustments to the number of stops along sections of Line 102 may produce some additional time to make up for the transit center stop. Currently, BCT stops only at stops with people actively waiting for the bus, so unproductive stops are already passed over. It is unlikely that significant time improvements will be made through bus stop balancing.

- A review of operating schedules identified that the layover or recovery time at the Redondo Beach Pier is long (sometimes, longer than 10 minutes). BCT should investigate if the layover can be shortened to reinvest that time into maintaining a 30-minute headway (or close to 30-minute) on Line 102 while maintaining consistency with state-mandated breaks.

[122] Source: City of Redondo Beach

- Adding additional buses to Line 102 to maintain a 30-minute headway. This is the least preferred option by BCT because of additional labor needs, as well as the potential need to expand the fleet.

In the immediate term, it was determined that the options presented above were not operationally feasible and that Line 102 service serving the RBTC would proceed with headways of around every 40 minutes all day. Instead, the short-range service plan explores options to improve service and reduce headways that are closer to every 30 minutes.

In addition to maintaining 30-minute headways during weekdays and serving the RBTC, another immediate need and recommendation is to improve Sunday service. Currently, Line 102 operates on Sundays from 9am-7pm with service every 40 minutes, but there is a gap in service from 12pm-3pm. The recommendation for the immediate service plan is to fill in this gap and provide 40-minute service consistently from 9am-7pm on Sundays [123].

7.2.1.2 Short-Range Service Plan

In the short-term, between FY23-24 and FY27-28, the main development that will have an impact on Line 102 is the redevelopment of the South Bay Galleria. Currently, the Galleria is a traditional mall in with an indoor shopping center, featuring a wide range of retail shops, restaurants, and a movie theater. The redevelopment of the space will take a phased approach to modernize the Galleria and make it a more useful and lively space. A rendering of the redevelopment is shown in Figure 7-4.

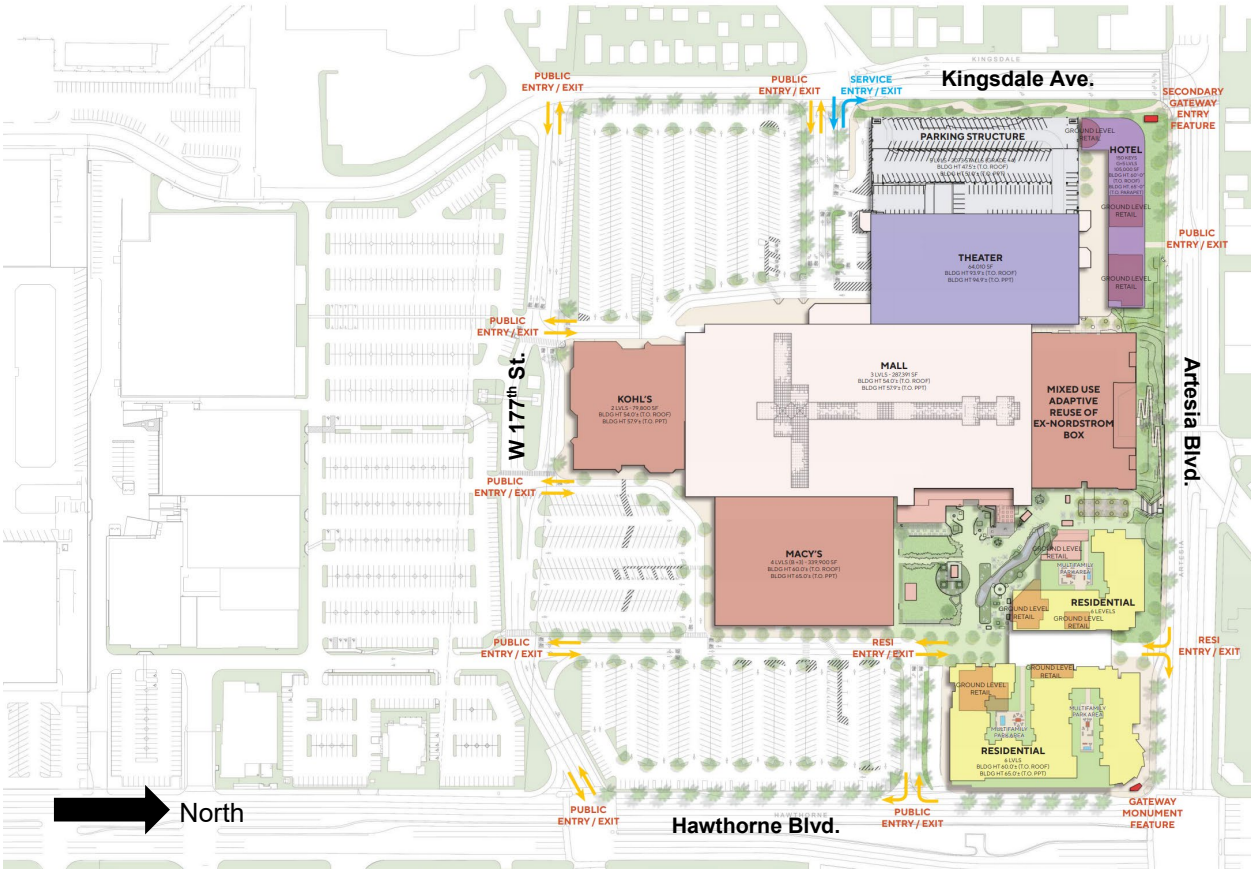
Figure 7-4: South Bay Galleria Redevelopment Rendering [124]



[123] This change to the Sunday schedule was made in February 2023.
[124] Source: South Bay Galleria redevelopment (design of residential building has changed and does not reflect what is shown here).

The redevelopment will also feature the construction of 300 apartments, with 25% designated as affordable. Three hundred parking spaces for the apartments will also be included. The apartments will be located on the northeastern corner of Artesia Blvd and Hawthorne Blvd and will be a mixed-use development with the inclusion of ground-floor retail. A 150-room hotel is planned for the northwestern corner of the space at Artesia Blvd and Kingsdale Ave. The redevelopment will retain some aspects of the original Galleria, such as the movie theater and some anchor stores (Macy's and Kohl's), but will utilize adaptive reuse to convert the space currently occupied by Nordstrom to include offices, a fitness center, and more restaurants, with the intent to transform the space into a 24/7, mixed-use destination (site plan shown in Figure 7-5).

Figure 7-5: South Bay Galleria Redevelopment Site Plan [125]



The redevelopment will also take steps to move programming towards the street edge to make it more pedestrian-friendly. This programming will take place along the Artesia Blvd side of the Galleria and will include sidewalk widening, grass and public green space, and reconfiguring the space to make it an open-air, outdoor mall, similar to the Grove in Los Angeles [126] or Americana at Brand in Glendale [127].

The redevelopment will happen in phases and is scheduled for full completion in 2026. Artesia Blvd activation will be completed first, followed by adaptive reuse of the old Nordstrom building. The last phase

[125] Source: https://www.redondo.org/civicax/filebank/blobdload.aspx?BlobID=39934
[126] https://thegrovela.com/
[127] https://americanaatbrand.com/

of the project includes the construction of the apartments and hotel. The mall is scheduled to remain open during all phases of construction.

The redevelopment of this space will likely increase travel demand to and from the Galleria, which may translate to higher ridership on Line 102. No changes are needed to the current Line 102 alignment in response to the Galleria redevelopment, as maintaining the existing stops at Artesia Blvd/Kingsdale Ave. and Hawthorne Blvd/Artesia Blvd are already planned.

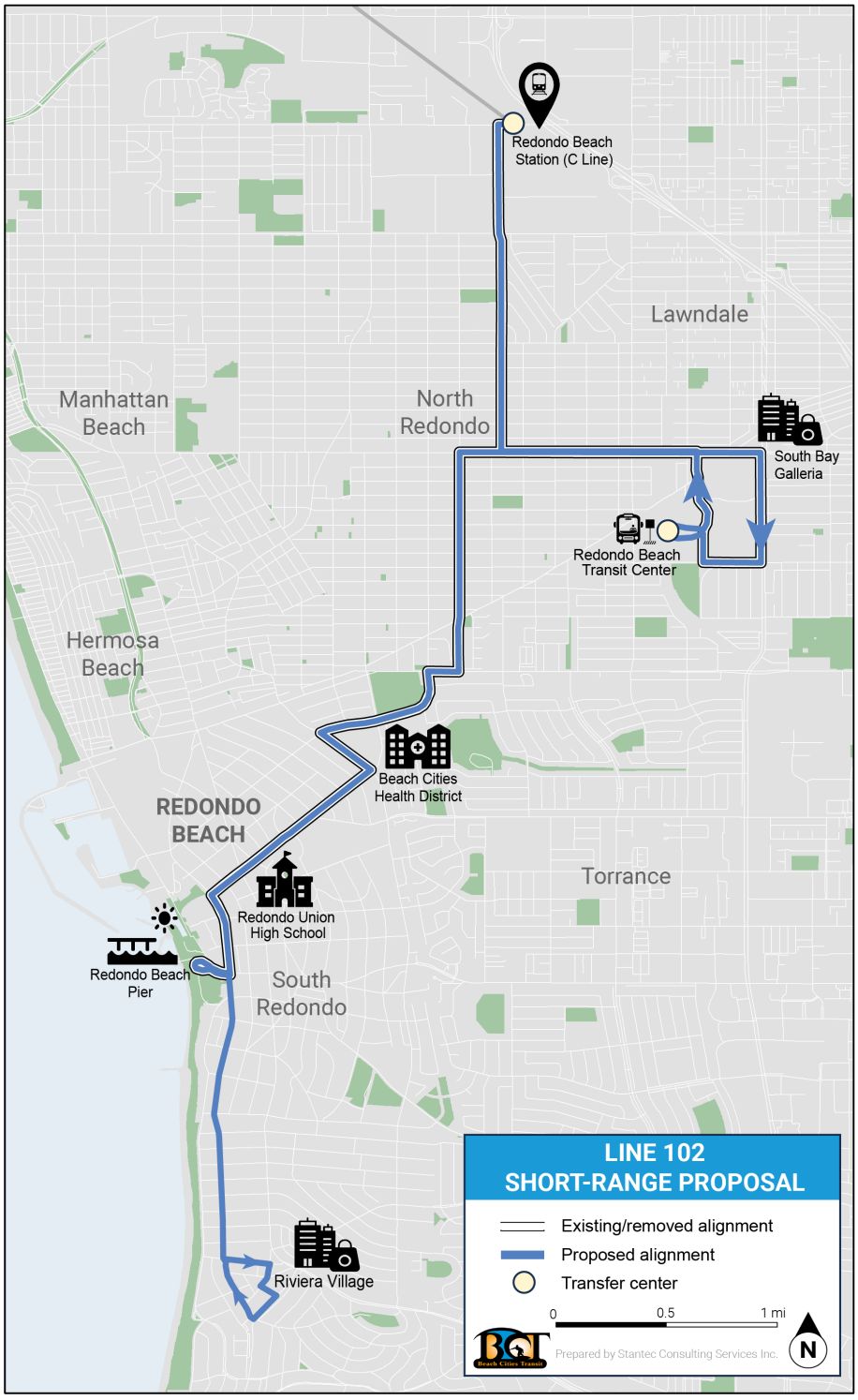
100% of Springfest survey respondents support this recommendation

As discussed in greater detail in Section 7.2.2, a recommended routing change to Line 109 will impact Line 102. It is recommended that Line 109 terminate at the Redondo Beach Pier instead of Riviera Village. Since it is important to maintain service to Riviera Village, the portion of the route between the pier and Riviera Village will be absorbed by Line 102. This change allows for better connections between lines 102 and 109 at the Pier and also positions Line 102 as the BCT line that provides access within and around the city of Redondo Beach (whereas Line 109 provides connections between the Beach Cities and access to the beaches). BCT will need to work together with the City of Redondo Beach and Torrance Transit to ensure that enough red curb space is provided to facilitate transit operations. Furthermore, enforcement is needed to reduce the number of scofflaws who illegally park in the red curb area that inhibits bus operations, as seen in the image in Figure 7-6. Figure 7-7 shows Line 102 short-range alignment changes. No changes are recommended for the Line 102 tripper service.

Figure 7-6: Illegally Parked Vehicles in the Space Reserved for Transit Vehicles at the Pier



Figure 7-7: Line 102 Short-range Changes



To achieve goals of increased ridership, to support increased activity at the South Bay Galleria stemming from its redevelopment, and to facilitate better connectivity between operators at the RBTC, it is recommended that incremental improvements in service span and frequency are implemented during the remaining years of the Short-range service planning period.

- In FY24-25 (plan year 2), it is recommended to decrease weekday headways from current headways to around every 33 minutes for most of the day. The increase in revenue hours is also inclusive of the additional mileage needed to absorb the southern portion of Line 109 between the Redondo Beach Pier and Riviera Village. As an additional vehicle is needed to operate this longer route, frequencies were maximized (headways minimized) to provide as frequent service as possible with this one additional vehicle.

75% of survey respondents would ride more often if the bus ran more frequently.

- A major finding from the review of existing conditions is that while weekday ridership on Line 102 has not reached pre-COVID-19 levels, FY21-22 weekend ridership has exceeded pre-pandemic ridership levels. In response to this, it makes sense to improve weekend service to further increase ridership and provide a better rider experience. In FY25-26 (plan year 3), it is recommended to increase Sunday service levels so that they match Saturday service levels, meaning that Sunday service would now operate around every 40 minutes from 8am-9pm.

77% of survey respondents support a later end time for the Line 102 on Sundays.

A summary of the existing and proposed service spans and frequencies for Line 102 are presented in Figure 7-8.

Figure 7-8: Existing and Proposed Service Spans and Frequencies for Line 102 (at full plan implementation)

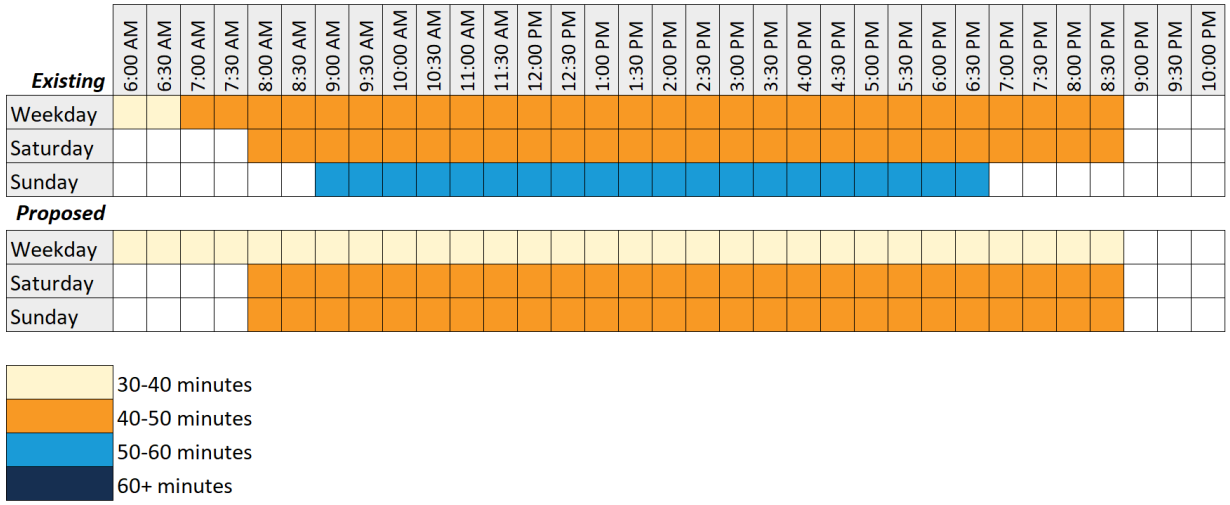


Table 7-2 presents year-by-year operational considerations.

Table 7-2: Line 102 Short-Range Operational Considerations

Year	Proposed changes	Baseline revenue hours (annual)	Proposed revenue hours (annual)	Difference
FY23-24	Routing changes to absorb the portion of Line 109 between Redondo Beach Pier and Riviera Village. Weekday service around every 33 minutes.	14,269	19,198	+4,930
FY25-26	Sunday service schedule was altered to match Saturday service.		20,342	+1,144

7.2.1.3 Long-Range Service Plan Outlook

In the long range, the Metro C Line extension will have a major impact not only on Line 102 but will help to transform the transportation landscape of the South Bay by extending the current light rail line from its current terminus at the Redondo Beach C Line station, through Redondo Beach, to terminate in Torrance at the Torrance Transit Center [128].

Two different alignments are currently being considered, one that takes advantage of the Metro-owned freight rail ROW (Alternative 1) and one that follows Hawthorne Blvd (Alternative 2). The current C Line with the two alternative options is shown in Figure 7-10. The C Line extension is expected to become operational sometime between 2030 and 2033.

[128] The operating plans for the K Line and C Line are currently in flux, where future operating plans could result in the future K Line continuing south from its currently-planned terminus to operate on the C Line between the Mariposa and Redondo Beach stations, eventually extending further down to Torrance with the C Line operating in an east-west direction only between Aviation/LAX and Norwalk. The Metro Board has instructed staff to conduct outreach and develop an updated Crenshaw/LAX Line operating plan recommendation that would be approved before the AMC station opens. This operating plan is important to consider but does not change the locations of current and future Metro rail stations that BCT interacts with.

Figure 7-9: Metro C Line Extension Alternatives [129]

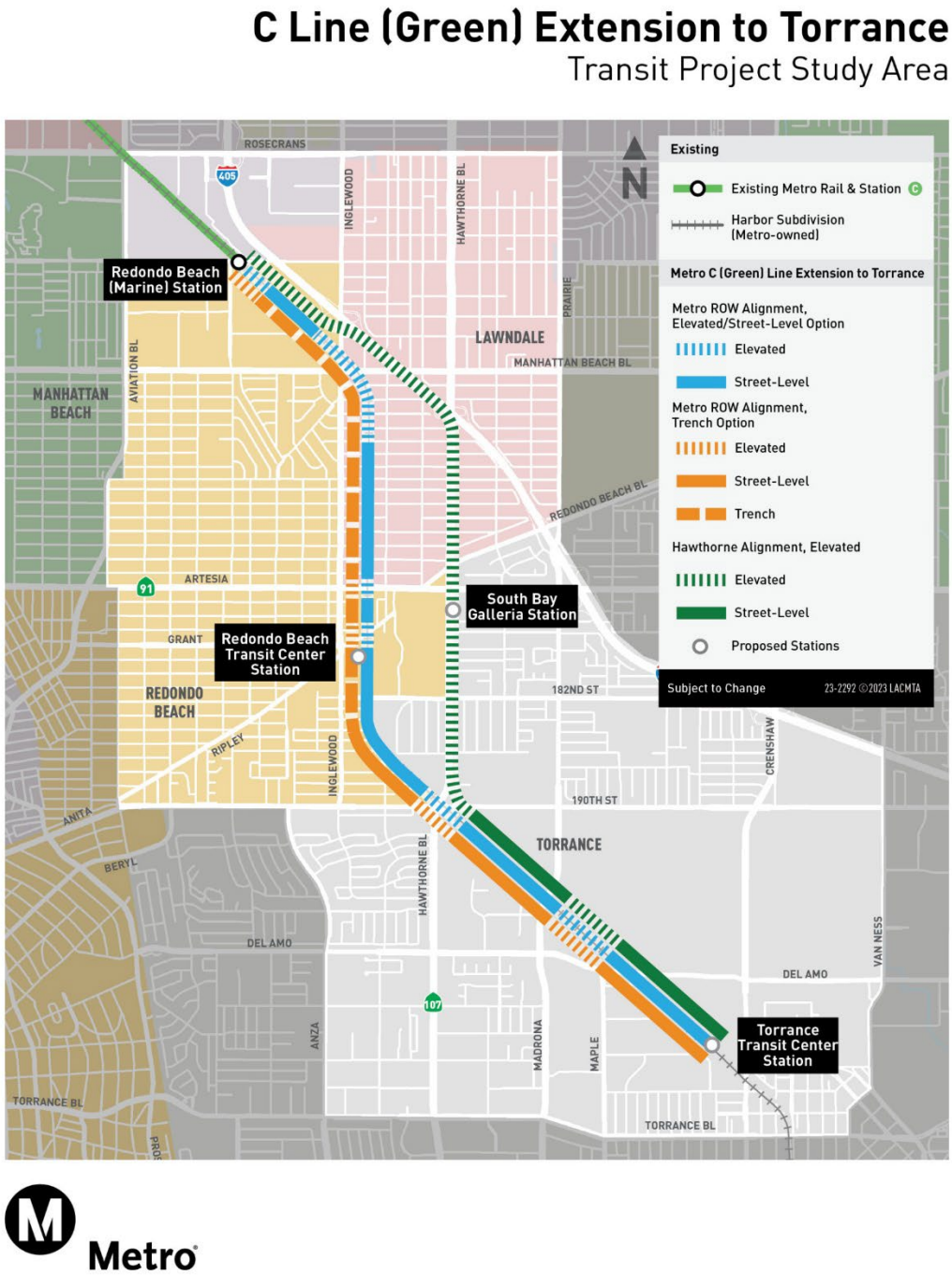


Figure 7-9 shows that Alternative 1 would stop at the RBTC, while Alternative 2 would have a stop at Hawthorne Blvd and Artesia Blvd, near the South Bay Galleria. While a preferred alignment has not yet been chosen by Metro, it will be important for BCT to serve the station regardless of alignment.

If Alignment 1 is chosen, no change will be needed for Line 102, as the rail station will be at the RBTC. Similarly, it has already been determined that it is important for BCT to continue to serve the South Bay Galleria directly, so BCT is well-positioned to serve the C Line extension station regardless of the chosen alignment. It will be important for BCT to continue to monitor progress on the C Line extension as the planning and construction process continues to move forward.

7.2.2 Line 109

Line 109 serves the Beach Cities from Riviera Village in South Redondo to LAX, providing service through Redondo Beach, Hermosa Beach, Manhattan Beach, and El Segundo. Through the Beach Cities, the line operates along Catalina Ave., Hermosa Ave., Manhattan Ave., and Highland Ave. to avoid service duplication with Metro's Line 232, which mainly operates along the Pacific Coast Highway through this area and provides weekday service around every 30 minutes.

Line 109 sees strong ridership transfers to Metro rail stations, including the Douglas C Line station and Aviation/LAX C Line station. Compared to Line 102, Line 109 sees lower average daily ridership and lower boardings per hour, though ridership is more consistent year-round.

There is an opportunity to make small but impactful changes to this line to make it more direct and achieve a more well-defined purpose. Currently, the line is quite long (approximately 18 miles one-way), and long trip lengths can be discouraging to potential riders. Furthermore, long bus alignments can negatively impact reliability as small issues compound into larger issues throughout a route's operation and over the course of a day.

The changes proposed here make Line 109 more streamlined and give it a more focused purpose: connecting major trip generators in the other Beach Cities to Redondo Beach, and providing an attractive transit option to travel to LAX, to use to transfer to Metro Rail stations, or to reach many of the recreational and entertainment destinations that the Beach Cities has to offer. Because of the destinations it serves, there is an opportunity to make the line more attractive to new population sectors, such as local residents who may not be aware of BCT (recommendations around marketing and public awareness are discussed more in Section 7.3.4), visitors, and tourists. These potential riders could use Line 109 to reach recreation, entertainment, and commercial destinations throughout the Beach Cities, such as Redondo Beach Pier/King Harbor, downtown Manhattan Beach, and Hermosa Beach Pier. Changes that straighten out the physical alignment and provide a more frequent service both address this opportunity.

Traveling to **entertainment** and for **recreational** purposes were the **top two** trip purposes for using BCT among survey respondents.

The service proposals also help to facilitate better internal transfers between lines 102 and 109 and easier transfers to Torrance Transit. Finally, the Line 109 proposed service plan integrates the changes taking place at LAX, mainly considering the LAX Automated People Mover (APM) and Airport Metro Connector (AMC) station.

The APM is an electric train system on an elevated guideway that will connect LAX's terminals with offsite parking, car rental, and transit facilities. The project is expected to become fully operational in 2024. The

[129] Source: https://www.metro.net/projects/green-line-extension/

APM will connect with the AMC, which itself will connect regional transit services to LAX at Aviation Bl./96th St. It is expected to be fully operational by 2024 (Figure 7-10). The AMC will include a K Line light rail station, bicycle parking, passenger pick-up and drop-off area, as well as a bus plaza that is slated to host bus service from BCT, Santa Monica Big Blue Bus, Culver City Bus, Torrance Transit, and GTrans.

Figure 7-10: LAX Automated People Mover and Airport Metro Connector Station [130]



7.2.2.1 *Short-Range Service Plan*

Several short-range routing alignment changes are proposed for Line 109, which achieve goals of making the service more direct, responding to changes and new transportation projects at LAX, and giving Line 109 a more defined and focused purpose.

Routing changes include:

- Adjusting the routing around LAX to serve the AMC so that riders can directly connect to the APM and LAX. Service along Century Blvd will be maintained. From Century Blvd, Line 109 will utilize Airport Blvd and W 98th St. to reach the AMC at Aviation Blvd and 96th St. Line 109 will no longer serve the current LAX bus center, as bus connections at LAX will be moving to the AMC station. This change should be implemented when the AMC opens, which is currently scheduled to happen in FY24-25.

92% of Springfest survey respondents support this recommendation.

[130] Source: https://www.metro.net/projects/airport-metro-connector/

- Re-route Line 109 around Manhattan Village Mall and Plaza El Segundo. This will help to make Line 109 more direct. The line will continue to serve the Douglas C Line station. This removal reduces route length and travel time. Changes to the Manhattan Village Mall complex along Rosecrans Blvd over the past few years have reduced the need to route Line 109 to Village Drive and Parkview Avenue, as there are now more entrances to the complex from Rosecrans Blvd It is recommended to implement this change in FY23-24, at the same time other routing adjustments will take place between the Redondo Beach Pier and Riviera Village.

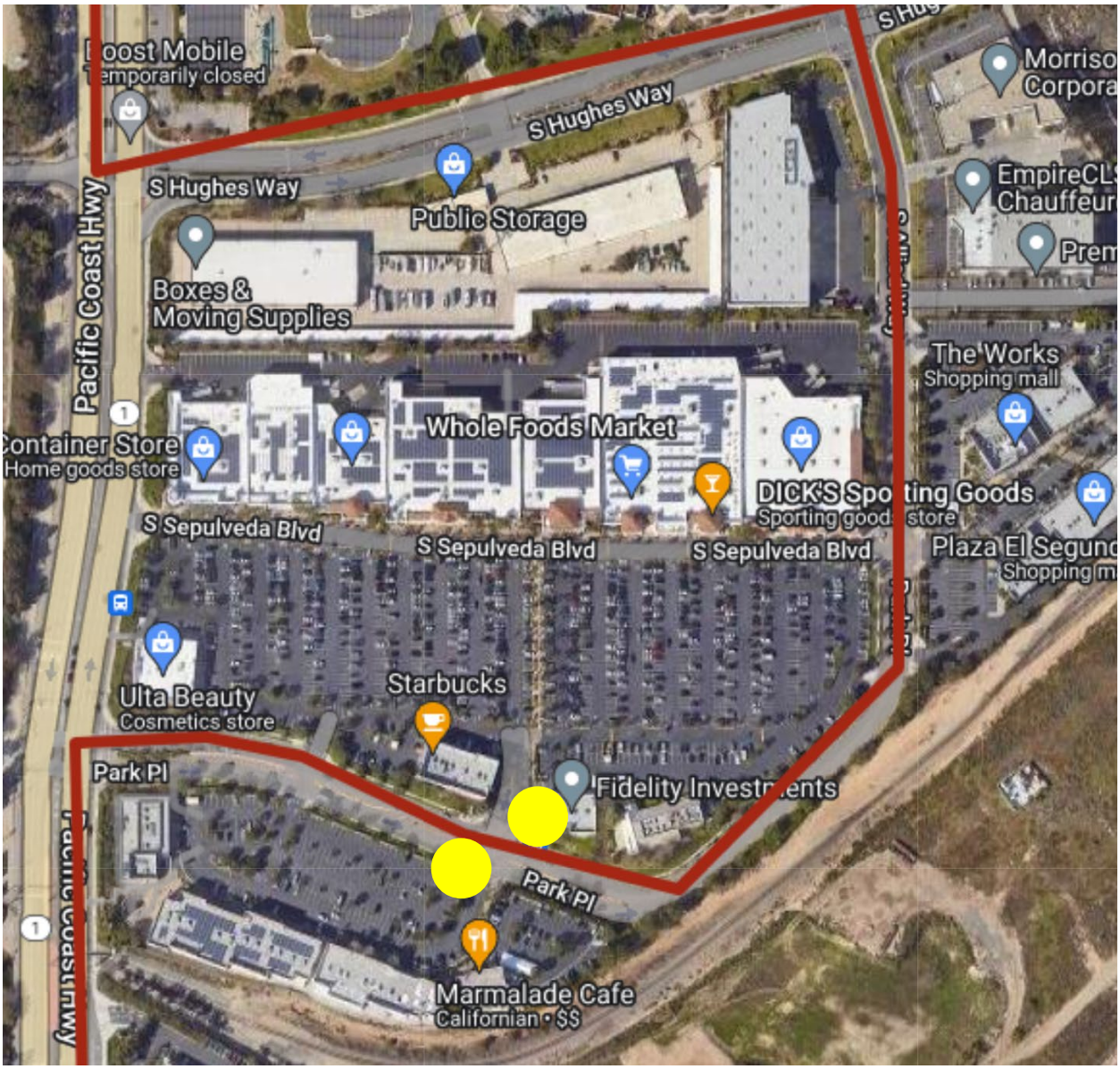
  100% of Springfest survey respondents support this recommendation.

- Statistics show ongoing regular low ridership at these BCT bus stop locations. Passenger boarding information was collected between February and April 2019. During that time, the stop at Manhattan Village Mall at Parkview Avenue and Village Drive recorded **one** boarding and **one** alighting, and the stops at Plaza El Segundo saw **one** passenger boarding and **two** passenger alightings. Changing the Manhattan Village Mall bus stop to share an existing bus stop with Metro at Rosecrans Avenue and Village Drive allows for continued service to Manhattan Village Mall.

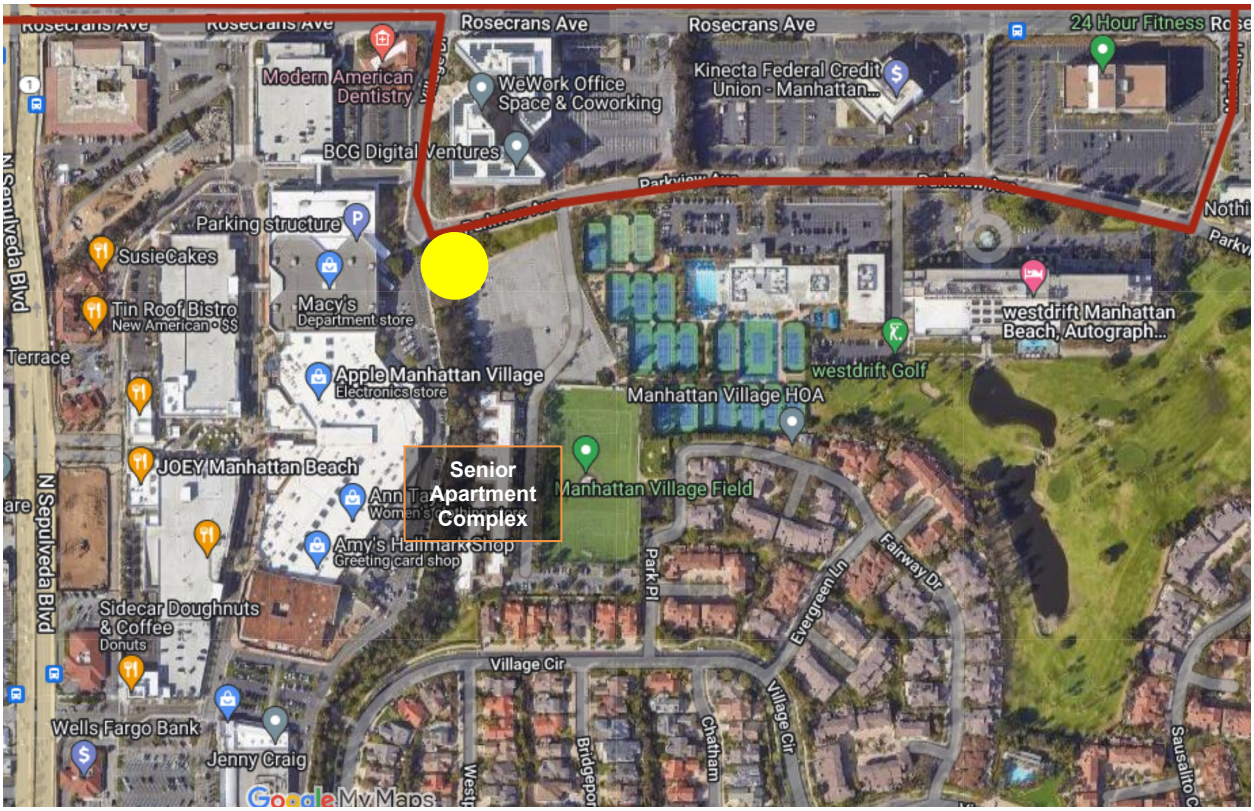
  While on the surface, it makes sense to directly serve these two large shopping and retail centers, a closer look shows that their design is very automobile-oriented and not transit-friendly. Figure 7-11 shows Plaza El Segundo in relation to the current Line 109 stops, shown in yellow.

  This shows that the current path between the bus stop and most of the destinations is not pedestrian-friendly and has limited sidewalk access. The second image shows the current BCT stop at Manhattan Village Mall in relation to the mall and senior apartment complex. The driveway access from the apartment complex to Parkview Avenue does not include a sidewalk, and the path is uphill, which is difficult for seniors with ambulatory issues. Until the area adopts a more transit-friendly design, rather than serve these destinations directly, BCT should instead invest in areas with more ridership and transit potential.

Figure 7-11: Plaza El Segundo and Manhattan Village Mall in Relation to Current Line 109 Stops [131]



[131] Source: Google Maps

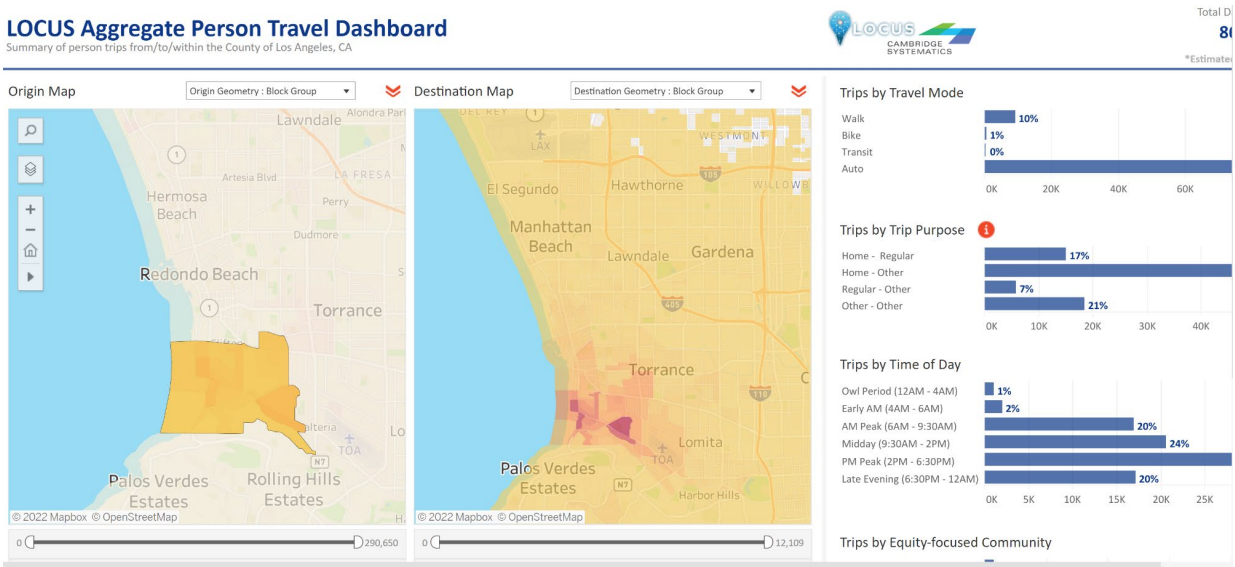


- The final route change proposal involves terminating Line 109 at the Redondo Beach Pier, as opposed to traveling south to Riviera Village. The Line 109 portion between the Redondo Beach Pier and Riviera Village would be absorbed by Line 102.

100% of Springfest survey respondents support this recommendation

An analysis of person trips using LOCUS data from the Metro Next Gen study shows that the majority of travel in South Redondo is within South Redondo—that is, most trips that begin in South Redondo also end in South Redondo, and few trips travel north to the other Beach Cities or other destinations that Line 109 serves (Figure 7-12).

Figure 7-12: Travel patterns in South Redondo [132]



This routing change has other benefits, including:

- Line 109 terminating at the pier enables easier access to the pier, King Harbor, and other potential trip generators like the Redondo Beach Farmer's Market and Veterans Park Senior Center. Further, the presence of more BCT vehicles within the Coral Way loop can help to increase public awareness of BCT services.
- Helping to facilitate transfers between lines 102 and 109, and create easier transfers between Line 109 and Torrance Transit Line 7. Potential challenges of this change are the constrained space within the Coral Way loop, conflicts with large vehicles (delivery trucks, tour buses), conflicts with smaller vehicles (taxis, Uber/Lyft, and personal vehicles), and increased traffic on event days, such as during the Farmer's Market. Coordination between BCT and Torrance Transit will be required to ensure that buses have sufficient space to layover at the same time. This may require communication of where it is illegal for non-transit vehicles to park.

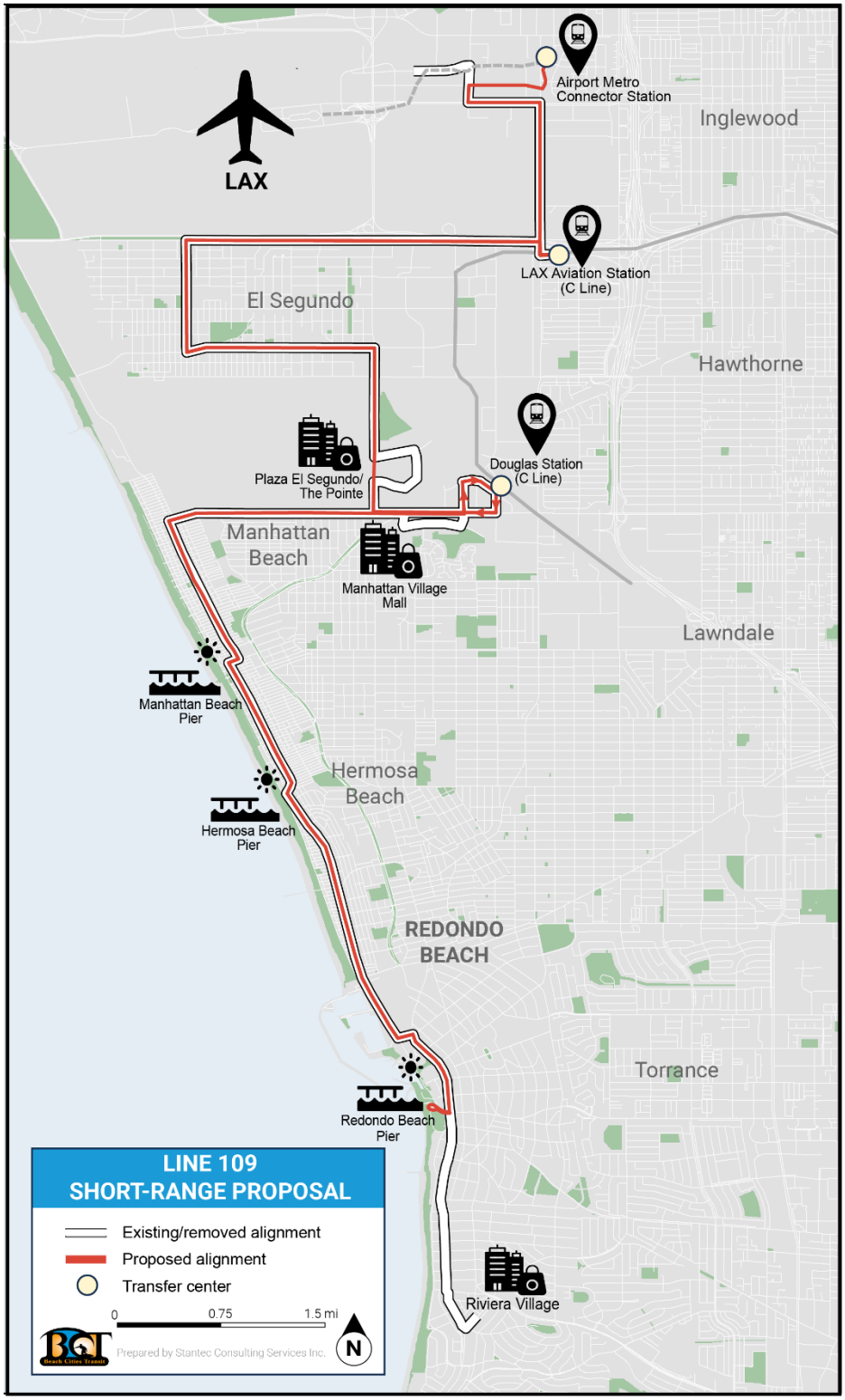
59% of survey respondents use at least one other transit service in addition to BCT.

- Helping to further define the purpose of each of BCT's lines, where Line 109 operates through the Beach Cities and Line 102 predominately operates within the city of Redondo Beach.

These routing changes are shown in Figure 7-13.

[132] Source: LOCUS Aggregate Person Travel Dashboard.

Figure 7-13: Line 109 Short-Range Changes



Following the proposed routing changes, it is recommended that Line 109 frequencies be modestly improved over the remainder of the 5-year planning period. While it is not always operationally feasible to operate on clockface or consistent headways throughout the day, BCT should strive for this as much as possible because it is easier to understand from a customer's point of view.

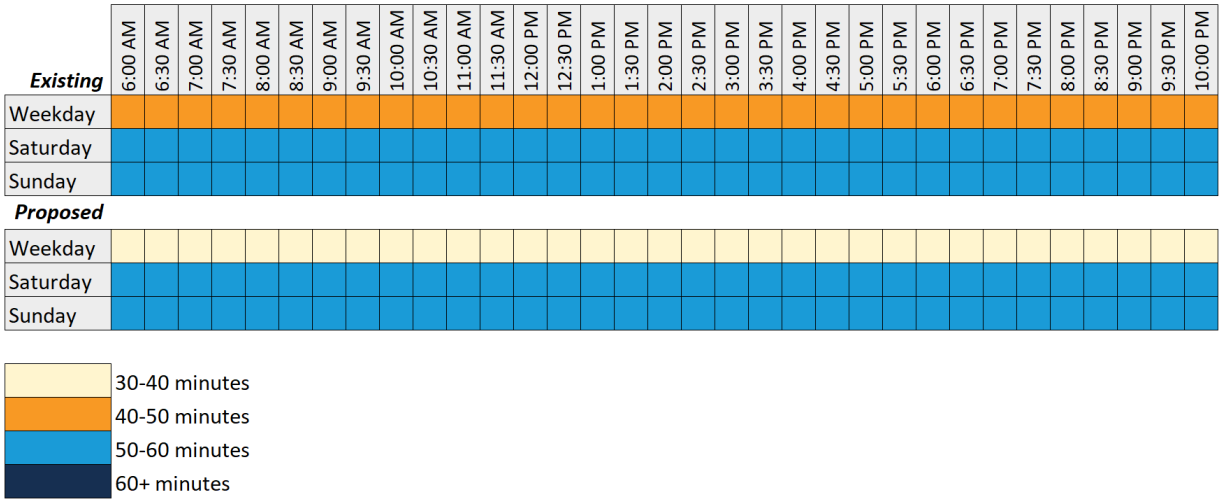
- In FY23-24 (Plan Year 1) it is recommended to implement routing changes where Line 102 will absorb the portion of Line 109 between the Redondo Beach Pier and Riviera Village, with Line 109 terminating at the Pier. This reduction in cycle time is not significant enough to reduce the number of vehicles required to operate Line 109; thus, it is recommended to maximize the frequency of service with the existing four vehicles, increasing weekday service to around every 41 minutes. Due to this, revenue hours do not change.

75% of survey respondents would ride more often if the bus ran more frequently.

- Beginning in FY26-27 (Plan Year 4), it is recommended to improve headways to 35-minute service on weekdays during the AM and PM peak periods, where 7am-9am is the AM peak and 4pm-6pm is the PM peak. Not only will more frequent service attract more ridership, but this will provide a better experience for existing customers, helping to retain customers in the long-term, acknowledging that many Line 109 riders use the service to get to and from the C Line Douglas Station during peak commuting hours.

A summary of the existing and proposed service spans and frequencies for Line 109 is presented in Figure 7-14.

Figure 7-14: Existing and Proposed Service Spans and Frequencies for Line 109 (at full plan implementation)



A summary of all of the proposed Short-range changes for Line 109 with operational considerations is outlined in Table 7-3.

Table 7-3: Line 109 Short-Range Operational Considerations

Year	Proposed changes	Baseline revenue hours (annual)	Proposed revenue hours (annual)	Difference
FY23-24	Routing changes around Manhattan Village Mall and terminating alignment at Redondo Beach Pier. Weekday service increased to around every 41 minutes.	20,918	20,918	0
FY24-25	Routing changes to serve the AMC and APM at LAX.		20,918	0
FY26-27	Implement 35-minute service during AM and PM peak periods.		21,677	+759

7.2.2.2 Long-Range Service Plan Outlook

Looking at a longer-term timeline, it is recommended that BCT monitor performance on Line 109 to understand if the changes implemented during the short-range timeline have resulted in improved ridership. It will also be important to collect rider feedback on the changes after they have gone into effect and respond to that feedback, as necessary.

Similar to the process taken for the Short-range Service Plan, BCT should continue to monitor the transportation, planning, and development landscape of the Beach Cities and the South Bay. Transportation and land use and development projects that could influence Line 109, or that should be served by Line 109 should be inventoried and necessary routing changes should be executed when these come online.

BCT should also continue to monitor and be aware of route schedules and any service changes of the other transit services that Line 109 interacts with, and adjust as appropriate. For example, Line 109 routing should remain aware of any C Line schedule changes or Torrance Transit changes to make sure transfers continue to be well-timed and convenient for riders.

As BCT moves forward with its transition to zero-emission buses as required by the California Air Resources Board Innovative Clean Transit mandate, a good location to deploy ZEBs is along Line 109. Specifically for Line 109, BCT can explore if shared charging infrastructure will be installed at any shared regional bus facilities, such as the AMC station. These opportunities can help facilitate on-route vehicle charging if this will be required based on the results of associated predictive power and energy modeling. Any on-route charging will need to be accounted for in schedules in case layover times will need to be adjusted.

Finally, using more robust service standards proposed in Section 7.3.3, BCT should track service and monitor performance. If Line 109 performance improves such as increased average daily boardings, boardings per revenue hour, vehicle loads, etc., enough, more frequent service should be introduced based on these service standards (for example, 15-minute service during peak weekday periods if it is warranted by ridership demand).

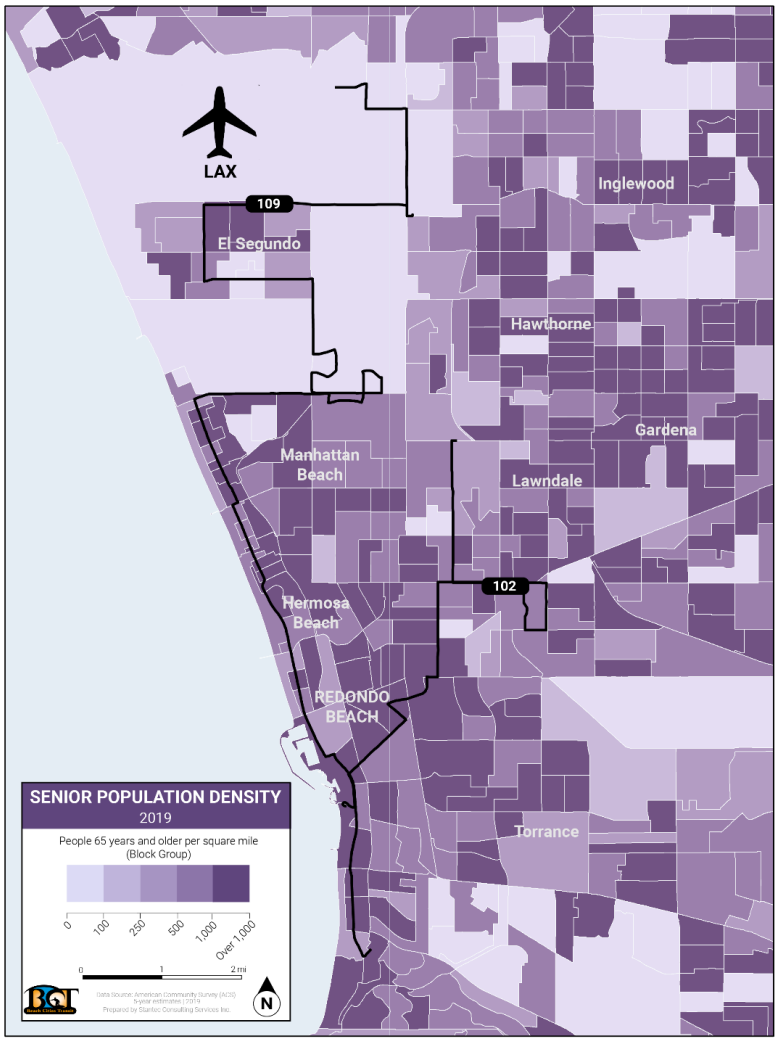
7.2.3 The WAVE

The WAVE provides DAR service to residents of Hermosa Beach and Redondo Beach who are seniors (62+) and individuals with impairments or disabilities. The WAVE service area includes Hermosa Beach and Redondo Beach, with additional designated satellite locations served in Torrance, Manhattan Beach, and Lawndale.

High concentrations of seniors exist throughout all of BCT's service area (Figure 7-15) but specifically within the South Bay Cities, as well as in Gardena and Lawndale. There are nine senior housing complexes that are located within Redondo Beach and Hermosa Beach; a full list is provided in Appendix B: List of Senior Housing Complexes Within Redondo Beach and Hermosa Beach. The WAVE has clients that live at several locations.

Currently, over 1,500 Redondo Beach residents and 120 Hermosa Beach residents are registered for the WAVE. This represents 12% of the eligible population of Redondo Beach [133]. As the population continues to age, it will be important to continue to understand how to engage with senior populations around transit use.

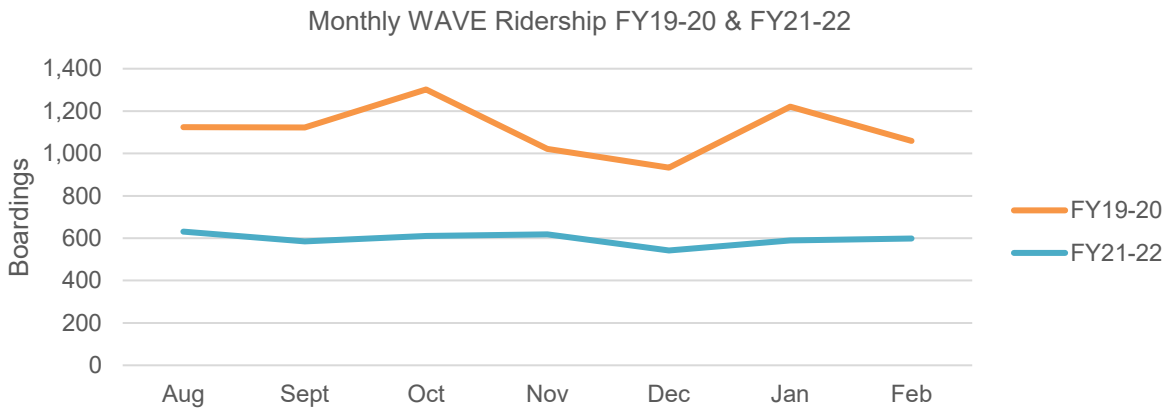
Figure 7-15: Senior Population Density (2019) [134]



[133] Data source: City of Redondo Beach.
[134] Data source: 2019 ACS 5-year estimates.

Following the COVID-19 pandemic, ridership on the WAVE remains low with 542 monthly trips in December 2021; 58% of December 2019 ridership. Additionally, the seasonal influx of ridership seen pre-pandemic has not returned as FY21-22 ridership remains relatively flat (Figure 7-16). As further discussed below, opportunities in the short term to improve ridership focus on marketing and engagement with target populations but also include technology improvements for fare payment and dispatching software.

Figure 7-16: WAVE Ridership Comparison [135]



As part of this study, engagement efforts focused on WAVE users as well as potential users. Workshop participants who would qualify for WAVE services indicated they were unaware or underinformed about the service and available destinations. There was a consensus that the senior populations in Hermosa Beach and Redondo Beach could be better informed about BCT and its services. Overall, outreach efforts identified a need for better engagement and marketing of WAVE services, particularly to senior populations.

7.2.3.1 Short-Range Opportunities

7.2.3.1.1 Outreach & Engagement

WAVE marketing and awareness were identified during community workshops to be an area where BCT could improve significantly. To interface with likely WAVE customers more directly, it is recommended that BCT develop and initiate a Marketing and Engagement Plan. This could take the form of direct outreach like pop-ups but also include a more robust travel training program for seniors and individuals with disabilities.

71% of WAVE rider survey respondents use WAVE once a month or less. These opportunities can improve the rider experience and encourage them to use the service more frequently.

As the Beach Cities population continues to age in place, the importance of leveraging organizational partnerships to meet potential and less frequent riders where they are will increase. The Beach Cities Health District is a key part of healthcare in the South Bay as well as a resource for senior populations. Strengthening BCT's position as a means of dependable transportation to and from this facility was identified in outreach as an area needing improvement. Additionally, senior centers and senior housing

[135] Data source: City of Redondo Beach

complexes in Hermosa Beach and Redondo Beach could benefit from programming and materials provided by BCT around travel training and transit options.

Finally, building awareness of WAVE services through travel training and information sessions at senior housing complexes and in communities with disabilities should be part of marketing and awareness. Partnering with an organization like the Friendship Foundation, an organization for Parents and Families with Special Needs, (identified during outreach activities) to build skills with its clients in navigating transit and understanding travel options within the South Bay could help promote WAVE ridership.

More discussion of marketing and travel training can be found in Section 7.3.4.

BCT currently promotes group trips by providing a reduced WAVE fare ($0.75 compared to $1.00) for parties of 3 or more traveling to and from the same destination. Marketing efforts like this and promoting social trips using the WAVE could be expanded. This could emphasize access to non-medical satellite locations like the Torrance YMCA as well as popular destinations within Hermosa Beach and Redondo Beach, such as farmer's markets. Metro's On the Move Riders Program provides an example and resource of social-focused outings oriented toward seniors; additional details are discussed in Section 7.3.4.

7.2.3.1.2 Technology Improvements

Access to high-quality data is key to making informed decisions but requires investment in the right tools. New scheduling and dispatching software could open opportunities for more advanced service delivery. While WAVE offers same-day and reservations as little as 30 minutes ahead of the trip, riders are increasingly seeking less planned, more spontaneous travel. Investing in new software could update the WAVE as a more rapid and efficient service.

WAVE rider survey respondents would ride more often with technology improvements:
Track trip on an app (**27%**)
Use an app or website to book trips (**27%**)

As part of BCT's current agreement with Transportation Concepts, in-house scheduling and dispatching software, Simpli Transport, is used for client management, trip-booking, and scheduling as well as driver-dispatch communications via a Mobile Data Terminal. This system, while providing for a variety of trip types (now, same day, reservation, and subscription), has been retired by its developers. Already performing poorly without the ability to export high-quality data into Excel, the retirement includes the elimination of all technical support.

High-quality data also comes from fare collection. Currently, WAVE fares cannot be paid with a TAP card [136]. Apart from providing a simple and consistent way to pay for transit, TAP cards offer access to valuable data on ridership. Accepting TAP stored value for fare payment on the WAVE vehicles will complement cash as an acceptable form of payment.

7.2.3.2 Long-Range Considerations

The WAVE provides high-quality service that is currently underutilized but highly valued by its riders. Long-term considerations for how BCT delivers on-demand service could include the revaluation of trip voucher programs with taxis or transportation network companies (TNCs) or piloting services open to the general public. As innovations in transit delivery continue to evolve, it would be advantageous for BCT to investigate options on how its successful services can be leveraged in different ways.

[136] The Transit Access Pass (TAP) is a reloadable smart card used by over 25 transit agencies in the Los Angeles metro area (including BCT).

7.2.3.2.1 Taxi/TNC Voucher Program

South Bay Cities have different approaches to providing supplemental transportation services for seniors and people with disabilities. Two different types of services are provided, dial-a-ride programs like the WAVE and dial-a-taxi programs with traditional taxi companies as well as TNCs. Manhattan Beach is the only other Beach City operating a dial-a-ride program after El Segundo transitioned to a dial-a-taxi program in mid-2021, due to driver shortages. El Segundo currently contracts with the TNC Lyft for dial-a-taxi service, providing a $600/month reimbursement per person.

Hermosa Beach offers a dial-a-taxi program, supplementing WAVE services with a $450/month reimbursement per person. Torrance's dial-a-taxi program reimburses participants $13 per trip, up to $156/month.

Operating costs differ based on program design, parameters, and utilization but FAP or other state funds are not eligible for taxi/TNC transportation subsidy programs.

Torrance, which has a similar number of registered residents (1,200 compared to BCT's 1,620 residents), spends an estimated $1 million annually ($1.2 million pre-COVID-19 and $800,000 during COVID-19) for their dial-a-taxi program. In addition to direct operating costs, Torrance spends $100,000 on staffing for dispatching and other associated managerial requirements. Comparatively, WAVE operating costs in FY 2021-22 were $530,000 and funded with FAP and Local Return funds.

Based on similar programs from Hermosa Beach, El Segundo, Torrance, and West Hollywood, BCT staff estimated costs for a taxi/TNC reimbursement program in Table 7-4. Depending on the percentage of eligible residents using the service (estimates included 4% to 7%), program costs ranged from $566,000 to upwards of $6 million for more than 7% utilization.

Table 7-4: Example of Estimated Costs for Taxi/TNC Program [137]

Eligible 65+	**9,375**		**9,375**	
Eligible Disabled	**2,433**		**2,433**	
Percentage and Number of Users	**4%**	**472**	**7%**	**827**
Up to 40 rides/month @ $15 value **Monthly Value per person:** $600/month	$3,400,992 / Year		$5,952,000 / Year	
Up to 30 rides/month. Avg trip value: $15 **Average Monthly Value per person: $450/month**	$2,550,774 / Year		$4,463,802 / Year	
Purchase up to 12 ride credits, @ $13 each **Monthly Value per person:** $156/month	$884,256 / Year		$1,547,100 / Year	
Purchase up to $100 ride credits monthly value per person **Average 10 trips/month** **$200/month (with a medical condition)**	$566,832 / Year		$991,956 / Year	

Providing a taxi/TNC subsidy program would change how to target demographics for the WAVE travel within the South Bay. Table 7-5 provides a look at how the WAVE service would compare to a taxi/TNC subsidy program. Whereas a service delivered by a taxi/TNC program would provide for more immediate trips, the quality of service delivered by the WAVE is superior to those provided by a taxi/TNC. Driver training and procedures set in place can help to ensure that riders are met with care and understanding, particularly for those with disabilities or mobility impairments.

[137] Data source: City of Redondo Beach

Table 7-5: Comparison of WAVE Service and a Taxi/TNC Subsidy Program

Delivery Area	WAVE service	Taxi/TNC subsidy program
Scheduling	WAVE provides a minimum of 30-minute reservation options for riders.	Taxi/TNC would allow for more immediate service.
Travel Behavior	Outreach and travel training are needed for robust on-demand transit service.	People are familiar with how to call a taxi service and increasingly value the ease of TNC app-based requests but barriers to technology use may still exist among senior and disabled populations.
Destinations	Serving any destination in Hermosa Beach or Redondo Beach with the ability to request satellite locations.	Taxi/TNC could provide transportation to any destination.
Responsibility	BCT is responsible for the delivery and quality of transportation through its contract with Transportation Concepts.	Taxi/TNC are responsible for the quality of transportation.
Care	BCT/Transportation Concepts trains its drivers to provide a higher quality of service with attention to people with disabilities or mobility impairments	There is no guarantee of quality service with taxi/TNC transportation.
Data	BCT/Transportation Concepts have full control of data associated with WAVE service delivery.	The majority of data is held by taxi/TNC.
Costs	Costs associated with WAVE delivery are known and funded through FAP and Local Return funds.	Taxi/TNC subsidy program costs are dependent on utilization but comparison to similar programs put it as substantially more expensive and BCT cannot use FAP funds to help fund it.

Additionally, the costs associated with a taxi/TNC subsidy program are unknown but estimated to be significantly larger than current WAVE costs. Any investment in a subsidy program would be better utilized by improving or expanding WAVE services. This analysis and the work by Redondo Beach staff have resulted in the recommendation by Stantec to not pursue a taxi/TNC subsidy program.

Instead, if the goal is to provide more spontaneous travel and flexibility with a more 'on-demand' model, similar to taxis or TNCs, BCT should invest in deploying new technology for scheduling and dispatching as described in the short-range opportunities. With new software that enables same-day service and dynamic scheduling, BCT can maintain the same operating model but leverage more advanced technology and capabilities for the benefit of the community.

7.2.3.2.2 Considerations for the General Public

Since the onset of the COVID-19 pandemic, WAVE productivity has been significantly lower resulting in 45% fewer boardings per hour in 2021 [138] compared to pre-pandemic levels. The WAVE service annually has unused revenue hours in the budget (an average of around 100 hours per month) that have historically been used to supplement fixed route hours. Moving forward, BCT can assess nominally increasing total annual service hours to allow for incremental WAVE service to the general public on the weekends without compromising the level of service and quality currently provided to its senior and disabled riders or fixed route service. BCT will need to conduct further analysis and peer research to understand when the WAVE should be open to the general public. The example below from Bakersfield, CA demonstrates how a strong

[138] Data Source: NTD; August – December 2019 had 1.98 boardings per revenue hour, compared to 1.10 for that same period in 2021

technology partner can streamline on-demand services by improving trip planning and scheduling, allowing for non-ADA trips to be scheduled when there is no demand, which can increase service efficiency and serve more passengers.

Leveraging an on-demand software system, **Golden Empire Transit (GET)** started commingling their non-emergency transportation, paratransit, and microtransit services in late 2020. Microtransit trips fill in the gaps between booked paratransit tips. This integrated mobility solution allowed GET to prioritize paratransit services while providing other types of rides when paratransit demand is low. ADA requirements are still met, but efficiency (passengers per vehicle hour) is up 60%.

Source: Partner Q&A: Talking integrated mobility with Golden Empire Transit - Via Transportation (ridewithvia.com)

Integrated mobility can provide a host of different services while still prioritizing senior and disabled populations. Expanding WAVE services does not need to mean opening the system completely to the public. Pilots can succeed that are based on carefully considered parameters focused on areas such as specific periods where usage is low creating excess supply or specifically targeted demographics combined with meaningful and effective marketing. Moreover, ongoing operating funding needs to be identified for the pilot so that if the pilot is successful, the new service can remain in place. For an on-demand service like the WAVE, a key challenge is estimating the number of revenue hours to budget; if demand exceeds revenue hours budgeted, BCT may need to either reduce service or may need to appropriate more funding for operations. One mechanism to mitigate this risk is to develop tiered service hour ranges and costs per revenue hour in the O&M contract. For example, OCTA's on-demand and paratransit contractor is paid a higher rate if monthly service hours fall between 8,333-16,667 hours and this rate gradually decreases for more revenue hours, helping both the agency and the contractor mitigate risk.

A series of questions in the BCT Rider Survey asked respondents to indicate the latest hour they would ride Line 102 and a separate question for Line 109. Respondents overwhelmingly indicated they would ride both Line 102 and 109 until the latest hour provided, 10pm and midnight (12am) respectively. These late hours were indicated most prominently for Friday and Saturday nights, with 50% of survey respondents noting they would ride Line 102 if service was extended until 10pm on Fridays and 57% stating they would ride if service was provided until 10pm on Saturdays. Respondents for Line 109 indicated 45% of riders would ride Line 109 if it ran until midnight on Fridays, and 56% noted they would ride until midnight on Saturdays.

On-demand services could fulfill this need, providing evening transit services from bars and restaurants along Hermosa and Redondo Beach Piers with safe, and more direct service into neighborhoods; the exact service area boundaries would need further study and determination. This service could be piloted on Friday and Saturday evenings, branded as the "Evening WAVE" to align with the current WAVE brand but emphasize the later hours of service. An example of this style of service from Ventura County is below:

Gold Coast Transit District (GCTD) leverages its paratransit fleet for late-night demand-response service open to the general public. Launched in 2021, Late Night Safe Rides complements GCTD's other demand-responsive services which include two paratransit services. On-demand requests for Late Night Safe Ride service are made a minimum 1-hr in advance with a $2.00 fare. The service operates from 7pm-12am every night, utilizing the existing paratransit fleet. This service was funded via CARES Act funds.

Many of these services use the existing capacity within GCTD's existing paratransit fleet to provide on-demand service for specific demographics and needs.

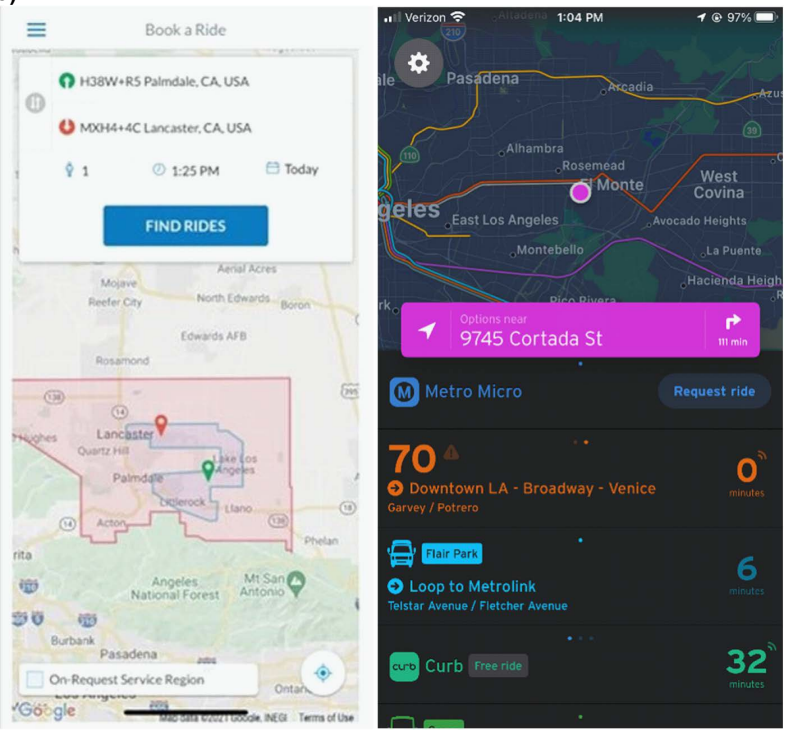
Source: ADA Paratransit and Other Demand-Responsive Transportation Services in Small to Midsized Transit Agencies. Washington, DC: The National Academies Press.

When proposing evening on-demand service, a participant in the technical working group session noted that focusing on on-demand service at later hours would avoid the challenges other on-demand services have encountered with high levels of ridership from school-aged children requesting rides for school service. Limiting pick-up and drop-off locations to specific areas such as major transit hubs and rail stations and major trip generators like business districts and shopping centers can help to minimize these challenges and ensure demand does not outpace supply. Competing with real-time booking from ride-hailing services like Lyft and Uber presents challenges for on-demand services. To provide real-time booking, an investment in a high-quality technology partner would be required.

Third-party software platforms such as Via [139], Transloc [140], Ecolane [141], RideCo [142], and others provide software solutions for microtransit trip planning and scheduling. Figure 7-17 shows an example screenshot from an on-request microtransit service (left) operating in the Antelope Valley. The screenshot from the Transit App (right) also in Figure 7-18 shows how microtransit services can be integrated with fixed route transit options to provide riders with a simple and easy way to use multiple modes to get to their final destination. In addition to providing a better customer experience, the use of these software to dynamically plan and manage on-demand services can help to enhance service productivity and efficiency.

[139] Public mobility solutions. | Via Transportation (ridewithvia.com)
[140] TransLoc - Mobility Solutions for Equitable Transit
[141] Industry Leading Transit & Paratransit Scheduling Software Provider | Ecolane
[142] On-Demand Transit - RideCo

Figure 7-17: Example Screenshots of Trip-Booking Apps: (Left) On-Request Micro Transit provided by Antelope Valley Transit Authority and (Right) the Transit App Showing Both Fixed Route and Microtransit Options (Metro Micro)



The example from the Antelope Valley described above provides a good potential model for BCT. AVTA contracted with a local transportation operator that is responsible for service delivery, as well as booking trips and scheduling trips, while the operator subcontracted with a technology company, Via, for the software used in customer-facing ride booking, as well as operator-facing scheduling, dispatching, and reporting. Using this approach can also help reduce the burden on the operator for trip booking, as customers can book trips themselves through the app; travel training for trip booking was also highly effective for AVTA. BCT could look to replicate this approach by stipulating in future contracts that advanced software is required for WAVE service, and in the interim, could issue an RFI to gather information about on-demand apps and solicit ideas for how to integrate with existing services and contracts. In the end, several agencies have found it prudent to use advanced on-demand software for scheduling traditional “dial-a-ride” services and on-demand services as it streamlines approaches, reduces the need for training on multiple platforms and designs-in advanced features that can be enabled (on-request trips) when the agency has capacity.

The next steps when considering on-demand viability will include a more detailed data analysis of hourly vehicle utilization to understand periods of low use. This analysis will give insights into where the service could be expanded as well as consider implementing additional services to the general public without negatively impacting existing WAVE services and riders. In addition, operational and cost considerations should be assessed in greater detail. Expanding service hours will require dispatch and maintenance personnel to work longer hours, and additional drivers may need to be hired to provide extended service, which may be challenging given national issues with transit operator shortages. Understanding potential O&M contractor cost increases will be important in determining the feasibility of implementing this service delivery model.

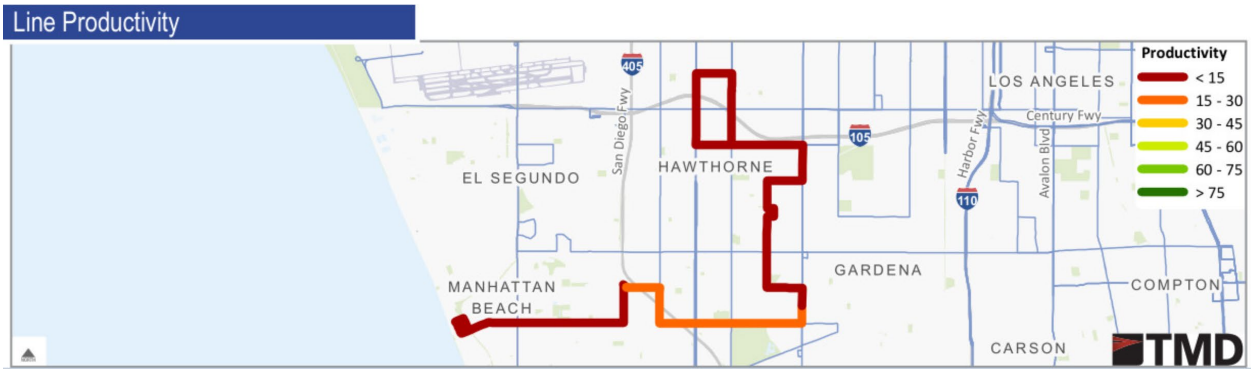
7.2.4 Options for Service Manhattan Beach Blvd

With multiple different service operators providing service in the Beach Cities and South Bay area, the most effective approach is for agencies to work together and ensure that service duplication is minimized. Agencies can collaborate to provide greater coverage in a service area across different service providers. When an agency removes a service from a service area, this also presents a potential opportunity for another agency to fill that service gap.

LA Metro launched its Next Gen Bus Study in 2018 with the goal of implementing a new and reimagined bus system that better meets the needs of current and future riders [143]. Through this process, Metro analyzed each line, and developed proposals for changing some lines, consolidating lines, and in some cases, eliminating lines entirely. Lines were eliminated when they reported very low-performance indicators, such as low ridership and low boardings per hour, in line with Metro's Transit Service Policy [144]. As a regional municipal operator, Metro has higher ridership performance standards than other transit operators.

One such eliminated line was Metro Line 126, which provided service operating mainly along Manhattan Beach Blvd, Yukon Ave., and Hawthorne Blvd between the Manhattan Beach Pier and the Hawthorne/Lennox C Line Station, also stopping at the Redondo Beach C Line Station (Figure 7-18). The service operated during weekday AM and PM peaks only, seeing an average of 13.7 boardings per revenue hour and 186 average daily boardings. The route was discontinued by Metro due to "underutilized service." The line was discontinued in December 2020 [145].

Figure 7-18: LA Metro Line 126 (discontinued) [146]



When Metro discontinues a route, this presents an opportunity for other municipal operators to fill this service gap, if the municipal operator determines there would be acceptable ridership, has vehicle capacity, funding, and if it integrates into their existing service plans. As the local service provider serving the Beach Cities, BCT can choose to provide service in this area in some capacity. For example, Metro discontinued Line 130 in 2021, which was taken over by Long Beach Transit and Torrance Transit. The eastern portion of Line 130 is now operated by Long Beach Transit and the western portion of Line 130 is operated by Torrance Transit.

[143] https://www.metro.net/about/plans/nextgen-bus-plan/
[144] https://www.dropbox.com/s/qmnfvhzv7mw8lat/nextgen-report-tsp-final.pdf?dl=0
[145] https://www.dropbox.com/s/u8x8lczlfjm33vq/nextgen_proposals.pdf?dl=0
[146] Source: https://la-metro.maps.arcgis.com/apps/MapSeries/index.html?appid=8decc337ba35474ba28d0b4e9ad71647#

In 2018, the City of Manhattan Beach adopted an updated Mobility Plan that considers mobility for pedestrians, cyclists, automobiles, and transit [147]. In conjunction with the plan's goal to build a convenient, efficient, and safe multimodal transportation network in Manhattan Beach, the plan's transit section assessed options to provide some kind of public transit service that provides an east-west connection within the city. The plan noted that during outreach, many participants noted the need for an east-west connection in Manhattan Beach. Sepulveda Blvd bisects the city, and participants noted that this division makes it difficult to travel between west and east Manhattan Beach. Residents also voiced concern that the western parts of the city and the downtown area get very congested, especially during summer months when Manhattan Beach becomes a major destination.

The City of Manhattan Beach considered a circulator or some other type of service to fill in this gap and address this community concern. In the Mobility Plan, the city assessed the feasibility of implementing an east-west circulator route that would address these requests from the community. The city assessed both year-round and summertime circulators but found both to be cost-prohibitive, not fiscally feasible, and operationally challenging. Currently, the only transit service provided by Manhattan Beach is a dial-a-ride service for Manhattan Beach residents who are 55 years of age or older or who have a qualifying disability to destinations within city limits and specific destinations outside of city limits, such as medical facilities [148]. The service is operated with a small fleet of cutaways, so it is likely that Manhattan Beach would need to either procure additional cutaways or larger vehicles to provide this service. Operating a fixed route service would require additional operational considerations, such as additional bus operators to operate the service, and potential maintenance considerations for maintaining a new vehicle type that their facility may not be outfitted to perform maintenance on. The City would also need to develop maps and other informational materials. Overall, an agency operating this service that already operates fixed route services with larger vehicles is better equipped to provide this service, and BCT operating this service, with additional operating funding from Manhattan Beach, can provide a "best of both worlds" approach that addresses the desire of Manhattan Beach city residents for this service and providing enhanced transit access to all South Bay residents and visitors.

Riders and non-riders who responded to the survey noted a desire for **service along Manhattan Beach Blvd., to Polliwog Park, and to and from summer concerts and events.**

The discontinuation of Line 126 and Manhattan Beach's determination to not provide east-west service within Manhattan Beach presents an opportunity for BCT to fill this gap. There are many reasons why providing this service is worthwhile, including:

- Fills in a known gap in service, and provides an east-west link and east-west connections in BCT's system.
- Responds to requests from the public and community members for service provision in this area.
- Provides access to multiple major trip generators:

[147] Microsoft Word - Final_Manhattan Beach_Mobility_Plan_Report_060418 2.docx
[148] https://www.manhattanbeach.gov/departments/parks-and-recreation/older-adults-program/dial-a-ride

- Manhattan Beach Pier
- Downtown Manhattan Beach
- Manhattan Beach Library and City Hall
- Polliwog Park
- Redondo Beach Performing Arts Center
- Manhattan Beach Art Center
- Manhattan Heights Community Center
- Aviation Park
- Connections to BCT Line 109
- Medical facilities (Torrance Memorial Urgent Care – Manhattan Beach, Providence Manhattan Beach Urgent Care, Torrance Memorial, Manhattan Dental Arts, CVS Pharmacy, UCLA Health Manhattan Beach Pediatrics)
- Grocery stores and other retail
- Redondo Beach C Line Station (depending on alignment)
- Redondo Beach Transit Center/South Bay Galleria (depending on alignment)

- Tackles the opportunity to generate more ridership and provide a more robust and frequent service that is more attractive to riders than the Metro Line 126 schedule.
- Provides the opportunity to minimize the operational and financial burden to BCT by operating this service as a seasonal service, during summer months only.
    - Specifically during the summer months, this service could be seen as a very popular option to attend summer programming, such as the Manhattan Beach Concerts in the Park series at Polliwog Park [149], summer camps held at the Manhattan Heights Community Center [150], Shakespeare by the Sea at Polliwog Park [151], and the various summer events held in downtown Manhattan Beach [152].

[149] https://www.manhattanbeach.gov/departments/parks-and-recreation/cultural-arts/concerts/concerts-in-the-park-bands
[150] https://www.manhattanbeach.gov/departments/parks-and-recreation/special-events/summer-camp-expo/summer-camps
[151] https://www.manhattanbeach.gov/departments/parks-and-recreation/special-events/shakespeare-by-the-sea
[152] https://www.downtownmanhattanbeach.com/events?view=calendar&month=06-2022

BCT could serve this corridor in a number of different ways. Below, four different route options are presented along with a consideration of the trade-offs between the different options. Operating estimates (revenue hour and vehicles required) are also presented along with each route option.

As mentioned, it is recommended that this new route provide service during only the peak summer months, and the service span, frequency, and months of that service should be tailored to provide service to as many events and special summer programming as possible. This includes many events that begin in the evening and can end later in the night, as well as summer programming for youths (such as summer camps at the community center) that have an earlier morning start time. Acknowledging this, the proposed schedule for the Manhattan Beach Blvd route is:

100% of Springfest survey respondents support this recommendation. With 27 total responses, this was also the most popular recommendation.

- Operate annually during the summer, when school trippers are not in service (approximately early June – mid-August)
- Operate Monday-Thursday: 8am-8pm, every 30 minutes
- Operate Friday-Sunday: 10am-11pm, every 30 minutes

This service schedule is intended to be the baseline and present a schedule that is operationally feasible. BCT can also pursue operational funding support through partnerships with the City of Manhattan Beach and event stakeholders to provide additional or supplemental service before and after large events, or services that are timed to align better with when events are beginning and ending. For example, the 2022 Manhattan Beach Concert in the Park series is held every Sunday evening from July 3-September 4 from 5pm-7pm at Polliwog Park. BCT can work with event organizers and the Manhattan Beach Department of Parks and Recreation to provide additional service the hour before and after the event, and coordinate routing and pick up/drop off locations, with event organizers advertising the service as a safe and convenient way to attend the concerts, without hassles to find and pay for parking.

BCT can also consider providing this service for free, to provide additional incentives to use it. Conversely, BCT can provide the service at a rate reduced from their original fare or have other special incentives where customers can ride for free to and from special events with proof of event attendance (such as a ticket stub) as an additional way to partner with event stakeholders.

Table 7-6-Table 7-9 and Figure 7-19-Figure 7-22 present four different route alignment options to serve Manhattan Beach Blvd Each table presents a description of the route, the destinations it would serve, route-specific opportunities and challenges, and operational considerations such as an estimate of daily revenue hours and vehicles required. Each route option features the same service spans and frequencies as listed above. This section concludes with a recommendation of which route alignment is the best choice for BCT.

Table 7-6: Manhattan Beach Blvd Route Option 1 Considerations

Route Option 1 – Redondo Beach C Line Station	
Description	The intent of this route is to provide local, direct service along Manhattan Beach Blvd between Manhattan Beach Pier and the Redondo Beach Station. The line travels along Manhattan Beach Blvd until Redondo Beach Ave., where it also serves the Redondo Beach C Line station. This alignment provides the east-west service along Manhattan Beach Blvd while also enabling more regional travel via its connection to the Redondo Beach C Line station.

Route Option 1 – Redondo Beach C Line Station	
Destinations served	• Manhattan Beach Pier • Downtown Manhattan Beach • Manhattan Beach Library and City Hall • Polliwog Park • Redondo Beach Performing Arts Center • Manhattan Beach Art Center • Manhattan Heights Community Center • Aviation Park • Connections to BCT Line 109 • Connections to BCT Line 102 • Medical facilities (Torrance Memorial Urgent Care – Manhattan Beach, Providence Manhattan Beach Urgent Care, Torrance Memorial, Manhattan Dental Arts, CVS Pharmacy, UCLA Health Manhattan Beach Pediatrics) • Grocery stores and other retail • Redondo Beach C Line Station (Line 102 connection)
Opportunities	• Shortest route length. • Most direct route. • Does not duplicate service from other transit providers.
Challenges	• A portion of the route that operates on Redondo Beach Ave. duplicates Line 102 service. • Does not penetrate too deeply into Redondo Beach city limits; the majority of the route is in Manhattan Beach city limits. • Road Closures during Manhattan Beach Special Events
Route length (one-way)	3.2 miles
Revenue hours	12 daily revenue hours, Monday-Thursday schedule 13 daily revenue hours, Friday-Sunday schedule 1,230 annual revenue hours
Vehicles needed	1 vehicle per day for 30-minute headways

Figure 7-19: Manhattan Beach Blvd Route Option 1

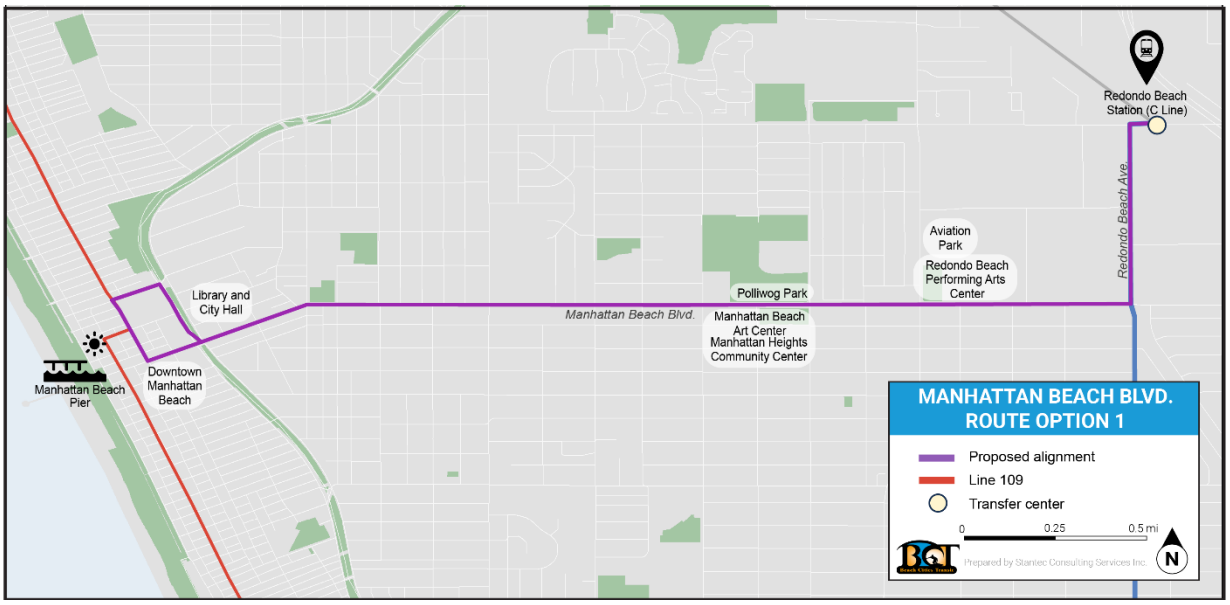


Table 7-7: Manhattan Beach Blvd Route Option 2 Considerations

Route Option 2 – Aviation Blvd	
Description	This route serves Manhattan Beach Blvd between Manhattan Beach Pier and Aviation Blvd, then serves Aviation Blvd to Artesia Blvd to loop around the South Bay Galleria and serve the Redondo Beach Transit Center.
Destinations served	• Manhattan Beach Pier • Downtown Manhattan Beach • Manhattan Beach Library and City Hall • Polliwog Park • Redondo Beach Performing Arts Center • Manhattan Beach Art Center • Manhattan Heights Community Center • Aviation Park • Connections to BCT Line 109 • Medical facilities (Torrance Memorial Urgent Care – Manhattan Beach, Providence Manhattan Beach Urgent Care, Torrance Memorial, Manhattan Dental Arts, CVS Pharmacy, UCLA Health Manhattan Beach Pediatrics, Venice Family Clinic-South Bay Family Heath Care, Soma Medical Group) • Grocery stores and other retail • South Bay Galleria • Redondo Beach Transit Center (Line 102 connection)
Opportunities	• More of this route alignment is within Redondo Beach city limits compared with route option 1. • Access through Aviation Blvd, a residential neighborhood, provides more opportunities for convenient access to the route from residents of that neighborhood.

Route Option 2 – Aviation Blvd	
	• Provides access to additional commercial and retail trip generators along Artesia Blvd • Transfer opportunities at Redondo Beach Transit Center with Metro 40, 210 211, GTrans Line 3, and Torrance Transit Line 3.
Challenges	• Considerable alignment duplication with Torrance Transit Line 8 along Aviation Blvd, Artesia Blvd, and Hawthorne Blvd to the South Bay Galleria. • Alignment duplication with Torrance Transit Line 13 along Artesia Blvd between Aviation Blvd and Hawthorne Blvd • Alignment duplication with BCT Line 102 along Artesia between Rindge Lane and Hawthorne Blvd, and along Hawthorne Blvd, W 182nd St., and Kingsdale Ave. to serve the RBTC and South Bay Galleria. • Serves more destinations, but has a less focused intent of providing an east-west connection along Manhattan Beach Blvd compared to route option 1.
Route length (one-way)	6.4 miles
Revenue hours	24 daily revenue hours, Monday-Thursday schedule 26 daily revenue hours, Friday-Sunday schedule 2,460 annual revenue hours
Vehicles needed	2 vehicles per day for 30-minute headways

Figure 7-20: Manhattan Beach Blvd Route Option 2

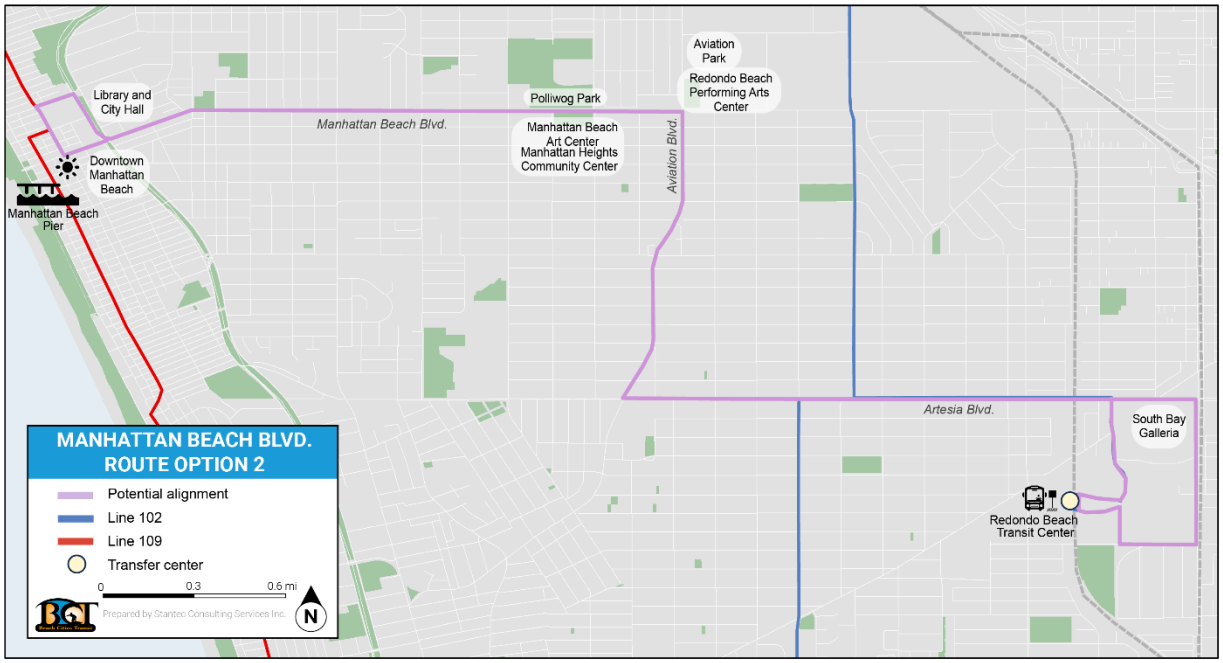


Table 7-8: Manhattan Beach Blvd Route Option 3 Considerations

Route Option 3 – Vail Ave.	
Description	This route serves Manhattan Beach Blvd between Manhattan Beach Pier and Aviation Blvd, then serves Vail Ave. to Artesia Blvd to loop around the South Bay Galleria and serve the Redondo Beach Transit Center.
Destinations served	• Manhattan Beach Pier • Downtown Manhattan Beach • Manhattan Beach Library and City Hall • Polliwog Park • Redondo Beach Performing Arts Center • Manhattan Beach Art Center • Manhattan Heights Community Center • Aviation Park • Anderson Park • Connections to BCT Line 109 • Medical facilities (Torrance Memorial Urgent Care – Manhattan Beach, Providence Manhattan Beach Urgent Care, Torrance Memorial, Manhattan Dental Arts, CVS Pharmacy, UCLA Health Manhattan Beach Pediatrics, Soma Medical Group) • Grocery stores and other retail • South Bay Galleria • Redondo Beach Transit Center (Line 102 connection)
Opportunities	• More of this route alignment is within Redondo Beach city limits compared with route option 1. • Access through Vail Ave., a residential neighborhood, provides more opportunities for convenient access to the route from residents of that neighborhood. • Provides access to additional commercial and retail trip generators along Artesia Blvd, but not as many compared to route option 2. • Transfer opportunities at Redondo Beach Transit Center.
Challenges	• Considerable alignment duplication with BCT Line 102, between Vail Ave., Artesia Blvd, and the RBTC. • Serves more destinations, but has a less focused intent of providing an east-west connection along Manhattan Beach Blvd compared to route option 1.
Route length (one-way)	6.2 miles
Revenue hours	24 daily revenue hours, Monday-Thursday schedule 26 daily revenue hours, Friday-Sunday schedule 2,460 annual revenue hours
Vehicles needed	2 vehicles per day for 30-minute headways

Figure 7-21: Manhattan Beach Blvd Route Option 3

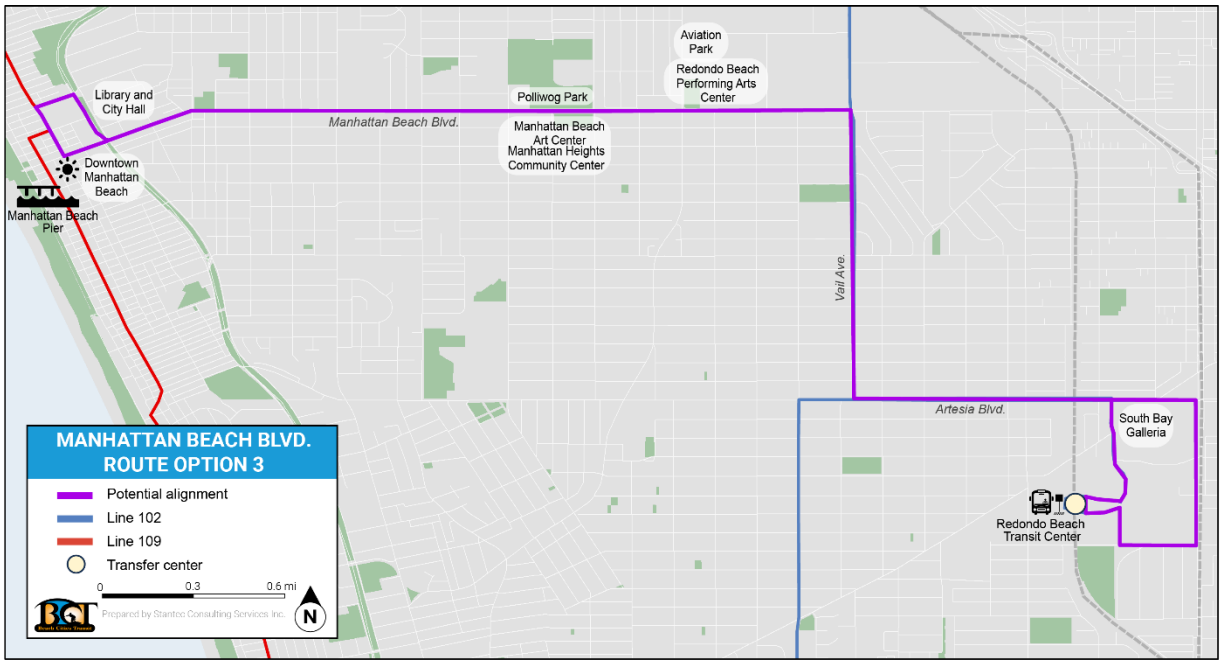


Table 7-9: Manhattan Beach Blvd Route Option 4 Considerations

Route Option 4 – Inglewood Ave.	
Description	This route serves Manhattan Beach Blvd between Manhattan Beach Pier and Aviation Blvd, then serves Inglewood Ave. to Artesia Blvd to loop around the South Bay Galleria and serve the Redondo Beach Transit Center.
Destinations served	• Manhattan Beach Pier • Downtown Manhattan Beach • Manhattan Beach Library and City Hall • Polliwog Park • Redondo Beach Performing Arts Center • Manhattan Beach Art Center • Manhattan Heights Community Center • Aviation Park • Connections to BCT Line 109 • Medical facilities (Torrance Memorial Urgent Care – Manhattan Beach, Providence Manhattan Beach Urgent Care, Torrance Memorial, Manhattan Dental Arts, CVS Pharmacy, UCLA Health Manhattan Beach Pediatrics, Soma Medical Group) • Grocery stores and other retail • South Bay Adult School • South Bay Galleria • Redondo Beach Transit Center (Line 102 connection)
Opportunities	• More of this route alignment is within Redondo Beach city limits compared with route option 1. • Provides access to residential, retail, and commercial trip generators along Inglewood Ave.

Route Option 4 – Inglewood Ave.	
	• Transfer opportunities at Redondo Beach Transit Center.
Challenges	• Alignment duplication with the Lawndale Beat along Inglewood Ave., though the Lawndale Beat service is currently suspended. • Serves more destinations, but has a less focused intent of providing an east-west connection along Manhattan Beach Blvd compared to route option 1.
Route length (one-way)	6.2 miles
Revenue hours	24 daily revenue hours, Monday-Thursday schedule 26 daily revenue hours, Friday-Sunday schedule 2,460 annual revenue hours
Vehicles needed	2 vehicles per day for 30-minute headways

Figure 7-22: Manhattan Beach Blvd Route Option 4



Table 7-10 assesses the four different route options across several different criteria to determine which route option is the best fit for BCT and should be considered for future exploration.

Table 7-10: Multicriteria Analysis of Different Manhattan Beach Blvd Route Options

Criteria	Route option 1 – Redondo Beach C Line Station	Route option 2 – Aviation Blvd	Route option 3 – Vail Ave.	Route option 4 – Inglewood Ave.	Notes
Alignment considerations	★★☆	★☆☆	★☆☆	★☆☆	-Route option 1 has the least amount of service duplication, internally among other BCT lines and externally with lines from other transit agencies. -Route option 1 is the most direct route. -Route options 2-4 penetrate deeper into Redondo Beach compared with route option 1.
Route length	★★★	★☆☆	★★☆	★★☆	-Route option 1 has the shortest route length. --Route option 2 has the longest route length.
Revenue hours	★★★	★★☆	★★☆	★★☆	-Route option 1 requires the least amount of revenue hours.
Vehicles required	★★★	★★☆	★★☆	★★☆	-Route option 1 requires the fewest vehicles to operate.
Other considerations	★★★	★★☆	★★☆	★★☆	-While route options 2-4 provide service to more destinations, route option 1 has a more well-defined purpose that is more in line with the original intent of this route.
Final score	**2.8/3.0**	**1.6/3.0**	**1.8/3.0**	**2.0/3.0**	

Table 7-10 shows that Route Option 1 has scored the highest across the evaluation criteria. From an operational standpoint, the route is the shortest and takes the least number of resources to operate. Route Option 1 is also the most direct route and facilitates both local travel along Manhattan Beach Blvd and provides an option for regional travel through its connection to the Redondo Beach C Line Station, which is also served by BCT, Metro Bus, GTrans, and Torrance Transit. Importantly, this route also features multiple bus transfer opportunities with the least service duplication and does not duplicate services from other agencies.

Overall, this analysis shows that different options were assessed across a number of different qualitative and quantitative categories to determine how to best serve this corridor, and found that Route Option 1 is the best overall fit. As Route Option 1 is the most cost-effective option, this alternative can show funding partners that BCT has done their due diligence in choosing the most affordable route option.

Regardless of which alignment is chosen, the success of this route hinges on close collaboration not only with the other participating municipalities, but also proactive partnerships with the organizations that

provide programming and events, such as the Redondo Beach Performing Arts Center, Manhattan Beach Parks and Recreation, Manhattan Beach Chamber of Commerce, and the Downtown Manhattan Beach Business + Professional Association. These partnerships will be critical to effectively advertise this route as a convenient and reliable way to reach events and destinations in Manhattan Beach.

In addition to partnerships for advertising the service, BCT will need to work closely with the other Beach Cities to receive support and funding; specifically from Manhattan Beach as the service will be operating predominately within Manhattan Beach and serving many Manhattan Beach destinations. Prior to COVID-19, the cost-sharing formula was set up so that each city contributed funding for operations based on the portion of route mileage within each city. It will be important for BCT to educate city partners on the importance of providing transit and the funding support that is needed to provide attractive and convenient transit that residents will see as a true alternative to driving. The best success will result from Redondo Beach's sister cities participating as true partners to BCT, and fully committed to providing transit-viable service.

After the service is implemented, BCT should regularly solicit feedback from riders and the community to receive input on the new service and how it can be improved. BCT can use this feedback to tweak and tailor the service to better fit the needs of Beach Cities residents and visitors.

7.2.4.1 Long-Range Service Plan Outlook

In the long term, BCT should continue to solicit community feedback on the service and can consider extending the summer Manhattan Beach Blvd service to be year-round. This will be dependent on the performance and success of the line during the summertime, and the operational and financial capacity of BCT to further extend service. During the summer service period of the Manhattan Beach Blvd route, it will be important for BCT to monitor ridership, productivity, and route performance. BCT should also seek public input on whether the community would support and use the service if it were year-round. BCT would also need to work with its municipal Beach Cities partners, particularly Manhattan Beach, to understand if more funding support to extend the service would be feasible. Collecting community feedback on how this service has been helpful and fills a community transportation need can also be helpful in communicating to Manhattan Beach that this is an important community service that should be expanded.

7.2.5 Service Plan Summary

Table 7-11 presents a summary of the Short-range Service Plan by service and by year, and Table 7-12 summarizes high-level revenue hour estimates by year required to implement the changes.

Table 7-11: Short-range Service Plan Summary

Plan year	1	2	3	4	5
Fiscal year	**FY23-24**	**FY24-25**	**FY25-26**	**FY26-27**	**FY27-28**
Line 102	Routing changes to absorb the portion of Line 109 between Redondo Beach Pier and Riviera Village (January 2024). Weekday service around every 33 minutes.	N/A	Alter Sunday service schedule to match the Saturday service schedule.	N/A	N/A
Line 109	Routing changes to straighten out alignment around Plaza El Segundo	Implement routing changes to serve the Airport Metro	N/A	Implement 35-min weekday service during AM and PM peaks.	N/A

Plan year	1	2	3	4	5
Fiscal year	**FY23-24**	**FY24-25**	**FY25-26**	**FY26-27**	**FY27-28**
	and Manhattan Village Mall, and terminate the line at Redondo Beach Pier (January 2024).	Connector and Automated People Mover at LAX.			
Manhattan Beach Blvd Link	Lead time for additional planning, outreach, etc.	N/A	Launch new line during summer months when school trippers are not in service.	Continue to monitor performance and adjust schedules as necessary, and begin to collect data to determine whether this service should be expanded year-round	
The WAVE	Various strategies to increase ridership among senior and disabled populations.				

Table 7-12 presents the projected estimate of revenue hours required to implement all the changes outlined here. If all changes over the five-year planning period are implemented, this would result in an increase of 8,063 hours or an increase in revenue hours of 19% compared to the baseline in plan year 5.

Table 7-12: Short-range Service Plan Annual Revenue Hour Estimates

Annual Revenue Hour Estimates						
Service	**Baseline [153]**	**Plan Year 1**	**Plan Year 2**	**Plan Year 3**	**Plan Year 4**	**Plan Year 5**
102 [154]	14,269	19,198	19,198	20,342	20,342	20,342
102 School Tripper	658	658	658	658	658	658
109	20,918	20,918	20,918	20,918	21,677	21,677
Manhattan Beach Blvd Line (Op. 1)	0	0	0	1,230	1,230	1,230
The WAVE [155]	6,412	6,412	6,412	6,412	6,412	6,412
Total	42,257	47,186	47,186	49,560	50,319	50,319
Percent change from baseline	**N/A**	**12%**	**12%**	**17%**	**19%**	**19%**
Percent change from prior year	**N/A**	**12%**	**0%**	**5%**	**2%**	**0%**

Table 7-13 shows estimates for peak vehicle requirements per line and plan year. For comparison, BCT NTD data for 2020 shows 10 fixed route vehicles operating in maximum service [156]. If BCT implements

[153] This baseline year assumes that the immediate-term service plan for Line 102 has been implemented (rerouted to serve the RBTC, new tripper schedules, and the gap in Sunday service has been filled). Fixed-route revenue hours in FY2019, 33,948, and in FY2020, 32,383 based on NTD reports.
[154] Line 102 baseline revenue hours assumes that the immediate service plan has been implemented.
[155] The WAVE service hours approximated as an average of annual revenue hours from 2017-2021 as reported to NTD.
[156] https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2020/90214.pdf

the entire short-range service plan, this would require an estimated increase of two vehicles operating at peak hours.

Table 7-13: Peak Vehicle Requirement Estimates

Peak vehicle requirement estimates						
Service	**Baseline [157]**	**Plan year 1**	**Plan year 2**	**Plan year 3**	**Plan year 4**	**Plan year 5**
102 [158]	3	4	4	4	4	4
102 School Tripper	3	3	3	3	3	3
109	4	4	4	4	5	5
Manhattan Beach Blvd Line (Op. 1) [159]	0	0	0	1	1	1
Total	**10**	**11**	**11**	**11**	**12**	**12**

[157] This baseline year assumes that the immediate-term service plan for Line 102 has been implemented (rerouted to serve the RBTC, new tripper schedules, and the gap in Sunday service has been filled).
[158] Line 102 baseline revenue hours assumes that the immediate service plan has been implemented.
[159] No increase in peak vehicle requirements as the Manhattan Beach Blvd Line will only be operating when school trippers are not operating, so this new service will not increase the peak vehicle requirement.

7.3 Supporting Recommendations

The supporting recommendations in the following sections detail the action items laid out in Section 7.1. These action items are recommended to complement the service plan changes and help to achieve the four goals of this study, setting BCT up for long-term success.

Many of these action items are interrelated, and some are associated with the service provision while others touch on other aspects of BCT operations that can increase efficiency and attractiveness. These supporting recommendations are designed to be implemented during the short-range service planning period.

Table 7-14: BCT goals and vision

Goal	Description	Action Items	Details
Goal 1	Align and grow with changes in the South Bay and Prepare for the Future	1A. Adjust routes and service levels strategically over time to respond to changes, growth, and demand	Detailed in the Service Plan section, BCT should adjust routes and service levels strategically over five-year short-range planning period.
		1B. Consider future land use developments and transportation projects	Similar to the motivation for this current study, BCT should continue to monitor new transportation projects and land use developments in the South Bay and provide service appropriately.
		1C. Build a more data-driven approach	Acquire APC across the BCT fleet to more accurately track stop-level passenger activity and make more data-driven decisions regarding service. Consider using planning softwares to assist with planning and data analysis.
		1D. Plan for zero-emission buses	Develop a CARB-compliant ZEB Rollout Plan and begin to implement the plan and transition the fleet. This also involves the construction of a new operations and maintenance facility, as BCT's current operations and maintenance building is undersized and in need of replacement to sustain the agency's operation. A new facility purpose-built for transit operations and maintenance functions, as well as outfitted to support battery-electric buses, is required for BCT to be able to continue to serve the South Bay in the long-term.
		1E. Work with other transit agencies to establish transit priority measures	Work with other transit operators in the South Bay to begin building support for transit priority measures and develop an understanding of what priority measures are viable in the South Bay.
		1F. Consider future rebranding with ZEB transition	Consider the viability of a future bus rebranding effort to help BCT stand out and grow public awareness.
Goal	**Description**	**Action Items**	**Details**
Goal 2	Enhance regional connectivity	2A. Work with transit partners to align schedules and improve customer trips	Work with transit partners to align schedules and improve customer trips. When introducing new services, ensure service schedules are aligned to facilitate transfers.
		2B. Continue to service transit hubs	Ensure transit hubs in the South Bay are served by BCT to facilitate more regional travel. When introducing new services, ensure existing transit hubs are served. Explore serving new transit hubs as they are established.
		2C. Increase TAP usage	Increase promotion of TAP to collect more detailed passenger data, which can be used to inform future service changes. TAP usage reduces the time it takes to board the bus, and can speed up trips. Greater TAP card adoption can enable easier regional travel, as the card can be used across all transit operators in the South Bay.
Goal	**Description**	**Action Items**	**Details**
Goal 3	Focus on growing BCT ridership	3A. Strengthen existing services and explore potential new routes	Strengthen existing services, such as adjusting frequencies and service span, strategically over time to grow ridership and make BCT service more attractive. Explore potential new routes that fill gaps in service that are currently not being served by any transit operator.
		3B. Explore opportunities to grow ridership and efficiency of the WAVE	Explore various strategies to grow WAVE ridership among senior and disabled populations and make the service more efficient.
		3C. Expand service design guidelines	Develop more detailed service guidelines extending beyond the Title VI program; fine-tuning them to provide a strong rationale for service provision and associated service levels. Additional metrics to track performance, such as passenger boardings per revenue hour, can help guide and inform future service changes.
		3D. Improve bus stops	As staffing capabilities allow, continue to maintain and update BCT's bus stop inventory. Explore opportunities to improve bus stops as BCT is able to. Continue to advocate for improved bus stops at stops outside of BCT's jurisdiction.
Goal	**Description**	**Action Items**	**Details**
Goal 4	Increase public awareness of BCT	4A. Develop a strategic marketing plan	Develop a strategic marketing plan to increase public awareness of BCT. This includes implementing the other action items listed under this goal.
		4B. Strengthen digital communications	Expand BCT's digital presence to reach a wider audience.
		4C. Explore marketing opportunities for local events and businesses	Explore partnerships with local events and businesses for marketing and public awareness. Advertise how to use BCT to get to South Bay events and destinations on social media and through online outlets.
		4D. Outreach to targeted communities	Conduct targeted outreach to specific communities to grow ridership, such as among senior and disabled communities to grow WAVE ridership.

7.3.1 Goal 1: Align and Grow with Changes in the South Bay and Prepare for the Future

The first project goal is to align and grow with changes in the South Bay and position BCT to be well-prepared for the future. Examining developments in South Bay transportation and land use projects has been an area of focus throughout this entire planning process. BCT should continue to adapt its service to be supportive of what is occurring in the South Bay, especially as new transportation projects transform the transportation landscape. Table 7-15 summarizes the action items and supporting recommendations related to this goal.

Table 7-15: Goal 1 Supporting Recommendations and Action Items

Goal	Description	Action Items	Details
Goal 1	Align and grow with changes in the South Bay and Prepare for the Future	1A. Adjust routes and service levels strategically over time to respond to changes, growth, and demand	Detailed in the Service Plan section, BCT should adjust routes and service levels strategically over five-year short-range planning period.
		1B. Consider future land use developments and transportation projects	Similar to the motivation for this current study, BCT should continue to monitor new transportation projects and land use developments in the South Bay and provide service appropriately.
		1C. Build a more data-driven approach	Acquire APC across the BCT fleet to more accurately track stop-level passenger activity and make more data-driven decisions regarding service. Consider using planning softwares to assist with planning and data analysis.
		1D. Plan for zero-emission buses	Develop a CARB-compliant ZEB Rollout Plan and begin to implement the plan and transition the fleet. This also involves the construction of a new operations and maintenance facility, as BCT's current operations and maintenance building is undersized and in need of replacement to sustain the agency's operation. A new facility purpose-built for transit operations and maintenance functions, as well as outfitted to support battery-electric buses, is required for BCT to be able to continue to serve the South Bay in the long-term.
		1E. Work with other transit agencies to establish transit priority measures	Work with other transit operators in the South Bay to begin building support for transit priority measures and develop an understanding of what priority measures are viable in the South Bay.
		1F. Consider future rebranding with ZEB transition	Consider the viability of a future bus rebranding effort to help BCT stand out and grow public awareness.

7.3.1.1 Action Item 1A: Adjust Routes and Service Levels Strategically Over Time to Respond to Changes, Growth, and Demand

This action item is detailed in the service plans in Section 7.2. The service plan for the two existing fixed routes aims to set BCT up for long-term success by (a) adjusting fixed routes in response to new transportation projects and developments, and (b) making other routing changes to improve route directness and develop a more focused route purpose. Introducing the new seasonal service along Manhattan Beach Blvd responds to community demand and fills a regional service gap.

Similarly, other strategic improvements in service span and frequency respond to feedback from the community and existing riders for more frequent service. These changes also look toward the future, as BCT can proactively provide more service to prepare for when overall transit service will be more robust in the South Bay, such as when the C Line extension opens around 2030.

7.3.1.2 Action Item 1B: Consider Future Land Use Developments and Transportation Projects

The link between land use and transportation is vital to a community's success, yet it can easily be overlooked if the two elements are siloed. While the South Bay may be growing at a slower pace than many other areas of the Los Angeles region, it is still growing and diverse, and its land use advancements should be paired with equal attention to the impacts of transportation decisions at both small and large scales.

We recommend that BCT coordinate with local and regional planning entities to not only design transportation solutions but also engage in land use decisions that will move the region forward. BCT needs to work proactively with relevant planning entities to ensure that land use developments are designed with transit access in mind, and that transit is not an afterthought in the design and development process.

BCT should also continue to monitor new transportation projects that could impact BCT operations, similar to the Metro C Line extension and LAX projects discussed in the service plans, to understand how BCT will need to adjust service in response. This can also help achieve Goal 2, enhancing regional connectivity. BCT can reference service standards and guidelines (more information in Section 7.3.3.3) to make sure service changes are appropriate.

7.3.1.3 Action Item 1C: Build a More Data-Driven Approach

BCT already utilizes technology to improve service and operations, such as automatic vehicle location (AVL) on all vehicles to aid with dispatching and enable real-time vehicle location services for customers. BCT should continue to acquire technologies that can improve service and decision-making through better, more granular data.

By adding automated passenger counters (APC) across its fleet, BCT can collect detailed stop-level passenger boarding and alighting activity. This will allow BCT to accurately collect information such as the number of boardings and alightings per stop, as well as understand passenger loads and ridership by time of day. This information can help with making decisions about prioritizing bus stop improvements and service provision. APC can also modernize BCT's ability to perform NTD data collection and move away from the manual sampling method that is currently used. When selecting an APC system, it will be important to understand the vendor's reporting and analysis capabilities, and BCT will need to make sure that they choose an APC system that is high quality, accurate, and fits the agency's needs.

Beyond APC, new software exists that can aid transit agencies in planning and designing services. BCT can also explore using its existing software to improve performance and service. Tracking and compiling real-time data to understand real-time on-time performance and historical data on run times and percent of trips that are early, late, and on time to pinpoint where congested areas and pinch points are that are affecting on-time performance and route efficiency. Furthermore, BCT planning staff could examine reliability issues and historical running times to write more accurate schedules based on actual running times.

Two case studies are presented below showing examples of how other agencies have used software and data to improve service.

Washington Metropolitan Area Transit Authority (WMATA) found that the number of early arrivals during COVID-19 more than doubled from pre-pandemic levels. Using software and GTFS-RT feeds, WMATA was able to aggregate both current and historical data on run times to identify routes with the highest levels of early arrivals and with run-time distributions that indicated opportunities for OTP gains. WMATA identified travel times and adjusted scheduling. This exercise resulted in adjustments to 34 routes, with each route experiencing a 7.2% increase in OTP. The improvement in these specific routes result in a systemwide increase in OTP by 6.2%.

Source: https://www.goswift.ly/blog/wmata-improves-on-time-performance-by-6-2-systemwide-with-swiftlys-run-times

The Oulu Public Transit Authority (OPTA) in Oulu, Finland used software to look at run time and OTP to be able to see their data on a more granular level. This enabled them to be able to build new timetables and schedules more quickly when they identified a way to improve run times and OTP. OPTA used this to adjust 20 routes, resulting in 10-20% OTP improvements along those routes. Run times have been reduced by up to 15 minutes on the modified routes, and these savings eliminated the need for two buses, freeing up these resources to be used elsewhere. OPTA also noted that being able to provide more accurate and efficient schedules has improved relationships with bus operators.

Source: https://www.goswift.ly/blog/oulu-public-transport-authority-eliminated-the-need-for-two-buses-with-swiftly

Finally, to improve the quality of data collected internally by BCT and well as to modernize scheduling practices, it is recommended that BCT require that their service contractor use industry-standard scheduling software for the WAVE. Currently, the operator of BCT uses an in-house scheduling and dispatching software called Simpli. Use of scheduling software commonly used in the transit industry such as Trapeze, Hastus, Optibus, RouteMatch, Via, and others can ensure that the software is updated on a regular basis and the transit agency always has access to the most up-to-date version of the software. Other advantages include more sophisticated methods of data scheduling, scenario "what if" analysis, data collection and exporting, and the ability to set parameters to tailor the scheduling and dispatching procedures appropriately. Adopting an industry-standard scheduling software that has modules or the ability to schedule general public demand response/microtransit-style services can also help set BCT up for the future should they decide to open the WAVE up to the general public in some capacity.

7.3.1.4 Action Item 1D: Plan for Zero-Emissions Buses [160]

CARB has set a requirement that all transit agencies in California submit a ZEB Rollout Plan. Small transit agencies (including BCT) must submit their board-approved plans by June 30, 2023 [161].

In order to accommodate a transition to ZEBs, BCT would first need to understand what new infrastructure would be required. Facility improvements and the construction of a new facility are most important to support a new fleet. BCT's current operations and maintenance building is undersized and in need of replacement to sustain the agency's operation. A new facility purpose-built for transit operations

[160] Please see Section 8 for more details on BCT's ZEB Rollout Plan.
[161] ICT-Rollout Plans | California Air Resources Board

and maintenance functions, as well as outfitted to support BEBs, is required for BCT to successfully transition to ZEBs and to support BCT operations in the long term. Route modeling and bus simulations using route schedules and blocking must be analyzed to determine the feasibility of a transition to one of several zero-emissions propulsion technologies.

To continue to support the goal of reducing emissions and creating a more sustainable South Bay, BCT needs to submit its ZEB Rollout Plan to CARB by July 2023. This plan will detail the ZEB procurement and phasing schedule as well as required facility modifications and upgrades to support the ZEB fleet. BCT can also take this opportunity for positive marketing to emphasize their commitment to sustainability and the environment as well as highlighting improvements that ZEBs provide for the community, such as a quieter ride and less noise on neighborhood streets.

7.3.1.5 Action Item 1E: Work with Other Transit Agencies to Establish Transit Priority Measures

Transit priority measures are a collection of tools, policies, and treatments that can be applied to help speed up buses, reduce transit delay, and ultimately, make the bus a more attractive and competitive option compared to private vehicle use. Transit priority measures aim to improve the attractiveness of transit, decrease travel times for bus riders, and improve reliability without infringing on pedestrians, cyclists, and other street users.

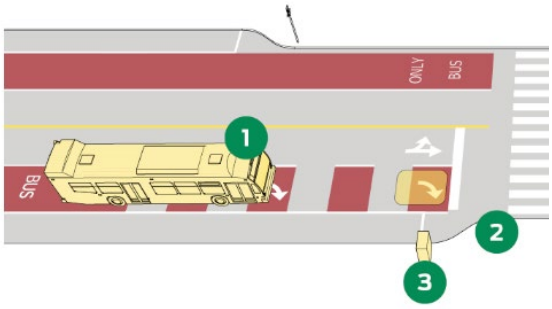
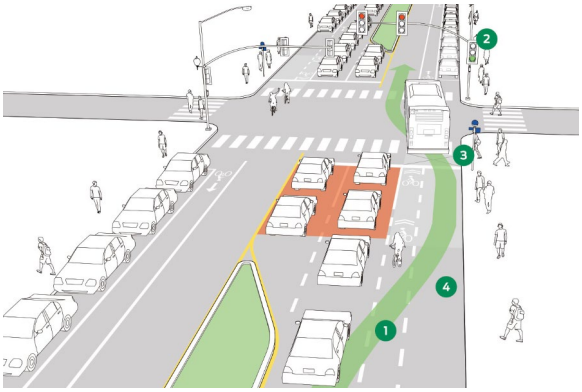
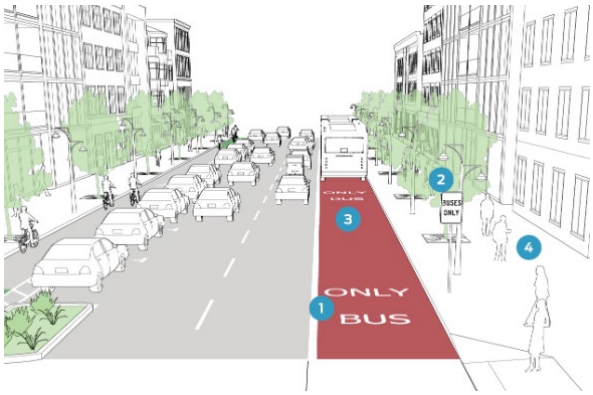
Different transit priority measures vary in the level of effort required to deploy them and to what degree they can alter the current street layout. Transit priority measures are a powerful way to move more people more efficiently, as buses have the capacity to carry many more people through a corridor compared to automobiles. As buses typically share the street with other forms of transportation and operate in mixed traffic, employing transit priority measures can improve both bus reliability and travel time.

Transit priority measures are becoming more common throughout the United States, and public support for transit priority measures is growing, with municipalities becoming more willing to partner with transit agencies to deploy different transit priority measures, as they see the benefits of prioritizing transit to create more sustainable and resilient communities [162].

Transit priority measures take a variety of different forms and vary in their scale, complexity, and disruptions to the current streetscape. Three common priority measures are summarized in Table 7-16.

[162] https://transitcenter.org/event/bus-lanes-are-essential-speeding-transit-during-covid/, https://transitcenter.org/wp-content/uploads/2018/05/Collaboration.pdf

Table 7-16: Transit Priority Measures Overview

Project	Concept	Example [163]
Transit Signal Priority	Extend the green signal so an approaching bus can make it through the intersection. Provide a signal for buses only at key intersections to provide buses the right of way before general traffic.	
Bus Queue Jumps	Combine short, dedicated transit facilities with either a leading bus interval or active signal priority to allow buses to easily enter traffic flow in a priority position. Can considerably reduce delay and result in run-time savings and improved reliability.	
Bus Only Lanes	Only buses (or bikes if low bus frequency) are permitted. Speeds up buses and improves journey time consistency.	

Providing more frequent service and other service improvements can only go so far when buses are operating in mixed traffic and can be impacted by traffic, congestion, and other unexpected disruptions.

[163] NACTO Transit Street Design Guide

Implementing transit priority measures can bring a transit agency to the next level of reliability, efficiency, and competitiveness. BCT could improve service by proactively working with other municipal operators to advocate for transit priority measures throughout the South Bay.

Transit signal priority (TSP) may be the most straightforward to implement, as it requires no changes to the physical layout of the street, and new TSP technologies are available as a cloud-based software platform that uses connected vehicle and machine learning technologies to prioritize the flow of vehicles in a city through an intersection or across a corridor to help improve reliability and decrease overall travel time [164].

With TSP, travel time savings of between five and 15 seconds per intersection are possible, though effectiveness varies depending on the characteristics of the specific intersection. According to the Government of the District of Columbia, a TSP pilot along 16th St. has seen corridor-specific run-time savings of up to 5% along the entire corridor and benefits of up to 10% to 15% along shorter segments of the corridor. The report further states a peer review reported time savings of between 2% and 18% [165].

BCT only has control over the portion of its routes that travel within the City of Redondo Beach as well as the majority of the routes are on streets that are not conducive for TSP, limiting the applicability and effectiveness of transit priority measures. TSP is also most effective and most typically applied along major arterials that are served by multiple transit routes. Moreover, the City's Public Works Engineering team is responsible for citywide traffic signalization projects. The BCT Transit staff would likely take a supportive role in the citywide TSP efforts that would benefit BCT routes, as well as other transit operators serving Redondo Beach. Understanding the feasibility of transit priority measures or TSP would also require coordination with other City departments, such as Public Works.

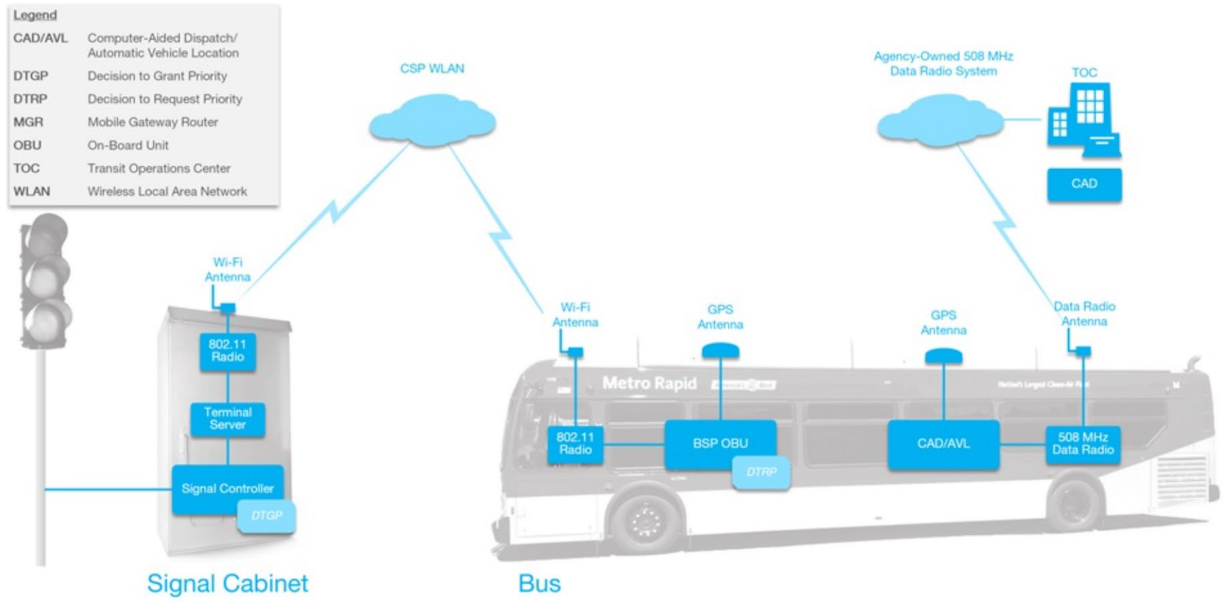
Instead, a more realistic and feasible option may be to continue to be active members and participants in the Countywide Signal Priority Program, led by Metro and Caltrans. This is the largest implementation of multi-jurisdictional TSP in the nation; establishing new TSP standards to implement TSP at nearly one-third of jurisdictions in Los Angeles County. Many of BCT's South Bay neighbors, including GTrans and Torrance Transit, are also partners in the program. It is likely a more judicious approach for BCT to continue to participate in this program and work with other transit agencies operating in the South Bay to understand how to leverage existing programs and initiatives to implement TSP that can make transit service more reliable and efficient [166].

[164] Home - LYT

[165] https://ddot.dc.gov/sites/default/files/dc/sites/ddot/page_content/attachments/DDOT%20Bus%20Priority%20Toolbox.pdf

[166] Countywide Signal Priority (CSP) – LA County Regional ITS Architecture (laconnect-it.com)

Figure 7-23: Los Angeles Countywide Signal Priority



7.3.1.6 *Action Item 1F: Consider Future Rebranding*

A distinct and eye-catching brand can act as free publicity and work to increase public awareness simply by having transit vehicles in operation out in the community. Public feedback from community members has shown an opportunity to rebrand BCT vehicles to develop a more distinctive and memorable brand.

Rebranding would involve redesigning how BCT presents itself to the public. Rebranding is particularly worth considering when a significant refresh is underway or when a new service is introduced. For example, LA Metro accompanied the introduction of their new Metro Micro microtransit program with a distinct van livery (a noticeable blue color and graphic pattern) to advertise the system. Other notable examples of distinct bus branding in the Los Angeles area include Santa Monica Big Blue Bus and Culver City Bus (see Figure 7-24).

Figure 7-24: Examples of Distinctive Bus Branding (from left to right: Metro Micro, Santa Monica Big Blue Bus, Culver City Bus)



When BCT acquires new buses during its ZEB transition, the agency could conduct a dedicated study to understand how users and potential users view/understand the BCT brand. Potential changes could include updating the bus livery/wraps to make them more distinctive. This could happen in conjunction with rebranding at bus stops, a project website refresh, and other rebranding opportunities.

Implementation of the new Manhattan Beach Blvd line or the transition to ZEBs are both excellent opportunities to introduce a rebranding. A rebranding that incorporates and advertises the new ZEB technology is also an opportunity to raise public awareness of BCT's commitment to sustainability and the environment, as seen on LADOT buses (Figure 7-25).

Figure 7-25: Electric LADOT Bus Branding





7.3.2 Goal 2: Enhance Regional Connectivity

A large metropolitan area requires strongly integrated transit networks to move people across the region. BCT should continue to work to improve transit connections with partner municipal agencies operating in the South Bay as well as other providers like Metro who connect the South Bay to the larger Los Angeles region. Enhancing regional connectivity will only continue to become more important as rail connections in the South Bay continue to expand. Table 7-17 summarizes the supporting recommendations and action items for Goal 2.

Table 7-17: Goal 2 Supporting Recommendations and Action Items

Goal	Description	Action Items	Details
Goal 2	Enhance regional connectivity	2A. Work with transit partners to align schedules and improve customer trips	Work with transit partners to align schedules and improve customer trips. When introducing new services, ensure service schedules are aligned to facilitate transfers.
		2B. Continue to service transit hubs	Ensure transit hubs in the South Bay are served by BCT to facilitate more regional travel. When introducing new services, ensure existing transit hubs are served. Explore serving new transit hubs as they are established.
		2C. Increase TAP usage	Increase promotion of TAP to collect more detailed passenger data, which can be used to inform future service changes. TAP usage reduces the time it takes to board the bus, and can speed up trips. Greater TAP card adoption can enable easier regional travel, as the card can be used across all transit operators in the South Bay.

7.3.2.1 *Action Item 2A: Work with Transit Partners to Align Schedules and Improve Customer Trips*

BCT should continue to establish timed transfers where transfer points exist between BCT and other transit operators. This is especially important for BCT for a few reasons. First, frequencies are generally low for BCT routes so passengers can't simply "show up and go", and thus rely on bus schedules to plan trips. Second, BCT operates in an area with multiple other operators, both local/municipal operators (such as Torrance Transit, GTrans, and others) and regional operators (like Metro bus and rail), so many BCT riders transfer and use more than one transit agency to reach their final destination. For example, the Line 109 FY19-20 TAP card data shows that of the 40% of riders that boarded using a TAP card, 24% of the TAP card trips were interagency transfers. Minimizing both the waiting time between vehicles and the chances of missed transfers to create well-timed transfers gives customers assurance and confidence that they will reach their final destination in a timely manner.

BCT should continue to coordinate bus timetable development with other agencies' schedules at key transfer points, such as the Redondo Beach Pier, RBTC, AMC station, and C Line stations. This should include regularly monitoring schedules and adjusting BCT schedules when necessary and feasible to facilitate transfers at key transfer points. When making regular/planned schedule updates, consult schedules from other agencies at transfer points to make sure schedules line up well for seamless and easy transfers. When communicating these updates to the public, BCT can emphasize that these schedule updates are happening to better align with the schedules of transit partners to encourage transfers to enable more regional travel.

7.3.2.2 *Action Item 2B: Continue to Service Transit Hubs*

Transit hubs are important pieces of community infrastructure, as they enable passengers to transfer between transit agencies easily, safely, and conveniently. Several hubs in the Metro area are served by BCT, including the Aviation/LAX, Douglas, and Redondo Beach C Line stations. The RBTC will also soon become an important transit hub to serve in the South Bay, as well as the AMC station near LAX. To encourage more regional travel, BCT should continue to connect with all major transit hubs in their service area. As more transit hubs are established, BCT should consider serving these as well.

7.3.2.3 *Action Item 2C: Increase TAP Usage*

TAP is the reloadable smart card used by over 25 transit agencies in the Los Angeles metro area (including BCT). In FY 2019-20, 40% of Line 109 passengers used TAP for payment. On Line 102, that number was between 21% and 12% in July and October 2019 (respectively).

Increasing TAP utilization would be beneficial for BCT in multiple ways. For example, sophisticated ridership data is collected as customers tap their cards, and BCT could use this data to inform future service changes. Greater use of TAP cards and less use of other methods, specifically cash, can help to reduce the time it takes for passengers to board the buses, speeding up bus trips. As TAP is accepted across different transit agencies operating in the county, a greater use of TAP cards can also enable easier regional travel.

TAP is sold and can be refilled at numerous vendors across the region, including convenience stores, pharmacies, and grocery stores, as well as at the Redondo Beach C Line Station and the RBTC [167]. BCT can invest in additional marketing to promote local locations that may already be frequented by residents and major transit hubs in Redondo Beach. For example, customers (and potential customers) may not know that they can reload their TAP at the same place where they buy their groceries.

Another method of improving TAP usage is to establish discounts at local businesses when the customer shows a TAP card; this could extend to other BCT proof-of-payments like student passes. Metro has provided "Destination Discounts" for transit riders at local businesses [168], while Metrolinx in Ontario, Canada has maintained a "Presto Perks" website for PRESTO Card users at local events/destinations, such as sporting events, museums, and other local events [169]. Advertising by BCT of the Destination Discounts in the Beach Cities will demonstrate this as an additional benefit of using transit and using a TAP card.

7.3.3 Goal 3: Focus on Growing BCT Ridership

BCT ridership has been declining year-over-year since 2016, with fixed-route ridership decreasing by over 16% between 2016 and 2019 (with an even further drop in 2020 due to the COVID-19 pandemic). Deliberate strategies will need to be implemented to reverse this trend. Table 7-18 outlines the action items included in Goal 3, focusing on growing BCT ridership.

Table 7-18: Goal 3 Supporting Recommendations and Action Items

Goal	Description	Action Items	Details
Goal 3	Focus on growing BCT ridership	3A. Strengthen existing services and explore potential new routes	Strengthen existing services, such as adjusting frequencies and service span, strategically over time to grow ridership and make BCT service more attractive. Explore potential new routes that fill gaps in service that are currently not being served by any transit operator.
		3B. Explore opportunities to grow ridership and efficiency of the WAVE	Explore various strategies to grow WAVE ridership among senior and disabled populations and make the service more efficient.
		3C. Expand service design guidelines	Develop more detailed service guidelines extending beyond the Title VI program; fine-tuning them to provide a strong rationale for service provision and associated service levels. Additional metrics to track performance, such as passenger boardings per revenue hour, can help guide and inform future service changes.
		3D. Improve bus stops	As staffing capabilities allow, continue to maintain and update BCT's bus stop inventory. Explore opportunities to improve bus stops as BCT is able to. Continue to advocate for improved bus stops at stops outside of BCT's jurisdiction.

[167] Vendor Locations (taptogo.net)
[168] Destination Discounts | The Source (metro.net)
[169] PRESTO Perks – Learn About | PRESTO: Tap On. Ride Easy. (prestocard.ca)

7.3.3.1 Action Item 3A: Strengthen Existing Services and Explore Potential New Routes

Providing quality service that is reliable and frequent is *the* proven way to grow ridership. While BCT strives to provide high-quality service currently and achieves consistently high OTP and delivers current service levels with high customer satisfaction, to help attract new ridership and maintain existing ridership, BCT needs to explore how it can improve service further. Strengthening existing services and introducing new services where warranted by demand can help to attract new riders to the system. Providing high-quality services is also crucial in maintaining long-term and existing ridership. Not only is this action item important for aligning and growing with changes in the South Bay and setting BCT up for long-term success (as discussed in Goal 1), but it is also a crucial component of strengthening BCT ridership. The service plans that address this action item are discussed in Section 7.2.

7.3.3.2 Action Item 3B: Explore Opportunities to Grow Ridership and Efficiency of the WAVE

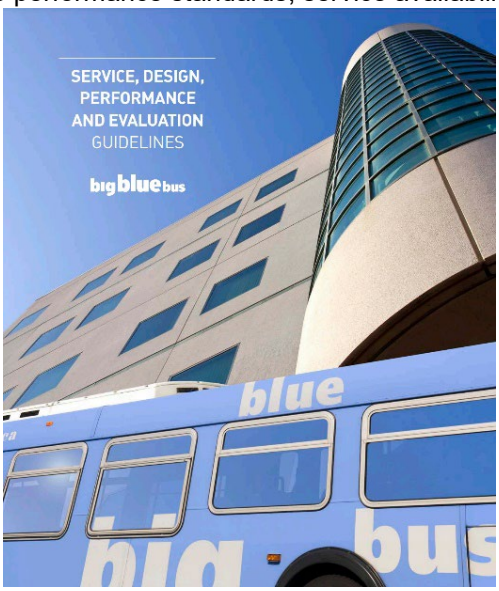
While WAVE service has returned to pre-COVID levels, ridership has not followed and is currently approximately 58% of pre-COVID ridership. BCT can explore multiple strategies to grow ridership and improve the efficiency of WAVE service, particularly among the eligible senior and disabled populations.

These strategies are explored in greater detail in Section 7.2.3 and include broader marketing and awareness strategies, partnerships with organizations that work directly with seniors and the disabled community in the WAVE service area, travel training, and technology improvements. In the long term, BCT should look at expanding the WAVE to be open to the general public during hours of low utilization, such as during weekend or evening periods, or deploying WAVE resources (vehicles, operators, scheduling, dispatching) as a microtransit-type service. Any service expansion would be set up to maintain the priority of senior and disabled communities so as not to affect their ride quality.

7.3.3.3 Action Item 3C: Develop Service Design Guidelines

Service design guidelines provide a rationale for service provision. The guidelines describe clear standards for each service type provided by a transit agency. Customers will be able to expect a certain level of service, and BCT would have metrics to track performance for each route.

BCT has established service guidelines as part of the agency's Title VI Program Plan, which includes vehicle load standards, vehicle headway standards, on-time performance standards, service availability standards, and transit amenities policies. Though it is a small transit agency, BCT can build on these standards with additional metrics to track *performance*, like minimum passenger boardings per revenue hour and passenger load factors.



Big Blue Bus in Santa Monica has developed a strong set of service guidelines that could be replicated in the BCT context[170]. Furthermore, while this information is collected in monthly operating reports, public reporting is currently missing from BCT's service design guidelines. Santa Barbara MTD publishes both monthly and quarterly ridership reports that detail information like the number of customers, how they paid, revenue hours and miles, and passengers per hour; much of this is separated by route and compared to the same time period in the previous year (see the example shown as Figure 7-26). While currently not possible with current staffing levels, additional staffing capacity would enable BCT to be able to provide this information to the public to help increase transparency.

[170] BBB Service Design Performance and Evaluation Guidelines_ Updated May 2015.pdf (bigbluebus.com)

Figure 7-26: Santa Barbara MTD Q1 2022 Quarterly System Ridership Report

SANTA BARBARA MTD

FY 2022 System Ridership Report for 3rd Quarter and for the Nine-Month Period Ending March 31, 2022

Ridership by Fare Category (January 2022 – March 2022)

	Quarter			YTD		
Fare Categories	Jan 22 - Mar 22	Jan 21 - Mar 21	% Change	FY 2021 - 2022	FY2020 - 2021	% Change
General Fare	151,796	24	632383.3%	480,100	46	1043595.7%
Transfers	71,178	121	58724.8%	225,485	490	45917.3%
Full Fare Prepaid [1]	181,423	48	377864.6%	552,756	183	301952.5%
Santa Barbara City College	38,421	67	57244.8%	97,003	210	46091.9%
Senior & Disabled Prepaid [2]	118,230	176	67076.1%	360,177	358	100508.1%
Shuttle	-	-	0.0%	-	-	0.0%
UC Santa Barbara	306,114	58	527682.8%	767,475	188	408131.4%
Youth Prepaid [3]	122,583	195	62763.1%	333,171	327	101787.2%
Free	14,471	570,000	-97.5%	49,407	1,692,029	-97.1%
Special Pass Programs	608	31	1861.3%	1,924	115	1573.0%
Senior Cash	23,701	65	36363.1%	74,178	94	78812.8%
Persons with Disabilities Cash	4,202	105	3901.9%	12,055	158	7529.7%
Tokens	3,909	3	130200.0%	10,722	6	178600.0%
Tap to Ride Transactions	1,423	-	100.0%	3,627	-	100.0%
Total	1,038,059	570,893	81.8%	2,968,080	1,694,204	75.2%

[1] Includes adult 10-ride and unlimited 30-day Passport use.
[2] Includes seniors' and persons with disabilities' 10-ride and unlimited 30-day Passport use.
[3] Includes K-12 Youth 10-ride and unlimited 30-day Passport use.
Source: MTD Passdat Program, MTD Transit Development Department, Planning Section

Revenue Hours and Revenue Miles (January 2022 – March 2022)

	Quarter			YTD		
Metrics	Jan 22 - Mar 22	Jan 21 - Mar 21	%Change	FY 2021 - 2022	FY2020 - 2021	% Change
Passengers	1,038,059	570,893	81.8%	2,968,080	1,694,204	75.2%
Revenue Hours	47,140	42,589	10.7%	139,181	128,779	8.1%
Passengers per Revenue Hour	22.0	13.4	64.3%	21.3	13.2	62.1%
Miles	579,582	517,490	12.0%	1,704,485	1,565,328	8.9%
Passengers per Mile	1.8	1.1	62.4%	1.7	1.1	60.9%

Source: MTD Passdat Program, MTD Transit Development Department, Planning Section

The callout box below details some common service standards that are typically employed by transit agencies. These go beyond the service standards required by Title VI reporting and are intended to help assess service and guide service investment. For example, guidelines can be grouped into categories that propose service frequency and span based on that route's boardings per hour and other factors.

Service standards range in depth and breadth. Some transit agencies with multiple service tiers require specialized design and performance metrics for different tiers, while others require one set of standards across the board. Typical standards that are incorporated in service design guidelines include:

- Service frequency by time of day/day of week and service tier
- Service span by day and service tier
- Passengers per revenue hour and revenue mile
- Passenger per revenue mile
- Cost per revenue mile and revenue hour
- Farebox recovery ratio
- Subsidy per passenger
- On-time performance
- Passenger load factor
- Bus stop spacing metrics

7.3.3.4 Action Item 3D: Improve Bus Stops

Bus stops are where a rider first interacts with a transit agency. Our recommendations include the development of a bus stop improvement plan that outlines both a prioritized schedule of infrastructure improvements and a concept for how bus stops can be a positive part of the BCT customer experience.

The first step in improving bus stop placement is to maintain an up-to-date inventory of bus stops and their condition. BCT currently has a bus stop inventory, but managing and implementing it is difficult due to current staffing levels. Amenities (benches, shelter, lighting, shade) should be added where possible, and digital signage should be used to clearly identify the travel direction where route travel directions overlap (like at South Bay Galleria).

Survey respondents most highly desired benches (64%), lighting (58%), bus shelters (47%), and bike racks (27%) at bus stops. Respondents also noted a desire for trash and recycling receptacles and real-time arrival information.

Though bus stops can only be controlled within each local jurisdiction, BCT should work with local municipalities (Manhattan Beach, Hermosa Beach, El Segundo, etc.) to implement improvements, especially at stops that see significant passenger activity. Developing standard bus stop design guidelines across the service area will assist governments with installing appropriate amenities. Bus stop design guidelines generally address spacing, locations, and their relation to traffic flow, signage, surface amenities, and other maintenance elements. Examples of bus stop improvements include bus bulbs (extended sidewalks to the travel lane), electronic message boards displaying real-time bus arrivals, and installing bicycle racks. Figure 7-27 shows new bus stop amenities in Culver City for Culver City Bus that launched a bus stop improvement program in 2021 [171].

[171] https://www.culvercitybus.com/News/Bus-Stop-Improvement-Project

Figure 7-27: New Bus Stop Amenities in Culver City



7.3.4 Goal 4: Increase Public Awareness of BCT

52% of non-rider survey respondents would be more willing to use BCT if they had more information about it.

Marketing and public awareness is an important element of transit operations. Transit users want to be informed of important service information, and potential users may be persuaded to use the bus if they are made aware of the potential convenience, time savings, or other benefits. Additionally, a high level of public awareness can help to communicate to non-riders in the community that BCT is providing an important and necessary community service that they can support even if they do not ride. This effort requires a deliberate marketing strategy, and BCT can begin by updating its strategic marketing plan. Maintaining and implementing the marketing plan is challenging due to current staffing levels. Targeted efforts should be made for local events and specific communities so that everyone feels like BCT can be part of their transportation options.

Table 7-19: Goal 4 Supporting Recommendations and Action Items

Goal	Description	Action Items	Details
Goal 4	Increase public awareness of BCT	4A. Develop a strategic marketing plan	Develop a strategic marketing plan to increase public awareness of BCT. This includes implementing the other action items listed under this goal.
		4B. Strengthen digital communications	Expand BCT's digital presence to reach a wider audience.
		4C. Explore marketing opportunities for local events and businesses	Explore partnerships with local events and businesses for marketing and public awareness. Advertise how to use BCT to get to South Bay events and destinations on social media and through online outlets.
		4D. Outreach to targeted communities	Conduct targeted outreach to specific communities to grow ridership, such as among senior and disabled communities to grow WAVE ridership.

7.3.4.1 Action Item 4A: Maintain a Strategic Marketing Plan

BCT should maintain and implement its strategic marketing plan to help grow awareness and visibility of BCT as a transit service in the South Bay. One major theme heard during public outreach was a general lack of awareness of BCT services, even among longtime residents of the Beach Cities. A marketing plan should reflect the role that transit plays in the community and service area by targeting current and potential users, Marketing plan objectives can include increasing visibility, building awareness of the services offered, improving user-friendliness, enhancing general public access to services, and establishing BCT as an organization that is performing an important community service.

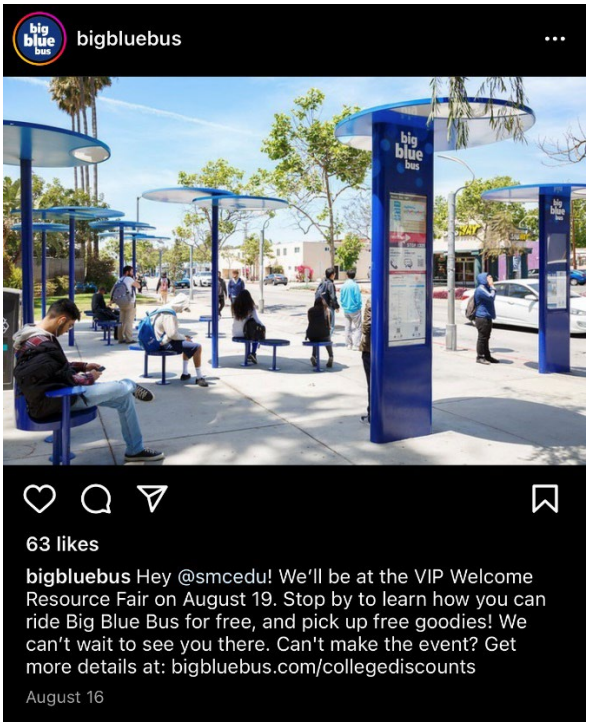
The outcomes of the marketing plan should include a phased implementation plan with actionable items, detailing the responsible entity for each action item as well as key performance indicators or other success measures post-implementation. The latter will be particularly beneficial in determining which strategies were most effective and should be continued. Marketing and public awareness should be an ongoing effort by BCT, and the marketing plan should act as a handbook to guide BCT through the implementation of the plan. The following action items in this section touch on specific ways to increase public awareness that could be included in a strategic marketing plan.

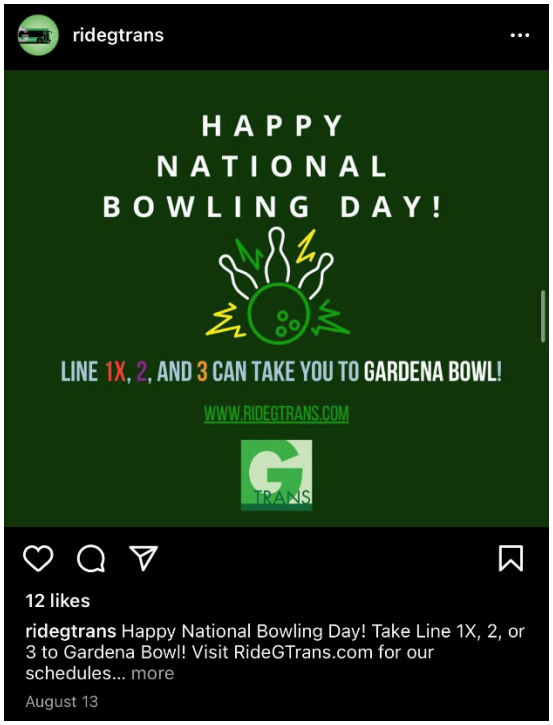
7.3.4.2 Action Item 4B: Strengthen Digital Communications and Marketing

Social media has been an increasingly important component of public transit marketing strategies over the past decade. While BCT does operate a Twitter account, other social media outlets such as Facebook and Instagram should also be utilized. Many (if not most) other transit agencies have accounts on a diverse range of platforms to disseminate information to residents; regional examples include Santa Monica Big Blue Bus [172], Torrance Transit [173], and GTrans in Gardena [174]. Figure 7-28 shows two different examples of transit agency Instagram posts. These are helpful in advertising if BCT will be at a community event or how people can reach local events using BCT services. Posting on all social media accounts in the case of service announcements can also help reach a wider audience. Due to BCT's small staff, BCT should explore if transit updates and posts can be shared through these additional social media outlets from another City department that manages City digital communications, or look into integrating this responsibility into future O&M contracts.

[172] www.facebook.com/SMBigBlueBus
[173] Torrance Transit - Home | Facebook
[174] www.facebook.com/RideGTrans

Figure 7-28: Example Instagram Posts





BCT launched a Real Time Information System so residents can track their buses live via the agency's website, text message, or phone call [175]. Real-time bus information is also available through third-party apps like Moovit and Transit [176] which enables more sophisticated trip planning. Though this is an important development in BCT operations, real-time arrival information would benefit from more robust advertisement, particularly as a perceived lack of such a service could turn potential riders off of using transit.

7.3.4.3 Action Item 4C: Explore Marketing Opportunities for Local Events and Businesses

The Beach Cities service area has a lively culture, with numerous events occurring across the region throughout the year along with a diverse range of businesses, restaurants, and other amenities. Efforts to encourage patrons to take transit could result in both increased ridership for BCT and greater attendance at the region's events or greater business patronage with the added benefit of reduced traffic and parking issues.

Polliwog Park, Redondo Beach Performing Arts Center, Redondo Beach Pier, and many other local sites are conveniently located near BCT service and hold events throughout the year. While some marketing is published on BCT's Twitter page, these efforts can be deepened by expanding the agency's social media presence (as described earlier) by using longer form online communication, or via more posts in Easy Reader. For example, LA Metro has used its blog called "The Source" to communicate travel directions to major events from different points in the region. Some events, like the 2016 LA Pride [177] and the 2022

[175] https://www.redondo.org/depts/recreation/transit/real_time_information_system.asp
[176] City of Redondo Beach - Real Time Information System
[177] How to get to LA Pride this weekend sans a car | The Source (metro.net)

MLB All-Star Game [178], had special shuttles operating to the site, and schedules/other pertinent information were explained on the blog. Efforts like this could be especially important in advertising the use of the new line operating along Manhattan Beach Blvd

Posting advertisements on buses or trains can also be an effective way of informing customers about transit connections. For example, the Metro and Metrolink had advertisements on buses and trains noting that transit could be taken to the Los Angeles County Fair (see Figure 7-29). BCT could partner with Metro or partner agencies like Torrance Transit or GTrans to advertise BCT service and destinations served by BCT more broadly. BCT should also work with the City to ensure that transit services can bypass detours created by the event so that BCT can be a viable option for getting to and from events. Additional staffing capacity can also help to develop a more robust advertising program.

Figure 7-29: Los Angeles County Fair and Transit Advertising



7.3.4.4 Action Item 4D: Outreach to Targeted Communities

Public transit plays an important role in ensuring that vulnerable residents can fully participate in the activities that form their daily lives. As part of this effort, BCT currently operates the WAVE Dial-a-Ride program for seniors and those with disabilities. However, there are opportunities for further supporting residents with varying needs, such as travel training, education, and outreach at senior centers.

BCT can form partnerships with seniors' residences, seniors' centers, and health centers within Redondo Beach and Hermosa Beach to organize information sessions/presentations. These presentations would be run by BCT employees, would provide information about routes, fares, and accessibility, and would act as Q&A sessions. Up-to-date information about BCT (maps, schedules, information about how to apply for the WAVE, etc.) and phone numbers for assistance and WAVE scheduling could also be posted on residence bulletin boards. These efforts would support older residents' independence, mobility, and quality of life.

[178] Go Metro to the All-Star Game at Dodger Stadium and All-Star Week events! | The Source

Metro operates the “On the Move Riders Program” [179], which informs older adults about how to use public transit effectively and safely through clubs across the region. Travel training programs like this can be highly beneficial for residents with disabilities and seniors, especially as each individual has specific needs that should be supported through their transit journey. While the program is operated by Metro, there are no active clubs in Redondo Beach, and the only active club in the Beach Cities is El Segundo, but BCT does participate in the programs when they are active in Redondo Beach. BCT should work to help establish more active clubs throughout the service area, such as at the Veterans Park Senior Center, Beach Cities Health District, or the Hermosa Five-O Senior Activity Center. BCT should work with Metro to host more frequent On the Move events in the BCT service area to help increase awareness of BCT services for seniors and those with disabilities.

BCT can also work to develop and host its own travel training program. Videos and individualized tours could be available, and local community groups can be involved in disseminating information to those who need help. Other community-based organizations (CBOs) could also participate in these outreach efforts, which ideally would be a mix of in-person and virtual events. Partnering with CBOs is especially important as it reduces the burden and amount of effort directly on BCT staff to conduct travel training.

7.4 Title VI Equity Analysis

Whenever a transit system is considering changes to its routes, services, and fares, it is important to understand the potential impacts these changes could have on low-income and minority populations to ensure service changes are equitable and do not disproportionately impact or burden these populations.

The *Title VI Requirements and Guidelines for FTA Recipients* (Circular 4702.1B) provide guidance and procedures to ensure transit service is provided in a nondiscriminatory manner. This means evaluating whether a service change or fare change has adverse effects on the service population and whether those adverse effects are borne disproportionately by low-income and minority populations.

According to the circular, if a transit provider operates 50 or more fixed route vehicles in peak service *and* is located in an Urbanized Area (UZA) of 200,000 or more in population, all elements described in the Circular must be included in that transit agency’s Title VI Program [180]. If a transit provider does not meet this threshold, the transit provider is only required to set systemwide standards and policies and is not required by the FTA to complete Service Equity Analyses in response to major service changes.

As BCT operates fewer than 50 vehicles in peak service, it is not mandated by the FTA to complete service equity analyses. Nonetheless, with a focus on equity, it is still important that BCT assesses and identifies the impacts that the proposed short-range changes to BCT services will have on low-income and minority populations. BCT defines a major service change as:

- Any increase in fares.
- Reduction in total system vehicle service hours of 25% or more of the total service miles or hours provided.
- Modifications to a route that exceeds 25% of the total inbound and outbound trip mileage of a route.

For the purposes of this analysis, the definitions of low-income and minority are as follows:

[179] https://www.metro.net/riding/move-riders-club/
[180] https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Title_VI_FINAL.pdf

- Low-income: up to 100% of the federal poverty threshold.
- Minority: any person who identifies as Black or African American; Asian; American Indian or Alaska Native; Native Hawaiian or Pacific Islander; or Hispanic or Latino.

To understand the potential impacts that the service plans presented here will have on these populations, we can compare the demographics of the BCT service area [181] to the demographics of the affected area. To determine the affected area, we first need to determine if and where a major service change is proposed. The proposed service plan does not recommend any fare increases or any service reductions. Table 7-20 assesses the baseline and proposed round-trip mileage for each route to understand if proposed modifications trigger a major service change.

Table 7-20: Assessment of Major Service Changes

	Baseline mileage (round trip)	Proposed mileage (round trip)	Difference (%)
Line 102	16.38	20.6	26%
Line 109	36	32.8	-9%
Manhattan Beach Blvd Line (Op. 1)	N/A	6.4	N/A

This table shows that the additional mileage added to Line 102 to serve the RBTC and Riviera Village results in a difference of 26% compared to the original round-trip mileage. Additionally, while the introduction of a new service does not trigger a major service change, the new Manhattan Beach Blvd Line (route option 1) has been included here to understand the equity impacts should the new line be introduced.

Table 7-21 presents the low-income and minority demographic information for the BCT service area, using 2016-2020 American Community Survey (ACS) 5-year estimates at the block group level. This shows that 41.9% of the population living within ¼ mile of BCT fixed routes are minority populations, and 5.2% of the households within ¼ mile of BCT fixed routes are low-income.

Table 7-21: BCT Service Area Demographics

Demographic	Percentage of service area population
Low-income	5.2%
Minority	41.9%

Next, these service area demographics are compared to the demographics within the vicinity of a major service change. These are the block groups within ¼ mile of BCT fixed routes between the Redondo Beach Pier and Riviera Village. The table also compares the demographics of the block groups that are within ¼ mile of the proposed Manhattan Beach Blvd line (route option 1).

[181] BCT's Tile VI Program defines BCT's service area as "the service area population living within close proximity (1/4 mile) of a BCT route."

Table 7-22: Affected Area Demographics

	Low-income %	Minority %
Line 102	3.5%	34.0%
Manhattan Beach Blvd Line (Op. 1)	5.2%	40.8%
Service area total	*5.2%*	*41.9%*

Comparing Table 7-22 with Table 7-21, the percentages of minority and low-income populations within the areas affected by a major service change are very close to the low-income and minority populations of the entire service area. In all cases, the percentage differences are less than 10 percentage points, showing that low-income and minority populations will not experience disproportionate burdens as a result of these service changes, and it also shows that non-minority and non-low-income populations will not disproportionately benefit from the introduction of new services and service improvements.

Following City Council approval of the aforementioned route modifications, BCT will begin the process of conducting public meetings and soliciting public comments regarding the proposed route modifications as outlined in BCT's Title VI Program and Community Outreach Plan. These elements include public hearing and notice at least 30 days prior to the hearing; development of plans, maps, or programs to help passengers understand service changes; outreach efforts including interaction with neighborhood associations, schools, and social service agencies, and presentations to community civic groups; public meetings in locations easily accessible to the public; surveys; providing multiple opportunities for participation; documentation of public comment and responses; and response to comments.

Additional procedures include publishing new routes and schedules in person and online at least one week prior to implementation, making BCT staff available to riders who may not be aware of modifications, and maintaining information available to the public regarding the route modifications for a 30-day period beyond the implementation of the changes.

8 ZERO-EMISSION BUS ANALYSIS

8.1 Modeling Process and Outputs

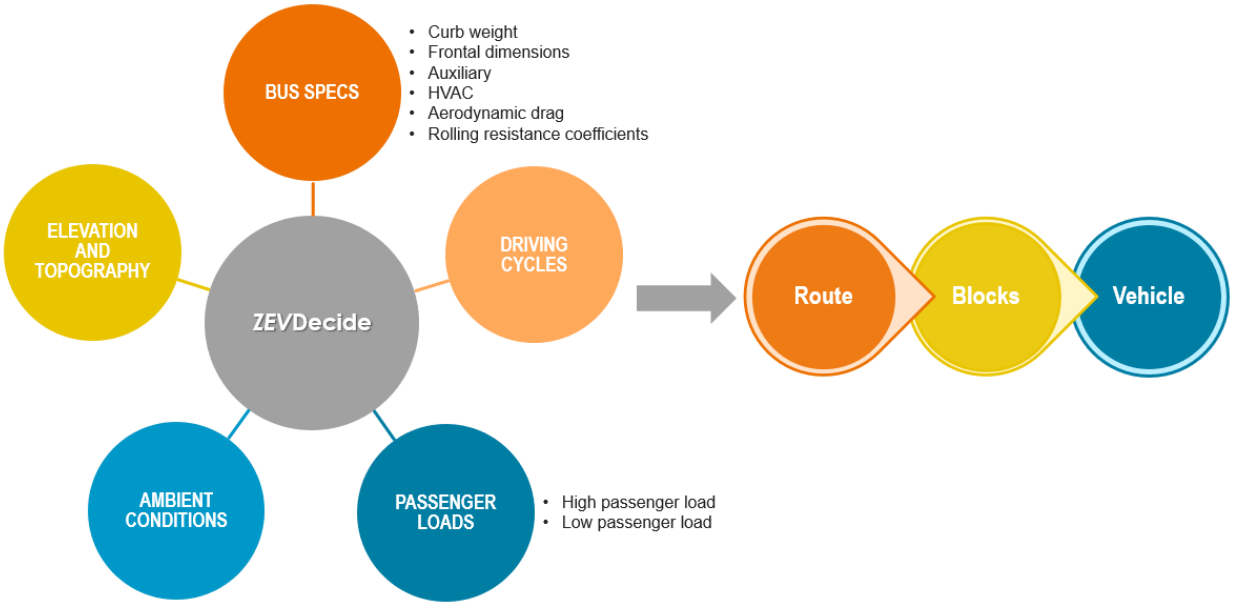
This section describes the process of bus modeling and route simulation, including the inputs and methodology.

ZEBDecide is a modeling tool designed by Stantec to support transit agencies in transitioning to zero-emission fleets, and ultimately helps to answer the question: what is the feasible and ideal composition of ZEBs for my fleet?

Energy modeling uses a two-pronged approach to understanding ZEB feasibility. The two-pronged approach first examines route-level operations, and secondly, examines fuel economy by aggregating route-level outputs to provide block/vehicle level fuel/energy requirements. In this way, Stantec and BCT will understand how different ZEB technologies perform under BCT's operating conditions, providing a more realistic estimate of operating range and energy consumption, and ultimately informing technology selection.

Figure 8-1 provides a schematic overview of the modeling process. The predictive ZEB performance modeling depends on several inputs, such as actual passenger loads, driving dynamics, topography, vehicle specifications, and ambient conditions subject to the environment in which the agency operates.

Figure 8-1: Modeling overview



Please note that only BEBs were modeled, no hydrogen options were included as a part of this exercise. There are several reasons why a hydrogen fleet was not explored for BCT:

- Many regional peers are moving forward with BEB fleets;
- BEBs are more commonly deployed than hydrogen – they have a proven record of accomplishment;
- There are more BE fleet options available to fit BCT's needs compared to hydrogen, especially for WAVE vehicles;

- BCT's small fleet would translate to low hydrogen fuel demand resulting in a more expensive per-bus cost compared to BEBs, particularly if an onsite hydrogen fueling station is constructed;
- Hydrogen fueling onsite presents higher up-front capital costs compared to BEBs;
- Most of BCT's operations can be converted to BEBs in a 1:1 manner;
- FCEBs are preferable for longer distance routes – BCT does not have this need;
- FCEBs are fueled via a hydrogen fueling station – BCT would either need to construct one (high upfront capital costs and large footprint) or look for an offsite fueling location;
- BCT's current facility lacks the space to accommodate a hydrogen fueling station; and
- BCT does not require the extended range provided by FCEBs,

Additionally, the table below summarizes some of the major considerations for BCT for both BEBs and FCEBs.

Table 8-1: Major Considerations for Deployment of BEBs or FCEBs

BEB Considerations	FCEB Considerations
More vendor options	Fewer vendor options
Lower bus purchase price compared to FCEBs	Higher bus purchase price compared to BEBs
Charging infrastructure is lower on a per-bus basis for smaller fleets	Charging infrastructure higher on a per-bus basis for smaller fleets
BCT's fleet would require 9 charging cabinets (120kW) with 18 plug-in connections	BCT's facility lacks sufficient space for an onsite hydrogen fueling station
Requires coordination with SCE – potential participation in the SCE Charge Ready Transport Program	Requires a dedicated BCT staff member to track weekly purchase of hydrogen and maintenance of hydrogen facility
Major safety and training considerations include working with high-voltage systems and charging procedures	Major safety and training considerations include the need for a hydrogen gas detection system, working with high-pressure fueling systems, and hydrogen fueling procedures

8.1.1 Modeling Inputs

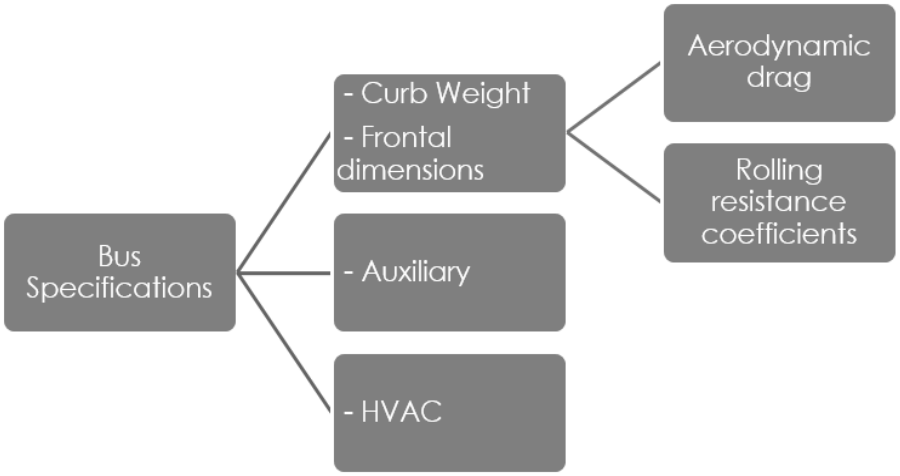
The following sections outline the inputs used in the modeling process for fixed route services and the WAVE.

8.1.1.1 Fixed Route

8.1.1.1.1 Bus Specifications

ZEBDecide is Stantec's proprietary ZEB modeling platform; its energy modeling process predicts ZEB drivetrain power requirements specific to given acceleration profiles. One key component to the modeling is the bus design or bus specifications that include curb weight and frontal dimensions (factors needed to account for aerodynamic drag and rolling resistance coefficients), auxiliary, and heating, ventilation, and air conditioning (HVAC) (Figure 8-2).

Figure 8-2: Detailed Bus Specification Inputs



For BCT, the key bus specifications used in the modeling process are detailed in Table 8-2. Some important things to note about the bus specifications used in the modeling:

- All fixed route services (excluding school tripper services) were modeled with 30-ft buses, which differs from BCT's current fixed route fleet which includes two cutaways.
- School tripper services were modeled with 40-ft buses [182].

[182] 40-ft buses were originally modeled for the school tripper services to reflect BCT's current operations, even though the final ZEB fleet composition only includes 30-ft buses for fixed route services. Additional analysis was completed to ensure that school tripper services could be successfully completed with 30-ft ZEBs.

Table 8-2: Bus Specifications for Fixed Route Energy Modeling

BEB models	30-ft	40-ft
Battery (kWh)	450	545
Curb Weight (lbs.)	29,700	33,000
Service type	Fixed route	Fixed route (school tripper)
		

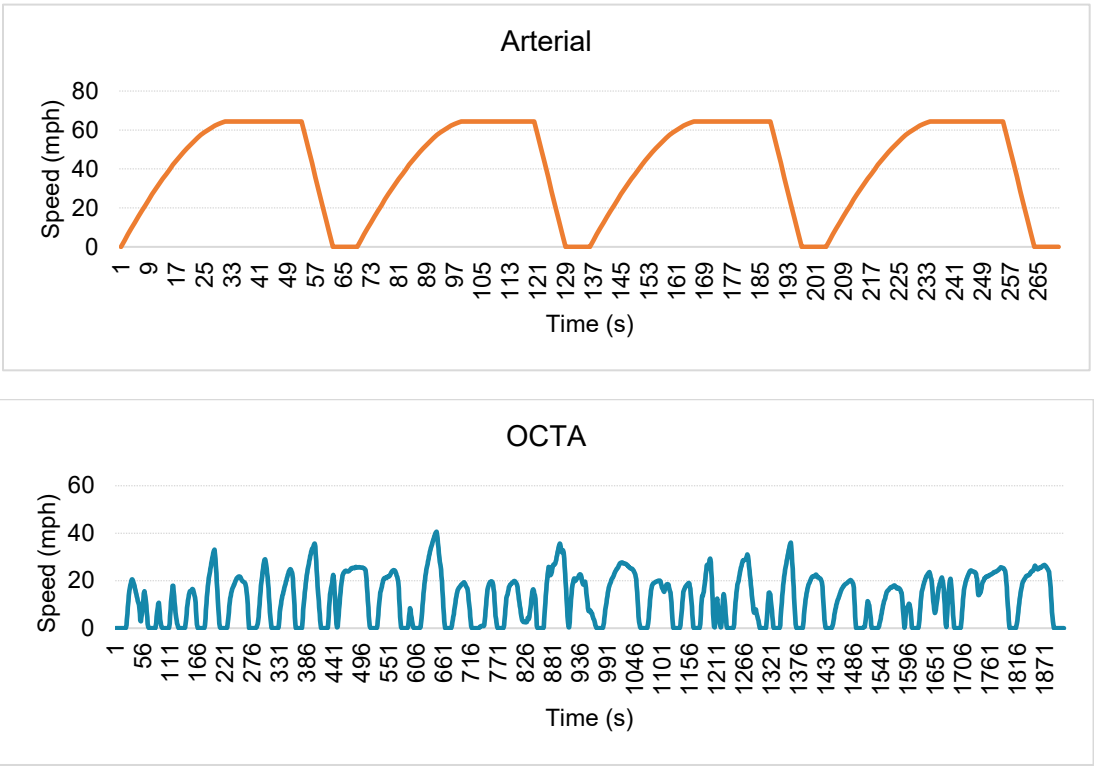
8.1.1.1.2 Representative Driving Cycles

Assigning representative driving cycles, also called acceleration profiles or duty cycles, is the other major step in energy modeling. A driving cycle is a speed versus time profile that is used to simulate the vehicle performance, and consequently, the energy use. Representative driving cycles were assigned to both routes based on BCT's operations and observed driving conditions.

The driving cycles have been created from data collection of real-world operations or chassis dynamometer tests and have been convened by the National Renewable Energy Laboratory (NREL) in a drive cycle database called DriveCAT [183] (examples shown in Figure 8-3).

[183] NREL DriveCAT - Chassis Dynamometer Drive Cycles. (2019). National Renewable Energy Laboratory. www.nrel.gov/transportation/drive-cycle-tool

Figure 8-3: Examples of Two Representative Driving Cycles



To assign driving cycles to BCT's routes, Stantec evaluated BCT's routes in terms of average speed, route length, the number of stops, and traffic levels. For lines 102 and 109, a medium city traffic cycle with frequent stops was chosen to reflect the operating conditions of the South Bay.

8.1.1.1.3 Passenger Loads

As the total weight of a ZEB impacts its performance, it is important to understand and capture passenger loads in the modeling process. To examine the impacts of passenger loads and its associated weight, Stantec worked with BCT to determine the appropriate passenger load for each route/service type. A 50% passenger load (based on the total seating capacity of each vehicle type) was used to model lines 102 and 109, and a 120% passenger load was used to model the school tripper services to capture conditions where all seated capacity is full, and standees are present.

8.1.1.1.4 Ambient Conditions

The ambient temperature has a significant impact on the fuel economy of the ZEBs since it is directly related to the power output from the batteries required for the HVAC system.

Stantec developed a correlation between ambient temperature and power requirements from the HVAC system. For example, moderate daily temperatures (between 55°F and 65°F) can have a nominal power demand on the HVAC system of up to 4 kW. Colder temperatures (below 45°F) or hotter temperatures

(above 70°F) can represent more strenuous loads of up to 12 kW. The power requirement for modeling purposes was set based on an annual average low-temperature average of 56°F [184].

8.1.1.1.5 Topography and Elevation

It is important to account for the impacts of terrain and elevation on the energy efficiency of ZEBs. The first step in the route elevation analysis is to determine the elevation gains and losses seen across BCT's routes. Furthermore, the total elevation gains will inform the maximum and average grades across each route. From there, an analysis of elevation based on route alignments was undertaken for both routes (Table 8-3).

Table 8-3: Elevation Analysis

Route	Average slope	Max slope	Weighted average slope
102	1.7%	9.9%	2.6%
109	1.4%	9.6%	1.8%

Each route shapefile (derived from GTFS data) was downloaded in Google Earth to create an elevation profile and understand the total elevation gains/losses seen for each route in the system (example for Line 109 in Figure 8-4). Additionally, the average and maximum grades for each route were similarly determined using these elevation profiles, which were used as the inputs for the topography analysis. the total elevation gains will inform the maximum and average grades across each route, as presented in the table above.

Figure 8-4: Line 109 Elevation Profile Generated from Google Earth



We used a literature review to determine how average grades and maximum grades could affect the fuel efficiency and vehicle performance of BEBs and FCEBs. While the average grade across the entire route was used to determine the penalty on fuel efficiency, individual sections of routes that displayed significant changes in elevation in a short distance were also analyzed since this could have an outsized effect on vehicle performance. Data collection from real-world operations provided the correlation between average grade and penalties to the fuel efficiency. A penalty factor for each route was then applied to the calculated route-level fuel efficiencies to account for topography. For BCT, portions of the routes traveling across sustained elevations will have the most impact on fuel efficiency.

On average, the energy use per mile increases by 2% for 30-ft BEBs, when accounting for the effects of the topography unique to the service area of BCT, meaning the BEBs are less efficient when accounting for topography.

[184] US Climate Data https://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339

8.1.1.2 The WAVE

Currently, there are few tested and deployed ZE models corresponding to vans and cutaways that fit an agency's need in the paratransit/demand response domain. For the WAVE, we modeled all WAVE services with both a BE cutaway and BE passenger van to understand the potential feasibility of transitioning more of the WAVE fleet to passenger vans. The WAVE service bus specifications are shown in Table 8-4.

Table 8-4: Bus Specifications for the WAVE Energy Modeling

BEB models	Passenger Van	Cutaway
Battery (kWh)	118	120
Curb Weight (lbs.)	14,330	16,200
		

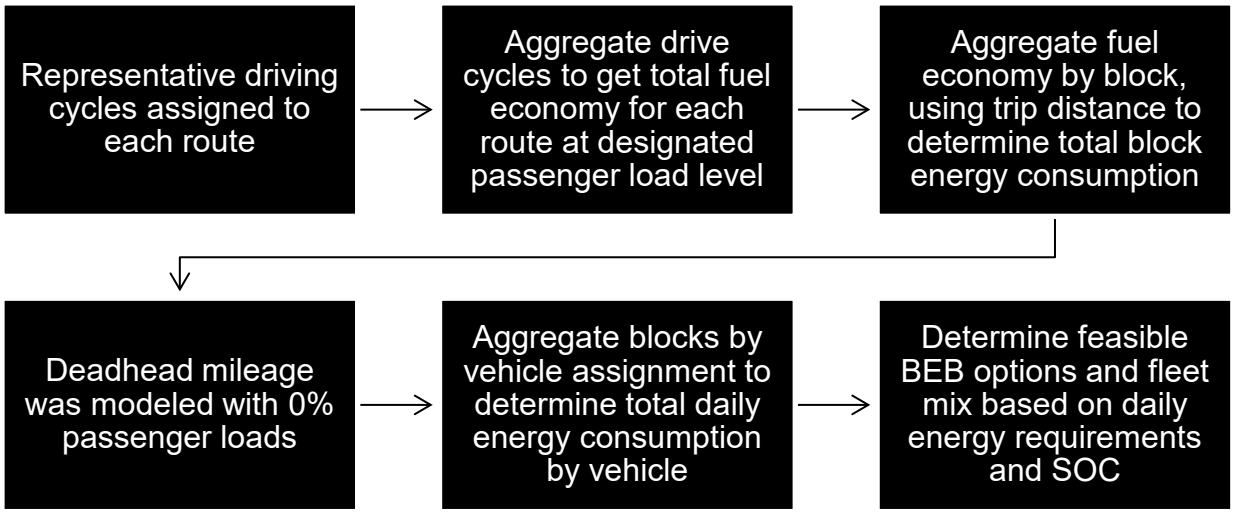
The modeling results for the WAVE assumed an average of four passengers onboard and does not directly consider topography. Instead, the model used driving speed information for all trips in October 2019 to predict the fuel economy. Other inputs, such as ambient temperatures, are the same as the parameters used in the modeling of the fixed routes.

8.1.2 Modeling Process

8.1.2.1 Fixed Route

Using the inputs in Section 8.1.1.1, the first step in modeling the fixed-route services is obtaining route-level fuel economy and energy use for the BEBs using the driving cycles assigned to each route. However, we cannot stop at route-level modeling as this does not fully capture daily vehicle usage due to interlining, deadheading, etc. The process of going from route to vehicle assignment is outlined in Figure 8-5.

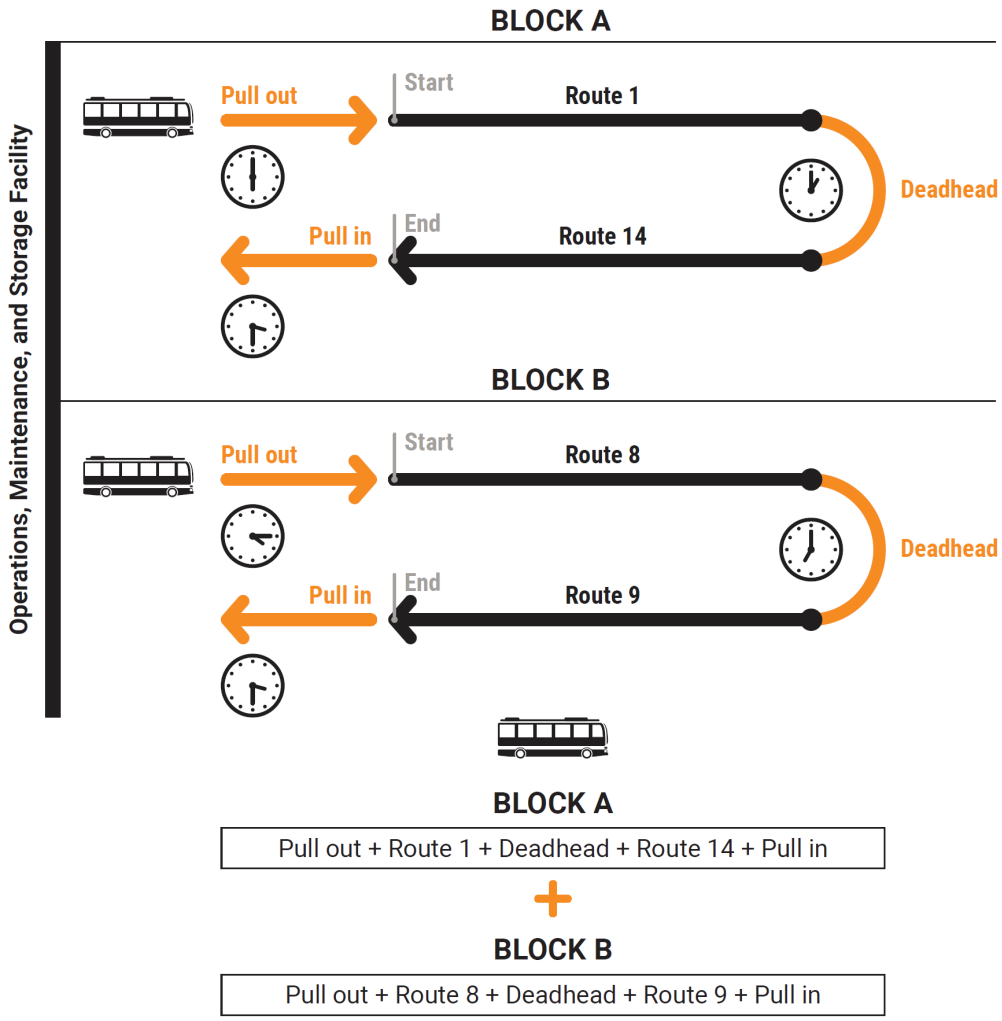
Figure 8-5: ZEBDecide Energy Modeling Process



After the route-level modeling is completed, fuel economies are then aggregated by block using the trip distance to determine the total energy consumption for each block. Finally, to understand the fuel economy and total daily energy consumption of each vehicle operated on a representative service day, blocks are aggregated at the vehicle level so that vehicles that are assigned multiple blocks throughout a day are modeled appropriately.

The graphic in Figure 8-6 demonstrates a typical relationship between routes, deadheading, blocks, and vehicle assignments.

Figure 8-6: Relationship between Routes, Blocks, and Vehicle Assignments.



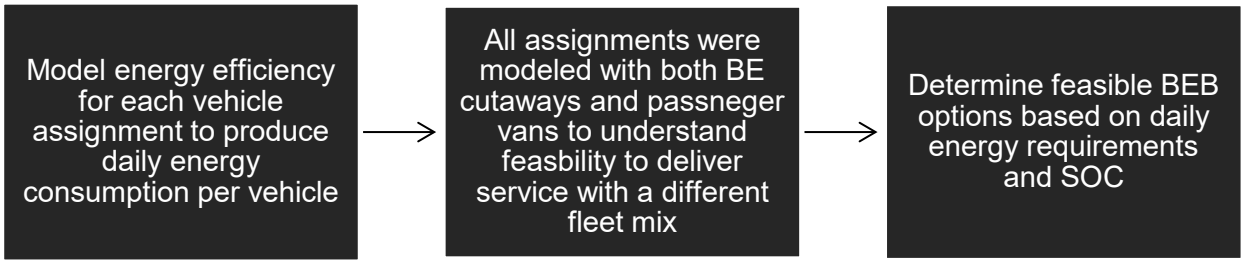
The results of the modeling provide insight into:

- Fuel economy and energy requirements
- Operating range
- The feasibility of BEBs to complete BCT's fixed route service. This is determined through the state of charge (SOC; the vehicle assignment can be successfully completed with a BEB if it can complete its scheduled service with at least 20% battery SOC).

8.1.2.2 The WAVE

As demand response services do not follow a fixed route and schedule, modeling inputs require adjustment to account for variations in service delivery. Therefore, instead of assigning representative driving cycles, the model considered the average driving speeds for each individual run; all daily WAVE vehicle assignments from October 2019 were modeled.

Figure 8-7: ZEBDecide Energy Modeling Process (Demand Response Services)



8.1.3 Modeling Results

8.1.3.1 Fixed Route

Following the assignment of driving cycles to routes and aggregating these to determine the total fuel economy for each route at different passenger loads, the modeling moves to aggregating fuel economy at the block and vehicle assignment level.

These steps define 1) the energy consumption at the block level—using data from each individual trip—and 2) the energy consumption for each vehicle assignment. The modeling results for these two steps of the process are presented below.

The overall energy or fuel demand per block was obtained by aggregating the fuel consumption from each trip according to the route-level results. The criteria to deem if a block can be successfully served by a BEB is if the SOC of the battery is above 20% after completing all the trips in a block [185]. Block-level modeling results are shown in Figure 8-8.

[185] OEMs recommend that a BEB charge only to 90% of its total battery capacity and not drop below 10% state of charge (SOC) to preserve battery life; dipping below 10% can void the battery's warranty.

Figure 8-8: Block-level Fixed Route Modeling Results [186]

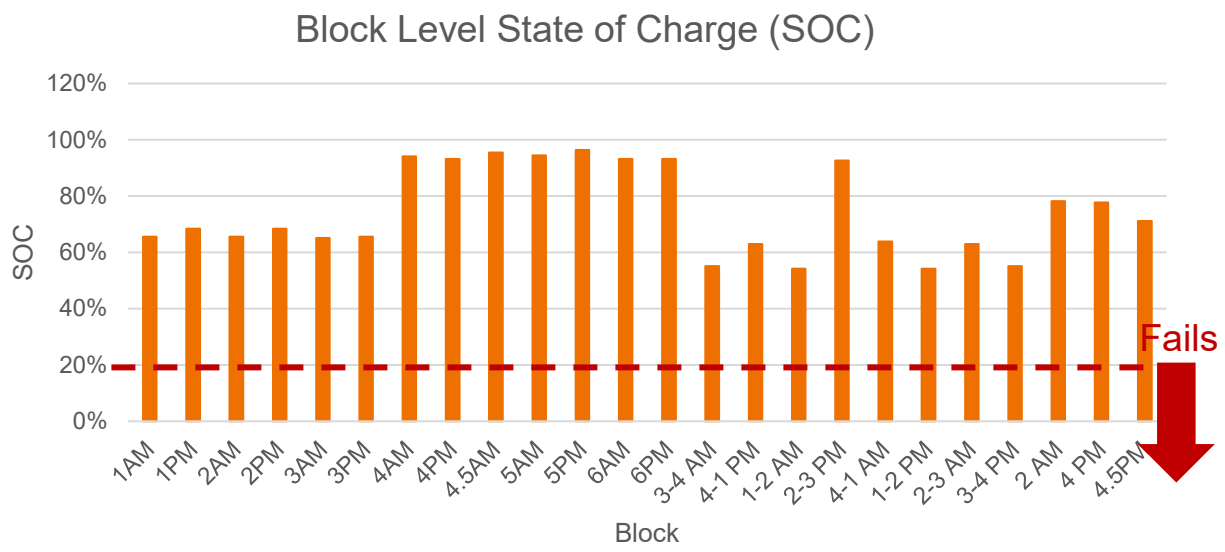


Figure 8-8 shows that at the block level, 100% of blocks can be successfully completed with BE equivalents. Next, these blocks are aggregated at the vehicle assignment level (Figure 8-9).

Figure 8-9: Vehicle-level Fixed Route Modeling Results

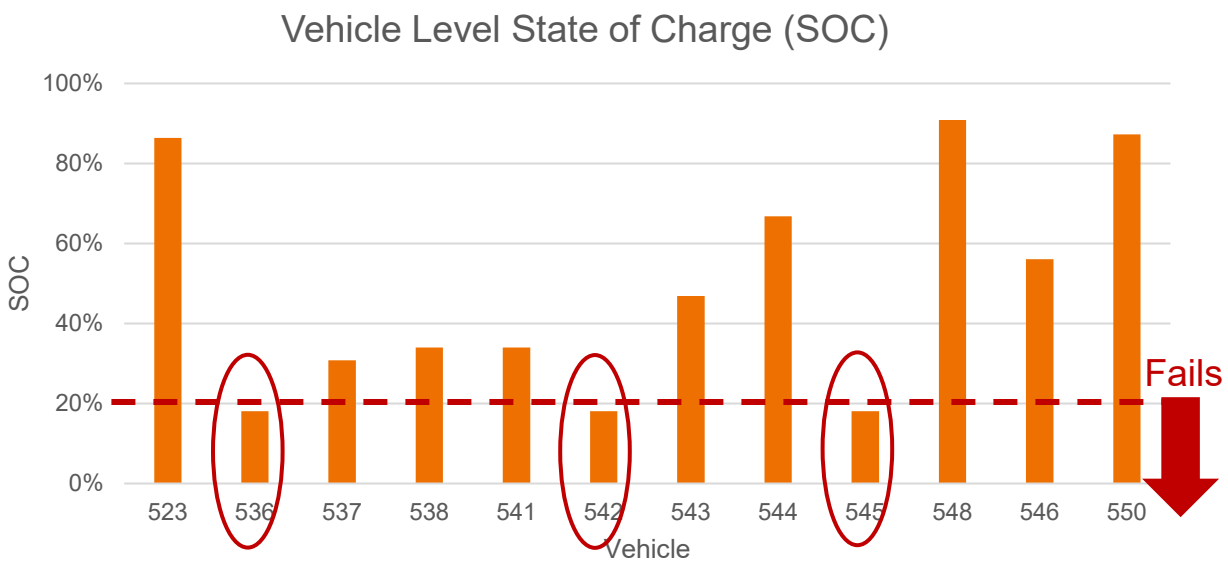


Figure 8-9 shows that when blocks are combined at the vehicle assignment level, 75% of vehicle assignments are successful. All vehicles that fail are very close to the threshold of a successful SOC, with a modeled SOC of 18% for these three vehicles when they complete their daily assigned service. All these

[186] Blocks are listed along the x-axis. The names of blocks are arbitrary and assigned by BCT's contracted operator, Transportation Concepts.

vehicles operate on Line 109 and complete more than one block. Table 8-5 shows the average fuel efficiency and predicted maximum range at the modeled passenger loads for each vehicle type.

Table 8-5: Average Fuel Efficiency and Estimated Range for Fixed Route Modeling Results

Vehicle type	Average fuel efficiency (kWh/mi)	Maximum range at modeled passenger loads for Line 102 and Line 109
30-ft	2.005	Approximately 170 miles
40-ft	2.385	Approximately 170 miles

8.1.3.2 *The WAVE*

As previously mentioned, all daily WAVE assignments were modeled with BE cutaways and passenger vans. All total daily vehicle assignments in October 2019 were modeled (98 total daily vehicle assignments) at the vehicle level under both vehicle types using the same criteria of success as the fixed route service (20% SOC). Figure 8-10 presents results when modeled with cutaways, and passenger van results are shown in Figure 8-11.

Figure 8-10: SOC Distribution for Cutaways

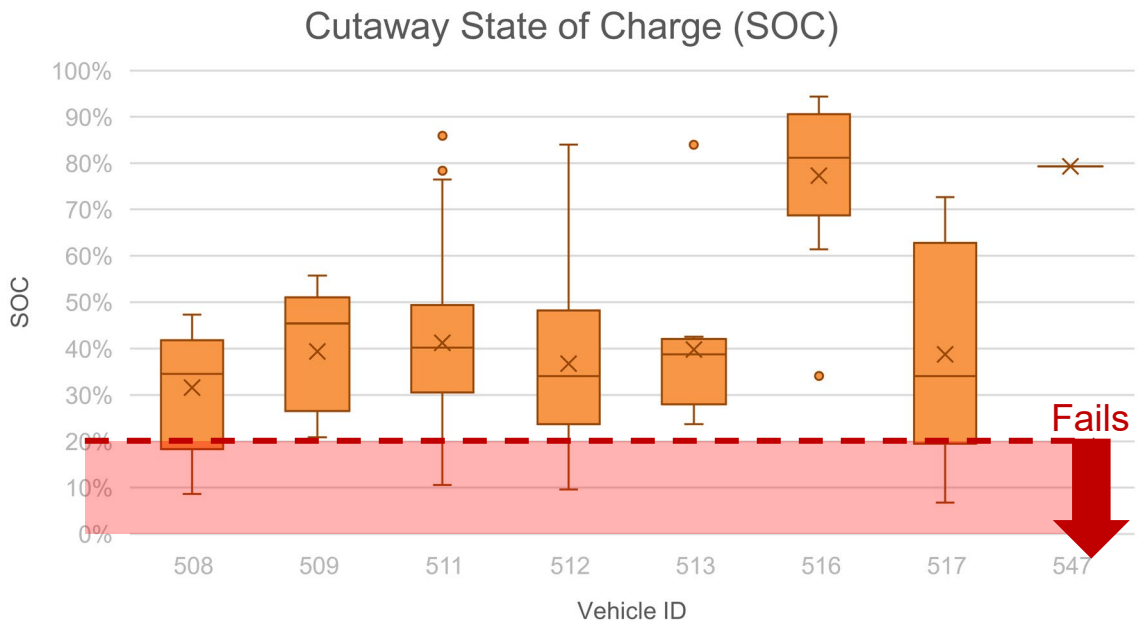


Figure 8-11: SOC Distribution for Vans

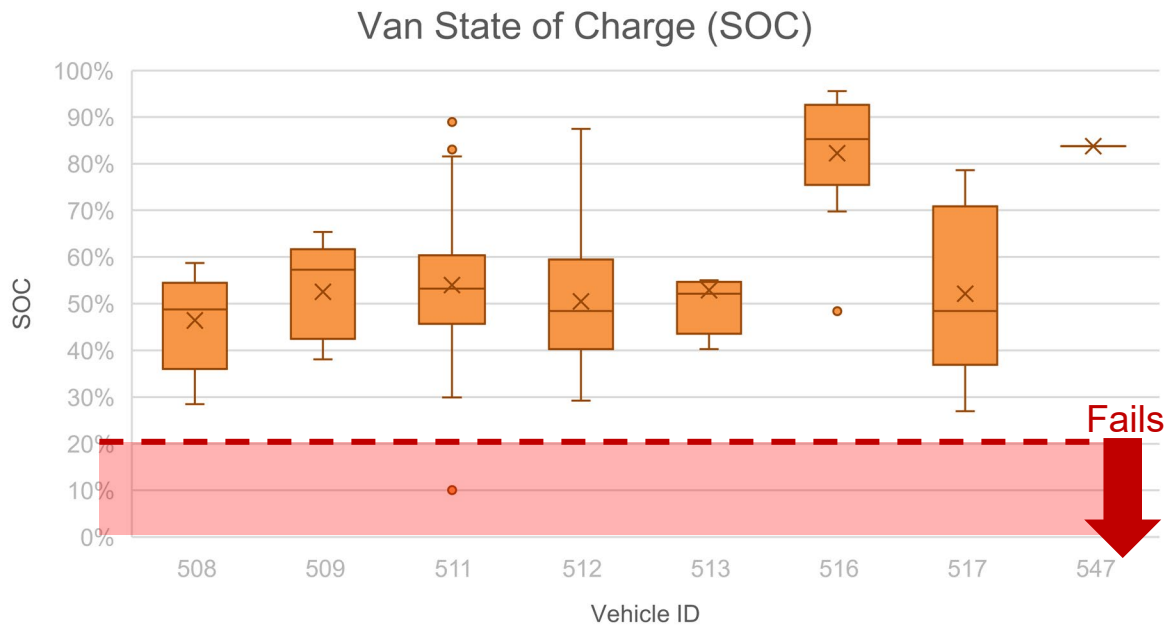


Figure 8-10 shows that 87% of the modeled vehicle assignments were successful, meaning that 85 of the 98 daily vehicle assignments completed in October 2019 could successfully be completed with a BE cutaway. Figure 8-11 shows an even higher success rate for BE vans, where 97% of daily vehicle assignments were successfully completed. Overall, this shows that the WAVE tends to complete lighter-duty cycles, and the majority of WAVE service could be successfully completed with either BE option. The average fuel efficiency and maximum range at the modeled passenger loads for each vehicle type are shown in Table 8-6.

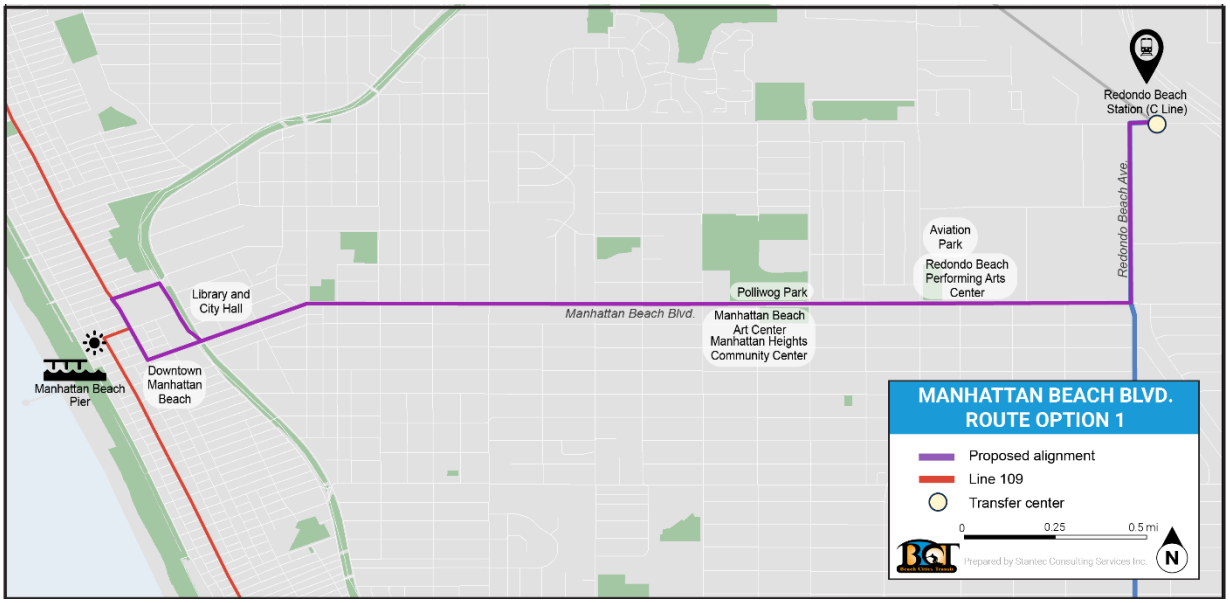
Table 8-6: Average Fuel Efficiency and Estimated Range for the WAVE Modeling Results

Vehicle type	Average fuel efficiency (kWh/mi)	Maximum range at modeled passenger loads
Cutaway	1.13	Approx. 85 miles
Van	0.87	Approx. 110 miles

8.1.3.3 Modeling Considerations for Manhattan Beach Blvd Service

The service planning exercise in TSS 2 revealed an interest and demand for fixed-route service operating along Manhattan Beach Blvd Four different alternatives were assessed, and it was determined that Alternative 1 was the preferred alignment, with plans to launch the service during the summer months (mid-June through mid-August, when school is not in session) in FY25-26.

Figure 8-12: Proposed Manhattan Beach Blvd Service



Based on this preliminary, high-level schedule, Stantec explored considerations for the electrification of this service. The service plan calls for service every 30 minutes between 8AM and 8PM Monday-Thursday and 10AM-11PM Friday-Sunday, which translates to a maximum of 24 daily round trips, or 153.6 revenue miles per day. The following inputs were considered:

- Service will be operated using a 30-ft BEB [187].
- Service was modeled with an average passenger load of 70%.
- An average fuel efficiency of 1.98 kWh/mi was applied to reflect urban driving conditions along Manhattan Beach Blvd

Based on these inputs, it was determined that a 30-ft BEB could travel 182 miles per charge under these operating conditions, or could complete a total of 29 round trips for the proposed Manhattan Beach Blvd Service. Even though this analysis did not directly consider deadheading, these results indicate that BCT can operate this service all day with one BEB on a single charge, inclusive of deadhead. This expected range is higher than the modeled range for Lines 102 and 109 due to higher average fuel efficiency and lack of topography challenges.

8.2 Preferred Fleet Composition and Fleet Optimization

This section outlines the development of preliminary fleet concepts. These fleet concepts were workshopped with BCT staff to understand tradeoffs and operational considerations between the fleet concepts to determine a preferred fleet concept. First, two fleet concepts were developed that would accommodate BCT's current service. Following this, a third fleet concept was developed that accounts for expanded service under the service plan presented in TSS 2. The preliminary fleet concepts are discussed in detail below and summarized in Table 8-7.

Under all fleet concepts, different configurations of cutaways and passenger vans were evaluated for the WAVE service. Currently, BCT operates five cutaways and one van for the WAVE. To right-size the fleet

[187] The addition of the Manhattan Beach Blvd. service does not increase the fleet size as it will be operating when school is not in session and thus can pull from that pool of available vehicles.

and match vehicle size with demand, a combination of cutaways and vans was determined to be the optimal mix for the future WAVE fleet. It was also noted that it may be easier to hire operators for passenger vans, and that BE vans have a slightly lower purchase price compared to BE cutaways.

The fleet optimization analysis, and process from moving from preliminary fleet concepts to a preferred fleet concept, consisted of several steps. First, two preliminary fleet concepts were developed based on the modeling results and BCT's current operations. These preliminary concepts took two different approaches to the ZEB transition, one that focuses on minimizing capital costs (Fleet Concept A) and a more conservative approach based on the modeling results that increase the fleet size (Fleet Concept B).

- **Fleet Concept A**: does not grow the fleet size. This approach assumes a 1:1 replacement for fixed route vehicles will be sufficient given that the three vehicles that failed in the modeling did so by only a small margin. However, this will require reblocking to accommodate the range limitations of these vehicles, and the SOC of the vehicles will need to be very closely monitored over the course of the day. This fleet concept also attempts to minimize capital costs by transitioning away from cutaways and only procuring BE vans for the WAVE service.

- **Fleet Concept B**: grows the fleet by four vehicles. The fixed route fleet increases by two 30-ft vehicles. Even with this increase, BCT will still need to split up the blocks from the three vehicles that failed according to the modeling; for instance, assigning the PM block from one of the failing vehicles to one of the new vehicles. Increasing the vehicle count will provide flexibility to the operations and could help mitigate range anxiety from operators.

  This concept also maintains some cutaways for the WAVE service, splitting the WAVE fleet between three BE cutaways and five BE passenger vans. In addition, the total WAVE fleet also grew by two vehicles to account for the small portion of vehicle assignments that failed in the modeling.

- **Fleet Concept C**: Following these two preliminary fleet concepts, the recommended service plan presented in TSS 2 was incorporated into Fleet Concept A to understand the increased fleet needs to support the recommended service plan, including Manhattan Beach Blvd service, and enhanced service levels on lines 102 and 109 (Fleet Concept C).

  Through this, it was determined that two additional 30-ft BEBs would be required to provide the increased service recommended in the service plan and to maintain a 20% spare ratio [188]. The addition of the Manhattan Beach Blvd service does not increase the fleet size as it will be operating when school is not in session and thus can pull from that pool of available vehicles.

Following this, the preliminary fleet concepts were presented to BCT staff and workshopped to come to a preferred fleet concept. This resulting preferred fleet concept takes a slightly more conservative approach to operations compared to Fleet Concept C increasing the fleet size by one 30-ft BEB. This fleet increase is inclusive of fleet growth to operate the recommended service plan as well as to account for vehicles that were unsuccessful in the modeling. It was also determined that all fixed-route services and school trippers would transition to 30-ft BEBs and the WAVE would maintain a mix of cutaways and vans, with a higher percentage of vans in the fleet compared to the current composition. This is further detailed in the table below.

[188] An estimated 12 vehicles will be in operation at peak service, requiring a total fleet size of 15 to maintain at least a 20% spare ratio.

Table 8-7: Preliminary and Preferred Fleet Concepts

	Fleet Concept A	Fleet Concept B	Fleet Concept C	Preferred Fleet Concept
30-ft (fixed route)	11	15	14	15
Cutaways (fixed route)	2	0	0	0
40-ft (fixed route)	1	1	1	0
Cutaways (the WAVE)	0	3	0	3
Passenger vans (the WAVE)	6	5	6	5
TOTAL VEHICLES IN FLEET	**20**	**24**	**21**	**23**

8.3 Power Demand Model and Charging Profile

One key aspect of the ZEB transition planning is assessing the fueling or charging needs of BCT's fleet to help inform the:

- Infrastructure and equipment right-sizing,
- Facility power needs, and
- Design constraints and opportunities.

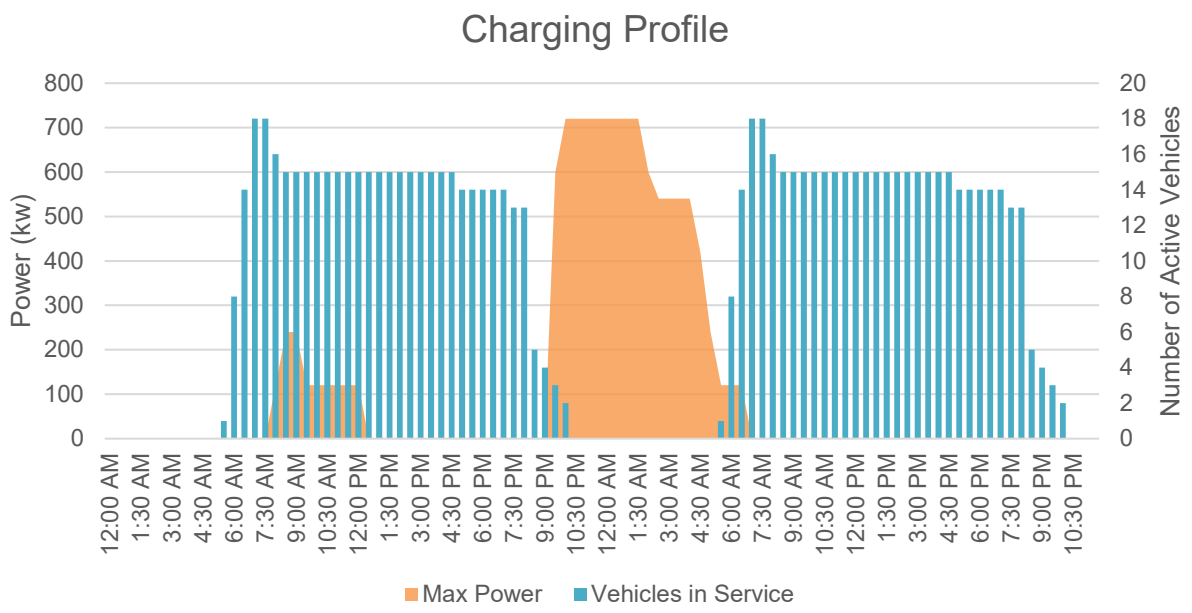
Based on the ZEB modeling and service plan, Stantec tested different charging specifications and configurations to best approximate how BCT could optimally recharge its revenue fleet (both fixed-route and demand-response vehicles). Stantec used its depot emulation tool to simulate how, based on pull-out and pull-in schedules and different charger characteristics, BCT can recharge its fleet and the maximum power that would be needed.

The power demand and charging profile presented in Figure 8-13 includes the two additional fixed route vehicles proposed to accommodate the five-year service plan and includes charging requirements for both the fixed route and WAVE fleets. For representative modeling purposes, it was assumed that five WAVE vehicles were in service from 6am to 8:30pm, the full hours of operation of the service. The model also avoided charging between 4pm and 9pm to avoid peak hour charges from Southern California Edison (SCE) and to minimize costs.

Using the depot emulation tool, we estimated that based on the full implementation of the service plan by plan year five, if all vehicles in service are BEBs, BCT's facility will require a maximum power capacity of

~700 kW that would be seen during the overnight refueling window (Figure 8-13) [189]. This information will be important for BCT to use as part of its planning work with SCE and during the service studies for charger installation; if the program is still active at the time that BCT begins to purchase BEBs [190].

Figure 8-13: BEB Charging Profile



8.4 Fleet Replacement Plan

Based on the preferred fleet composition, the proposed service plan, and BCT's current fleet roster, Stantec developed a fleet replacement plan (Figure 8-14 and Table 8-8). This fleet replacement plan gradually phases out CNG buses as they 'age' out based on fleet replacement information from BCT and the FTA useful life benchmarks [191] and phases in ZEBs as per the ICT regulation and BCT's needs. The fleet forecast in Table 8-8 also shows the phasing of infrastructure (chargers) and timing of battery replacement for the BEBs (battery replacements are not required for BE cutaways or vans as the useful lives of these vehicles are too short).

According to this plan, BCT is scheduled to procure its first BEB in 2029 and will achieve a fully ZE fleet by 2040. The fleet replacement plan informs the ICT ZEB Rollout Plan Section D and also informs BCT's capital plans (Section 11.2).

[189] The charging profile includes both fixed-route vehicles (charged with 120 kW dual-dispenser chargers) and demand-response vehicles (charged with 60 kW dual-dispenser chargers).
[190] Program funding is currently set to expire in 2024 but SCE has indicated the program may be extended, but further details are not currently available.
[191] https://www.transit.dot.gov/TAM/ULBcheatsheet

Figure 8-14: BCT Fleet Composition Through 2040 by Vehicle Type and Technology

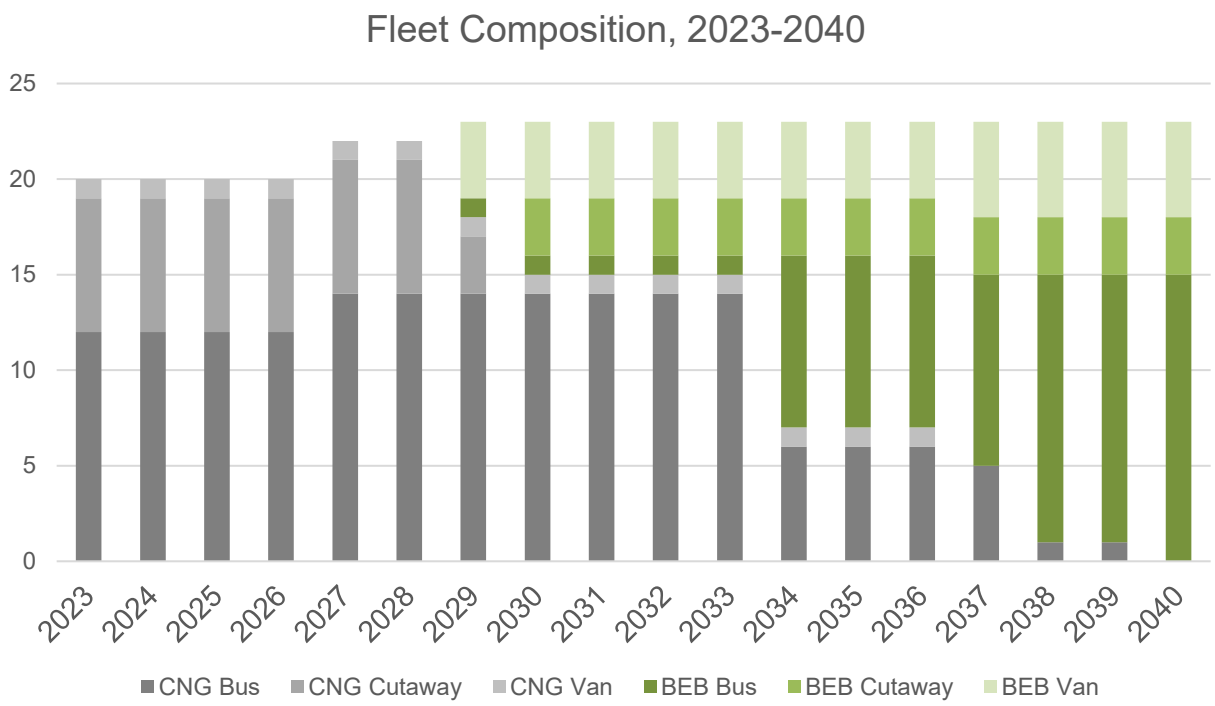


Table 8-8: 2023-2040 Fleet Forecast

Fleet Forecast		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
CNG Buses	New	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Added	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
	Retire	-	-	(1)	(3)	-	-	-	-	-	-	-	-	(8)	-	-	(1)	(4)	-	(1)
Total CNG Buses		**12**	**12**	**12**	**12**	**12**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**6**	**6**	**6**	**5**	**1**	**1**	**-**
BE Buses	New	-	-	-	-	-	-	-	1	-	-	-	-	8	-	-	1	4	-	1
	Added	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Retire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Battery Replacements															1					8
Total BE Buses		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**8**
CNG Cutaways	New	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Added	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Retire		-	-	-	-	-	-	(4)	(3)	-	-	-	-	-	-	-	-	-	-
Total CNG Cutaways		**7**	**7**	**7**	**7**	**7**	**7**	**7**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
BE Cutaways	New	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3	-
	Added	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Retire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(3)	-
Total BE Cutaways		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CNG Vans	New	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Added	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Retire	-	-	-	-	-	-	(1)	-	-	-	-	-	-	-	-	(1)	-	-	-
Total CNG Vans		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**
BE Vans	New	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	4	-	-
	Added	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	Retire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(4)	-	-
Total BE Vans		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**4**	**-**	**-**
Total ZEB Vehicles	**Total**	0	0	0	0	0	0	0	5	8	8	8	8	16	16	16	18	22	22	23
Total ZEB in Fleet %	**% ZEB**	0%	0%	0%	0%	0%	0%	0%	22%	35%	35%	35%	35%	70%	70%	70%	78%	9%	9%	100%

Fleet Forecast		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
BCT ZEB % of Purchases [192]	% ZEB	0%	N/A	0%	0%	N/A	0%	0%	100%	100%	N/A	N/A	N/A	100%	N/A	N/A	100%	100%	100%	100%
ICT Purchase Requirement	% ZEB	0%	0%	0%	0%	25%	25%	25%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total ZEB		0	0	0	0	0	0	0	5	8	8	8	8	16	16	16	18	22	22	23
Total Non-ZEB		20	20	20	20	20	22	22	18	15	15	15	15	7	7	7	5	1	1	0
Total Fleet		20	20	20	20	20	22	22	23	23	23	23	23	23	23	23	23	23	23	23
Infrastructure Phasing																				
Cumulative Dispensers [193]								8						16				24		

[192] N/A = no purchases made that year.

[193] All the major electrical equipment, modifications, utility upgrades, and conduit should be incorporated during the construction of the new facility in FY2028 so that the physical installation of the chargers and dispensers can be a simple connection to the already installed infrastructure. Each charger can be connected eight to six months before new electric vehicles arrival.

8.5 Other Transition Considerations

In addition to the procurement and deployment of ZEB, there are substantial operational changes that come with the implementation of this technology. As operations adjust to new processes to charge, maintain, and operate BEBs, assistive technologies are required to manage and deploy vehicles. This section provides insight into best practices and market availability resources as well as the implications to disadvantaged communities and greenhouse gas emissions. Facility improvements and modifications required to support the ZEB transition are discussed in Section 9.1.2.

8.5.1 Operational and Planning Considerations

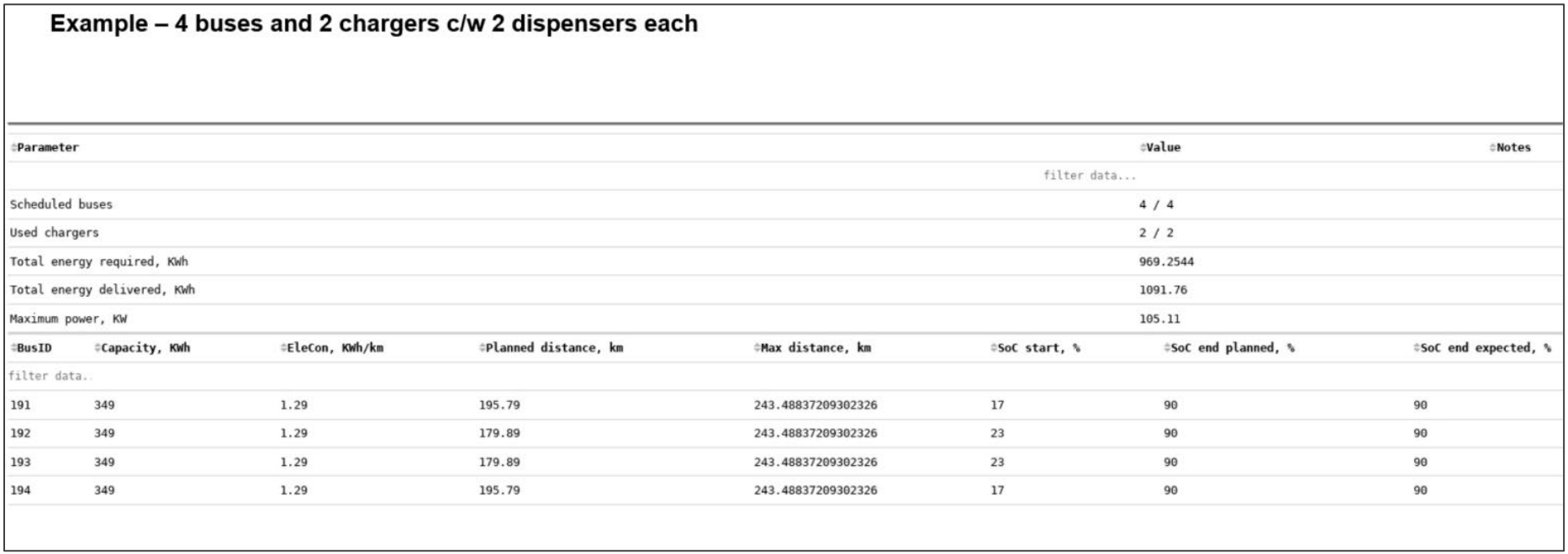
This section provides guidance and strategies for various operational and planning requirements when implementing BEBs.

8.5.1.1 Planning, Scheduling, and Runcutting

Key considerations for BEB planning and scheduling include the fact that the useable energy of the battery is 80% of the nameplate capacity. In other words, while BCT may purchase buses that have a 450-kWh battery, for instance, operationally the agency should plan for 80% of that capacity or ~360 kWh. This fact, together with the modeling conducted by the Stantec team in this study, will help guide the deployment and charging parameters for BEBs in BCT's operations scheduling.

Developing a 'cheat sheet' like the depot planning tool from Siemens below (Figure 8-15) that tracks the requirements for SOC, energy (kWh), estimated and planned mileages, and fuel economy (kWh per mile) will be important for planning and dispatching.

Figure 8-15: Example Depot Planning Tool to Understand Scheduling and Operations of BEBs (Source: Siemens).



Example – 4 buses and 2 chargers c/w 2 dispensers each

Parameter	Value	Notes
	filter data...	
Scheduled buses	4 / 4	
Used chargers	2 / 2	
Total energy required, KWh	969.2544	
Total energy delivered, KWh	1091.76	
Maximum power, KW	105.11	

BusID	Capacity, KWh	EleCon, KWh/km	Planned distance, km	Max distance, km	SoC start, %	SoC end planned, %	SoC end expected, %
filter data..							
191	349	1.29	195.79	243.48837209302326	17	90	90
192	349	1.29	179.89	243.48837209302326	23	90	90
193	349	1.29	179.89	243.48837209302326	23	90	90
194	349	1.29	195.79	243.48837209302326	17	90	90

Non-revenue tests during vehicle commissioning should be conducted in different parts of BCT's service area to ascertain actual range and fuel economy across longer routes, routes with topography variations, and simulated passenger loads and HVAC testing. Regarding HVAC testing, it is important to keep in mind that energy consumption varies with seasonality [194].

Training for the scheduling and planning team will be needed so that they understand the importance of scheduling BEBs to the correct blocks. Training will also likely be needed in collaboration with BCT's scheduling software provider to account for combined BEB and CNG operations, and finally an entirely BEB operation.

In the long term, it is also important to consider battery capacity degradation, as most BEB battery warranties specify that the expected end-of-life capacity is 70% to 80% of the original capacity over six to twelve years [195]. With an estimated 2% battery degradation per year, BCT will also need to take into consideration the need to rotate buses so that older buses are assigned shorter blocks, while newer BEBs are assigned the longest blocks. Transit agencies can improve battery outcomes through efforts like avoiding full charging and discharging events, avoiding extreme temperature exposure, and performing regular maintenance on auxiliary systems that consume energy. Despite relatively consistent year-round temperatures in the South Bay, BCT will still need to carefully monitor battery health and degradation levels.

Developing specific performance measures, goals, and objectives for BEB deployment can also help to track BEB progress and understand if adjustments to the BEB deployment strategy will be required.

8.5.1.2 Operator Needs

As BEBs have different components and controls than conventional ICE buses, BEB bus performance also differs. Training is important so that operators understand how to maximize BEB efficiency—mastering regenerative braking and handling during slick conditions—and have practice on how to do so prior to ZEB deployment for revenue service. Operations staff need to also be briefed on the expected range and limitations of BEBs (such as variability in energy consumption from HVAC under different weather conditions) as well as expected recharging times and procedures [196].

To operate effectively, BEB operators need new skills such as understanding battery SOC, remaining operating time, estimated range, and other system notifications as well as becoming familiar with the dashboard controls and warning signals. Procedures need to be prepared and understood by the operators so they can take the correct actions when a warning signal appears.

It is well known that driving habits have a significant effect on BEB energy consumption and overall performance and range (i.e., fuel economy can vary significantly between operators). As indicated above, operators must become knowledgeable on the principles of regenerative braking, mechanical braking, hill holding, and rollback. The training for BEBs needs to include optimal driving habits such as the recommended levels of acceleration and deceleration to maximize fuel efficiency. Another option is to implement a positive incentive program that encourages operators to practice optimal driving habits for BEBs through rewards, certificates, or other incentives. The AVTA in Lancaster, California, an early adopter of BEBs, has a program of friendly competition between operators, where, for instance, an operator with the best average monthly fuel economy (the lowest kWh per mi) gets one month of a preferred parking spot in the employee lot.

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[194] While the ZEBDecide considers HVAC and heating use, it will still be important to track performance and energy consumption and how it varies with seasonality.
[195] National Academies of Sciences, Engineering, and Medicine 2020. Guidebook for Deploying Zero-Emission Transit Buses. Washington, DC: The National Academies Press. https://doi.org/10.17226/25842.
[196] For more information related to workforce training and preparing operators for BEBs, please refer to Section 2.6.3, Workforce Considerations.

Finally, BEBs are much quieter than conventional ICE buses. Operators should be aware of this and that pedestrians or people around the bus may not be aware of its presence. Agencies have also stated that due to the vehicle's lack of noise, some operators forget to turn off the bus after parking, another component to add to operator training and safety procedures.

8.5.1.3 Maintenance Needs

Early information suggests that ZEBs may require less preventative maintenance than their non-ZEB counterparts since they have fewer moving parts. However, not enough data currently exists to provide detailed insights into long-term maintenance practices for large-scale ZEB deployment in North America. One early finding is that spare parts may not be readily available, so one maintenance consideration is to coordinate with the OEMs and component manufacturers to develop spare parts inventories and understand lead times for spare parts. This means it will be important for BCT to coordinate spare parts procurement needed for ongoing BEB maintenance sooner rather than later so maintenance can be completed without interruption.

In terms of preventative maintenance, BEB propulsion systems are more efficient than internal combustion engines and thus can result in less wear and tear. Without the ICE and exhaust, there are 30% fewer mechanical parts on a BEB. BEBs also do not require oil changes and the use of regenerative braking can help to extend the useful life of brake pads. Early studies from King County Metro show that the highest percentage of maintenance costs for BEBs came from the cab, body, and accessories system. It is recommended that BCT require OEMs to provide a list of activities, time intervals, skills needed, and required parts needed to complete each preventative maintenance task for BEBs.

Many current BEBs also contain onboard communication systems, which are helpful in providing detailed bus performance data and reporting error messages, which can assist maintenance personnel in quickly identifying and diagnosing maintenance issues.

8.5.1.4 Charging Needs

BEB recharging is substantially different than fueling a CNG or other fossil fuel bus. As part of the recommendations, plug-in chargers (120 kW) are proposed for BEB charging at the main operations and maintenance facility. Once BEBs return to the yard and are parked, a service line technician would plug in the dispenser to recharge the bus. Smart charging software, described in Section 8.5.2.1, would monitor and control overall charging levels to balance energy needs with overall power demand. These systems help ensure that BEBs are charged but that this charging is spread out to avoid large surges in power demand.

Figure 8-16: A BEB Plugged into a Charger in Lancaster, CA (Antelope Valley Transit Authority) [197]



8.5.2 Supporting Technology

Technology for ZEBs will help BCT manage the fleet and its investment in zero-emission propulsion. First, for BEBs, charge management or smart charging technology is imperative to manage electrical demand to curb potentially costly demand charges and mitigate the maximum power requirements of bus charging. Second, fleet tracking software typically provided by an OEM will help track useful analytics related to the fleet and operations to help BCT make informed decisions. The City and transit operations contractor will need to coordinate oversight and management of the systems to ensure cost-effective use of power.

8.5.2.1 Smart Charging

To optimize BEB charging by minimizing charging during peak times of the day and to restrain the total power demand required for a BEB fleet, transit agencies deploy smart charging. Smart charging refers to software, artificial intelligence, and switching processes that control when and how much charging occurs, based on factors such as time of day, number of connected BEBs, and SOC of each BEB. This requires chargers that are capable of being controlled as well as a software platform that can effectively aggregate and manage these chargers. A best practice is to select chargers where the manufacturers are participants in the Open Charge Point Protocol (OCPP), a consortium of over 50 members focused on bringing standardization to the communications of chargers with their network platform.

[197] Image credit: https://www.govtech.com/fs/calif-transit-district-operates-first-all-electric-bus-fleet

A simple example of smart charging is when buses A, B, and C have 440 kWh battery packs all return to the bus yard with a SOC of about 25%, and all are plugged in in the order they arrived (A, B, C, though within a few minutes of each other). Without smart charging, they would typically get charged sequentially based on arrival time or based on SOC, if the charge time is 2.2 hours, then A is charged first in about 2.2 hours, moving on to B where charging is complete after 4.4 hours from arrival, and C completes at the 6.6 hour mark. However, if bus C is scheduled for dispatch after three hours, it would not be fully charged and ready to leave on time.

This is solved by a smart charging system that 'knows' bus C is to be dispatched first and therefore would get the priority charging in the first 2.2 hours, so it is ready in time for its 'hour three' rollout.

Another implementation of smart charging mitigates energy demand when possible. For example, if two buses are each connected to their own 150 kW charger and they both need 300 kWh of energy, if the buses do not need to be dispatched for five hours, the system will only charge one bus at a time, thus generating a demand of only 150 kW, while still fully charging both buses in four hours. However, if both buses need to be deployed in two hours, the system will charge both simultaneously as needed to make a rollout. A smart charging system helps optimize costs by looking for opportunities to avoid or minimize charging during the most expensive times of day to curb potential demand charges.

Well-planned and coordinated smart charging can significantly reduce the electric utility demand by timing when and how much charging each bus receives. Estimations on the ideal number of chargers are critical to the successful implementation of smart charging strategies.

There are a number of offerings in the industry for smart charging, charger management, and fleet management from companies such as (in alphabetical order) AMPLY Power, Evenergi, I/O Systems, Siemens, and ViriCiti. Additionally, the charger manufacturers all have their own native charge management software and platforms. These platforms have management functionality and integration that often exceeds the abilities of the other platforms providing data and functionality similar to that of the third-party systems; particularly in the yard when BEBs are connected to the chargers. However, the third-party platforms tend to provide more robust data streams while the BEBs are enroute, including real-time information on SOC and usage rates. These platforms can cost well over $100 per bus per month, depending on the number of buses, and type of package procured.

Three leading charge management system (CMS) providers have been evaluated as shown in Table 8-9. Information within this table was provided by the providers. Please note that this table is for informational purposes and to provide high-level information about the differences between different CMSs. The information in this table is reflective of this current point in time. Prior to procurement, the features and criteria should be verified with the provider. Note that Viriciti was purchased by ChargePoint in 2021, the stated intent is to operate Viriciti separately from ChargePoint. A Buy America evaluation will be required for these providers.

Table 8-9: Charge Management System Vendor Comparison

Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
1	Number of installations (facilities) with multiple high-voltage direct current chargers utilizing the software	14	More than 300	300+
2	Quantify uptime % of cloud base service	99.99%	99.99%	99.99%
3	What networking protocols or modes are supported, i.e., wired Ethernet, cellular, other	Hardwired ethernet is recommended, and cellular and facility WIFI are supported	Cellular is recommended, wired Ethernet, and WIFI are supported	Cellular
4	OCPP 1.6 compatibility	Yes	Yes	Yes
5	OCPP 2.0 compatibility	Yes	Yes	Yes
6	List available data fields that can be reported (such as starting and ending SoC, bus ID, charging power, …)	• SOC: start and end of charging session, SOC all the time whether a bus is plugged in, parked, or in the field. • Rate of charge (kW) of each charger port. • Bus ID at all times whether a bus is plugged in. • Location of a bus (in depot, in field, etc.) • Charging session: -Energy dispensed -Duration of charging,	Reports: • Uptime, downtime, and offline chargers (in hours, percentage, and total for a group) • Energy Reports (in kWh and hours of duration) Transactions: • -Charger OEM, Charger Name, Connector type, Connector/port number (1 or 2) • Vehicle Name/Number • Start Time and End Time	

Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
		• Power and energy consumed at electrical meter and dispensed at each charger port. • Charger health: -Available -Faulted -Maintenance needed, etc.	• Start SOC and End SOC • Power • -Reason for ending charge session • -Duration of charging session • kWh charged • Range at start of transaction • Range at the end of the transaction • Graphic representation of Power, SOC, and Energy throughout each transaction • Complete list of charging transactions (equipped with the data previously stated) • Complete list of user logs and documentation of user interactions.	
7	OpenADR2.0b or better common signals	Yes. In addition to OpenADR, also support custom DR integrations including CPower and Leap Energy.	No information available	Yes
8	Support Network Time Protocol (NTP/UTC) time synchronization	Yes	Yes	Yes

Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
9	Describe software security features for system integrity and reliability	AMPLY has implemented security procedures at multiple levels for protecting customer information: • AMPLY databases are encrypted using industry-standard AES-256 encryption • Both the database and application are running inside a VPC which has tightly managed access using IAM • The database is accessible only to the application nodes • No passwords are stored in the database and authentication is done using AWS Cognito • Authorization is tightly managed as part of the lower layers of the Amply software framework • Credentials are not stored in the database or code and are managed via the AWS systems manager • Software packages and dependencies are regularly reviewed for security vulnerabilities • Cloud infrastructure, roles & security groups are regularly reviewed to ensure security	No information available	ISO 27000:2015
10	Capable of remote software upgrades	Yes – automatic, over-the-air updates	Yes – Updates through the Cloud	Yes

Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
11	Is the user interface web-based or is any local app or software required	Web-based user interface accessible from any web-enabled device	Operates through a cloud-based platform which can be accessed through any web browser on a computer or mobile device. Web base only.	Web-based
12	Ability to set a charge-power limit to reduce energy charges while also maximizing bus availability	Yes. Pause or curtail charging sessions during peak energy costs. Optimized charging during off-peak or vehicle dwell times to achieve target SOC by defined roll-out times.	Yes, customizable application that allows the user to create and manipulate charging parameters as needs or schedules change.	Yes
13	Ability to set charging to minimize demand charges while also maximizing bus availability	Demand (kW) management and reduction to achieve roll-out but will spread out charging. Sequential, dynamics, and parallel charging capable	Yes, customizable application that allows the user to create and manipulate charging parameters as needs or schedules change.	Yes
14	Ability to recognize bus stall and bus numbers and evaluate charge needs by block and state of charge (i.e., park management)	Yes	Yes	Yes
15	Manual override (computer/HMI input) for selection of (bus) charging sequence	Yes. A manual override button located within the UI accessible by a specific user is creditable. Override can also be performed by email, phone call, or ticket request.	Yes, users can manually prioritize groups of chargers or single chargers in order to meet the demand as needed.	Yes
16	Describe desktop output/reports for charge telematics	• Energy Report - net (panel) load, modeled load (assuming no CMS),	• Uptime, Downtime, and Offline chargers (in hours, percentage, and total for a group)	No response

Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
		aggregate and individual charger load • Charge Detail Records - plug-in and session start & stop times, session duration, session energy, vehicle start & end soc, vehicle ID • Health Records - % normal, faulted, offline, and uptime for EVSEs, controllers, system & software components • Vehicle Logs - Geo location and SOC information • Charge Ready Transport - CRT formatted report for PG&E, SCE, and other Utilities Fleet Ready Programs	• Energy Reports (in kWh and hours of duration) • Complete list of charging transactions (equipped with the data previously stated) • Complete list of user logs and documentation of user interactions.	
17	Is there a local controller to preserve the same control functionality in case cloud connectivity fails (e.g., WIFI outage)?	Yes, AMPLY Site Controller (ASC) is installed at the electrical main and is connected to the breaker. CTs will meter 3- phases of power for real-time demand management. ASC can be hardwired to each EVSE via CAT6 to send OCPP directly to the charger. If CMS cellular connection is temporarily down, ASC has programmed commands to continue charging until a cellular connection is restored.	Two signals are sent with all communications to the charger, the set parameter, and a failsafe value. If the connection is disrupted for any reason or duration of time, the charger will revert to the failsafe value until connectivity is reestablished.	Yes

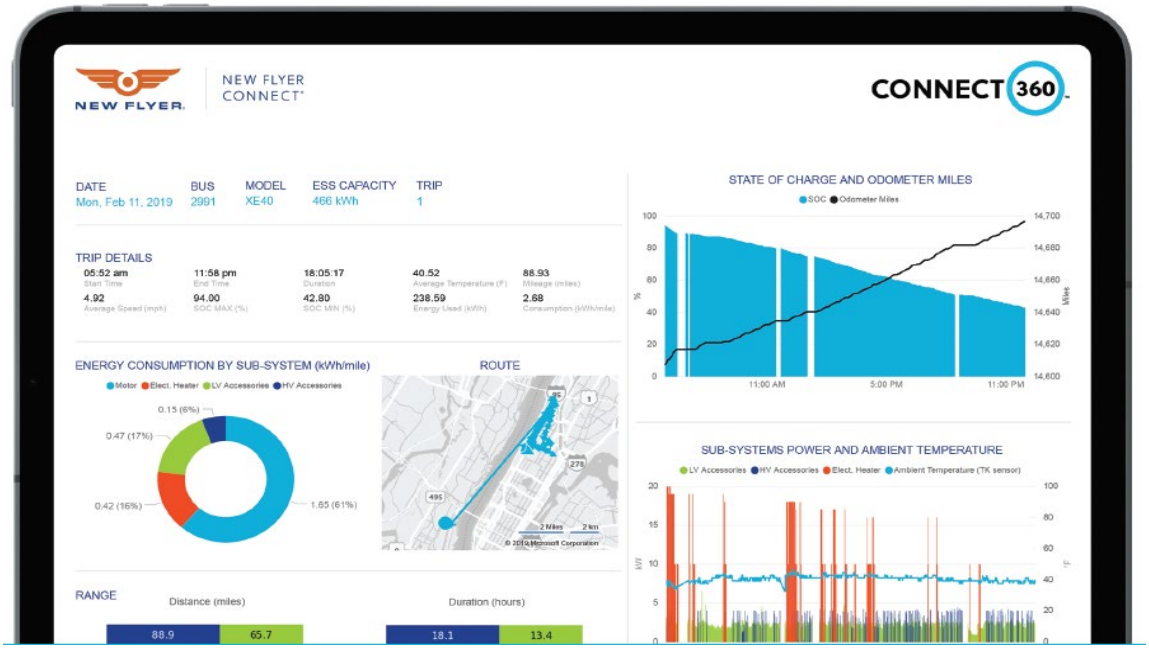
Item No.	Criteria Description	Amply Power - OMEGA	Viriciti - Agnostic Management Platform	ChargePoint - CMS
18	Other features criteria, or comments	OMEGA supports algorithmic optimization across a wide set of use cases in addition to TOU energy management including load management, tariff-based optimization across usage, demand and subscription charges, factoring in unmanaged loads, and demand response signals from OpenADR and other providers. It also offers flexible alerting and notifications for EVSE faults and other conditions.	• Provided system built to scale. If charging needs to change or if a new OEM is desired, the system is able to monitor any charging infrastructure (assuming that charger OEM is OCPP compliant) and easily exchange chargers in the system. • Through an API, there is the ability to integrate with other planning or ITCMS platforms to optimize planning. • Other features may include our agnostic telematics system, which is capable of monitoring any vehicle OEM and operates off the same platform as the charger monitoring infrastructure - decreasing operational complexity by reducing software applications and increasing visibility into energy usage/expenditure.	No response

8.5.2.2 *Fleet Tracking Software*

Software like Fleetwatch provides agencies with the ability to track vehicle mileage, work orders, fleet maintenance, consumables, and other items. However, with more complex technologies like BEBs, it becomes crucial to monitor elements such as the status of batteries, and energy consumption on a bus in order to track its performance and understand how to improve fuel efficiency. Many OEMs offer fleet tracking software. While AVLs and APCs will continue to play important roles in operations planning, the tracking of fuel consumption and fuel economy will start to form important key performance metrics for fleet management as well as help inform operations planning.

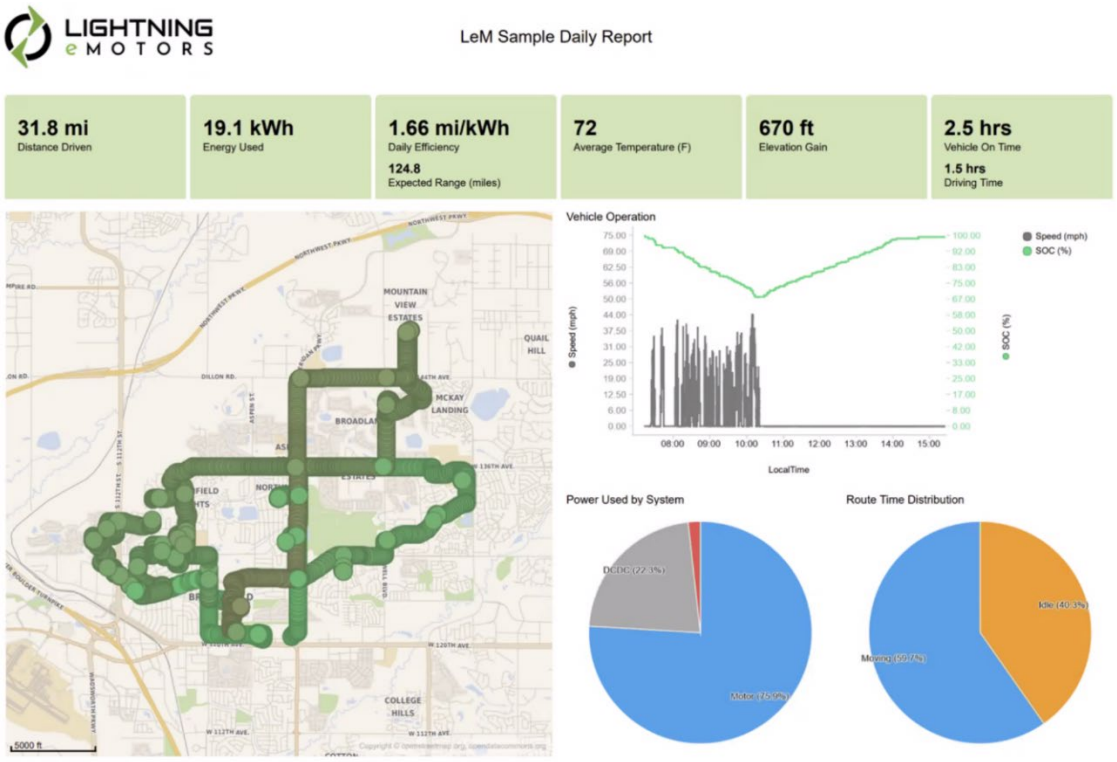
The screenshot below is an example of New Flyer's tool (New Flyer Connect 360, Figure 8-17 and Lightning eMotors, Figure 8-18), but other OEMs also offer similar tools (like ViriCiti) depending on an agency's preference.

Figure 8-17: Example of New Flyer Connect 360 [198]



[198] https://www.newflyer.com/tools/new-flyer-connect/

Figure 8-18: Example of Lightning eMotors daily summary report



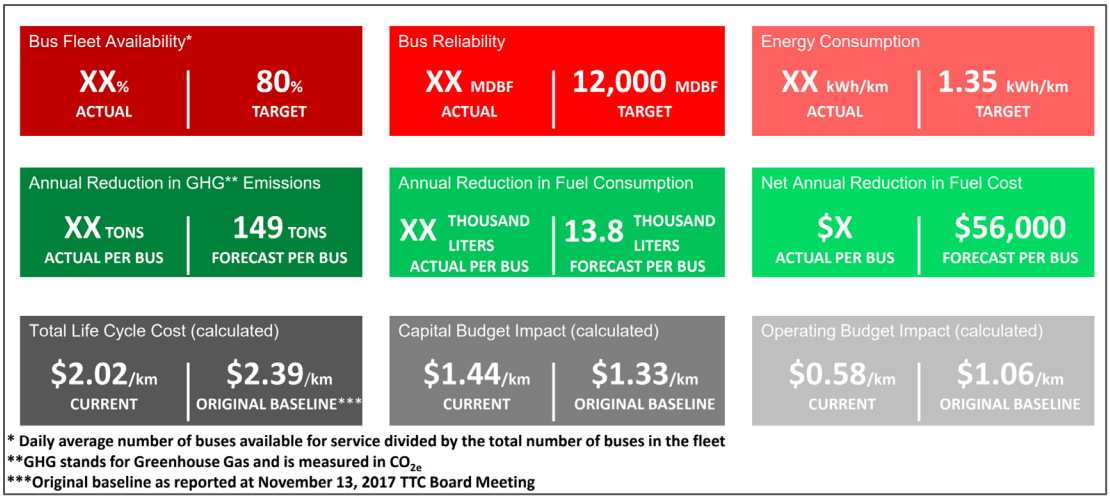
At a minimum, the fleet tracking software should track a vehicle's SOC, energy consumption, distance traveled, and hours online. Tracking these key performance indicators (KPIs) can help compare a vehicle's performance on different routes, under different ambient conditions, and even by different operators.

When looking at other transit agencies, AVTA operates a nearly 100% BEB fleet of over 50 vehicles; they collect and report the following information at monthly board meetings:

- ZEB vs. non-ZEB miles traveled
- ZEB vs. non-ZEB maintenance cost per mile
- ZEB vs. non-ZEB fuel/energy costs by month ($ per kWh vs. $ per gallon)
- ZEB vs. non-ZEB fuel/energy cost per mile
- Average fuel consumption/fuel economy per month
- Total ZEB vs. non-ZEB fuel and maintenance costs per month
- The mean distance between failures
- ZEB vs. non-ZEB fleet availability

The Toronto Transit Commission (TTC) is currently testing BEBs from three different OEMs and is tracking the following KPIs for its BEBs to compare with its ICE buses (Figure 8-19).

Figure 8-19: Example of TTC eBus KPIs. [199]



All BEB equipment should be connected to BCT's current data collection software, networks, and integrated with any existing data collection architecture. All data should be transmitted across secure VPN technology and encrypted.

Beyond the BEB itself, charger data should be collected as well, such as the percentage of battery charge status and kWh rate of charge. Furthermore, it will be important for BCT to track utility usage data from SCE to understand energy and power demand and costs.

8.5.3 Workforce Considerations

The deployment of a new propulsion technology will require new training regimes for operators and maintenance staff. This section describes some key training considerations as well as the implications of the adoption of BEBs.

8.5.3.1 Training

BEB manufacturers have basic training modules for bus operators and maintenance technicians that are typically included in the purchase price of the vehicle, with additional training modules and programs available for purchase. It will be important for BCT maintenance leadership to work with staff and the maintenance technician union to understand how best to approach training for BEBs, and whether in addition to basic training from OEMs, further training is needed.

The recommendations for minimum required training for operators and maintenance technicians are as follows:

199 https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2018/June_12/Reports/27_Green_Bus_Technology_Plan_Update.pdf

- BEB operator training (total 56 hours)
    - Operator drive training (four sessions, four hours each)
    - Operator vehicle/system orientation (20 sessions, two hours each)

- BEB Maintenance technician training (total 304 hours)
    - Preventative maintenance training (four sessions, eight hours each)
    - Electrical/electronic training (six sessions, eight hours each)
    - Multiplex training (four sessions, each session consisting of three eight-hour days)
    - HVAC training (four sessions, four hours each)
    - Brake training (four sessions, four hours each)
    - Energy Storage System (ESS), lithium-ion battery, and energy management hardware and software training (six sessions, eight hours each)
    - Electric drive/transmission training (six sessions, eight hours each)

Acquiring the following tools and safety materials should be a top priority to ensure successful in-house ZEB maintenance and management.

- Operational training module
- High voltage interface box
- Virtual training module
- High-voltage insulated tools
- Insulated PPE
- Electrical safety hooks
- Arc flash clothing

Table 8-10 below provides a framework of potential training methods and strategies to bolster BCT's workforce development and successfully transition to a 100% ZEB fleet.

Table 8-10: Potential Training Methods

Plan	Description
Train-the-trainer	Small numbers of staff are trained and subsequently train colleagues. This maintains institutional knowledge while reducing the need for external training.
Bus vendor training and fueling vendor	OEM training provides critical, equipment-specific operations and maintenance information. Prior to implementing ZEB technology, BCT staff will work with the OEMs to ensure all employees complete the necessary training.
Retraining & refresher training	Entry-level, intermediate, and advanced continuous learning opportunities will be offered to all BCT staff.
California Transit Training Consortium (CTTC)	CTTC offers transit maintenance workforce development courses for transit agency staff.
ZEB training from other transit agencies	BCT should leverage the experience of agencies that were early ZEB adopters, such as the ZEB University program offered by AC Transit.
National Transit Institute (NTI) training	NTI offers zero-emissions courses such as ZEB management and benchmarking and performance.
Local partnerships and collaborations	BCT could work with local schools to showcase potential careers in bus and facilities management to students.

Plan	Description
Professional associations	Associations such as the Zero Emission Bus Resource Alliance offer opportunities for sharing and lessons learned across transit agencies.

The priority in maintenance needs will be the issue of safety in dealing with high-voltage systems. All maintenance personnel in the garage, whether performing servicing, inspection, or repairs or those in other routines (e.g., plugging and unplugging BEBs) must be educated on the characteristics of this technology. One essential component is the provision and mandate of additional personal protective equipment (PPE) beyond that which is required by automotive garage workplace legislated standards or BCT's policies. Examples of such apparel include high voltage insulated work gloves, flame retardant clothing, insulated safety footwear, face shields, special insulated hand tools, plus grounding of apparatus that staff may be using. Also, procedures in dealing with accidents and injuries must be established with instructions and warning signs posted.

Current BEBs also contain on-board communication systems, which are helpful in providing detailed bus performance data and report error messages, which can assist maintenance personnel in quickly identifying and diagnosing maintenance issues.

Beyond training related to the operations of the BEB and depot chargers, training will be required for the operators to properly execute on-route charging. This would include training on properly aligning the bus under the pantograph, deploying the charger, and ensuring charging is efficient. The allowable margin of error for bus-charger alignment is small, and improper alignment will result in a missed charge. Maintenance technicians will also need training on repairing and servicing pantograph chargers.

Finally, it is highly recommended that all local fire and emergency response departments be given training as to the layout, componentry, safety devices, and other features of BEBs. This should reoccur every few years, but the specific frequency can be dependent on agency discretion. In addition, agency-wide orientation to familiarize the agency staff with the new technology should also be conducted prior to the deployment of the first BEBs.

8.5.3.2 Implications of BEBs on Workforce

As previously mentioned, early information suggests that BEBs may require less preventative maintenance than their CNG counterparts since they have fewer moving parts. However, BEBs are so new and there are so few in service that there is not enough data to provide detailed insights into long-term maintenance practices for large-scale BEB deployments in North America.

Because BEBs have fewer moving components that can malfunction and require replacement, repair, and general maintenance, transit agencies could theoretically save on maintenance costs because: 1) fewer parts could break and need replacement (capital) and 2) less labor is needed to maintain the vehicles (operating). From the workforce side, there are broader concerns about possible staff reductions. A lower level of maintenance could lead to a possible reduction in the number of maintenance staff required to maintain an all-BEB fleet vs. a traditional ICE fleet.

Nonetheless, while a future 100% fleet of BEBs may require a smaller complement of maintenance staff, during the transition period, it is highly improbable that a reduction in staff would be warranted. First, CNG technicians would be required until the last CNG bus is retired; based on the transition schedules explored in this report, the earliest time point would be 2039. Second, existing staff can be trained on BEBs to maximize staff retention. As BEB pilots have demonstrated, the learning curve for maintenance as well as the continuing maturity of the technology means that a robust maintenance program is still needed. Indeed, preventative maintenance is still required for a BEB fleet, and experience from a pilot of BEBs revealed comparable labor hours required for work orders across fleets of BEBs, and ICE buses.

Looking further into the future, it is challenging to predict staffing levels for BEBs. As technology matures and becomes more sophisticated, technicians will need to be trained not only on machinery but also on components that require computer and diagnostic skills.

If realized, one potential strategy to manage lower workforce needs is through natural attrition tied to BCT's implementation schedule for transitioning to ZEBs.

8.5.4 Providing Service in Disadvantaged Communities

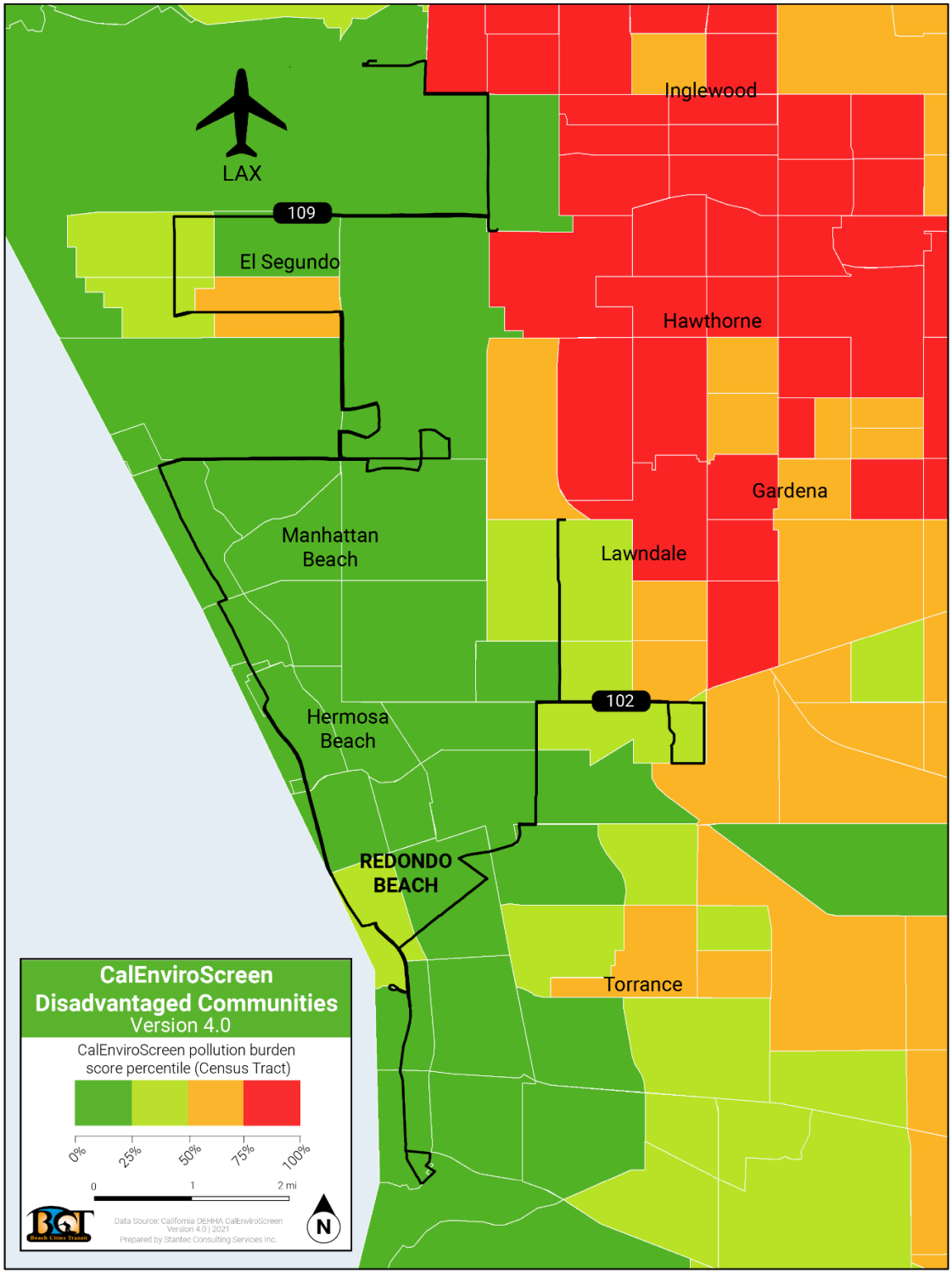
CARB defines Section F of the rollout plan as "Providing Service in Disadvantaged Communities" based on disadvantaged communities as identified by CalEnviroScreen, an online mapping tool developed by the Office of Environmental Health Hazard Assessment (OEHHA). The tool identifies (at the census tract level) the state's most pollution-burdened and vulnerable communities based on geographic, socioeconomic, public health, and environmental hazard criteria.

ICT provisions require that transit agencies describe how they are planning to deploy ZEBs in disadvantaged communities by outlining the location of the disadvantaged community (census tract) where the ZEB will be deployed, how many ZEBs, and in what year the ZEBs will be deployed.

In addition, identifying disadvantaged communities is beneficial to transit agencies when applying for different funding sources, specifically sources that can help BCT fund their ZEB transition. Some funding sources (such as the Transit and Intercity Rail Capital Program, and Low Carbon Transit Operations Program) have requirements to identify disadvantaged communities under CalEnviroScreen criteria as part of the application or have special funding reserved for specific projects within disadvantaged communities. More information can be found in Section 11.5, Potential Funding Sources.

Figure 8-20 shows that overall, the pollution burden in the Beach Cities is low, and the pollution burden worsens as you move further inland. Line 109 touches two census tracts in the Inglewood/Hawthorne area that are defined as disadvantaged. While not on the map, the proposed future Manhattan Beach Blvd service does not traverse any disadvantaged communities. Based on this information, BCT can make the largest positive impact with their ZEB transition by prioritizing ZEB deployment along Line 109.

Figure 8-20: CalEnviroScreen Disadvantaged Communities (2021) [200]



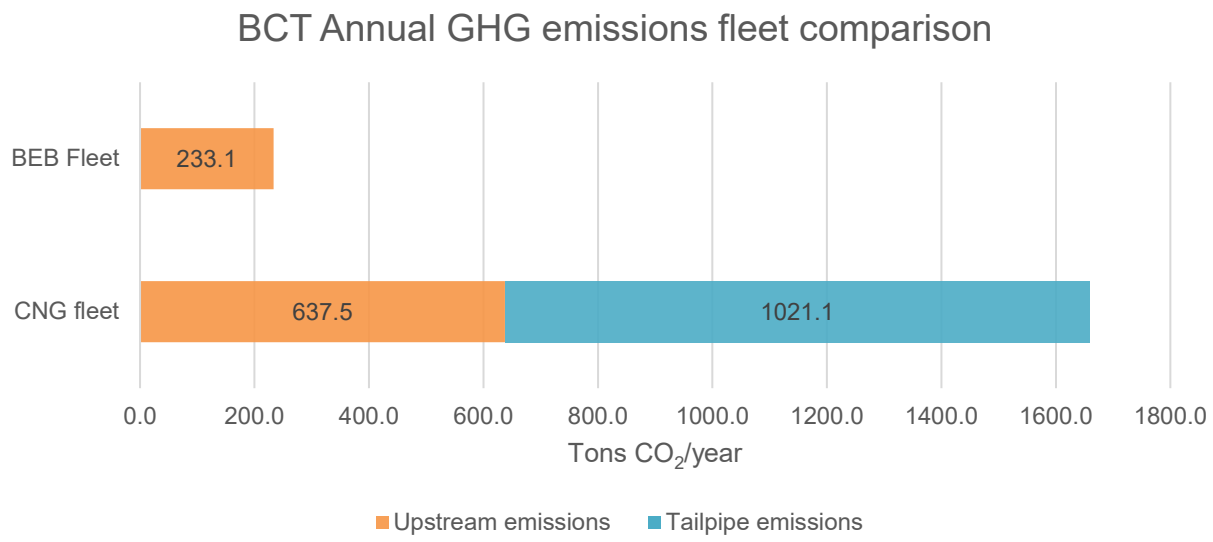
8.5.5 GHG Impacts

Based on the ZEBDecide modeling of GHGs, BCT's CNG fleet emits 1,658.6 tons of GHGs in a year. [201] In contrast, the future BEB fleet will only emit 218.8 tons annually; while tailpipe emissions of BEBs are nil, residual GHGs result from the carbon intensity of the electric grid. As modeled, a complete BEB fleet can reduce BCT's GHG footprint by 1,413 tons annually, or by 87%. Table 8-11 shows the annual emissions of the fleet as well as a breakdown of annual emissions per vehicle and Figure 8-21 presents a comparison of annual emissions between the two fleets.

Table 8-11: Annual Emission in Tons of CO_2 per year for BFT's Fleet by Service Type

	CNG Fleet	BEB Fleet
Fleet tailpipe emissions (ton CO_2/year)	1,021.1	-
Upstream emissions (ton CO_2/year)	637.5	218.8
Total Ton CO_2/year	**1,658.6**	**218.8**

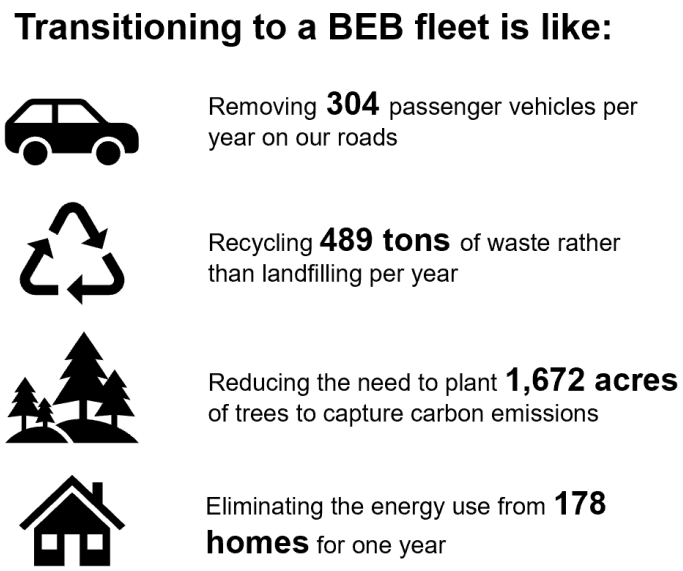
Figure 8-21: Annual Emissions Comparison



Using the EPA GHG equivalent calculator [202], we used the annual emissions that will be displaced by the BEB fleet to create relative comparisons to the benefits. As presented in Figure 8-22, implementing a BEB fleet will eliminate emissions equivalent to removing 304 passenger vehicles per year or reducing the need to plant 1,672 acres of trees to capture carbon emissions.

[200] Data source: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40
[201] All GHG calculations are presented in tons (not metric tons) of CO_2 equivalent, which is calculated using the short-term 20-year global warming potential of CO_2, methane, black carbon, and particulate matter.
[202] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Figure 8-22: Equivalent Benefits of Implementing a BEB Fleet at BCT



8.5.6 Procurement Guidance

Currently, BCT operates a fleet of buses, cutaways, and vans, and this same fleet composition will be carried over through the ZEB transition, with some minor changes. BEB options for vans, cutaways, and smaller buses (those less than 40 ft in length) are more limited, and by extension, procurement options are more limited as well.

For 30-ft to 35-ft heavy-duty transit bus options, Gillig manufactures a 30-ft and 35-ft model equipped with a 444-kWh battery. Other well-known OEMs such as New Flyer and Proterra produce vehicles in 35-ft configuration with 490-525 kWh batteries. Finally, BYD, ElDorado National, and GreenPower also produce BEBs in 35-ft configurations with a variety of battery sizes. Table 8-12 below provides an overview of some 30-35-ft BEBs. The New Flyer and Proterra vehicles are on the state's Department of General Services master contract for vehicles that BCT can purchase without having to develop specifications or go out for bid.

For heavy-duty buses, BCT should specify two rear-mounted charging ports accepting a minimum charging rate of 60 kW (200 ADC) at 480 VDC or greater via SAE J1772 to maximize flexibility when parking and charging the vehicles, as well as SAE J3105-compliant charge bars on the roof of the buses, to enable fast overhead pantograph charging.

These vehicles are summarized in Table 8-12.

Table 8-12: Summary of Heavy-Duty Vehicle Options

Make and model	Battery size (kWh)	Notes	Example Vehicle Photos
BYD K7M-ER K8M	266 (30-ft) 352 (35-ft)	Eligible for a $120,000 HVIP voucher. Supports DC and AC charging, and on-route charging. Available in 30-ft and 35-ft.	
Gillig Low Floor BEB	444	Eligible for a $120,000 HVIP voucher. Available in 30-ft and 35-ft.	
El Dorado (ENC) Axess EVO-BE	492 (32-ft) 738 (35-ft)	Available in 32-ft and 35-ft models. Enabled for on-route charging.	
New Flyer Xcelsior CHARGE NG	435	Eligible for a $120,000 HVIP voucher. Available in 35-ft. Enabled for on-route charging.	
Arboc Specialty Vehicles Equess CHARGE	350 (30-ft) 437 (35-ft)	Available in 30-ft and 35-ft models. Plug-in capabilities only.	

Make and model	Battery size (kWh)	Notes	Example Vehicle Photos
Proterra ZX5	492	Eligible for a $120,000 HVIP voucher. Available in 35-ft. Optional on-route charging capability.	

Current options for cutaways are more limited, but there is a clear and growing need for more ZE cutaways with larger batteries and longer ranges as more agencies that operate demand-response services and these vehicle types begin to transition to ZE. Currently, two BE cutaways are on the market but neither have yet been Altoona-tested. It is assumed that, due to the growing number of ZE cutaways on the market in the past few years, options will continue to emerge and improve, such as through larger batteries with longer ranges as well as improved battery and fuel efficiency.

The Lightning Systems E450 Shuttle Bus has a 129-kWh battery with a range of up to 120 miles. The vehicle is eligible for a $60,000 incentive per vehicle under the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) [203]. Another cutaway available for a $60,000 HVIP voucher is the GreenPower EV Star+ with a battery size of 118 kWh and a stated range of up to 150 miles [204]. Finally, the Optimal-EV S1LF is a low-floor cutaway with a 113-kWh battery and a 125-mile range. The vehicle utilizes Proterra's battery management system.

Currently, only the GreenPower EV Star+ is listed in the CalACT/MBTA Purchasing Cooperative, but as more agencies begin to purchase BEBs, it is expected that more vehicles will be added. BCT should specify two rear-mounted charging ports accepting a minimum charging rate of 60 kW (200 ADC) at 480 VDC or greater via SAE J1772 to maximize flexibility when parking and charging the vehicles.

As part of the fleet modeling and optimization process, it was also determined that BCT will transition to a mixed fleet of vans and cutaways for the WAVE service (specifically to achieve a mix of more vans and fewer cutaways than the current mix), to help right-size the fleet to demand. BE van options include the Ford eTransit van, which can be outfitted to accommodate six ambulatory passengers with one wheelchair position, four ambulatory passengers with two wheelchair positions, or three ambulatory passengers with three wheelchair positions. There is also the GreenPower EV Star passenger van, which can seat up to 19 ambulatory passengers or nine ambulatory passengers with two wheelchair positions. As with cutaways, it is assumed that more BE van options will be available in the future.

Some example vehicles are summarized in Table 8-13, but these are only illustrative examples. BCT should participate in a competitive tendering process for its fleet procurement and use programs like the CalACT/MBTA Purchasing Cooperative, and State Department of General Services (DGS), or participate in joint procurements with other transit agencies, to streamline procurement. BCT should also leverage APTA's Standard Bus Procurement Request for Proposal which contains language about charger

[203] https://californiahvip.org/vehicles/lightning-systems-lev110e-bus-ford-e-450-with-lightning-powertrain/
[204] https://californiahvip.org/vehicles/greenpower-ev-star-plus/

specifications, data logging and telematics, and other information that would be useful to include for vehicle and charger procurements [205].

Table 8-13: Summary of Medium-Duty Vehicle Options

Vehicle type	ZEB type	Make and model	Battery size (kWh)	Range (miles)	Notes	Example Vehicle Photos
Cutaway	BE	Lightning Systems E450 Shuttle Bus	129	120	Eligible for a $60,000 HVIP voucher. Supports both Level 2 and DC fast chargers.	
	BE	GreenPower EV Star+	118	150	Eligible for a $60,000 HVIP voucher. Supports both Level 2 and DC fast chargers.	
	BE	Optimal-EV S1LF	113	125	A low-floor vehicle with an ADA-compliant entry ramp. Uses Proterra battery management systems. Supports both Level 2 and DC fast chargers.	
Passenger Van	BE	Lightning Systems Electric Zero Emission Transit Passenger Van	80-120	140-170	Eligible for a $45,000 HVIP voucher. Low-floor vehicle and CARB certified. Uses Proterra battery management systems. Supports both Level 2 and DC fast chargers.	

[205] https://www.apta.com/research-technical-resources/standards/procurement/apta-bts-bpg-gl-001-13/

Vehicle type	ZEB type	Make and model	Battery size (kWh)	Range (miles)	Notes	Example Vehicle Photos
Passenger Van	BE	GreenPower EV Star Battery Electric Bus	118	150	Eligible for a $60,000 HVIP voucher. Supports both Level 2 and DC fast chargers.	

8.5.7 Battery Degradation

Battery degradation is unavoidable due to battery use and charging/recharging cycles. To some extent, the magnitude and rate of degradation can be controlled by the user.

Following the recommendations of the manufacturer becomes especially important to preserve the battery life. This includes charging the battery to a maximum of 90% SOC and not allowing the battery to dip below 10% SOC. Furthermore, avoiding fast charging (below 300 kW) can help extend the lifespan of the batteries.

Nevertheless, natural battery degradation will always occur, and vehicle manufacturers are offering extended warranties in their purchase agreements to account for battery degradation of 20% of its nameplate capacity. Battery replacements for cutaways and passenger vans are also assumed to be available but might not be necessary to go beyond the warranty given the shorter utilization cycle of these vehicles. Actual experience may differ, and BCT will need to work with its vendors to understand warranty terms. For the heavy-duty buses that are in service for longer lifetimes, the assumption is that at least one battery replacement near the midlife would be needed, and as such, BCT should purchase an extended warranty to cover that replacement. Any further battery replacements would be post-warranty expenses.

8.5.8 Other Considerations

Finally, because a ZEB transition and implementation is an agency-wide endeavor that also includes the need to actively consider utilities as a stakeholder and partner, an agency-wide approach is required. Clearly, any discussions around changes associated with BEBs will need to include the union representing the bus operators and maintenance technicians due to the large role they will play in the success of the ZEB transition and implementation. Overall, a successful strategy for BCT could be to form a steering committee or task force composed of staff from each major functional department and union representation to help ensure the impact of ZEBs is fully considered for each. Having the task force name a leader who acts as a champion for the ZEB conversion within the agency and to external stakeholders is another good idea. External communication will be critical during the transition to ensure customers are made aware of changes to bus operations. ZEB conversion also offers an excellent marketing opportunity for BCT to promote its climate commitments.

9 INFRASTRUCTURE PLANNING

9.1 Infrastructure Needs

This section provides an overview of the high-level space needs program, conceptual site master plan, and ZEB infrastructure needed for the 23-vehicle fleet as well as the new OMF. A detailed space needs program will be required in order to proceed with an actual design for a new facility. This scope can be provided either during or after the environmental review processes (California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA)) but is highly recommended to be completed prior to finalizing a detailed master plan for the new facility which may ultimately impact the environmental analysis, requiring an amendment to one or both of the CEQA and NEPA reporting.

9.1.1 Operations and Maintenance Facility

9.1.1.1 Space Needs Program

As previously noted, the existing operations and maintenance building and bus parking area is too small and in need of replacement to sustain the agency's operation. The primary difference between the existing and the proposed facilities is the new facility would be purpose-built for transit operations and maintenance functions – accommodating proper building systems, working clearance, and safe/efficient workspaces for all staff. The new facility would also include the administration department which is currently housed offsite from the OMF. As evident in Table 9-1 below, the current facility at about 6,000 sq. ft. is undersized for the current operations. A new facility where all functions can be housed at a single facility will improve collaboration and efficiencies for BCT's operations. Refer to Appendix C: Space Needs Program for further information on the individual spaces and their functions.

Table 9-1: Proposed Building Areas

Department	Proposed Areas	Notes
Maintenance	7,626	Three maintenance bays, shops, storage, etc.
Operations	1,698	Ops offices, dispatch suites, operator lockers, etc.
Administration	2,116	Offices, workstations, conference rooms, etc.
Wash Bays	1,440	Manual wash bay
Shared Spaces	2,460	Restrooms, lockers, break room, training room, etc.
Building Utilities	924	Electrical, mechanical, IT, custodial rooms
Total:	**16,264**	**Values are in square feet unless noted otherwise.*

To reduce the overall impact on the existing park-and-ride lot, the OMF is proposed to be a two-story building to reduce the overall footprint of the facility. However, this is a more expensive solution due to the nature of the building being more complicated and requiring stairs and an elevator. BCT and the City of Redondo Beach (City) may wish to consider the pros and cons of this approach for the future design phases for the facility.

Table 9-2 outlines the various parking needs for revenue, non-revenue, and employee vehicles. These areas equate to the largest program areas for any transit operations and maintenance facility as illustrated in Table 9-3 below. Since space is a significant premium at the BCT OMF location, employee parking is proposed as being 'outside the fence' of the facility as a part of the park-and-ride lot.

The fleet quantities are based on the projections in Section 8.2, Table 8-7, but the non-revenue and employee parking quantities are based on general rule-of-thumb estimates for similar-sized operations. Future detailed space needs programming should consider shift overlaps, peak visitor demands, and general staffing projections to right-size the future parking needs at a new facility.

Table 9-2: Proposed Parking Sizes and Quantities

Vehicle Type	Space Standard	Quantity	Notes
30' Fixed-Route Bus	14' x 35'	15	Revenue fleet = 23 vehicles [206]
Cutaway Bus	14' x 30'	3	
Passenger Van	10' x 20'	5	
Non-Revenue	10' x 20'	3	Parking for relief vehicles, maintenance trucks, etc.
Employee Parking	9' x 18'	56	Includes visitor, accessible, and employee electric vehicle spaces

Table 9-3 summarizes the potential site area needs for a new bus operations and maintenance facility for BCT's projected fleet and assumed space needs. The existing facility, at 35,700 sq. ft., is only about 75% of the projected needed size of the new facility of 45,700 sq. ft. This number could vary depending on specific site conditions, construction budgets, preference on building setbacks, and desire for the potential for additional growth beyond the horizon of this study. Regardless, the need for additional space is clear based on this discrepancy between the existing site and the future needs of the agency.

Table 9-3: Proposed Site Areas

Area	Proposed Area	Notes
Buildings Total	16,264	Table 9-1 above
Fleet & Non-Revenue Vehicle Parking	16,555	Summation of parking quantity in Table 9-2. Parking areas plus 50% grossing factor for circulation aisles, etc.
Employee Parking	16,695	Summation of parking quantity in Table 9-2. Parking areas plus 50% grossing factor for circulation aisles, etc.
Misc. Exterior Spaces	4,135	The estimated area includes space for future expansion.
Grand Total:	**~ 54,000**	**= ~ 1.23 acres**
		Values are in square feet unless noted otherwise.

The proposed site area size should be considered as an approximation for a new facility of the programmatic requirements noted herein. Various design options may result in slightly different outcomes for the final space needs and facility size. Planning for future growth beyond the horizon of this study should also be carefully considered so the agency is not short on space for another 15 to 20 years without any opportunity for expansion.

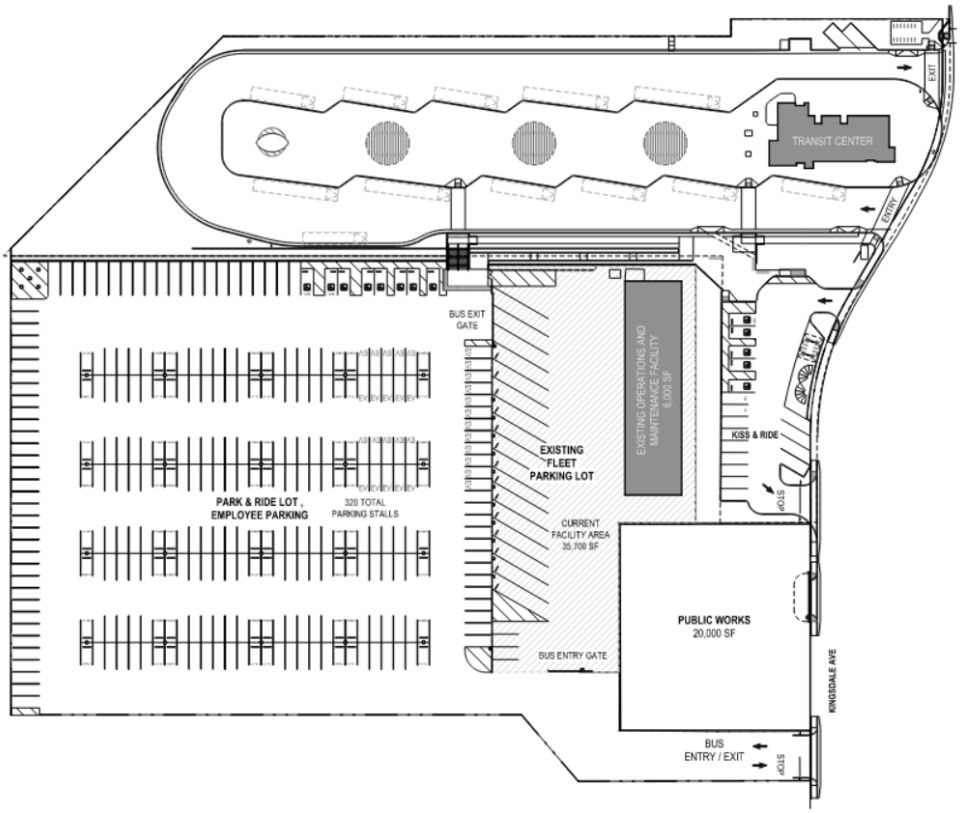
[206] Total revenue fleet of 23 reflects the increase in fleet size from 20 to 23 due to the recommended service plan and ZEB preferred fleet composition.

9.1.1.2 *Conceptual Master Plan Layout of New Facility*

One of the first steps in establishing a viable property is to evaluate the zoning of the parcel(s) proposed for a new facility. The property is zoned I-1: Industrial. Fortunately, the existing facility and property are already in a zone suitable for use as a vehicle maintenance facility and a conditional use permit or other administrative process should not be required for the permitting of the new facility.

The area of the property where the new OMF is proposed is an open parking lot in the southwest corner (see Figure 9-1 below) with little to no existing infrastructure to displace. There do not appear to be any underground or above-ground utilities in this area and this portion of the site should be relatively simple to construct a new facility within.

Figure 9-1: Existing Conditions Site Plan for Transit Center & Existing Operations & Maintenance Facility

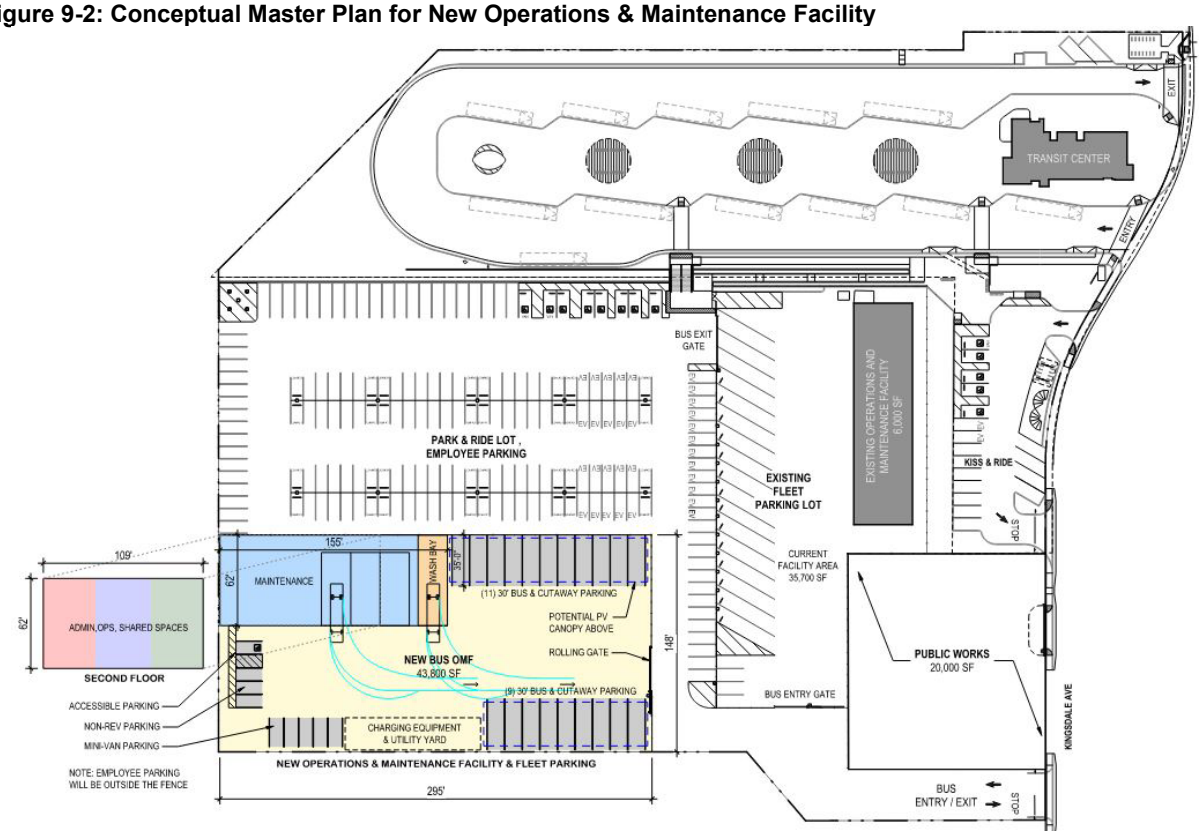


However, it is not within the scope of this study to provide a detailed site assessment of the existing conditions so a detailed site survey and existing condition investigation should be provided prior to the detailed design of the new facility. The proposed conceptual site plan in Figure 9-2 considers the use of the southwest corner of the park-and-ride lot for several reasons:

- To allow for simple phasing of construction of the new facility while the existing facility and park-and-ride lot are in use during the entire duration of construction.
- The proposed approach moves the industrial nature of the bus facility away from the public street.
- The location reduces the potential for unforeseen conditions within the existing site since the proposed area appears to not have any negative existing conditions.

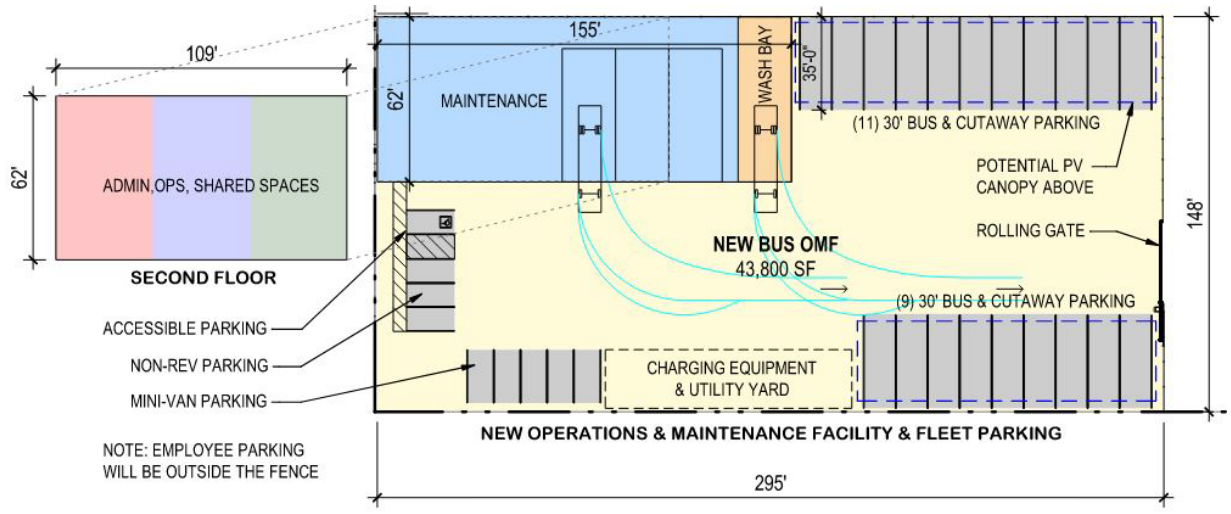
- The location allows for potential future phasing of a parking structure to the north of the OMF and adjacent to the transit center for park-and-rider users.
- This location will keep the bus facility and bus traffic as close as possible to the entry/exit drive without preventing park-and-ride vehicle access through the site.

Figure 9-2: Conceptual Master Plan for New Operations & Maintenance Facility



The conceptual site plan in Figure 9-2 is for illustrative purposes only and is one of many approaches to implementing a new bus facility at the specified property. This particular layout utilizes approximately 43,800 sq. ft. (about one acre), less than the programmed site area of about 54,000 sq. ft. recommended in Table 9-3 above largely because the facility is proposed as a two-level building.

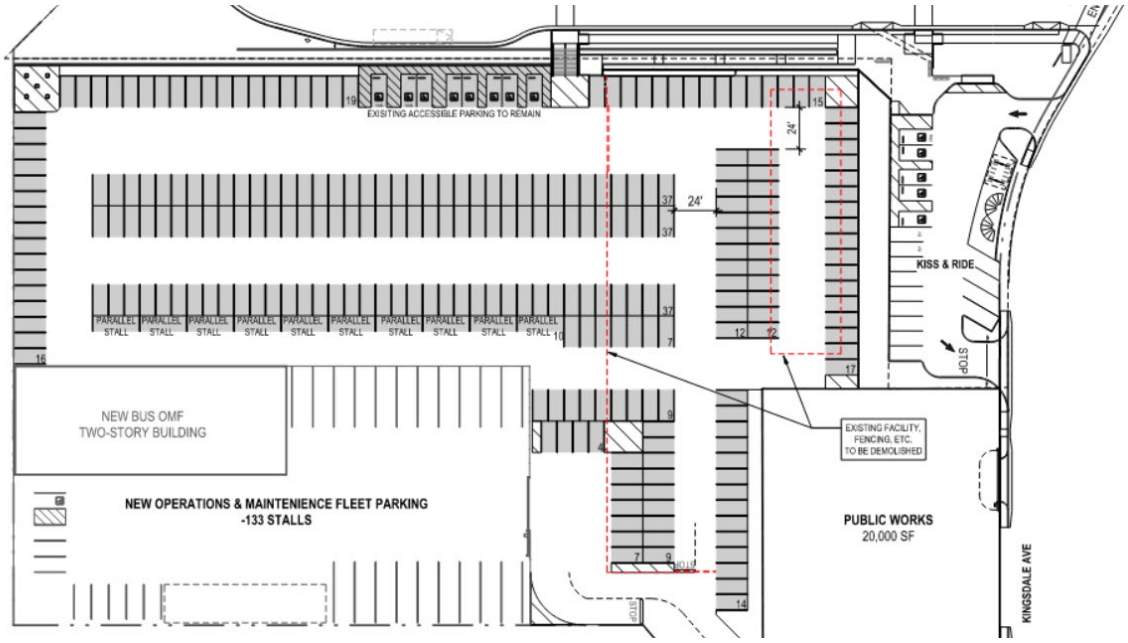
Figure 9-3: Enlarged Plan for New Operations & Maintenance Facility



The proposed layout considers employee parking to be outside the actual OMF boundary. The fenced-in OMF will contain parking for the transit fleet, non-revenue vehicles, and accessible employee/visitor spaces. Adequate space is allocated for the vehicle charging equipment and the associated electrical infrastructure that would also be required. This equipment would include charging cabinets, switchgear, transformer, backup generator, and/or battery-energy storage system. The master plan also considers the potential for photovoltaic solar canopies over the bus parking to aid in offsetting demand from the electrical grid. As previously noted, the building is proposed to be two floors to reduce the overall impact on the site. The administration, operations, and shared spaces would be on the second floor over about two-thirds of the ground floor maintenance level.

In order to maximize the parking capacity of the park-and-ride lot and following the demolition of the existing bus facility, the parking lot could be reconfigured and restriped per Figure 9-4 below. The existing lot accommodates 320 total parking spaces. The new OMF would remove about 133 spaces, but the removal of the existing OMF would allow for about 83 new parking spaces. The final net parking total would be about 270 spaces, a reduction of about 50 spaces from the current condition. For a 270-space parking lot, eight accessible spaces are needed with one of which being van accessible, 54 spaces would need to be clean-air/EV capable with 14 of those with electric vehicle charging stations per CalGreen table 5.106.5.3.1.

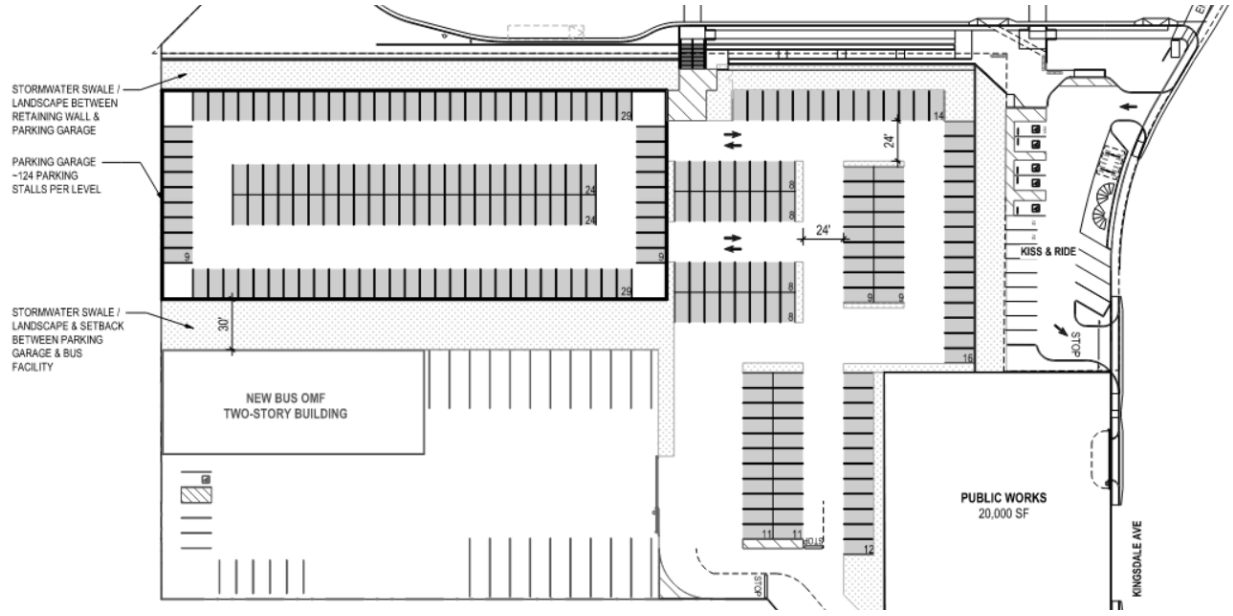
Figure 9-4: Enlarged Plan of Potential Park-and-Ride Lot Modifications



In order to offset the reduction in the park-and-ride lot capacity due to the new OMF, a new parking structure could be constructed on a portion of the lot. Figure 9-5 below illustrates the potential footprint of a continuous ramp parking structure that could accommodate about 124 spaces per above-grade-level and about 100 spaces at grade. The remainder of the surface parking lot would allow for about 114 spaces. Therefore, in order to get the total parking capacity back to the current 320 total spaces, the parking structure would need to be one full level above grade (100 + 124 + 114 = 338 spaces). For additional levels of parking, 124 spaces can be added for each level. Therefore, a three-level structure would provide about 462 spaces and a four-level structure would provide about 586 spaces (number of levels includes ground level).

When constructing a parking structure at the property, the City may wish to consider additional improvements to the park-and-ride lot. For illustrative purposes, landscape islands and stormwater swales are shown in Figure 9-5 to account for the potential space this could require.

Figure 9-5: Enlarged Plan of Potential New Park-and-Ride Parking Structure



A detailed space needs programming and a final master planning phase is highly recommended to develop the specific requirements of a new facility for BCT and to explore all potential options for utilization of any property prior to proceeding with environmental studies or detailed design. See further discussion on this topic in Section 9.2.

Full-size site plans of the above Figures are included in Appendix D: Site Plans.

9.1.2 ZEB Infrastructure & Bus Yard

This section outlines the proposed facility modifications for BEB implementation at BCT's bus operations and maintenance facility. The master plan concept has been developed proposing ground-mounted dispensers. There is sufficient space for ground-mounted dispensers as opposed to overhead charging dispensers for highly space-constrained locations. Given the relatively small size of the facility, maximizing flexibility and avoiding conflicts on the property are critical. The charging cabinets and electrical utility equipment should be located in an aggregated area, away from bus parking and along the edge of the property. Charging dispensers would be located at the head of the parking stalls, requiring only a couple of additional feet to be added to each parking space.

Since the current fueling systems used by BCT are currently offsite, there is no need to phase out and remove the fueling equipment as the fleet shifts to BEB vehicles. Phasing of the BEB charging system infrastructure installation will be relatively simple and can be carried out with minimal impacts on continued operations. As operators currently fuel the vehicles at the offsite location, work rules do not preclude operators from 'fueling' (charging) and as such, operators (or bus services, depending on when the bus needs to be charged) would be responsible for plugging in buses for charging each day.

9.1.2.1 Proposed ZEB Facility Improvements

The following summarizes the proposed improvements for the ground-mounted dispensers needed to charge the proposed transit fleet. While the site planning configuration depicted in Figure 9-3 above is

the proposed configuration for the new facility, the following proposed improvements can provide guidance for BCT for any potential facility configuration:

- A new 1,500 kVA transformer and 2,500 A switchgear to provide adequate power to the facility, along with associated equipment pads and bollards.
- A new 1,500 kW generator with a 270-gallon belly tank for diesel fuel storage in order to support 100% service for one day; the current calculation assumes fuel is needed for approximately one day of outage. Doubling the tank size will provide the capacity to fully charge the fleet for two days of service. The generator would ideally be located within the charging equipment/utility yard to be as close as possible to the electrical switchgear supporting the chargers.
- An automatic transfer switch between generator and switchgear.
- Charging equipment:
    - Option 1: A minimum of (12) 120-kW charger cabinets with a 1:2 charger-to-dispenser ratio (SAE J1772-compliant) to serve a maximum of (16) active (in revenue service) 30 ft. buses, three cutaways, and five passenger vans = (24) plug-in connectors.
    - Option 2: A minimum of (24) 60-kW charger cabinets with a 1:1 charger-to-dispenser ratio (SAE J1772-compliant) to serve a maximum of (16) active (in revenue service) 30 ft. buses, three cutaways, and five passenger vans = (24) plug-in connectors. In this approach two charging cabinets can be paired together to deliver about 120 kW to one of two buses at a time, allowing for some additional flexibility.
- Equipment pads and associated bollard protection around chargers and dispensers.
- Power main feeder and sub feeders.
- Communication system panel/distribution cabinet and conduits to each charger.
- Pavement replacement/repair for trenching associated with electrical distribution for locations where new electrical service and switchgear will be allocated will be required in portions of the site not otherwise improved with the new OMF.

9.1.2.2 Grid Connection Upgrades

The facility will require new electrical service connections from SCE. The utility will likely require that a service study be performed to identify any transmission or distribution system upgrades that may be needed to support the additional power demands from the bus chargers. It will be up to the utility to determine if the local power distribution system has the capacity to serve BCT's new charging loads as well as any other planned loads in the area.

The recommendations here are focused on those infrastructure upgrades that are to be located on the facility property and do not include any required utility system upgrades that the service study may identify. The extent and timing of the system upgrades will determine the net cost to the agency. Nevertheless, there is a possibility that the current transformer can support a small portion of the BEB fleet without major upgrades. To evaluate this, BCT would need to coordinate with SCE and conduct a load assessment for the current transformer to determine how many chargers can be connected as an interim step to deploy BEBs prior to completing major grid connection upgrades.

As described in Section 9.1.2.1 above, the proposed BEB charging system would require a new 1,500 kVA, 480 V, 3-phase service from SCE to serve the entire fleet. To access this level of service, it is anticipated that a new SCE service will be required and fed from the utility distribution lines running along

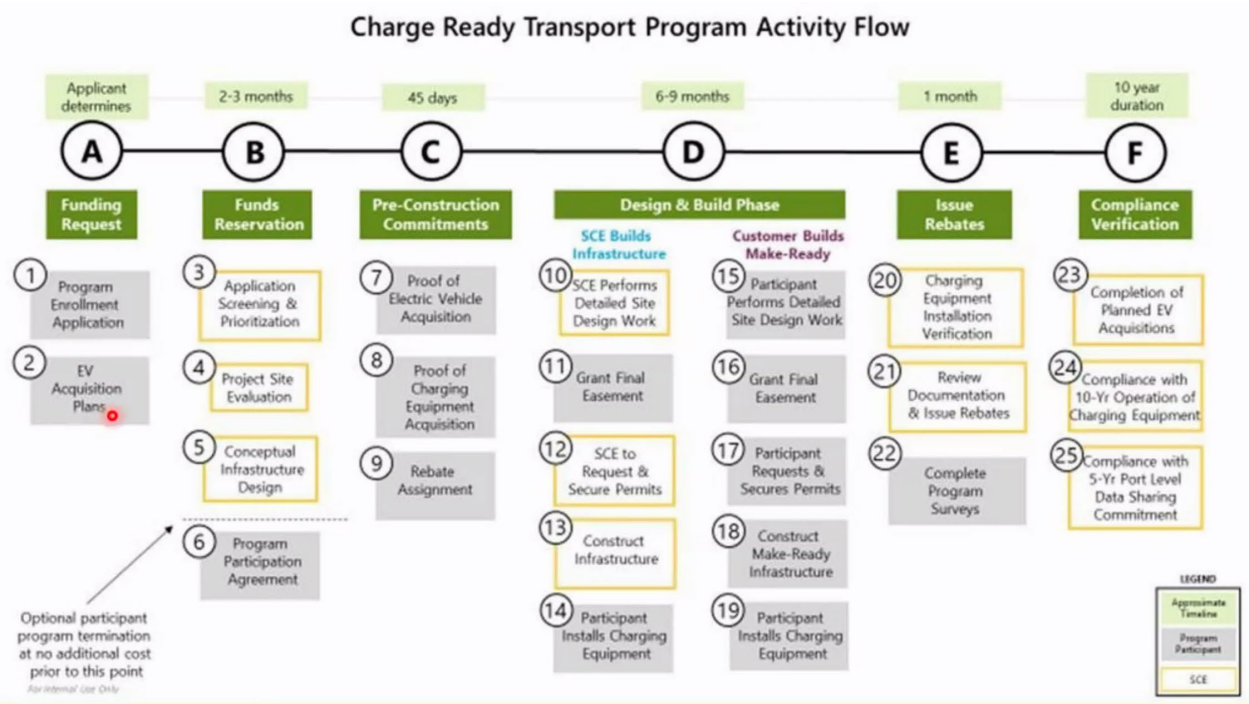
the adjacent public streets. The total BEB charging demand is significantly greater than the existing building electrical feeder capacity and it is typical to have a dedicated electrical feed for the charging equipment that is separate from the building feeder. This configuration simplifies operations and allows for dedicated BEB charging metering which can be necessary to take advantage of utility incentive rate structures.

9.1.2.3 SCE Charge Ready Transport Program

Supporting the transition to electric vehicles, the Charge Ready Transport (CRT) program operated by SCE can provide funding for the installation of infrastructure supporting the deployment of electric trucks, buses, and off-road equipment. Along with funding for infrastructure, SCE also provides logistics support for construction including site design and permitting. This program provides funding for all infrastructure up to the charging station, utility costs, and infrastructure on the customer side up to the charging station [207].

Charging infrastructure is split into utility side (transformer, meter, etc.) infrastructure, and consumer side (control panel, charging stations, etc.) infrastructure. Consumer-side construction of charging infrastructure can be done through SCE or managed in-house, whereas utility-side infrastructure is always constructed by SCE. Charger connections (dispensers) must be deployed on a 1:1 ratio with electric vehicles (EVs) using chargers approved by SCE and they will require a purchase commitment of any future vehicles if the infrastructure is set up ahead of time. The graphic below shows the process of SCE's program.

Figure 9-6: SCE Charge Ready Program Flow Chart, Source: SCE

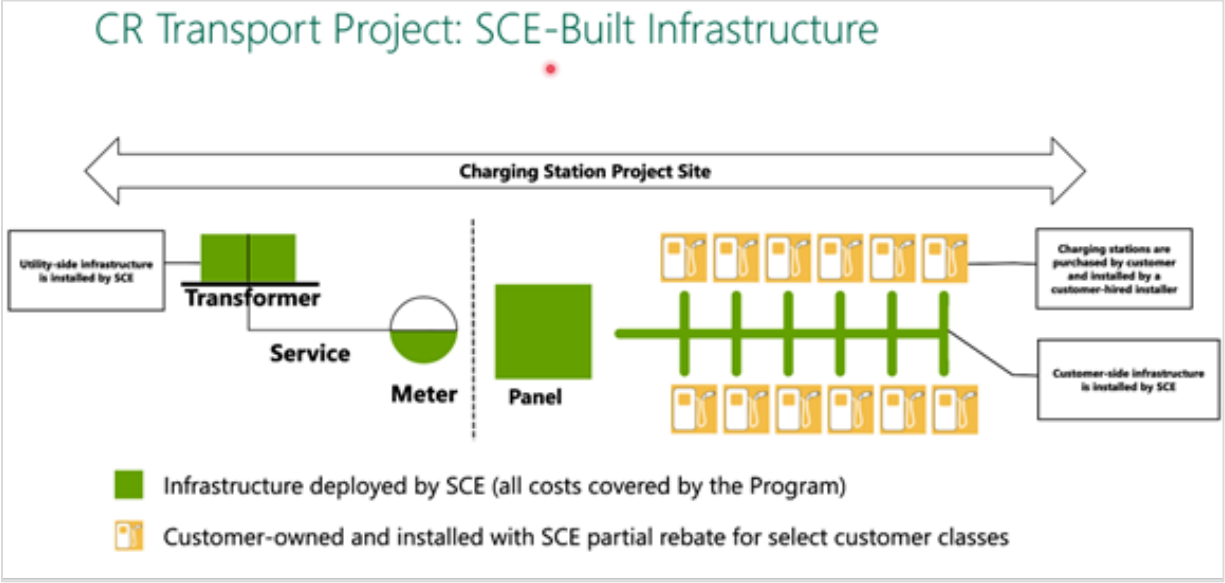


[207] The program launched in 2019 for a five-year period; it is currently unknown if the program will still be in operation when BCT procures its first BEBs.

The SCE-Built Option (Figure 9-7) provides all the modifications from the utility side and the customer side (behind the meter), supplying all the needed grid upgrades and connections so that the customer only has to purchase the chargers and connect them. Additionally, the CRT program provides up to 50% rebates for the purchased chargers. However, this option requires the client to provide easements or entrance rights so that SCE can have direct and unrestrictive access to the property. The easement will be required for the duration of the owner's obligation to the CRT Program and could potentially be quit-claimed back to the owner after the term of the program expires. Such entrance rights may represent a risk from a legal standpoint to certain clients. Furthermore, another risk is the limited options of approved charger vendors on the SCE list, for example, there are only a couple of vendors that provide a 2-to-1 charger-to-dispenser connection; higher ratios of chargers-to-dispensers are not currently on the pre-approved list, and thus limits the configuration options and final design of the yard if using this approach.

Of significant importance and limitation, the SCE-Built approach is restrictive to adding additional distributed energy resource (DER) connections, such as a connection to on-site generators, solar photovoltaic, or battery (energy storage) systems to the SCE meter and switchgear. There are currently no exceptions to this in the SCE-Built option.

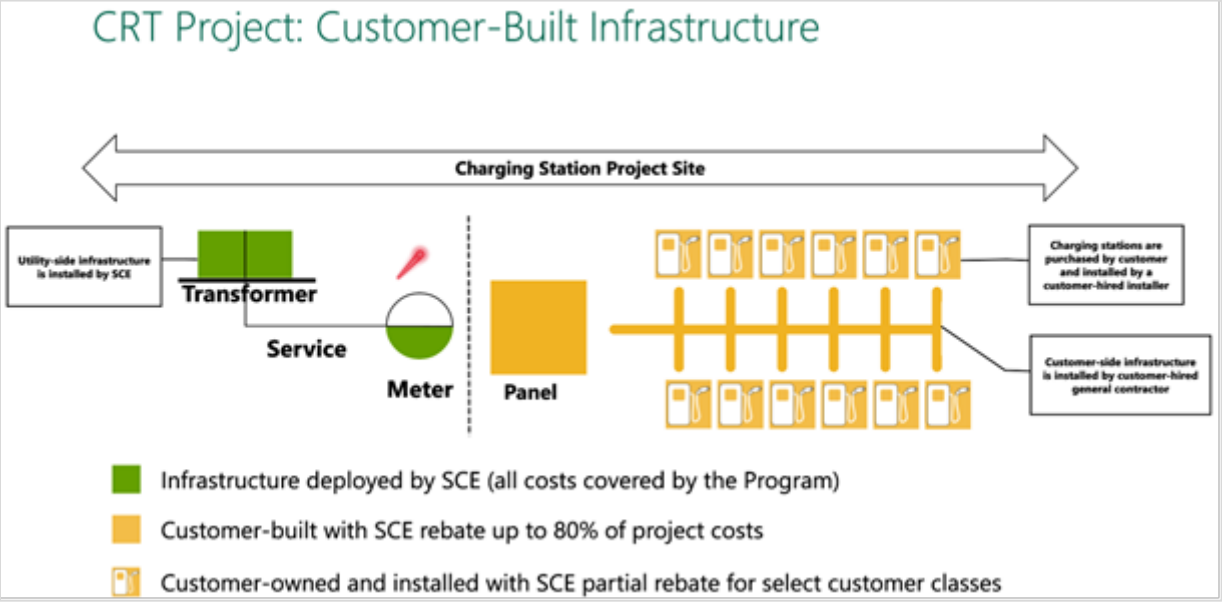
Figure 9-7: SCE-Built Infrastructure option for the CRT program



Property of SCE

In the Customer-Built Option (Figure 9-8), SCE covers the infrastructure on the utility side, but the customer is responsible for all the behind-the-meter infrastructure. While the CRT program offers a reimbursement of the cost of up to 80%, the actual cost of the rebate is completely up to SCE. While this option will actually allow for the installation of DER supplemental equipment, it will not be covered by the CRT program and will require separate trenching and conduit. The same equipment vendor limitations apply for the customer-built option as described above.

Figure 9-8: Customer-Built option for the CRT program



Property of SCE

The general customer requirements of the CRT program are:

- Lease or purchase at least two medium or heavy-duty battery-powered EVs or convert at least two fossil-fuel vehicles to electric.
- Select, purchase, and install SCE-approved charging equipment in the quantity approved by SCE.
- Keep the charging equipment operational for at least ten years.
- Provide data related to charging equipment usage for a minimum of five years.
- Grant easement(s) depending on the built option, as described above.

As part of the program, SCE will:

- Perform on-site visits to evaluate the site's electrical infrastructure needs.
- Develop utility-side and customer-side of the meter cost estimates.
- Design, secure permit, project manage, and install the necessary infrastructure depending on the selected built option.
- Install a separate meter dedicated to the EV charging infrastructure and waive customer demand charges through 2024 with commercial EV rates.
- Make final inspections once the charging equipment is installed.

9.1.2.4 Photovoltaic Systems

The potential for on-site power generation is another important consideration for BCT's long-term resiliency and sustainability goals. BEBs require a large amount of power, more than could be generated even if the entire transit center property were to be covered in solar panels. However, the power demands for the building and the level of charging could be generated onsite through canopies over the bus parking, non-revenue vehicle parking, and on the rooftop of the new operations and maintenance facility. The City could also consider solar canopies over the park-and-ride lot parking stalls to increase the generation potential for power for transit operations.

Since solar power can only be generated during the day, the system would likely need to be paired with a battery energy storage system (BESS) in order to hold that energy. The BESS would then be dispensed into buses during peak, heavy demand-charge times or simply at night when the buses are not in use. These systems are expensive and capital-intensive but can be acquired through power purchase agreements and third-party vendors that install the infrastructure and equipment and then sell it back to the user(s).

An additional consideration in installing a PV system (with or without a BESS) is whether BCT intends to utilize SCE's Charge Ready program as discussed in the section above. Only the Customer-Built option would allow for the inclusion of these systems.

9.1.2.5 Communication Infrastructure

Infrastructure for data communications within the charging system will include IP Ethernet wiring between each charger and its associated dispensers, as well as between each charger and a local data switch. The actual wiring will be a conventional Cat 6 Ethernet cable between devices or fiber, which would require a telecom cabinet. As the maximum length allowed for ethernet is 328 feet, the dispensers cannot be too far from their respective charger. Although longer distances are possible with fiber optic cable, the DC power cables that need to run parallel with the ethernet cables begin to have problems with voltage drop at this distance, so 328 feet is a recommended limit.

Once the ethernet lines from each charger are routed back to the facility's data switch, the data can be contained within BCT's local network and managed directly by the agency. Alternately, the data can be routed to a cloud-based system—as needed to provide smart charging and data aggregation—that is managed by a third party and/or is provided by the charger manufacturer. However, this would likely require coordination and approval of security and access, as it would necessitate outside entities operating within BCT's local network. Additionally, is recommended for BCT to implement a Wi-Fi network in the bus yard for smart charging communication to buses while any other communication upgrade is occurring or as an alternative to traditional communications systems.

9.1.2.6 Fire Protection Considerations

With the implementation of BEBs, fire protection and life-safety concerns can be significant. However, due to the relatively new advent of these associated technologies, building and fire protection codes have not specifically addressed most of these concerns. NFPA 855 'Standard for the Installation of Stationary Energy Storage Systems' is a standard that can potentially be applied to BEB storage, but this particular standard is excessive relative to the capacity of the batteries onboard buses and considering all of BCT's buses are stored outside. The need for enhanced fire protection systems has not been determined as a baseline requirement for BEB implementation and would be left up to the discretion of the local fire marshal and the local building officials. The need for additional fire lanes or fire 'breaks' within long continuous rows of bus parking may need to be discussed with the local fire department but is unlikely considering the size of the fleet stored onsite and the relatively open nature of the site with drive aisles between all of the bus parking.

If BCT decides to install photovoltaic solar canopies above the bus parking stalls, an NFPA 13-compliant automatic sprinkler system could be required because the canopy has a 'use' underneath it as defined by the California Fire Code.

Furthermore, all modifications to the facility should be reviewed with the local Authorities Having Jurisdiction (AHJs), in particular the local fire marshal. Fire truck access to the site and hydrant access will need to be reviewed and approved by the pertinent AHJs prior to the implementation of any additional infrastructure for charging equipment or solar canopies. However, since the site is designed for bus

movements, fire truck access is relatively straightforward and should be accommodated without significant changes to the facility.

In summary, no fire protection systems are required for minimal BEB implementation but considerations for covered canopies could trigger additional fire protection system upgrades to the facilities.

9.1.2.7 Fall Protection and Safety Infrastructure Considerations

Fall protection systems are recommended for any vehicle maintenance and inspection shop but considering that BCT will have a mixed vehicle fleet for some time, it is unlikely that one system will be able to meet all of the agency's needs. Fall protection systems would be required to safely access the rooftops of buses for potential battery inspection and maintenance since it is likely that the batteries will be mounted on the roofs of some of these vehicles.

9.1.2.8 Emergency Backup Planning

Transit agencies need to consider the portion of service (and thus of their BEB fleet) that will be deployed or operated during grid-outage conditions. Redondo Beach is not typically subject to emergency public safety power shutoffs so the backup planning would largely need to consider unplanned and/or scheduled power outages. Considerable planning needs to be addressed to ensure that vehicles can charge during shutdowns to maintain transit service.

For the purposes of the site planning, Stantec assumed backup power would be provided via a diesel-fired 1,500 kW generator with a storage capacity for 270 gallons of diesel in order to serve one revenue day at 100% service levels [208]. A separate generator may be considered to provide backup power to the operations and maintenance facility or a larger generator could be provided to back up both the OMF and the charging equipment. See Figure 9-9 for an example generator installation.

Figure 9-9: Typical Stationary Back-Up Diesel Generator with Belly Tank Fuel Storage



If BCT wishes to operate for more days during an emergency, the size of the generator will stay the same, but the required quantity of fuel will scale linearly. The total amount of fuel required to be stored onsite will depend on the anticipated duration of the utility electrical outage and the amount of time

[208] Propane or natural gas generators are possible but uncommon, particularly at this size. A generator sized to back-up a house can easily run on propose or natural gas, but this is very uncommon for a 1500 kW generator. It's also less resilient because in a major disaster the natural gas utility may be disrupted.

required to receive a fuel delivery of diesel fuel, as well as on environmental regulations and local policies.

Adequate space has been planned for in the conceptual master plan for either a new permanent generator or accommodation for a mobile generator with a load bank connection. The generator would be placed relatively close to its respective distribution panel. If permanent generators are installed, bollards should be installed surrounding the entire electrical equipment yard, but if a mobile generator is chosen as the preferred method of backup power, then the protective elements should be removable or installed in a manner to allows a mobile generator to be parked near the load bank cabinet to minimize the connection cable distance.

A permanent generator on-site will require an additional permit from the Air Quality Management District (AQMD) and will have annual limitations on the duration it is allowed to run. However, a temporary mobile generator that has been certified by the CARB would not require a permit by the AQMD but will have further restrictions on when it can be used such as actual or imminent blackouts. Under any scenario, BCT should consider close coordination with both the AQMD and CARB as part of any plan to install a generator at the facility.

While diesel-fired generators will provide emergency backup power, another potential avenue for resiliency is through renewables, such as solar energy generated through photovoltaics (PV) as noted above. Several agencies have deployed solar PV assets to generate renewable energy to power their facilities. With the adoption of a BEB fleet, additional harvesting of solar PV energy, together with storage of this energy in a battery electric storage system (BESS), can be used to charge a portion of the fleet with energy that does not come ‘from the grid’. As such, this strategy could be used to diminish some of the costs associated with charging, particularly during peak time-of-use periods. However, these additional assets are capital-intensive and require favorable energy policies to compensate such facilities for the additional services a BESS can provide.

Nevertheless, solar arrays and stationary batteries have limitations. The power generated with solar PV arrays will likely account for a small portion of the energy requirements of a BEB fleet, and in the case of stationary batteries, once they have been discharged to charge a BEB, they need to be recharged, which typically takes several hours. In the event of an emergency, relying solely on solar energy is impractical. As such, deploying complementary fossil fuel-powered generators is necessary to generate the power required to charge a BEB fleet.

9.2 Future Planning and Design Needs

9.2.1 Facility Design & Permitting Needs

In order to implement the proposed improvements for the new operations and maintenance facility, BCT and the City will need to procure professional consulting and design services to complete the environmental review processes, design the new facility, and support BCT through the construction of the project.

First, given the size of the proposed project, both CEQA and NEPA clearances will be required prior to beginning the final design of the new OMF and should be considered for the next step of the project. Any professional consulting services solicited by BCT should be provided by an environmental planning firm experienced in the CEQA/NEPA processes specifically for transit operations and maintenance facilities. The City and BCT may choose to use the conceptual master plan provided herein as the starting point for the environmental review process or include scope for the environmental consultant to revalidate the program and site plan approach at the time of starting the environmental review process. Regardless, the environmental documentation should be focused on the general size of the facility, quantity of vehicles, and general siting of the proposed improvements. Detailed specifics about building orientation or exact figures on the program should not be dictated in the environmental documentation so that the final design is not overly constrained by the environmental approvals. While amendments can be submitted to the final approved clearances, that process takes additional time and budget and could be avoided.

Following the CEQA clearance for the project, the design and engineering process can commence. There is minimal risk in commencing the design after CEQA is completed and the project is submitted for NEPA review. The City and BCT will need to hire a complete team for architectural and engineering (A&E) services for the new OMF – the design team. It is recommended that the solicitation be based on qualifications for experience with designing similar transit operations and maintenance facilities. The design services should include all of the following disciplines: overall project management; architectural; landscape architecture; civil, structural, electrical, lighting, plumbing, fire protection, and mechanical engineering; security, IT, audio-visual, and communication systems design; electric vehicle charging equipment design, and cost estimating services. In addition, geotechnical engineering and surveying will also be required. These services could be procured along with the environmental review process, the A&E professional services, or be separate from either procurement. Ideally, the geotechnical and survey are not carried out by the design team and are directly sourced by the City since these are documentation of existing conditions. BCT will also need to procure professional commissioning services as required by the California Energy Code and CalGreen Code. The commissioning agent can be a part of the design team contract but for a project of this size, they are not permitted to be the same staff as the design team working on the project. The A&E services should include scope from re-validating the space needs program through the preparation of construction documents, bid support services, and construction support services.

The design team should be responsible for managing the entire design and permitting process through plan check review and approval by the City and all other AHJs. As a City project, the permitting process could be assumed to be slightly more streamlined, but the design team should ultimately be responsible for gaining all required project clearances from the planning, building, public works, and fire departments; air pollution control district if a generator is involved; and any other AHJ's that may be eventually involved with the project. Most, if not all, of these entities will be identified in the CEQA process for the project. At the end of the permitting process, the design team's management of the overall project will generally shift to the construction manager when the project transitions to the bid and award phase.

To support the City and BCT during the construction of the facility and act on behalf of all of the City's interests, construction management (CM) services should be procured prior to the project being issued for construction bids and can be solicited early on in the process to support the City with writing contract

requirements, front-end project specifications, providing constructability review, etc. at the City's discretion. CM services are vital to a project having dedicated staff responsible for the day-to-day management of the generator contractor's submittals, change orders, construction schedule, payment applications, etc.

Lastly, the City and BCT will need to issue for bid the construction of the facility. This is a fairly standard process by which the City advertises the project plans, specifications, etc. for construction bids. It is recommended that bidders be qualified with experience with similar public facility projects, with a preference for transit or public works maintenance and operations facilities. Additionally, experience with Buy America Act (BA) compliance would be helpful to ensure the general contractor and their subcontractors understand the unique requirements of BA compliance in the likelihood that the project will have some federal funding involved.

The timeframe for the proposed services and implementation are outlined in Section 10.

10 PHASED IMPLEMENTATION PLAN

The coordinated implementation plan in Table 10-1 presents a comprehensive plan for implementing the five-year service plan, ZEB transition, and facility construction. The timeline of the plan goes through 2040 to reflect a full transition to ZE operations.

Table 10-1: Coordinated implementation plan, 2024-2040 [209]

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
2024	Bus Facility	Procure professional environmental support services for CEQA and NEPA clearances for the new OMF by the end of 2024.	BCT, Redondo Beach City Council	BCT should assume the CEQA and NEPA processes will take about 12 to 18 months in total. Design of new facility can commence following CEQA clearance (about 6 - 9 months).
	Fleet Procurement	Fleet Procurement: 1 CNG bus (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $533,000
	Service Planning/ Operations	Line 102: routing changes to absorb the portion of Line 109 between Redondo Beach Pier and Riviera Village. Line 109: routing changes to straighten alignment around Plaza El Segundo and Manhattan Village Mall, and terminate line at Redondo Beach Pier. One month prior to routing changes, install signs at any stops that will be closed stating the stop will no longer be in service, and providing information on the new closest stops. Manhattan Beach Blvd Line: assess conditions and placement of Metro Line 126 bus stops and identify needs in coordination with the City of Manhattan Beach for stops within their jurisdiction. This process should incorporate Transit Amenities Policies as outlined in BCT's Title VI Program. At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).	BCT, Redondo Beach Police Department (Parking Enforcement), Torrance Transit, other relevant City departments, Manhattan Beach	-BCT should coordinate with Torrance Transit regarding routing changes around the Pier to ensure that schedules are coordinated to facilitate seamless transfers. -BCT will need to coordinate with relevant City departments to ensure sufficient space for buses is provided at the Pier, including coordinating with Parking Enforcement to mitigate potential issues of illegal parking preventing BCT vehicles from accessing the space. -One month prior to service changes, BCT should conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT should work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -BCT website should be updated as service changes are implemented. -BCT maps and schedules should be updated as service changes are implemented.
2025	Fleet Procurement	Fleet Procurement: 3 CNG buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,632,000
	Service Planning/ Operations	Line 102: increase weekday service to every 33 minutes all day Line 109: implement routing changes to serve the Airport Metro	BCT, other relevant City departments, Manhattan Beach	-BCT should examine schedules of other operators that will be serving the Airport Metro Connector Station to understand if schedules can be

[209] Estimated capital costs in 2023$. Information on capital cost sources provided in Appendix E: Financial Considerations and Inputs and Appendix F: Cost Estimate.

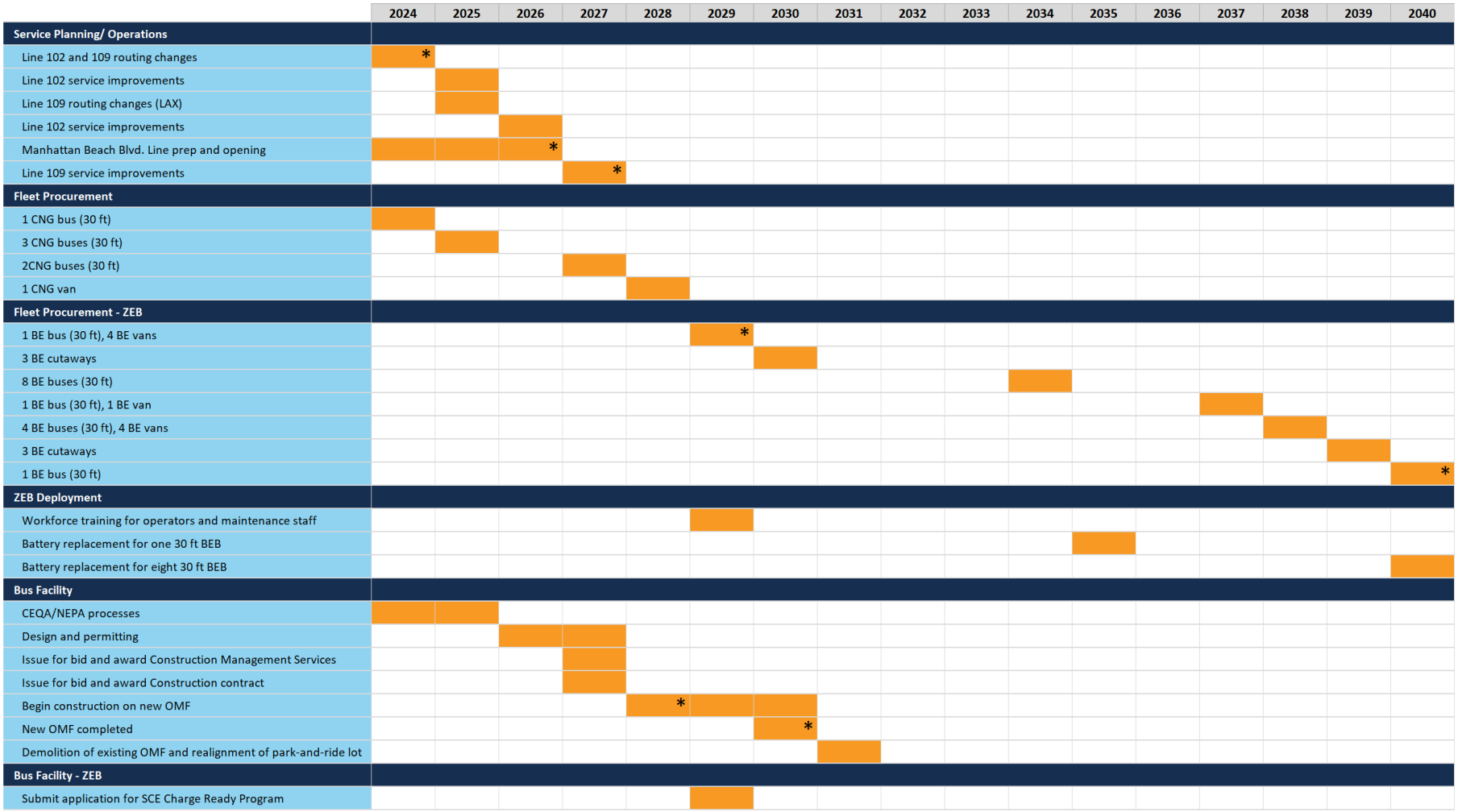
Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
		Connector Station and Automated People Mover at LAX At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).		better coordinated to facilitate transfers. -BCT should work in coordination with Manhattan Beach to install required bus stop infrastructure for stops within Manhattan Beach city limits. -One month prior to service changes, BCT should conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT should work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -BCT website should be updated as service changes are implemented. -BCT maps and schedules should be updated as service changes are implemented.
2026	Bus Facility	Procure professional architectural and engineering services for the design of the new facility and site improvements at the beginning of 2026.	BCT, Redondo Beach City Council	Design process should begin with detailed programming and master planning tasks to resume and validate the proposed space needs program and conceptual master plan. Design and permitting for new facility can be expected to take about 12 to 18 months, but can commence following project approval from CEQA.
	Service Planning/ Operations	Line 102: Sunday service schedule improved to match Saturday schedule (all day service around every 40 minutes). Manhattan Beach Blvd Line: finalize installation of bus stop infrastructure, conduct dry runs and operator training on new route, and launch service in summer 2026. At least 30 days prior to the implementation of service changes, BCT will hold public hearings and solicit feedback from the public on proposed service changes following all guidelines outlined in BCT's Public Participation Process (Community Outreach Plan).	BCT, Transportation Concepts, other relevant City departments, relevant stakeholders to help promote the launch of the Manhattan Beach Blvd service (Manhattan Beach Department of Parks and Recreation, Manhattan Beach Chamber of Commerce, Redondo Beach Performing Arts Center, Downtown Manhattan Beach Business + Professional Association, etc.)	-Transportation Concepts/O&M Contractor should execute dry runs of the Manhattan Beach Blvd alignment to confirm run time and develop schedules, complete runcutting, and paddles. -BCT should work with various stakeholders in the months leading up to the launch to continue to advertise the service. After service launch, collect data on ridership and performance as well as public feedback on rider satisfaction. -One month prior to service changes, BCT should conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT should work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -BCT website should be updated as service changes are implemented.

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
				-BCT maps and schedules should be updated as service changes are implemented.
2027	Bus Facility	Issue for bid and award mid-2027: Construction Management Services for the new Bus OMF (if City doesn't have on-call contracts or other means by which to procure CM services. Issue for bid and award mid to end of 2027: Construction contract for the new Bus OMF.	BCT, Redondo Beach City Council	CM services should be procured first to aid in solicitation of general contractors for the construction of the new BMF.
	Fleet Procurement	Fleet Procurement: 2 CNG buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,135,123
	Service Planning/ Operations	Line 109: implement 35-minute weekday service during AM and PM peaks (7-9am and 4-6pm) Manhattan Beach Blvd Line: continue to monitor performance and adjust schedules as necessary. Begin to collect data to determine whether service should be expanded year-round. BCT should do this on a continuous basis.	BCT, other relevant City departments	-One month prior to service changes, BCT should conduct robust outreach to customers and areas that might be affected, including flyers on buses and at relevant stops. -BCT should work with other City departments (such as the Department of Community Development, Community Services Department, etc.) to expand outreach capabilities. -BCT website should be updated as service changes are implemented. -BCT maps and schedules should be updated as service changes are implemented.
2028	Bus Facility	Early 2028, begin construction on new Bus Operations and Maintenance Facility (OMF).	BCT	Estimate construction period 18 months from award of contract to final commissioning of the facility. City should allow for contingency in schedule for unexpected delays, etc. so that facility can be opened in time for arrival of first electric vehicles.
	Fleet Procurement	Fleet Procurement: 1 CNG van	BCT, Redondo Beach City Council	Estimated capital cost: $63,320
2029	Bus Facility - ZEB	If the program is still active, apply for participation in the SCE Charge Ready Transport Program for charging infrastructure installation. Vehicles must arrive on site within 18 months from the time the application was submitted.	BCT, SCE	Application will need to be coordinated with new OMF design and construction.
	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft) 4 BE vans	BCT, Redondo Beach City Council	Estimated capital cost: $1,871,781
2030	Bus Facility	New Bus OMF to be completed. BCT to move contractor and operations into new facility.	BCT	OMF will need to be completed and commissioned prior to arrival of first BEB in order to allow for installation of charging equipment and coordination with SCE if utilizing SCE's Charge Ready Transport program (if the program is still available in the future).

Year	Element	Action Item	Responsible Party/ Parties	Implementation Details
	Fleet Procurement - ZEB	Fleet Procurement: 3 BE cutaways	BCT, Redondo Beach City Council	Estimated capital cost: $870,651
2031	Bus Facility	Demolition of existing bus maintenance facility and realignment of park-and-ride parking lot.	BCT	City may choose alternative approach to expanding park-and-ride lot, but it can be assumed that the existing facility will not be suitable for long term use by other functions. The existing building is well beyond its useful life in 2023.
2032	N/A	N/A	N/A	N/A
2033	N/A	N/A	N/A	N/A
2034	Fleet Procurement - ZEB	Fleet Procurement: 8 BE buses (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $8,443,000
2035	ZEB Deployment	Battery replacement for one 30 ft bus	BCT	No additional cost; cost included in vehicle purchase price extended warranty.
2036	N/A	N/A	N/A	N/A
2037	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft) 1 BE van	BCT, Redondo Beach City Council	Estimated capital cost: $1,372,000
2038	Fleet Procurement - ZEB	Fleet Procurement: 4 BE buses (30 ft) 4 BE vans	BCT, Redondo Beach City Council	Estimated capital cost: $5,589,000
2039	Fleet Procurement - ZEB	Fleet Procurement: 3 BE cutaways	BCT, Redondo Beach City Council	Estimated capital cost: $1,024,000
2040	Fleet Procurement - ZEB	Fleet Procurement: 1 BE bus (30 ft)	BCT, Redondo Beach City Council	Estimated capital cost: $1,178,000
	ZEB Deployment	Battery replacement for eight 30 ft buses	BCT	No additional cost; cost included in vehicle purchase price extended warranty.

To further assist the City in navigating the implementation of this plan, a Gantt chart has been developed which highlights key milestone dates (Figure 10-1). Please refer to Table 10-1 for more information.

Figure 10-1: Implementation Plan Schedule



Stantec

11 FINANCIAL PLAN

This section describes the financial plan that monetizes the service and capital plans for the short-range transit planning horizon. In general, the five-year financial plan forecast assumes sufficient operating and capital funding to expand service levels, cover future capital needs, and expand staffing and/or services. More information about the assumptions and inputs used in this section can be found in Appendix E: Financial Considerations and Inputs.

11.1 Operating Costs

To project operating costs, past budgets were analyzed to understand cost trending, and current contract rates were reviewed with BCT staff. The operating costs presented here are based on the following key assumptions:

- BCT will continue paying a hired operations and maintenance (O&M) contractor for both fixed-route and DAR services.
- BCT will continue paying a fixed monthly fee, as well as an hourly rate per revenue hour.

The analysis is focused on the contract values per fiscal year (FY) that the City would pay an O&M contractor; the forecasts below do not capture other costs, such as City administration time and/or other ancillary costs not directly related to revenue service delivery.

Table 11-1 provides the key cost inputs for costs per revenue hours and the fixed monthly costs, as well as the annual revenue hours of the proposed five-year service plan.

Table 11-1: Operating Cost Estimates for the Five-Year Service Plan

Plan Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Fiscal Year	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**
Fixed Monthly Rate	$103,502	$108,574	$114,002	$121,982	$130,521
Fixed Hourly Rate	$48.57	$50.95	$53.50	$57.24	$61.25
Annual Revenue Hours	**47,186**	**47,186**	**49,560**	**50,319**	**50,319**
Total Operating Cost	$3,533,848	$3,707,007	$4,019,360	$4,344,162	$4,648,253

The City will issue an RFP for service for a new contract period to begin in July 2026 (Plan Year 4). After this, it is expected that costs and associated wages will be higher subject to the RFP process. It is estimated that this will be at least a 7% increase compared to the previous year, which is reflected in the table.

Overall, the plan sees a moderate increase (12%) in revenue hours in year 1 from current service levels largely to account for routing adjustments particularly for the extension of Line 102 to serve the Redondo Beach Transit Center. Costs are also expected to increase as the hourly and monthly rates are adjusted each year of the contract to account for inflation. With additional service added in year 5, it is expected that the contractor operating costs will top $4.6 million, which is about 32% more in operating costs compared to current operating costs for about 23% more revenue service hours.

We note that the City's approved budget in FY21-22 was over $180 million, and the FY27-28 transit service budget would constitute about 3% of the City's total budget from FY21-22. [210]

11.2 Capital Costs

The major capital costs for the timeframe of the five-year service planning period are replacement vehicles (both ICE and ZEB), the acquisition of equipment for the transition to ZE vehicles, as well as facility modifications. As per CARB's ICT regulation, small agencies like BCT must begin acquiring ZEBs in 2026, but due to the number of vehicles BCT needs to buy in 2027 and 2028 and accounting for the 25% ZEB purchase requirement, BCT will start purchasing ZEBs in 2029 and still be in compliance [211].

11.2.1 Fleet

Table 11-2 highlights the replacement capital costs of vehicles through the five-year service plan horizon. This time frame will see BCT replace four 30-ft CNG buses with four new 30-ft buses, and expand the fleet with two additional 30-ft CNG buses in 2027. The full fleet replacement schedule can be found in Section 8.4.

Table 11-2: Capital Investment for Buses During the Five-Year Service Plan Horizon

Capital Item	FY23-24	FY24-25	FY25-26	FY26-27	FY27-28
	(Yr 1)	(Yr 2)	(Yr 3)	(Yr 4)	(Yr 5)
CNG 30-ft bus	$532,569	$1,631,890	$-	$1,135,123	$-
CNG Van	$-	$-	$-	$-	$63,320
BEB 30-ft	$-	$-	$-	$-	$-
BEB Cutaway	$-	$-	$-	$-	$-
BEB Van	$-	$-	$-	$-	$-
Total	**$532,569**	**$1,631,890**	**$-**	**$1,135,123**	**$63,320**

To help with longer-term fleet capital planning, Table 11-3 shows the forecasted capital expenditures for the fleet plan in Section 8.4 through 2040 when we predict BCT's fleet will be 100% ZEBs.

[210] Note that the operating budget for BCT is not solely paid for by the City of Redondo Beach, but rather is funded partly by the City, partly by the City of Hermosa Beach, as well as a blend of federal, state, and local grants/programs/measures.

[211] In 2027 and 2028, BCT is purchasing two vehicles in 2027 and one vehicle in 2028. When considering the 25% ZEB purchase regulation in force from 2026 through 2028, when accounting for rounding, 25% of vehicles purchased in each of these years is less than one bus. As such BCT is able to purchase conventional buses in these years while remaining compliant with the ICT regulation, as per CARB's guidance.

Table 11-3: Capital Investment for Buses, FY28-29 Through FY39-40

Capital Item	FY28-29	FY29-30	FY30-31	FY31-32	FY32-33	FY33-34	FY34-35	FY35-36	FY36-37	FY37-38	FY38-39	FY39-40
	(Yr 6)	(Yr 7)	(Yr 8)	(Yr 9)	(Yr 10)	(Yr 11)	(Yr 12)	(Yr 13)	(Yr 14)	(Yr 15)	(Yr 16)	(Yr 17)
CNG 30-ft bus	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
BEB 30-ft	$973,238	$-	$-	$-	$-	$8,442,831	$-	$-	$1,114,412	$4,540,708	$-	$1,178,393
BEB Cutaway	$-	$870,651	$-	$-	$-	$-	$-	$-	$-	$-	$1,023,529	$-
BEB Van	$898,542	$-	$-	$-	$-	$-	$-	$-	$257,220	$1,048,052	$-	$-
Total	**$1,871,781**	**$870,651**	**$-**	**$-**	**$-**	**$8,442,831**	**$-**	**$-**	**$1,371,632**	**$5,588,761**	**$1,023,529**	**$1,178,393**

The total cumulative capital cost for the fleet through 2040 is over $23.6 million. Note that the cumulative capital expense presented in this section does not capture the cost of operating service, and does not consider any rebates, vouchers, credits, or other alternative financing methods. Therefore, there may be opportunities to offset the cost of investment for this ZEB fleet.

11.2.2 Facility and Infrastructure

To support the successful deployment of the ZEB fleet, significant upgrades, and facility modifications are needed, including BEB chargers and dispensers, a new transformer and switchgear, in addition to a completely new building for operations and maintenance function and a reorganization of the yard. More details can be found in Section 9.

With regard to infrastructure costs, Stantec's cost estimator Jacobus and Yuang, Inc. developed rough order of magnitude cost estimates based on the facility plans. Table 11-4 provides a summary view of the expected costs, and the full cost estimate can be found in Appendix F: Cost Estimate.

Table 11-4: Total Opinion of Probable Cost with Escalation Plus Equipment Cost and Soft Costs

Site Costs	
Site Demolition	$450,351
Park & Ride Lot/Employee Parking	$604,309
OMF Sitework	$8,153,797
Admin-Ops & Maintenance Facility	$9,139,965
Escalation	$3,957,755
Equipment Costs	
Maintenance/Bus Wash Equipment	$1,000,000
Escalation	$423,843
Soft Costs	
Architectural/Engineering Fees	$3,559,503
Environmental Consulting (CEQA/NEPA)	$177,975
Construction Contingency	$1,186,501
Construction Management	$1,898,402
Surveys, etc.	$1,186,501
Total Opinion of Probable Cost with Escalation, Equipment, and Soft Costs	**$31,738,902**

Based on the high-level cost estimate, we estimate that BCT could spend $31.7 million on facility upgrades between 2023 and 2028. As described in Section 9.2, BCT needs to develop more detailed design drawings based on the concept developed by Stantec and with detailed drawings, BCT can get a more accurate cost estimate.

11.3 Financial Plan Summary

The table below summarizes estimated operating and capital costs for BCT over the 5-year service planning period. Please note that only bus procurement is included in capital costs, as the capital cost estimates for facilities and infrastructure are high-level, and BCT needs to develop more detailed design drawings to derive a more accurate cost estimate for facility and infrastructure construction.

Table 11-5: Financial Plan Summary

Plan Year	Year 1	Year 2	Year 3	Year 4	Year 5
Fiscal Year	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**
Total Operating Cost	$3,533,848	$3,707,007	$4,019,360	$4,344,162	$4,648,253
Total Capital Costs	$532,569	$1,631,890	$-	$1,135,123	$63,320
Total	$4,066,417	$5,338,897	$4,019,360	$5,479,285	$4,711,573

11.4 Other Cost Considerations

While the ZEB fleet transition and facility modifications and infrastructure upgrades will account for the largest capital cost expenditures, and the expansion of service over the five-year service plan horizon is modest, other recommendations are expected to trigger costs to BCT, but with less certainty than the ZEB fleet. Here, we outline the key elements that BCT should evaluate further.

11.4.1 Bus Stop Amenities

As revealed by our analysis and ride alongs, BCT should work with its partners in the different municipalities where it operates buses to explore opportunities to improve bus stop amenities. Bus stop amenities include poles with signs (highlighting route names, frequencies or timetables, and maps), benches, shelters, ADA platforms, bulb-outs, and digital signs with real-time arrival predictions. It is recommended that benches be installed at stops that represent the top 30% ridership locations and shelters at stops that represent the top 15% ridership locations. However, as BCT does not have direct jurisdiction over any rights-of-way, BCT will need to work closely with its partner municipalities to evaluate the ability to upgrade any bus stops.

For the Redondo Beach Pier bus stop, BCT and the City should evaluate the capacity to support additional BCT buses in coordination with other public transit services, and general public use of the Torrance Circle area. There is significant potential as a ‘showpiece’ stop with more robust infrastructure as a new bus transfer location, Improved amenities such as shading, network information, real-time arrivals, and additional seating, In accordance with the Pier’s design scheme.

Moreover, with the proposed introduction of the new summer beach bus route along Manhattan Beach Blvd, BCT will need to evaluate bus stop locations and install new bus stops along the route alignment. Fortunately, as Metro previously operated Line 126 along much of the alignment proposed for the beach route, BCT can evaluate the old Line 126 bus stop locations and any leftover equipment for re-use, if any still exists. BCT will need to coordinate with Manhattan Beach to install furniture within Manhattan Beach city limits.

11.4.2 Technology

Apart from the real-time arrival information collected and shared with its riders, BCT’s customer-facing and internal technology is rather limited. During this study, we identified several needs and opportunities for additional technology deployment to improve the customer experience, as well as improve planning and operations.

- **Advanced scheduling software.** BCT's current O&M contractor uses legacy scheduling software for both fixed-route and dial-a-ride services; moreover, the O&M contractor uses a subcontractor to develop blocking and runcuts, as well as bus schedules. The outcome is a slow, unresponsive process that makes testing or implementing changes slow and inefficient. As an indirect cost, BCT should require that in future bids for O&M contractors, vendors demonstrate the use of modern transit planning software that can optimize schedules quickly, test multiple scenarios, and result in efficient dial-a-ride manifests.

- **Automatic passenger counters (APCs).** BCT would benefit from APCs installed on its fleet to allow for accurate data capture of passenger boardings and alightings by a bus stop, by the time of day, and by the day of the week. APC data will help build a more complete portrait of where ridership is heavier, which stops are unused, and what times of day see greater demand than others. Leveraging the power of APC data to track passenger loads will help BCT better adjust service levels depending on demand. BCT carries out manual ride counts which are time-consuming, and as such, infrequent and provide a static snapshot, that while helpful, isn't as robust as the data collected by APC. APCs will modernize BCT's ability to perform NTD data collection and move away from the manual random sampling method that is currently in use. As BCT begins to acquire new vehicles to renew the fleet, BCT should also include APCs as part of the bus specifications. Costs for APCs vary by vendor and system, and generally include hardware and software costs; BCT can reach out to transit agency peers throughout Los Angeles to understand comparable costs and lessons learned for other agencies deploying APCs.

11.4.3 Additional Staffing and Capacity

BCT's administrative staff is lean and nimble. Staff work across multiple projects and functions with an all-hands approach. Based on the recommendations and discussion with BCT staff, we envision the need for additional staff or capacity for the following purposes:

- **Managing and implementing the ZEB transition.** With many moving parts, including bus acquisitions, facility planning, and construction management, as well as liaising with city partners and SCE, the deployment of ZEBs will require more staff time. Indeed, as learned through BCT's experience with the construction at the RBTC, construction management has become more and more time-consuming. Ensuring that the ZEB transition takes place according to schedule, ongoing management of ZEB facilities, utility coordination, and management, oversight of the ZEB fleet and maintenance needs, and capital planning for ZEB-related needs will require constant oversight that is outside of the bandwidth of BCT's small and nimble team. Hiring a new dedicated City staff member to plan and manage ZEB facilities and oversee fleet activities related to utility management and vehicle maintenance is recommended.

- **Marketing and communications.** Sometimes, people don't ride transit service because they aren't aware of the services and its benefits, the destinations it serves, or maybe have heard negative things from others about the service. Raising the BCT brand equity in the community is crucial to supporting BCT's mission. Our surveys and stakeholder engagement found that knowledge about BCT services was lacking within the communities. Comments ranged from not knowing anything about public transit to "I don't know how to find out about the bus." In particular, WAVE has plenty of spare capacity so rider travel training and other outreach and engagement activities are needed to grow ridership. As such, we recommend that BCT update its marketing and communications strategy, and this could be achieved internally or by hiring a marketing firm to develop a strategic plan. Regardless of who develops the plan, the implementation will fall on BCT staff and additional staff time will be required.

11.5 Potential Funding Sources

Table 11-6 provides an overview of potential funding sources for BCT as it moves through the implementation of the five-year service plan and ZEB transition. BCT receives funding for operations through a variety of local and state sources, which are allocated through the FAP. More recently, BCT has received Federal COVID Relief funding for operations to help mitigate the effects of the COVID-19 Pandemic, but these funds were allocated on a one-time basis.

For capital expenditures, BCT has historically used a variety of sources including allocated FTA 5307 funds, and local matches provided by Local Return funds from Proposition A and Measure R Clean Fuel Capital that are allocated to BCT using the FAP methodology. Other funding sources, including State Transit Assistance (STA) and SB1 State of Good Repair (SGR) funds, have been used for capital expenses in the past. As ZEBs are more expensive compared to BCT's current CNG fleet, BCT will need to explore other funding sources, including competitive grant funding, to help fund the ZEB transition. This is also true for required charging infrastructure and associated electrical upgrades.

An * is used to denote which funding sources require the identification of disadvantaged communities based on CalEnviroScreen.

Table 11-6: Potential funding sources

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
Federal (FTA/FHWA)	Flexible Funding Programs – Surface Transportation Block Grant Program [212]	Formula	Capital	Provides funding that may be used by states and localities for a wide range of projects to preserve and improve the conditions and performance of surface transportation, including highway, transit, intercity bus, bicycle, and pedestrian projects [213]	Can be used across a wide variety of transit capital projects including transit centers.	As part of the Bipartisan Infrastructure Law, has designated over $14 billion annually each year between 2023 and 2026.
	Urbanized Area (UZA) Formula Grants (Section 5307) [214]	Formula	Capital for regions with a population greater than 200k; can be used for operating with approval from FTA.	5307 grant funding makes federal resources available to urbanized areas (populations greater than 50k) for transit capital and operating assistance. Local match required. [215]	For agencies with a UZA population of less than 200,000, grant funding is eligible for operating assistance. For populations that surpass the 200,000 UZA threshold, these funds can only be used for capital uses. Eligible capital uses include capital investments in bus and bus-related activities such as replacement, overhaul, and rebuilding of buses. Agencies can allocate these funds for the purchase of ZEBs. Under the UZA category, BCT uses the majority of these funds for capital purchases and is subject to Capital Allocation Procedure.	80% of eligible net capital project cost, 90% of vehicle-related equipment required for ADA or CAA compliance, 50% of net operating project cost
	State of Good Repair Grants (Section 5337) [216]	Formula	Capital	Provides capital assistance for maintenance, replacement, and rehabilitation projects of high-intensity fixed guideway and bus systems to help transit agencies maintain assets in a state of good repair. Local match required.	Signals and communications, power equipment and substations, passenger stations and terminals, security equipment and systems, maintenance facilities and equipment, operational support equipment, including computer hardware and software; transit asset management plans. In the past, BCT has used these funds for capital improvements at the Transit Operations Facility.	80% of eligible net capital project costs.

[212] Flexible Funding Programs - Surface Transportation Block Grant Program - 23 USC 133 | FTA (dot.gov)
[213] STBG - Federal-aid Programs - Federal-aid Programs and Special Funding - Federal Highway Administration (dot.gov)
[214] Urbanized Area Formula Grants - 5307 | FTA (dot.gov)
[215] FTA Urbanized Area Formula Program Section 5307 grant fact sheet (dot.gov)
[216] State of Good Repair Grants - 5337 | FTA (dot.gov)

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
	Enhanced Mobility of Seniors & Individuals with Disabilities (Section 5310) [217]	Formula	Both	Assisting private non-profit groups in meeting the transportation needs of older adults and people with disabilities when the transportation service provided is unavailable, insufficient, or inappropriate to meet these needs. Funding based on each state's share of population. [218]	Purchase of new buses, vans, wheelchair lifts, ramps, and mobility management programs.	80% of eligible capital costs, 50% for operating expenses, 100% of the eligible 10% program administration costs
	Grants for Buses and Bus Facilities Formula Program (Section 5339a) [219]	Formula	Capital	Capital projects to replace, rehabilitate, and purchase buses, vans, and related equipment, and to construct bus-related facilities, including technological changes or innovations to modify low or no-emission vehicles or facilities. [220]	BCT uses these funds for the purchase of new buses and related infrastructure and facility equipment.	80% of the net capital project cost. 85% of total transit bus cost. 90% of net project cost for leasing or acquiring low-no bus-related equipment and facilities.
	Grants for Buses and Bus Facilities (Discretionary Program) (Section 5339b) [221]	Competitive	Capital	Funds vehicle purchases and upgrades to or new bus-related facilities. [222]	Purchase of new buses and related infrastructure and facility equipment, and upgrades to new bus-related facilities.	In FY2023, the FTA announced the availability of $470 million in grants.
	Low- or No-Emission Bus Grants (Section 5339c) [223]	Competitive	Capital	Purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities [224]	Purchase of ZEBs and related infrastructure and related activities to support the ZEB transition, including construction costs.	85% of total transit bus cost. 90% of net project cost for leasing or acquiring low-no bus-related equipment and facilities. 0.5% of a request for workforce development training 0.5% for training at the National Training Institute. In FY2023, the FTA announced the availability of $1.2 billion in grants

[217] Enhanced Mobility of Seniors & Individuals with Disabilities - Section 5310 | FTA (dot.gov)
[218] Section 5310 | NADTC
[219] Grants for Buses and Bus Facilities Formula Program - 5339(a) | FTA (dot.gov)
[220] Fact Sheet: Grants for Bus and Bus Facilities Section 5339 (dot.gov)
[221] Grants for Buses and Bus Facilities Program | FTA (dot.gov)
[222] Low or No Emission and Grants for Buses and Bus Facilities Competitive Programs FY2023 Notice of Funding Opportunity | FTA (dot.gov)
[223] Low or No Emission Vehicle Program - 5339(c) | FTA (dot.gov)
[224] Low or No Emission and Grants for Buses and Bus Facilities Competitive Programs FY2023 Notice of Funding Opportunity | FTA (dot.gov)

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
	Charging and Fueling Infrastructure Discretionary Grant Program [225]	Competitive	Capital	The Charging and Fueling Infrastructure (CFI) Discretionary Grant Program is a competitive grant program to strategically deploy publicly accessible electric vehicle charging infrastructure as well as hydrogen, propane, and natural gas fueling infrastructure along designated Alternative Fuel Corridors or in other publicly accessible locations. At least 50 percent of CFI funding must be used for a community grant program where priority is given to projects that expand access to EV charging and alternative fueling infrastructure within rural areas, low- and moderate-income neighborhoods, and communities with a low ratio of private parking spaces.	Can be used to install charging infrastructure, but must be publicly accessible, so this program may not be applicable for BCT.	Both tracks of the Charging and Fueling Infrastructure Grant Program provide $1.25 billion for a total of $2.5 billion over 5 years. This first round of funding makes $700 million from Fiscal Years 2022 and 2023 funding available. 20% local match required.
	Innovative Coordinated Access and Mobility Pilot Program (ICAM) [226]	Competitive	Capital	This program provides competitive funding to support innovative projects for the transportation disadvantaged that will improve the coordination of transportation services and non-emergency medical transportation services. Local match required. [227]	Eligible activities include deploying mobility management strategies, vehicle purchase, and purchase of IT equipment.	No minimum or maximum grant award 80% federal funding of project costs
	Expedited Project Delivery Pilot Program (Section 3005b) [228]	Competitive	Capital	Expediting delivery of new fixed guideway capital projects, small start projects, or core capacity improvement projects. These projects must utilize public-private partnerships and be operated and maintained by employees of an existing public transportation provider.	Funds can be used to help expedite a number of capital projects given they meet the requirements laid out in the description.	The program will cover 25% of the project cost. The FTA has proposed $450 million in funding for FY2023.
	Public Transportation Innovation (Section 5312) [229]	Competitive	Both	Provides funding to develop innovative products and services assisting transit agencies in better meeting the needs of their customers [230]	Research, development, demonstration and deployment projects, and evaluation of technology of significance to public transit. [231]	Funds are allocated on a discretionary basis. The FTA website will update when this grant opportunity becomes available.

[225] https://www.transportation.gov/rural/grant-toolkit/charging-and-fueling-infrastructure-grant-program
[226] Innovative Coordinated Access and Mobility Grants | FTA (dot.gov)
[227] Fact Sheet: Innovative Coordinated Access & Mobility Pilot Program | FTA (dot.gov)
[228] Expedited Project Delivery Pilot Program - Section 3005(b) | FTA (dot.gov)
[229] Public Transportation Innovation - 5312 | FTA (dot.gov)
[230] Transit Cooperative Research Program - 5312(i) | FTA (dot.gov)
[231] Public Transportation Innovation Section 5312 Fact Sheet (dot.gov)

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
Federal (DOT)	Accelerating Innovative Mobility (AIM) Program [232]	Competitive	Both	AIM will drive innovation by promoting forward-thinking approaches to improve transit financing, planning, system design, and service. The AIM Initiative also supports innovative approaches to advance strategies that promote accessibility, including equitable and equivalent accessibility for all travelers. Local match required.	Eligible activities include all activities leading to the development and testing of innovative mobility, such as planning and developing business models, obtaining equipment and service, acquiring or developing software and hardware to implement the project, operating or implementing the new service model, and evaluating project results.	In FY2020, a total of $14 million was administered.
	Workforce Development Initiative [233]	Competitive Cooperative Agreement	Operating	Provides resources and support for public transit agencies to recruit, retain, and train transit workers to ensure the transit industry has the workforce needed for today and in the future. 20% local match requirement for recipients. Recipients may derive that match through in-kind activities not funded by the Federal government and match from other Federal agencies as noted in the Coordinated Council on Access and Mobility resources on match. Technical Assistance and Workforce Development Program projects = No local match.	Cooperative agreements with transit agencies to develop innovative workforce projects. Reports and information on the results of those projects. Meetings and conferences to gather information about public transit agencies. A new transit workforce technical assistance program.	Funds from this program can be used to help recruit new bus operators and train existing operators and maintenance staff on zero-emission technologies to help retain and develop BCT's existing workforce.
	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants [234]	Competitive	Capital	Formerly TIGER and BUILD, RAISE is a discretionary grant program aimed at supporting investment in infrastructure. RAISE funding supports planning and capital investments in roads and bridges. Transit, rail, ports, and intermodal transportation. Local match required.	Can be used for capital expenditures to improve transit such as vehicle purchases and dedicated bus lanes.	FY2023 includes $1.5 billion for RAISE grants
	Transportation Infrastructure Finance and Innovation Act (TIFIA) [235]	Credit/Loan	Capital	The TIFIA program provides credit assistance for qualified projects of regional and national significance, including for the construction of new transit operations and maintenance facilities. The credit program is designed to fill market gaps and leverage substantial private co-investment through supplemental, subordinate investment in critical improvements to the nation's transportation system. [236]	TIFIA is a credit assistance and loan program that transit agencies can use to fund the construction of new transit facilities to support the ZEB transition. TIFIA provides low-interest rates, flexible amortization (up to 35 years repayment period, deferrable for five years after substantial project completion), no pre-payment penalty, and interest does not accrue until proceeds are drawn.	TIFIA can be used to fund up to 49% of total project costs. Applicants must submit a detailed letter of interest to the DOT, and the project must be included in the STIP to be eligible.

[232] Accelerating Innovative Mobility | FTA (dot.gov)
[233] Workforce Development Initiative | FTA (dot.gov)
[234] RAISE Discretionary Grants | US Department of Transportation
[235] Program Overview | Build America (transportation.gov)
[236] TIFIA Credit Program Overview | Build America (transportation.gov)

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
State	SB1 (State of Good Repair) Program [237]	Formula	Capital	Provide additional revenues for transit infrastructure repair and service improvements. [238]	These formula funds are eligible for transit maintenance, rehabs, and capital projects. Agencies can choose to dedicate these funds to the purchase of ZEBs to continue the ZEB transition. BCT is currently utilizing these funds for capital improvements at the Transit Operations Facility.	Funding is based on service area population and farebox revenues.
	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) [239]	Voucher	Capital	The voucher program created in 2009 aimed at reducing the purchase cost of zero-emission vehicles. A transit agency would decide on a vehicle, contact the vendor directly, and then the vendor would apply for the voucher. [240]	Purchase of zero-emission vehicles for an agency's transition to a zero-emission fleet.	Portion of $65.6 million of funding for public transit buses
	Transportation Development Act (TDA) – Local Transportation Fund (LTF) [241]	Formula	Both	LTF is derived from ¼ percent of the statewide general sales tax on diesel fuel and returned to the county in which it was collected. [242]	Available to fund costs associated with operating public transit, including operations, capital projects, administration and planning, and transit-related research and development projects. BCT uses TDA funds for operating expenses utilizing the Public Transportation Modernization, Improvement, and Service Enhancement Account and the Transit System Safety, Security, and Disaster Response Account.	Formula funding based on diesel fuel sales tax.
	State Transit Assistance (STA)	Formula	Both	Statewide sales tax on gasoline and diesel, STA provides funding allocated to Municipal transit operators.	Funds can be used for public transportation, transportation planning, and community transit. This includes operating and capital expenses.	BCT receives formula funds proportional to the previous year's operator revenues. Funds are allocated through LA Metro's FAP.
State/South Coast AQMD	Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) [243]	Formula	Capital	Funding to help procure low- and zero-emission vehicles and equipment. In 2022, the application window was open from July 25-August 31. Local match required. [244]	Purchase of zero-emission vehicles for an agency's transition to a zero-emission fleet.	Transit buses are eligible for up to $80,000 in funding.
State/CARB/ Caltrans	Low Carbon Transit Operations Program (LCTOP) [245]*	Formula	Capital	LCTOP is a formula funding transit agencies commonly used for operations. Funding comes from 5% and 10% of the annual Cap and Trade auction.	Many agencies are already recipients of these funds and can use these funds to purchase ZEBs and related equipment.	In FY2020, the average award per agency for LCTOP funding was $912,000.

[237] 2022 State of Good Repair Program Guidelines (ca.gov)
[238] State of Good Repair | Caltrans
[239] California Air Resources Board and CALSTART reopen incentives for clean trucks and buses | California Air Resources Board
[240] Home - Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project | California HVIP
[241] Transportation Development Act | Caltrans
[242] TDA Program Presentation (ca.gov)
[243] Carl Moyer Program | California Air Resources Board
[244] South Coast AQMD - Carl Moyer Memorial Air Quality Standards Attainment (Carl Moyer) Program (aqmd.gov)
[245] Low Carbon Transit Operations Program (LCTOP) | Caltrans

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
State/CARB/ Caltrans	Transit and Intercity Rail Capital Program (TIRCP) [246]*	Competitive	Capital	TIRCP provides grants from the Greenhouse Gas Reduction Fund (GGRF) to fund transformative capital improvements that will modernize California's intercity, commuter, and urban rail systems, and bus and ferry transit systems, to significantly reduce emissions of greenhouse gases, vehicle miles traveled, and congestion.	This program funds a wide variety of projects that support new or expanded bus and rail services, improve multimodal facilities, and can include equipment, fueling, maintenance, and other costs as long as the project helps to reduce GHGs.	The five cycles of TIRCP funding have awarded $6.6 billion in funding to nearly 100 projects throughout California.
State/CARB	Sustainable Transportation Equity Project (STEP) Implementation Planning & Capacity Building [247]	Competitive	Both	Address community residents' transportation needs, increase access to key destinations, and reduce greenhouse gas emissions by funding planning, clean transportation, and supporting projects. Implementation: Local match of 20% required Planning & Capacity Building: No local contribution required	Purchase of vehicles and related equipment and infrastructure to reduce GHGs.	In the past, CARB has awarded a total of $44.5 million through the STEP program. CARB is currently working with stakeholders to determine the future of STEP going forward.
State/CARB/Air Pollution Control District	Volkswagen Environmental Mitigation Trust [248]	Both	Capital	Mitigate the excess nitrogen oxide (NOx) emissions caused by VW's use of illegal emissions testing defeat devices in certain VW diesel vehicles. Funds allocated to Zero-Emission Transit, School, and Shuttle Buses are overseen by the San Joaquin Air Pollution Control District. [249]	Purchase of zero-emission vehicles for an agency's transition to a zero-emission fleet.	$20 million of the $65 million first installment set aside for Zero-Emission Transit, School, and Shuttle Buses remain. The second installment of $65 million is now available.
California Pollution Control Financing Authority (CPCFA)	Medium-Heavy-Duty (MHD) Zero Emission Vehicle Financing Program [250]	Competitive	Capital	The CPCFA is developing a purchasing assistance program for MHD ZEV fleets. This will provide financial support and technical assistance to fleet managers deploying ZEV fleets. The program was noted to be established by January 1, 2023, but no further information is available at this time. BCT should continue to monitor this opportunity as more information becomes available.	SB 373 aims to provide financing tools and non-financial support tools for operators of medium- and heavy-duty fleets to transition their fleets to zero-emission vehicles.	Funding has not been established; BCT should continue to monitor.
LA Metro Formula Allocation Procedure (FAP)	Local Sales Tax Revenues	Formula	Both	Funds from Proposition A and C and Measures R and M are derived from local sales tax and returned to municipal transit operators as Local Return.	Funds are used for operations based on proposition/measure requirements. Some FAP funds can be used for capital if not designated toward operations. Proposition A funds can be used for local match requirements for vehicle procurement.	These funds are allocated through LA Metro based on population, formula (fare units), or at the discretion of the LA Metro Board.
Local Return, Prop A Transit Funds	Jurisdiction Contributions (Hermosa Beach, Manhattan Beach, and El Segundo)	Formula	Both	Cities included in BCT's jurisdiction contribute the Local Return transit funds received through Proposition A to Redondo Beach.	These funds are used for operating expenses but can be used for capital if not needed for operations. 5% of Proposition A funds are earmarked for projects that promote integrated public transportation. BCT uses these for WAVE demand response service.	Jurisdiction Contributions account for 4% of Line 109 operating costs.

246 Transit and Intercity Rail Capital Program | CalSTA
247 Planning and Capacity Building, Clean Mobility in Schools (CMIS), and the Sustainable Transportation Equity Project (STEP) | California Air Resources Board
248 Materials | Valley Air District
249 Volkswagen Environmental Mitigation Trust (californiavwtrust.org)
250 2021 - Senate Bill 372 (Leyva, Connie), Medium- and Heavy-Duty Fleet Purchasing Assistance Program: Zero-Emission Vehicles (Chaptered) | California Air Resources Board

Funding Source	Funding Name	Competitive or Formula	Capital or Operating	Description	Potential Applications	Potential Funding
Administered by CARB	Low Carbon Fuel Standard (LCFS credits) [251]	N/A	N/A	LCFS credits are not necessarily funding to be applied for; rather, they are offset credits that are traded (through a broker) to reduce operating costs.	Once ZEBs are acquired and operating, agencies can collect LCFS and 'sell' them to reduce the operating costs of ZEBs.	Both hydrogen and electricity used as fuels are eligible for LCFS credits. Credit prices range, but the average credit price between 2016 and 2019 was between $65 and $200 per credit, with an average of $10,000 per vehicle.
Administered by CARB	Transportation Development Credits [252]	N/A	N/A	Although they are not funds for projects, Transportation Development Credits, also called "Toll Credits", satisfy the federal government requirement to match federal funds [253]	Toll credits provide a credit toward a project's local share for certain expenditures with toll revenues. FHWA oversees the toll credits within each state.	The Local Share is 20% and ranges from region to region.
Southern California Edison (SCE)	Charge Ready Transport (CRT) [254]	N/A	Capital Infrastructure	SCE provides utility distribution service upgrades to support the installation of charging equipment and provides rebates to participants for the purchase and installation of approved EV charging equipment. The program launched in 2019 for a five-year period; it is currently unknown if the program will still be in operation when BCT procures its first BEBs. [Can be used for facility electrical upgrades and charging equipment rebates]	SCE customers must lease or purchase a minimum of two EVs, purchase and install SCE-approved charging equipment, and maintain charging equipment for at least five to 10 years. Data sharing requirement for five years as well as grant easements depending on the build option.	SCE will cover the costs leading up to the vehicle charger. In addition to infrastructure costs, SCE offers vouchers for the installation of approved chargers and equipment.

[251] LCFS Credit Generation Opportunities | California Air Resources Board
[252] Transportation Development Credits (Toll Credits) For Federal Transit Administration Projects (ca.gov)
[253] TRANSPORTATION DEVELOPMENT CREDITS (TOLL CREDITS) SECTION 5311 Rural Transit Program (ca.gov)
[254] Charge Ready Transport Program (sce.com)

One chief source of capital funding for ZEBs is the Low or No Emission (Low-No) and Bus and Bus Facility grants. In December 2021, the FTA released a Dear Colleague letter outlining new requirements for Low-No and Bus and Bus Facility grant applications. The letter details the requirement for a Zero-Emission Fleet Transition Plan in response to amendments in the statutory provisions for these programs as part of the Bipartisan Infrastructure Law. The FTA Zero-Emission Fleet Transition plan includes six major elements, presented in Table 11-7. Moving forward, to qualify for these funding opportunities, a transit agency must include a transition plan with these elements. BCT can use much of the material in this report and the ICT Plan to apply for this important source of federal funding [255].

Table 11-7: FTA Zero-Emission Fleet Transition Plan Requirements

Element	Description
1: Long-Term Fleet Plan and Application Request	Demonstrate a long-term fleet management plan with a strategy for how the applicant intends to use the current application and future acquisitions.
2: Current and Future Resources to Meet Transition	Address the availability of current and future resources to meet costs for the transition and implementation
3: Policy and Legislative Impacts	Consider policy and legislation impacting relevant technologies.
4: Facility Evaluation and Needs for Technology Transition	Include an evaluation of existing and future facilities and their relationship to the technology transition.
5: Utility Partnership	Describe the partnership of the applicant with the utility or alternative fuel provider.
6: Workforce Training and Transition	Examine the impact of the transition on the applicant's current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers of the applicant to operate and maintain ZEVs and related infrastructure and avoid displacement of the existing workforce.

[255] To view a list of winners and projects, please see https://www.transit.dot.gov/funding/grants/fy22-fta-bus-and-low-and-no-emission-grant-awards

12 NEXT STEPS

With this final TSS report that details the service plan, ZEB plan, and facility needs, BCT and the City's next steps include adopting this plan and to begin the implementation, particularly proceeding with the next steps needed to (1) construct the new OMF and (2) prepare the Title VI requirements for outreach and public notice for routing and service changes proposed for Plan Year 1. By championing the recommendations proposed here, BCT and the City can help expand public transit accessibility and mobility around the South Bay, create healthier and more sustainable communities through transitioning to ZEBs, and set BCT up for long-term success through the construction of a new, purpose-built OMF.

13 APPENDICES

APPENDIX A: PUBLIC OUTREACH SUMMARY REPORT

See attached PDF.



Public Outreach Summary Report

April 2023

Prepared By:

JCL CONSULTING GROUP

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APPENDIX 336

A. Overview

The City of Redondo Beach's ("City") Beach Cities Transit ("BCT") Transit Services Study ("Study") solicited public input and feedback to help develop recommendations for improving Short- and Long-Range Service Plans and Strategic Planning with Zero Emission Bus Implementation. BCT provides fixed-route and dial-a-ride services (with dial-a-ride services branded as the WAVE) to the Beach Cities area of Los Angeles County. Public outreach components of this Study focused on engaging bus and WAVE riders, transit service partners, and non-riders in and around Redondo Beach, Manhattan Beach, Hermosa Beach, El Segundo, and near Los Angeles International Airport (LAX). The following is a summary of the City's public outreach and community collaboration efforts that took place throughout the Study.



B. Public Participation Plan

A kickoff meeting and early team check-ins enabled JCL to fine tune the outreach goals and deliverables for the Study before finalizing a detailed Public Participation Plan (PPP). Background data was collected from BCT related to the service areas, partner agencies, key stakeholder groups, and relevant news to assist with the development of the outreach approach. The PPP served as a blueprint document for public engagement to guide Team meetings, Database, Website, E-comms, Community Events and timelines. The final draft of the document can be found in the Appendix.

Project Timeline

Public outreach for the Study began in Spring 2022 and concluded in Spring 2023, with a final technical report in Summer 2023. Two minor modifications were made to the original timeline during the course of the Study in order to maximize public participation:



1) The Study duration was extended from Spring 2023 to Summer 2023 to allow time for further technical analysis.

2) A Public Town Hall Meeting that was originally planned for Fall 2022 was exchanged for a Spring 2023 pop-up event at the 40th annual "Springfest" in Redondo Beach, where public reactions to the final recommendations were solicited.

C. Branded Collateral Material

JCL applied the City's style guidelines to develop vibrant collateral materials that reflected the intent and goals of the Study.

Fact Sheet	Social Media Assets
Email Headers	Print Ad
Website	Presentations
Flyers	Poster Boards



All materials were designed with a common 'look and feel' so audiences would recognize official communications of the Study. An overview fact sheet, available in English and Spanish, was used as the primary handout, which outlined the Study's objective, timeline, and how to participate. Fact sheets were disseminated online (project website and social media), handed out at in-person community engagement events, and included in focus group and technical working group presentations.

D. Website

JCL/Stantec built and hosted www.BCTServicesStudy.com in English and Spanish to serve as the central portal for all information. JCL conducted ongoing reviews and updates to remain in step with the developments of the Study. The website remains active for the duration of the Study to allow visitors to 'Leave a Comment' and opt-in to the database for ongoing general information from BCT. The site contained the following information:

Fact Sheet	Survey
Maps	
Timeline	Leave a Comment
Contact	Events



E. Notifications & Stakeholder Database



Public notifications for meetings and events began 3-4 weeks in advance via email (Constant Contact) and Social Media (Twitter). Relevant materials were made available for download and emailed to participants of virtual meetings. Traditional outreach methods were utilized to ensure equal access to project information via e- blasts, collateral materials, website, electronic and printed surveys in English and Spanish, and available in non-digital print format upon request.

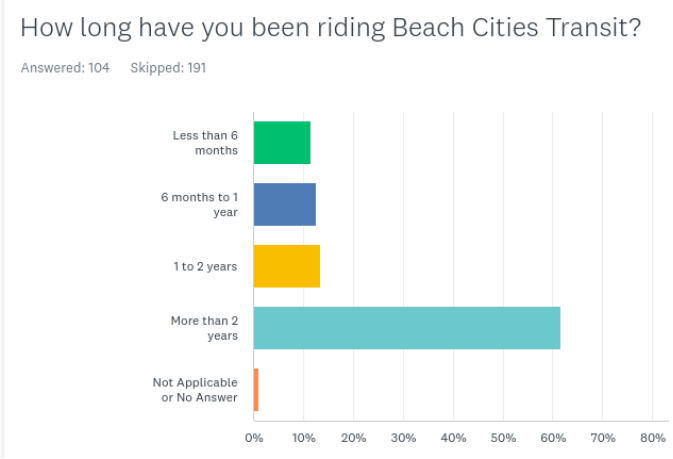
Stakeholder Database

A comprehensive and reliable database is critical to ensuring proper community outreach. The stakeholder database for BCT grew throughout the course of the Study with each meeting and community event. The database is included in the Appendix E: Final Stakeholder Database.

Local Government	Schools
Hotels	Chambers of Commerce
Businesses	Advocacy Service
Transit Stakeholders	Special Needs

F. BCT Survey Engagement

The primary focus of public outreach for this Study was a comprehensive survey to support the technical team's efforts in assessing travel habits, needs, and interests of the traveling public. the survey was launched early in the Study process so that feedback from the community could be integrated into the service plans and recommendations. A total of 295 surveys for **280 validated surveys** were collected online from June to August 2022, in addition to **337 transcribed comments** and reactions to survey questions and display boards at live events, for a total of 632 "total responses". The online survey was promoted through various online and media sources, as well as e-blasted to known stakeholders.



The survey (administered through Survey Monkey) effectively captured important feedback from BCT riders, WAVE riders, and non-riders that helped guide technical aspects of the study.

Analysis of the survey results offers insights into ridership motives, perceptions, and opportunities for improving and increasing BCT

and WAVE usage overall. Detailed survey analysis reports are in the Appendix.

Survey Findings

The online survey was broken into three subsets: BCT Transit Rider; WAVE Dial-A-Ride Customer; and Non-Rider. Based upon responses, it was determined that respondents were split, favoring riders, between Riders/Customers (154 of 280) who used BCT services in the past 3 years and non-Riders (126 of 280), who have not used any BCT services in the past 3 years. Questions posed to Riders/Customers pertained to methods, frequency, purpose, and preferences about their current experience in using BCT services. Non-Riders were queried to determine their awareness, familiarity, and likelihood to use BCT services in the future. All respondents were asked to provide a home zip code, personal demographics, and their current transportation habits. The complete survey analysis is presented in Appendix F: BCT Survey Engagement (Rider Survey in Appendix F: Section 1.1, WAVE Rider Survey in Appendix F: Section 1.2, and Non-Rider Survey in Appendix F: Section 1.3).

BCT and WAVE Rider & Customer Satisfaction Highlights

A multi-part question on overall rider satisfaction was asked of BCT Riders and WAVE Users that allowed respondents to rate their range of contentment with service (see Appendix F: Figure 12; Figure 26).

- A strong majority of BCT fixed route respondents expressed that they were either **Satisfied or Extremely Satisfied** with times spent onboard the bus, value for fare paid, bus cleanliness and comfort, personal safety on the bus/at stops, and their overall experience.
- WAVE customers who completed the survey expressed **general satisfaction** with travel times and hours the WAVE service is available, while some respondents expressed dissatisfaction with the registration process for the service.

Non-Rider Feedback Highlight

A multi-part question posed, "What factors would encourage you to ride BCT more often?" to non-BCT Riders. In line with responses given during in-person engagement, the majority of respondents to the survey stated that having more information about BCT services was the determining factor (See Appendix F; Figure 33). Plus, 85% agreed or strongly agreed that public transit is an important service for the community (See Appendix F; Figure 32).

Demographic Information (Optional Questions)

Overall respondent demographics skewed female (60%), white or Caucasian (63%), and over 35 years old with under 35 (Under 18, 18-24, and 25-34) making up only 21% of respondents. Respondents overwhelmingly indicated household incomes greater than $75,000 with only 15% indicating a household income below $75,000. This largely aligns with the demographics of the overall service area, where the majority of South Bay residents are over 35 years of age (with a median age of 40), 66% of residents identifying as white or Caucasian, and median household income above $75,000 (specifically $125,000).

Comparative analysis of respondents relative to the demographics of census data against the City of Redondo Beach may be accomplished at https://www.city-data.com/city/Redondo-Beach-California.html.

G. Public Outreach

Three virtual public *Focus Group Meetings (3)* were conducted over a three-week period in July 2022. Participants were recruited through targeted outreach, social media, and invitations to organic stakeholders. During the 75-minute sessions, participants were presented with information related to existing BCT performance, as well as challenges and opportunities for public transit to be improved. The structure of the meetings was designed to capture the opinions and preferences of a diverse stakeholder group, including business groups, employees, commuters, seniors, students, parents, caregivers, community-based organizations, and non-profit organizations.



Three live *Pop-Up Engagements (3)* engagements were conducted by study team members at the Metro C (Green) Line Douglas Station, Redondo Beach's Farmers Market, and the 40th Annual Springfest '23 in Redondo Beach. These bilingual (English and Spanish) engagements included dedicated survey time with incentivized participation. The City of Redondo Beach also conducted five hyper focused engagements at senior cen`ters and Farmers Markets.

General Outreach Analysis



BCT's ability to affect ridership by employing broader information and awareness campaigns was a common theme repeated through each channel of engagement during the study's public outreach efforts. Focus group participants, pop-up attendees, and survey respondents made varying statements demonstrating their lack of knowledge services offered by BCT.

- *"I would ride more if I had more information."*
- *"I would ride more if I felt more comfortable".*
- *"I would ride more if the bus went to more places."* – Respondents did not know the location of bus stops, tying back to lack of information and awareness. Example: A vast majority of the weekly Redondo Beach Farmers Market attendees interviewed were unaware of two bus stops there at venue.
- BCT riders who regularly use the bus lines expressed dismay about irregular service. NOTE: This observation must be measured against low post-COVID ridership.
- Bus stop amenities such as lighting, benches, and shelters are highly ranked enhancements identified by study participants in every channel of engagement.
- Older Adults are incredibly open to participating in mobility training for greater independence and improved quality of life.

Date	Event	# of Participants/ Responses Collected	Purpose
5/20/2022	**City Engagement:** Manhattan Beach Senior Fair	7 comment cards	Promote the BCT Survey and engage with the Beach Cities residents
7/12/22	**Focus Group #1**: Businesses	5 attendees	Engage in a robust discussion with businesses and businesses groups
7/14/22	**Pop-up:** Douglas C Line Station	88 comments & reactions	Promote survey responses and engage with transit users
7/19/22	**Focus Group #2:** Seniors, Students, Caregivers	7 attendees	Engage in a robust discussion with seniors, students, and caregivers
7/20/2022	**City Engagement:** Redondo Beach Senior Open House, Veterans Park	1 comment cards	Promote the BCT Survey and engage with the Beach Cities residents
7/21/22	**Pop-up:** Redondo Beach Farmers Market	74 comments & reactions	Promote the BCT Survey and engage with the Beach Cities residents
7/22/2022	**City Engagement:** Hermosa Beach Farmers Market	21 comment cards	Promote the BCT Survey and engage with the Beach Cities residents
7/26/22	**Focus Group #3:** Organizations	8 attendees	Engage in a robust discussion with seniors and community stakeholder groups
7/27/2022	**City Engagement:** Redondo Beach Senior Open House, Perry Park	7 comment cards	Promote the BCT Survey and engage with the Beach Cities residents
8/11/2022	**City Engagement:** El Segundo Farmers Market	8 comment cards	Promote the BCT Survey and engage with the Beach Cities residents
4/15/23	**Pop-up in lieu of Public Meeting:** Redondo Beach Springfest 2023	91 comments & reactions	Solicit public feedback to the final Recommendations

H. Technical Working Group Meeting

In addition to gathering feedback from transit riders, the study engaged with a group of transit service operators to brainstorm future routes, stops and connection solutions that would promote optimal efficiency and the greatest success in the South Bay Region for providers and riders alike. The

Technical Working Group Meeting was held virtually on August 10, 2022. Chief among topics of discussion included presenting draft service recommendations for initial feedback, including routing changes to Line 102 and 109 and the proposed summer beach bus along Manhattan Beach Blvd. The session also discussed how to increase WAVE ridership and awareness. Technical Working Group participants provided a voice and perspective on their local communities and how BCT could better serve their communities to improve mobility, or how BCT can work with other transit agencies to improve overall mobility and accessibility in the South Bay.

The group formed to advise the study consisted of an 8- member group, representing transit agencies and municipalities in the region, including:

- City of Redondo Beach
- City of Manhattan Beach
- City of Hermosa Beach
- City of El Segundo
- Torrance Transit
- LA Metro
- GTrans
- Palos Verdes Peninsula Transit Authority (PVPTA)

A summary of the discussion grouped by discussion topic is presented below.

Fixed route key discussions

- Considerations for alternate routing of Line 102 were discussed to route trips leaving RBTC along Ripley past Adams Middle School. Ripley was determined to not be an ideal street for transit as it is a hilly residential collector. The Redondo Beach Council Member did indicate support for the proposal and support from constituents in that area.

- The proposed route realignment to Line 109 would no longer provide access to Plaza El Segundo as there is no stop along Sepulveda SB. The Metro representative provided insight on previous attempts by Metro to get a southbound stop along the west side of Sepulveda, across from Plaza El Segundo. Issues due to access to the oil refinery blocked the attempt. There was general support for this realignment considering ridership levels and the benefits of streamlining to the overall route, with the general consensus being that the positives from streamlining the route outweigh the negatives of removing these underutilized stops.

- Additional context for the origins of the Line 109 detour along Rosecrans was provided by the Manhattan Beach representative. Originally requested to provide direct service to the Manhattan Village Mall and near the senior community on Parkview Ave, there was a consensus that the streamlining and elimination of this detour was warranted.

- Service recommendations for Line 102 to take over the southern portion of Line 109 from the Redondo Beach Pier to Riviera Village, with Line 109 terminating at the pier were proposed in this technical working group. The representative from Torrance Transit shared their operational experiences with multiple buses

serving the pier. Due to limited curb space at the pier, Torrance Transit experiences challenges with Lines 3 and 7 buses needing to maneuver within the limited space. Discussion of dedicating additional red curb was brought up as well as the operational importance of proper scheduling. Further explanation of this service change can be found in Section 7.2.1 of the Transit Services Study Final Report.

- The proposed addition of an east-west route focused on beach service was discussed with this group. Generally well received, the idea of a pilot with the potential for a permanent route was discussed. The service recommendation for this route can be found in Section 7.2.4.

WAVE key discussions

- Outreach and marketing of WAVE services were discussed at length in this working group. It was identified that if senior populations are widely unaware of the WAVE, it is the responsibility of Beach City partners to engage their local populations. Uncertainty of key partnerships between BCT/WAVE and organizations like Beach Cities Health District to promote LA Metro's *On the Move Riders Program* was brought up. Discussion of outreach and engagement with WAVE-eligible residents can be found in Section 7.2.3 with further elaboration in Section 7.3.4.4.

- Considerations for expanding WAVE service to the general public as a late-night service were proposed. A representative from Hermosa Beach noted that an on-demand service would likely be popular on nights and weekends in downtown Hermosa Beach as a way to get home safely after a night out. The representative from PVPTA pointed out that evening service could avoid the challenges other all day on-demand services have run into with high demand from students after school. Further discussion of WAVE service considerations can be found in Section 7.3.3.2.

J. Comments Log

337 transcribed comments and reactions to survey questions and display boards were captured throughout the comment portion of the Study. Many of the comments amplified sentiments of the Study Team and Technical Working Group participants, largely related to a lack of awareness and education about BCT and the services they offer. All comments are noted in Appendix G.

Sampling of Summarized Comments

1. A Participant stated that more easily accessible printed materials available in businesses (grocery stores were mentioned) regarding BCT services and bus schedules would encourage them to consider using BCT more often.
    a. See Section 6.4 in TSS 2 for recommendations related to enhancing public awareness.

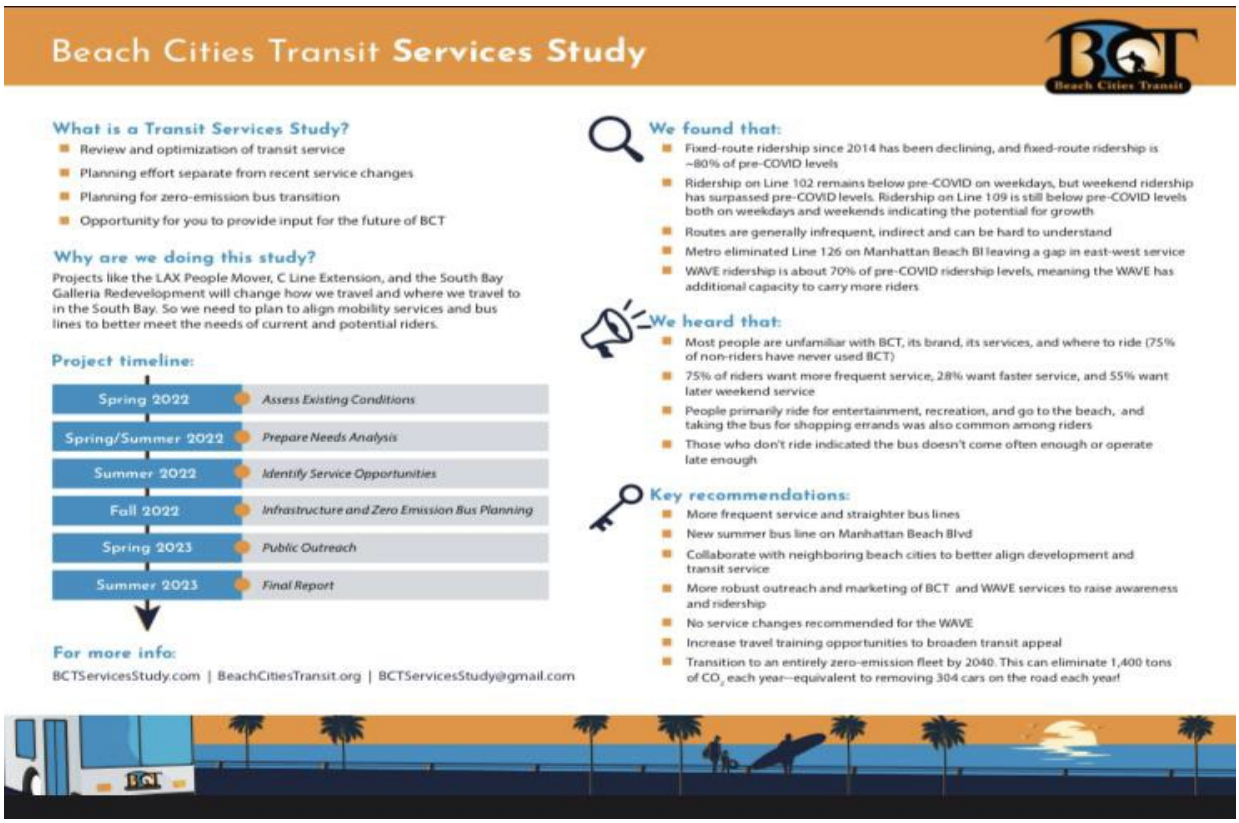
2. A Participant, like some stated in pop-up events, mentioned just generally having better line connections to places they may consider going. The "limitation" of the routes prevent them from exploring the region more utilizing BCT.
    a. See Section 5.4 in TSS 2 which discusses expanded services, and see Section 6.2 in TSS 2 for recommendations related to regional connectivity.

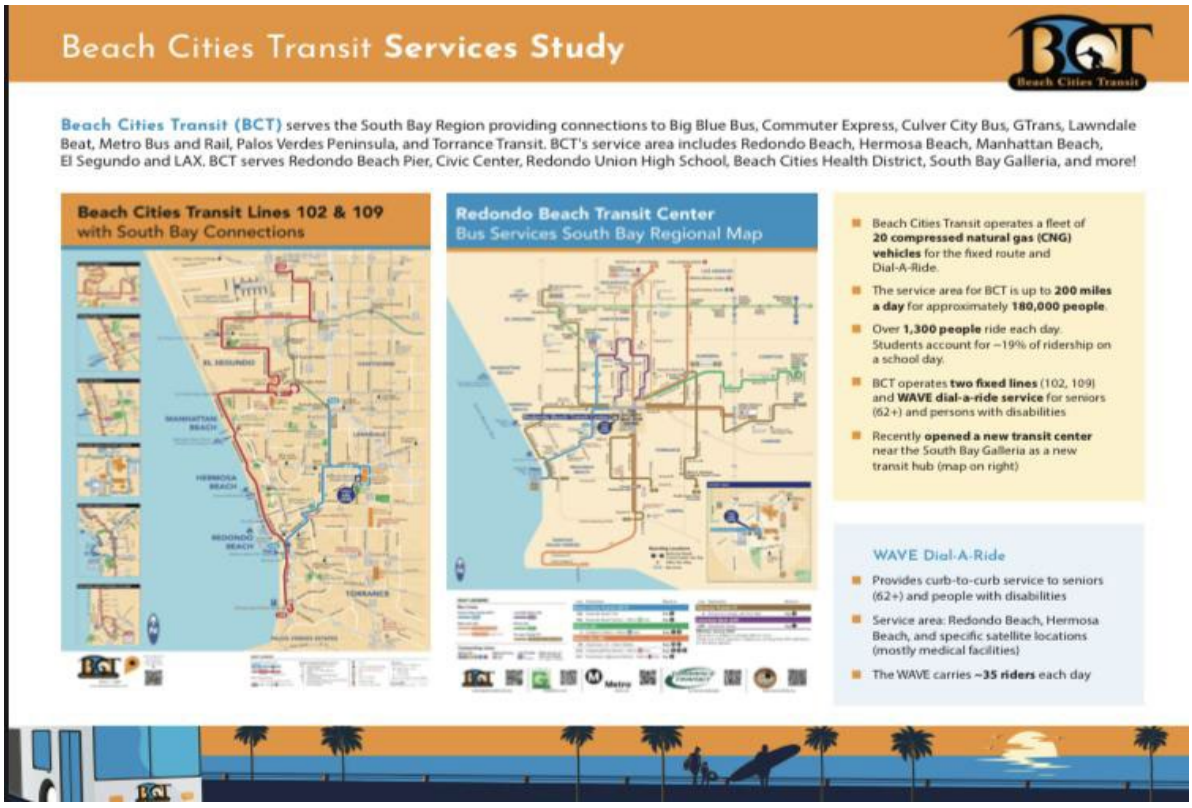
3. A Senior stakeholder discussed their desire to start using the service regularly - both fixed line and possibly Dial-a-Ride - in the future. When the stakeholder was given a description of “travel training”, they stated that they would find it beneficial and a training they would definitely use.
    a. See Sections 5.3 and 6.3.2 in TSS 2 for recommendations related to travel training.

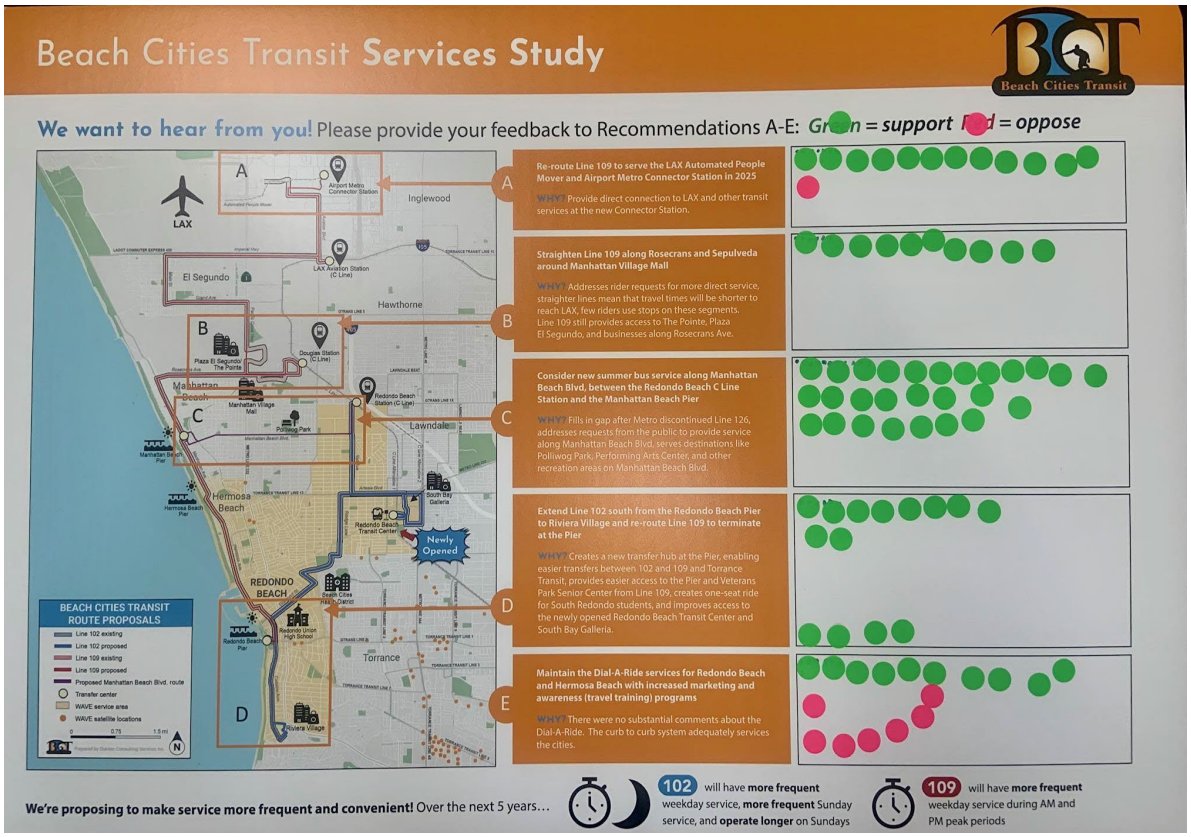
I. FINAL RECOMMENDATIONS



On April 15, 2023, a pop-up engagement at the 40th Annual Springfest was the backdrop of the final public engagement to publicly announce the Study team's final Recommendations. Stakeholders were provided with an opportunity to provide input on the Recommendations, ask questions, and comment by placing green and red dots on graphic boards and maps of the proposed changes. To incentivize participation, a prize wheel, a "selfie" photo station, and fun giveaways were offered. A total of 91 written comments and reactions were captured at the final public event, with several hundred more visitors who were exposed to BCT, with respect to marketing and general awareness. Final recommendations were posted to the project website for public comment. Eblasts and Twitter posts went out to the BCT database and followers to encourage the public to 'Leave a Comment'.




Beach Cities Transit Services Study
Beach Cities Transit (BCT) serves the South Bay Region providing connections to Big Blue Bus, Commuter Express, Culver City Bus, GTrans, Lawndale Beat, Metro Bus and Rail, Palos Verdes Peninsula, and Torrance Transit. BCT's service area includes Redondo Beach, Hermosa Beach, Manhattan Beach, El Segundo and LAX. BCT serves Redondo Beach Pier, Civic Center, Redondo Union High School, Beach Cities Health District, South Bay Galleria, and more!
Beach Cities Transit Lines 102 & 109 with South Bay Connections
Redondo Beach Transit Center
Bus Services South Bay Regional Map
Beach Cities Transit operates a fleet of 20 compressed natural gas (CNG) vehicles for the fixed route and Dial-A-Ride.
The service area for BCT is up to 200 miles a day for approximately 180,000 people.
Over 1,300 people ride each day. Students account for ~19% of ridership on a school day.
BCT operates two fixed lines (102, 109) and WAVE dial-a-ride service for seniors (62+) and persons with disabilities
Recently opened a new transit center near the South Bay Galleria as a new transit hub (map on right)
WAVE Dial-A-Ride
Provides curb-to-curb service to seniors (62+) and people with disabilities
Service area: Redondo Beach, Hermosa Beach, and specific satellite locations (mostly medical facilities)
The WAVE carries ~35 riders each day


Beach Cities Transit Services Study
We want to hear from you! Please provide your feedback to Recommendations A-E: Green = support Red = oppose
A
Re-route Line 109 to serve the LAX Automated People Mover and Airport Metro Connector Station in 2025
WHY? Provide direct connection to LAX and other transit services at the new Connector Station.
B
Straighten Line 109 along Rosecrans and Sepulveda around Manhattan Village Mall
WHY? Addresses rider requests for more direct service, straighter lines mean that travel times will be shorter to reach LAX, few riders use stops on these segments. Line 109 still provides access to The Pointe, Plaza El Segundo, and businesses along Rosecrans Ave.
C
Consider new summer bus service along Manhattan Beach Blvd, between the Redondo Beach C Line Station and the Manhattan Beach Pier
WHY? Fills in gap after Metro discontinued Line 126, addresses requests from the public to provide service along Manhattan Beach Blvd, serves destinations like Polliwog Park, Performing Arts Center, and other recreation areas on Manhattan Beach Blvd.
D
Extend Line 102 south from the Redondo Beach Pier to Riviera Village and re-route Line 109 to terminate at the Pier
WHY? Creates a new transfer hub at the Pier, enabling easier transfers between 102 and 109 and Torrance Transit, provides easier access to the Pier and Veterans Park Senior Center from Line 109, creates one-seat ride for South Redondo students, and improves access to the newly opened Redondo Beach Transit Center and South Bay Galleria.
E
Maintain the Dial-A-Ride services for Redondo Beach and Hermosa Beach with increased marketing and awareness (travel training) programs
WHY? There were no substantial comments about the Dial-A-Ride. The curb to curb system adequately services the cities.
BEACH CITIES TRANSIT ROUTE PROPOSALS
Newly Opened
We're proposing to make service more frequent and convenient! Over the next 5 years…
102 will have more frequent weekday service, more frequent Sunday service, and operate longer on Sundays
109 will have more frequent weekday service during AM and PM peak periods

Each recommendation and how it was received by the public is summarized below.

- Recommendation A: re-route Line 109 to serve the LAX Automated People Mover and Airport Metro Connector Station in 2025 to provide a direct connection to LAX and other transit services at the new Connector Station. Out of 13 total reactions, 92% of responses support this recommendation.

- Recommendation B: straighten Line 109 along Rosecrans and Sepulveda around Manhattan Village Mall, to address rider requests for more direct service and a quicker travel time to LAX. This recommendation removes service to stops that see very few passenger boardings and still maintains access to The Pointe, Plaza El Segundo, and businesses along Rosecrans Ave. 100% of respondents at Springfest support this recommendation.

- Recommendation C: consider new summer bus service along Manhattan Beach Blvd., between the Redondo Beach C Line Station and Manhattan Beach Pier. This fills in a gap in service left after Metro discontinued Line 126, addresses requests from the public to provide service along Manhattan Beach Blvd., and serves many entertainment and recreational destinations like Polliwog Park and the Performing Arts Center. Reception from the public at Springfest was very supportive of this recommendation, with 27 total respondents, 100% of which support this recommendation.

- Recommendation D: extend Line 102 south from Redondo Beach Pier to Riviera Village and re-route Line 109 to terminate at the Pier, creating a new transfer hub at the Pier which enables easier transfers between Line 102 and Line 109 and Torrance Transit. This also provides easier access to the Pier and Veterans Park Senior Center from Line 109, creates a one-seat ride for South Redondo students, and improves access to the newly opened RBTC and South Bay Galleria. 100% of respondents at Springfest support this recommendation.

- Recommendation E: maintain the WAVE DAR services for Redondo Beach and Hermosa Beach with increased marketing and awareness (travel training) programs, as there were no substantial comments about the WAVE in previous outreach activities. The curb-to-curb system adequately services the cities. 59% of respondents support this recommendation.

Overall, these responses show a high level of support and excitement for implementing the proposed recommendations, while reactions to Recommendation E present an opportunity for more targeted outreach regarding the WAVE to understand specifically why there is more opposition to this recommendation compared to the other recommendations.

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APPENDIX

A-1 Public Participation Plan

A-2 Branded Collateral Materials

A-3 Focus Group Presentation

A-4 Technical Working Group Presentation

A-5 Final Stakeholder Database (w/ highlighted participants)

A-6 Survey Results

A-7 Transcribed Comments

A-8 Public Meeting Pop Up Project Boards

APPENDIX A-1: PUBLIC PARTICIPATION PLAN

PUBLIC PARTICIPATION PLAN
Beach Cities Transit: Transit Services Study
April 2022 DRAFT (revised 4/25/2022)

JCL CONSULTING GROUP

PUBLIC PARTICIPATION PLAN

This Public Participation Plan (PPP) will serve as a blueprint and guiding document for how public engagement will be managed for the Beach Cities Transit (BCT) Transit Services Study (the Study) for the City of Redondo Beach (City). JCL Consulting Group (JCL) will engage a broad and multilingual representative sample of the community to build public awareness about the Study and to gather meaningful input to inform technical alternatives. Each of the sections below expands JCL's role as the Outreach lead. The final draft of this document will be archived for record keeping.

- PDT Meetings
- Stakeholder Database
- Comment Log
- Branding
- Webpage
- E-communications
- Media Notifications
- Surveys
- Focus Groups
- Townhall Meetings
- Summary Report
- Outreach Timeline

1. Project Development Team (PDT) Meetings

Approach: City and Stantec will determine a list of PDT members. Stantec will coordinate monthly meetings to help guide the development of the Study. The role of this internal technical advisory group will be to provide perspectives and input to aid in the fulfillment of the Study goals by identifying existing issues and opportunities, sharing insights on community opinion and need, and providing feedback to help define the final Study. JCL will participate in key PDT meetings, as needed, to work effectively and in concert with the team. In addition, Stantec/JCL will arrange and lead outreach coordination calls with the City, as needed to achieve outreach goals and objectives outlined in this initial plan.

Lead: City/Stantec

Support: JCL

Timing: Project Kickoff Meeting, Feb 23, 2022; recurring PDT Meetings

Deliverable:

- JCL participated in Kick-Off Meeting and a PPP Meeting
- JCL will participate in recurring PDT Meeting(s) as needed
- JCL will hold outreach coordination calls, as needed

2. Stakeholder Database

Approach: JCL/Stantec will develop a contact list which will serve as the official stakeholder database for the Study. It will build upon existing lists provided by the City, which will be tiered by stakeholder type such as City Council, Sister Cities, Community Groups, and General Plan list.

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Critical information collected will include post mail addresses for direct mailing and e-mail addresses for electronic notifications (or e-blasts). The database will also be used as a tool to document and track meeting participation, meeting notifications, public input, and other interactions with each contact. The following types of information will be collected in the database:

- First Name
- Last Name
- Organization
- Department
- Title
- Email
- Address
- City
- State
- Zip Code
- Phone
- Mobile Phone
- Record Source
- Date of Entry
- Category
- Subcategory
- Notes
- Engagement Participation

A comprehensive and reliable database will be critical to ensuring proper community outreach. Through ongoing outreach efforts, JCL will gather and add new contacts throughout the life of the Study.

Lead: City

Support: JCL/Stantec

Timing: Develop March – April 2022; maintained ongoing thereafter through February 2023

Deliverable:

- Draft and final Master Stakeholder Database
- Ongoing database maintenance throughout Study

3. Comment Log & Issues Matrix

Approach: In order to store any feedback collected and inquiries received, JCL/Stantec will develop a Comment Log & Issues Matrix. JCL, as directed by City, will log all comments and questions onto the team-shared drive. This tool will provide assigned team member(s) access to update, track and assess public interests, concerns and sentiment for alternatives development and reporting. JCL will develop the monitoring tool and maintain ongoing record for team use and providing additional summaries, as needed. Comments gathered will be shared with the City and Stantec throughout the engagement process, particularly at key milestones and used to inform the technical process.

All new contacts gathered from public comment will be recorded in this master database to ensure ongoing inclusion in the Study engagement process. JCL will work with City and Stantec to manage all inquiry responses. As needed, JCL can work with City staff to draft a set of standard responses for general inquiries and manage response to questions. JCL will continue to manage and update the database with contacts from the comment log to ensure all new stakeholders and interested parties are included in the engagement process going forward.

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Lead: JCL/Stantec

Support: City

Timing: Develop template in April 2022; maintained ongoing through life of Study

Deliverable:

- Draft, final and share Comment Log & Issues Matrix template
- Maintain ongoing log updates throughout Study
- Present periodic log summaries following outreach milestone or as needed

4. Branding

Approach: JCL/Stantec will apply the City's existing Style Guide as the lead to develop a logo and other materials that align with existing branding. The City's brand style guideline has been added to the Team's shared drive. JCL will include concepts for the Study name, logo, website graphics, presentation templates, and imagery that reflects the intent and goals of the Study.

Lead: JCL/Stantec

Support: City

Timing: March – April 2022

Deliverable:

- Create draft and final branding, name, logo(s), slogan(s), url
- Branding in Mandarin and Spanish translations, as needed
- Develop templates for collateral, website, noticing, PowerPoint presentation, exhibits and other Study materials, as needed

5. Collateral Resources

Approach: JCL/Stantec will develop needed collateral, which will include basic information to provide stakeholders with a background and purpose and need for the Study among other information that tells the story through images and few words. An Overview Fact Sheet and Frequently Asked Questions (FAQ) will be designed chief among these materials; however, other print/downloadable resources may be needed to fully explain the Study and for public meeting announcements. All collateral will be designed with a common 'look and feel' so that community members recognize official publications of the Study. All material development will be a collaborative process with the City; however, the City will have full control over final product messaging and design/layout. JCL will provide translation services for collateral

APPENDIX A-1: PUBLIC PARTICIPATION PLAN

resources as determined to be necessary following consultations with the City. Lastly and as needed, JCL will work with the City to refresh information collateral at the end of this first phase to ensure messaging is accurate and responsive to future Study development.

Lead: JCL/Stantec

Support: City

Timing: April 2022; update materials as needed

Deliverable:

- Final Overview Fact Sheet content/design
- Final FAQ content/design
- Final other collateral materials, as prescribed and within budget
- Translation for Overview Fact Sheet and any other collateral in the approved languages

6. Webpage Development

Approach: JCL/Stantec will build and host www.BCTServicesStudy.com to serve as a central portal for all information. This site will display accurate and pertinent information, including collateral material, maps, surveys, meeting flyers, and links related to the Study. If requested, JCL can have the site content translated into Spanish, Vietnamese, or other languages.

Throughout the Study's life, JCL/Stantec will conduct ongoing reviews of the webpage and make periodic recommendations to maintain the integrity and benefit of the site. The Study webpage may also serve as a means of collecting contact information from interested parties wanting to follow the Study and receive Study updates and meeting invites.

Lead: JCL/Stantec

Support: City

Timing: Website Outline March 2022; Launch April-May 2022; Updated content ongoing

Deliverable:

- Draft and final webpage content. JCL will assist with the development of webpage content.
- Facilitate launch of live webpage
- Periodic review and recommendations to refresh/update webpage content

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7. E-communications Tool Kit

Approach: An E-communications Tool Kit may be established, if deemed necessary, to facilitate and increase Study awareness and to support notification efforts for public surveys and public meetings. This tool kit would allow the City to cast a wider net and ultimately reach more community members throughout the greater Study area by extending engagement efforts to leverage well-established stakeholders, community groups and organizations, adjacent cities and relevant agencies. Using the tool kit, participating stakeholders will be able to share the Study's messages and announcements on their online communication platforms. The tool kit provides a menu of copy-ready text and links for stakeholders to incorporate into their websites, social media, newsletter, e-blasts or message networks. Email correspondence from the Study will come from BeachCityTransit@gmail.com (reserved). In conjunction with copy-ready text, graphics can be created (with City approval) and included that can be dropped into various social media platforms. These graphics would provide content to easily convey Study messaging. JCL can translate the tool kit into non-English languages to enhance reach into the local communities, as directed by the City.

To facilitate distribution, JCL/Stantec can also collaborate with City to designate a tool kit distribution list on the Stakeholder Database. JCL will distribute the tool kit, per the City's direction, prior to upcoming public engagements.

Lead: JCL/Stantec

Support: City

Timing: February/May 2021

Deliverable:

- Tool kit development
- Translation into non-English as needed
- Execute distribution of toolkit and documentation as needed

8. Notifications and Media

Approach: To establish public awareness about Public Surveys and Meetings, JCL/Stantec will develop a list of online notification platforms, content, graphics, languages, targeted audiences, and proposed distribution schedules around each outreach milestone.

City Twitter and other email lists will be weighed and determined for use in Study outreach. These engagement methods, along with stakeholder database e-blasts, public counter flyer displays, and other

APPENDIX A-1: PUBLIC PARTICIPATION PLAN

notices may be recommended to disseminate meeting and survey invitations. JCL will draft all content and clear final copy, graphics and schedule with the City prior to any distribution.

As noted, geofencing and Facebook ads are available, as needed, to communicate with geographical and demographically targeted communities. JCL can work with the City and within the limits of selected tools to send electronic ads directly to targeted users of mobile and other computer devices and/or Facebook users. All notices may be translated into non-English languages, as directed by City.

Lead: JCL/Stantec

Support: City

Timing: Spring – Summer 2022, as needed

Deliverable:

- Prepare notification calendar for each outreach milestone
- Draft, design, and final e-blast content, as needed
- Draft, design, and final social media, as needed
- Draft and final media advisory, as needed
- Translation as needed
- As needed, draft/design and final social media ads (targeted) as needed

9. Survey

Approach: A survey will be developed using Survey Monkey, an online tool to create forms and surveys that contain both text and graphics and make asking questions easy and shareable on any mobile or desktop device through a seamless interface. The surveys will also be developed for print format to collect data at in-person events and pop-ups.

In addition to supporting generic multiple-choice questions, the BCT survey tool also allows for the collection of open-ended, geographic responses which will assist the team in collecting meaningful insights and opinions from the public by way of a live interactive map, which allows users to provide input by both, category, and location. Members of the public will have their say by simply dragging and dropping pins on a map interface. The public, key stakeholders, and anyone else with an interest in the Study can all add and view feedback in this live map, allowing for greater transparency throughout the survey.

Survey questions, including overview and demographic questions, will be developed by the City and Stantec with JCL providing recommendations and supporting question refinement. JCL will translate the final survey into other languages as needed. The City will provide review oversight and final approval prior to survey launch. The engagement tool(s) will be promoted through various online and media sources as

APPENDIX A-1: PUBLIC PARTICIPATION PLAN

well as e-blasted to known stakeholders using Constant Contact or similar eblast tool. JCL will gather and present survey results and share with the team.

Lead: JCL

Support: City/Stantec

Timing: Digital Surveys Summer – Fall 2022;
Print Surveys at Live Pop-Up events

Deliverable:

- Draft, design, and finalize online survey content, digital and print
- Translation into approved languages, as needed
- Launch online surveys
- Post and share combined survey through online media resources

10. Public Meetings

Approach: Four (4) virtual public meetings and two (2) live pop-up engagements will help spread the word about the Study. JCL/Stantec will collect valuable feedback from a broad and diverse audience to help refine Study findings and inform the next steps of development. Following each public engagement, JCL will report on the level of engagement and key takeaways. Surveys and comments will be documented for incorporation into the study. All public meetings can be recorded and posted to the project website, as directed by the City.

Public Meetings
Virtual public meetings for this study will consist of three (3) Focus Group meetings and one (1) Townhall meeting. JCL will work with City and Stantec to prepare a live virtual experience. The team will agree on the appropriate staff, speakers, language support and other details leading up to the scheduled meeting dates. JCL will lead the coordination and logistics and will assist with the development of presentation materials, from an outreach perspective. The City will serve as emcee for both Focus Groups and the Virtual Townhall, with Stantec providing technical support. Notifications, as noted previously, will begin approximately 3-4 weeks prior to each meeting. Relevant material will be made available for download at the time of the meetings and on the Study webpage.

Focus Groups (3) consist of technical experts from BCT, Sister Cities representatives, and community-based organizations (CBOs) with a focus on transit. The purpose of these meetings is to inform the technical analysis and alternatives. All Focus Group sessions will be publicly announced and streamed for public viewing and Q&A.

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JCL CONSULTING GROUP

Virtual Townhall (1) will be the final public meeting in the series to report the Study's process and findings to the broader community, including seniors, students, and business owners within the Study area. The Townhall meeting will include extended outreach to Stakeholders in the database to reach the largest audience possible. Select stakeholders in the Study database will be asked to share the eblast and digital assets announcing the meeting date. The Virtual Townhall meeting may include language translators and ASL interpreters, as requested.

Pop Up engagements (2). JCL will set up a survey station on a college campus during May 2022 and at a Metro C (Green) Line connection during Summer 2022 to solicit responses from students and commuters in digital and print formats. Surveys will be made available in multiple languages, as needed. To help incentivize participation, JCL will offer free water bottles to survey takers.

Lead: JCL/Stantec

Support: City

Timing: Three (3) virtual stakeholder Focus Groups, Spring – Summer 2022
One (1) publicly announced virtual Townhall Meeting, Summer 2022
Two (2) pop up engagements with printed surveys, May 2022 and Summer 2022

Deliverable:

- Hold three (3) Zoom meetings and one (1) Zoom webinar
- Lead dry-run rehearsals with presenters
- Provide interpretation services as needed
- Record and document meeting participation and public comments
- Staff two (2) live pop-up events, one during May 2022 to capture student feedback and one at a C (Green) Line connection during Summer 2022

APPENDIX A-1: PUBLIC PARTICIPATION PLAN

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JCL CONSULTING GROUP

11. Summary Report

Approach: An outreach report will be prepared by JCL/Stantec and submitted to summate all engagement activities to support the Study. This document will provide a clear concise record of the development and implementation of all outreach activities. The outreach report will capture public engagement activities, including the various resources and tools. The JCL/Stantec prepared report will also categorize and summate all comments received. The City staff will be provided opportunity to review and provide feedback on the outreach report prior to final submission for record keeping.

Lead: JCL/Stantec

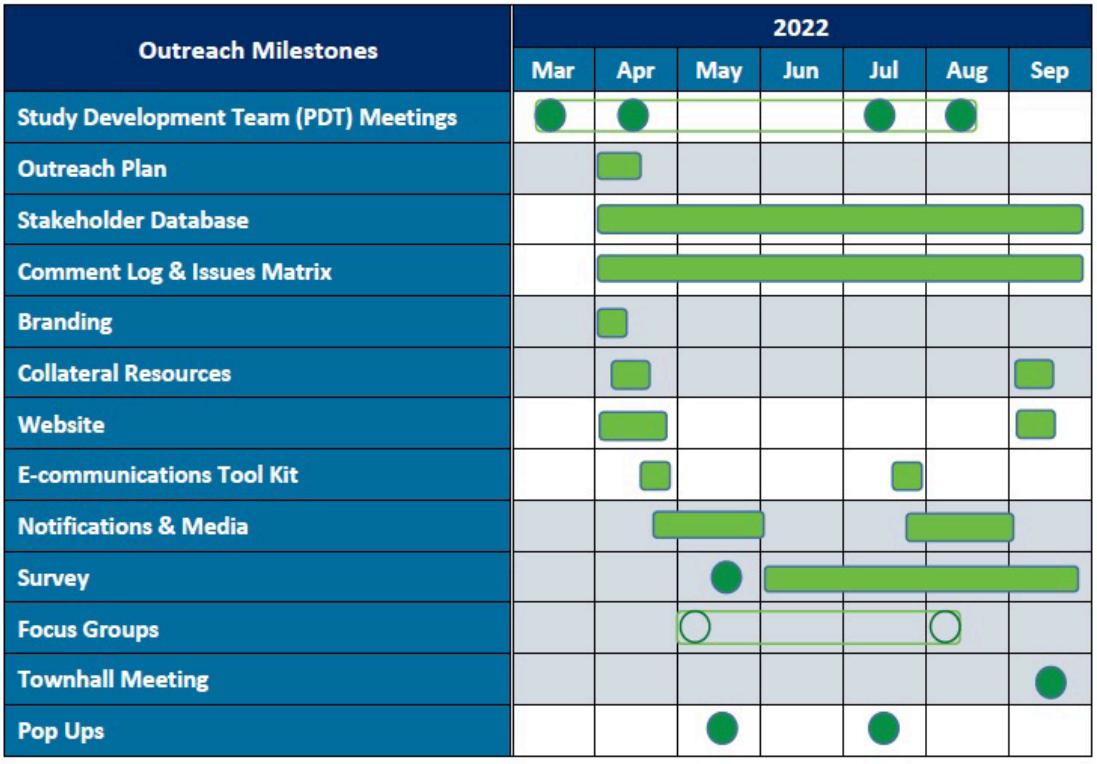
Support: City

Timing: 2023

Deliverable:

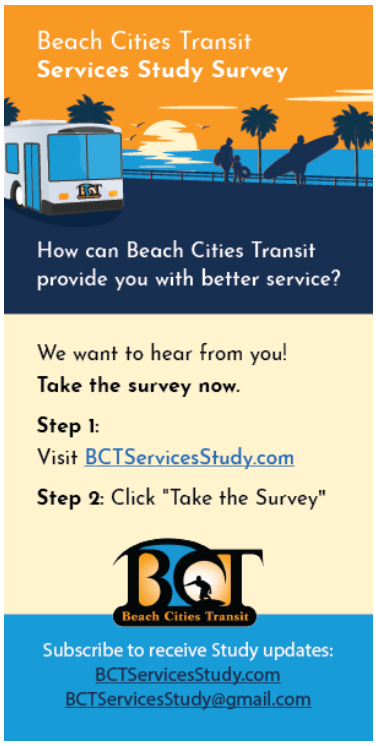
- Draft and finalize Outreach Summary Report

OUTREACH TIMELINE



APPENDIX A-2: BRANDED COLLATERAL MATERIALS











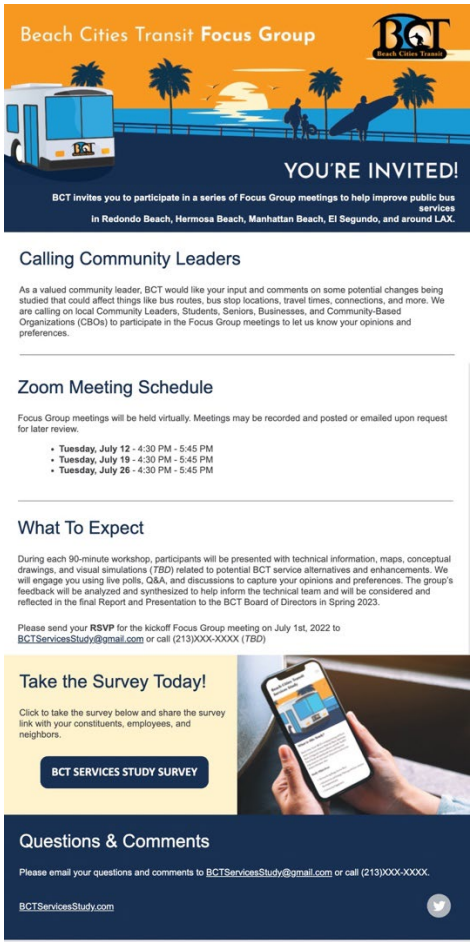
APPENDIX A-2: BRANDED COLLATERAL MATERIALS







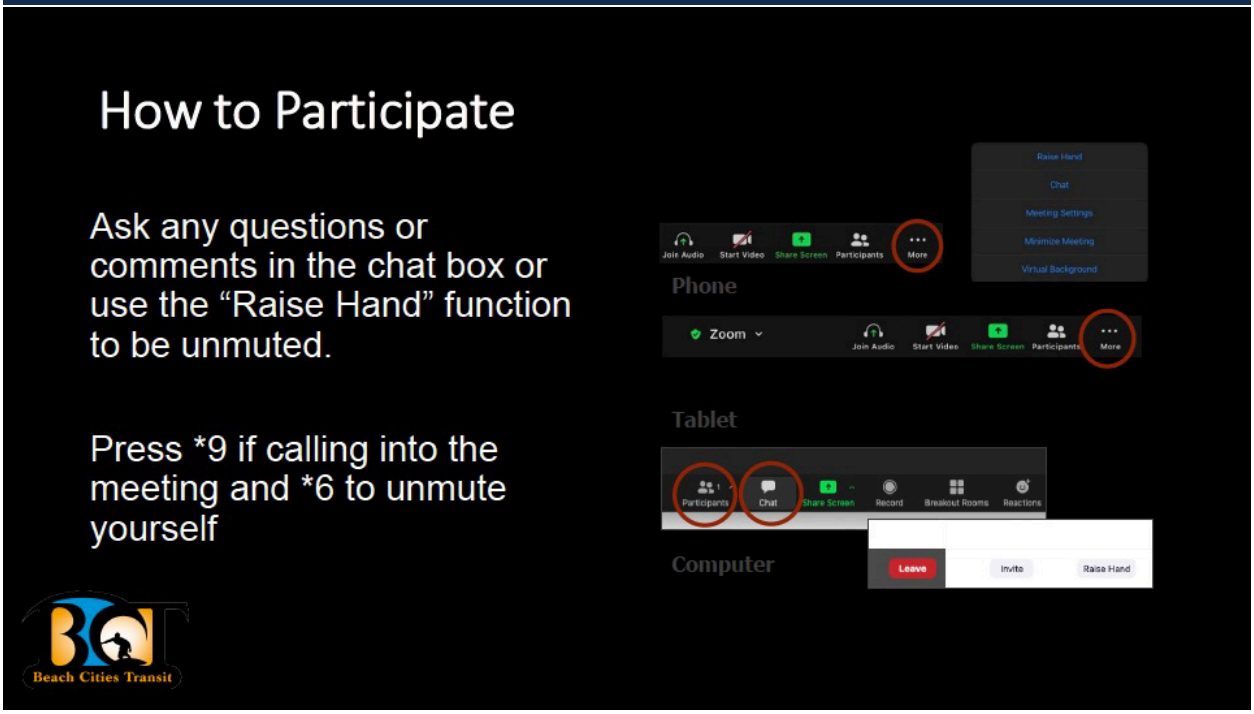
APPENDIX A-2: BRANDED COLLATERAL MATERIALS



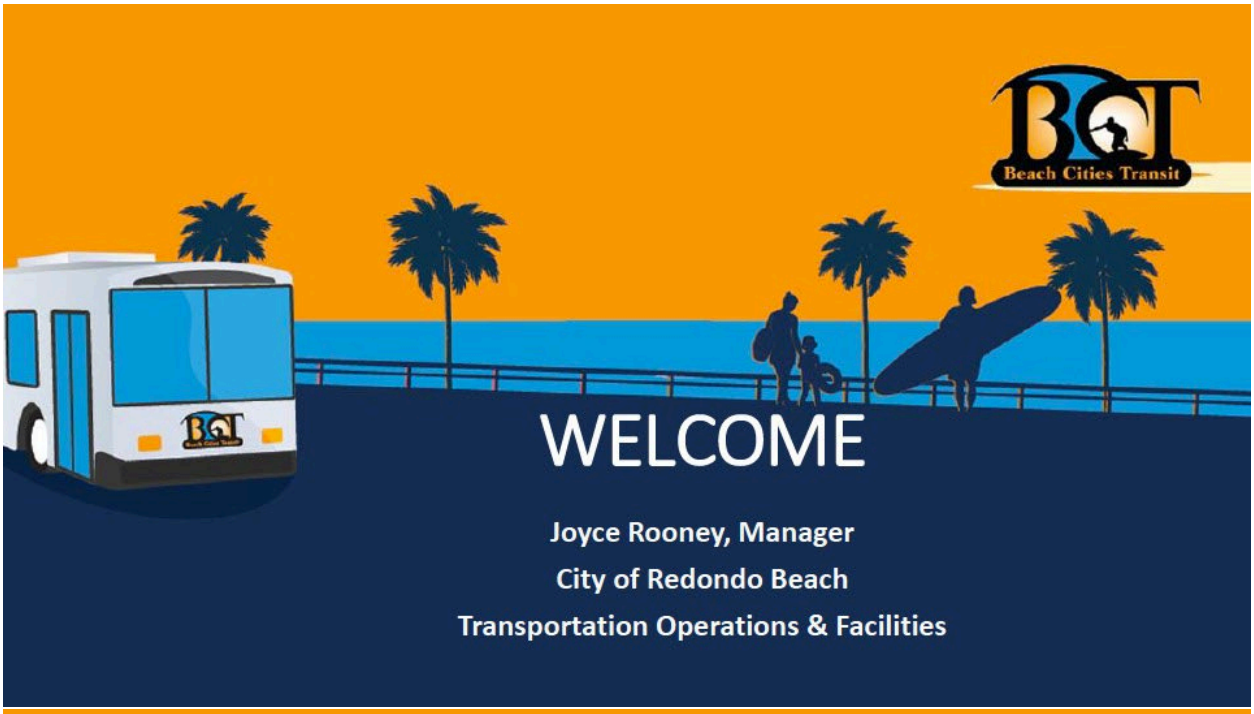
APPENDIX A-3: FOCUS GROUP PRESENTATION

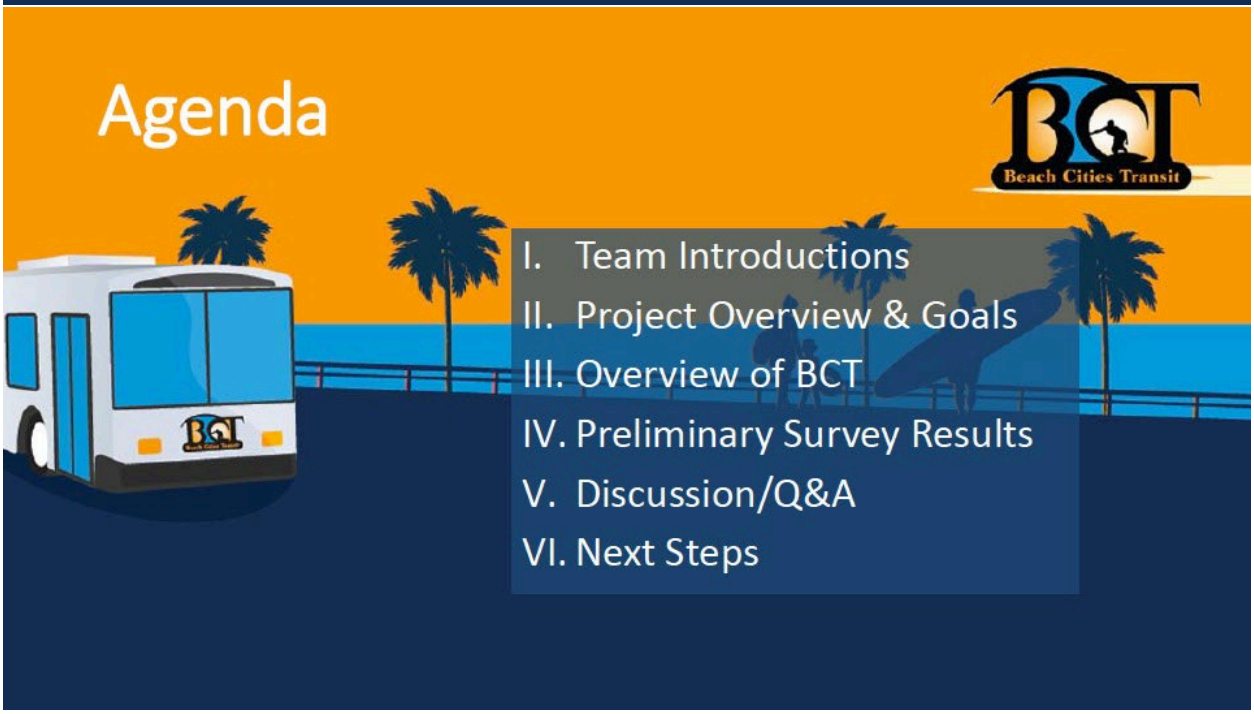
FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION



Project Team Introductions

Joyce Rooney
City of Redondo Beach
Beach Cities Transit

Leslie Scott
City of Redondo Beach
Beach Cities Transit



David Verbich
Stantec



Amanda McDaniel
Stantec



Ian Lowell
Stantec



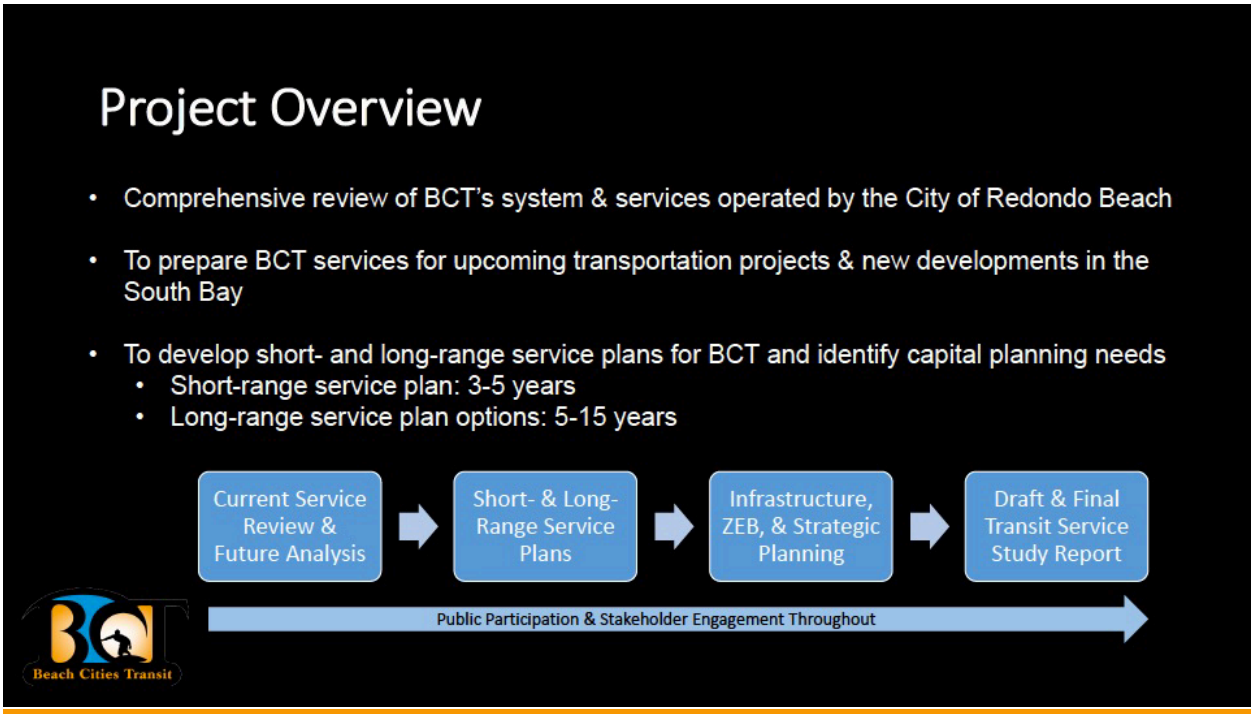
JC Lacey
JCL Consulting

APPENDIX A-3: FOCUS GROUP PRESENTATION



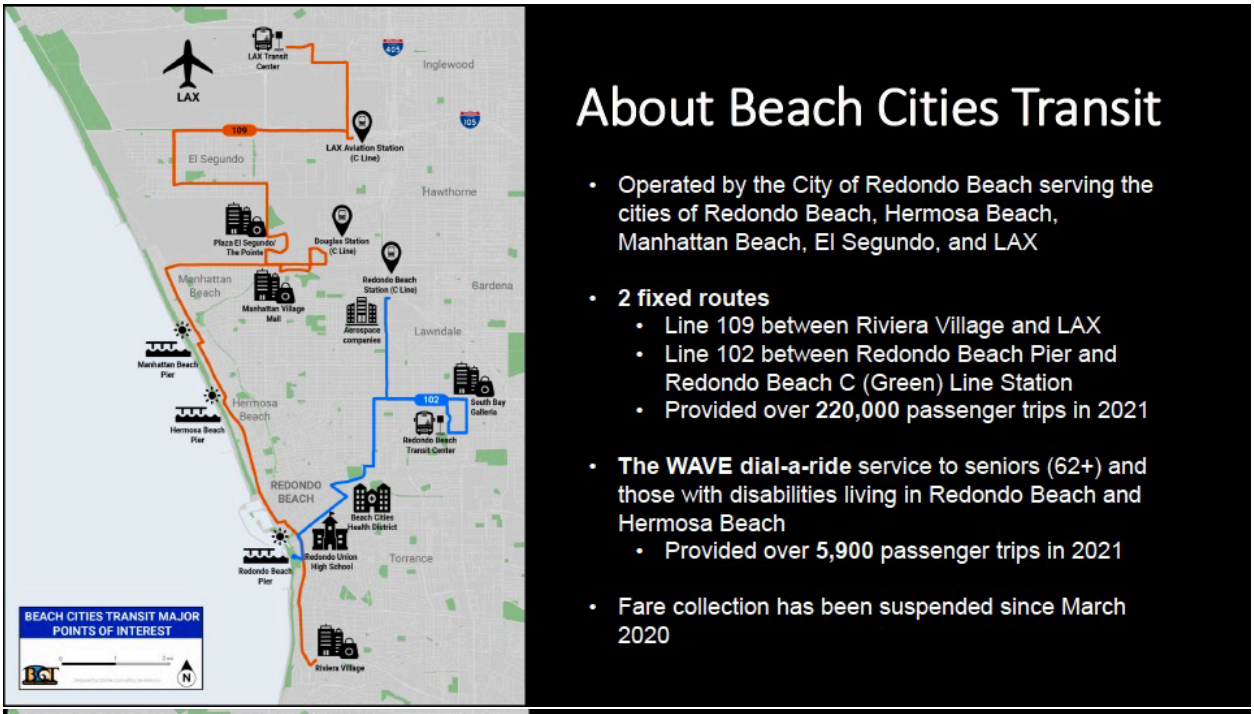


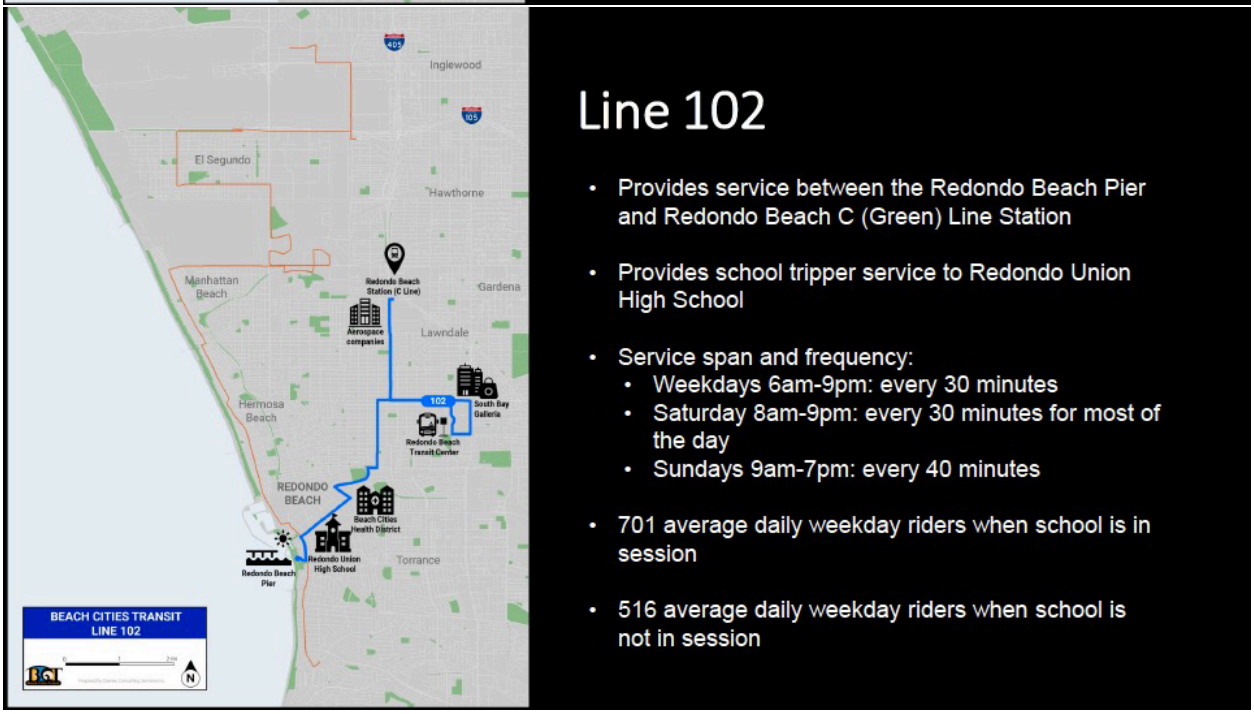
APPENDIX A-3: FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION



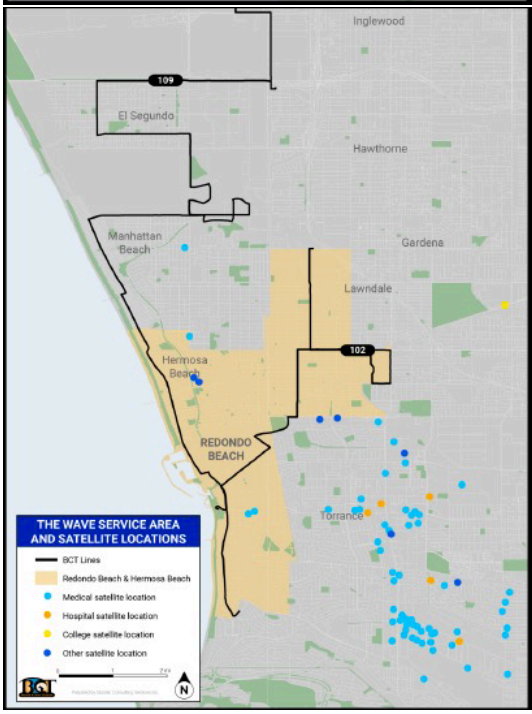


APPENDIX A-3: FOCUS GROUP PRESENTATION



Line 109

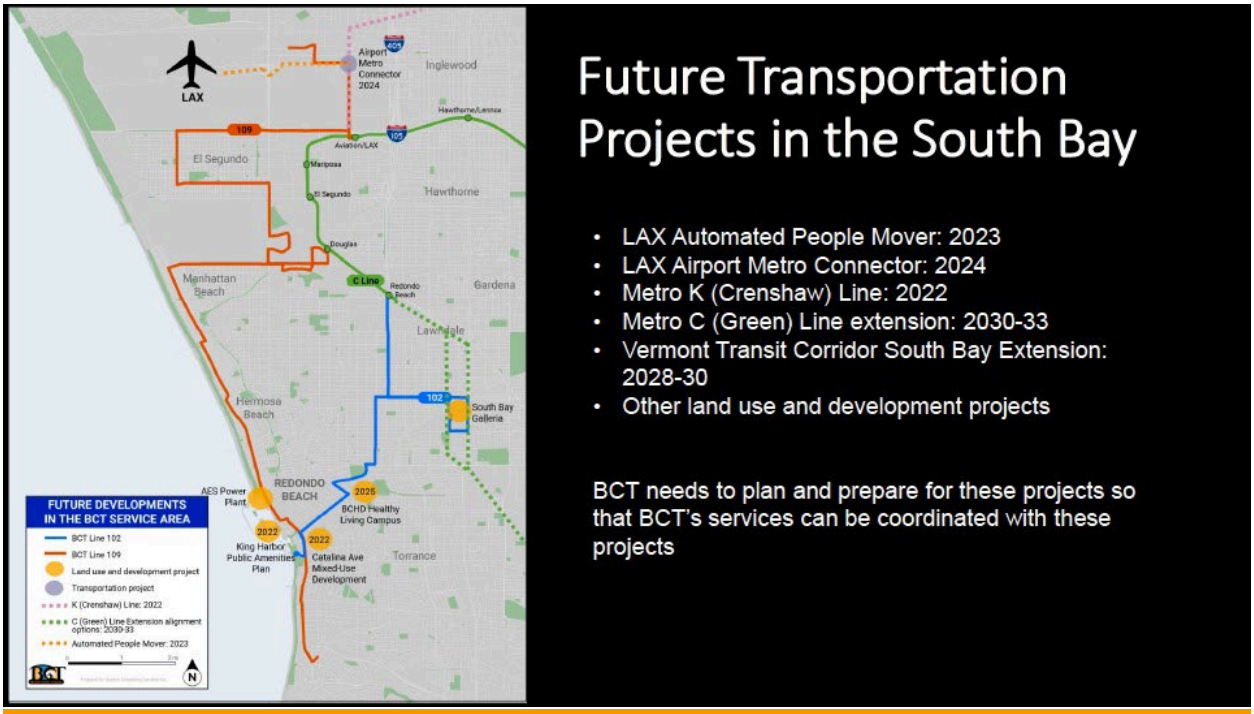
- Provides service between the Riviera Village and LAX, including multiple large employment centers in Manhattan Beach and El Segundo
- Service span and frequency:
  - Weekdays 6am-10pm: between every 40 and 55 minutes
  - Weekends 6am-10pm: every 60 minutes
- 580 average daily weekday riders

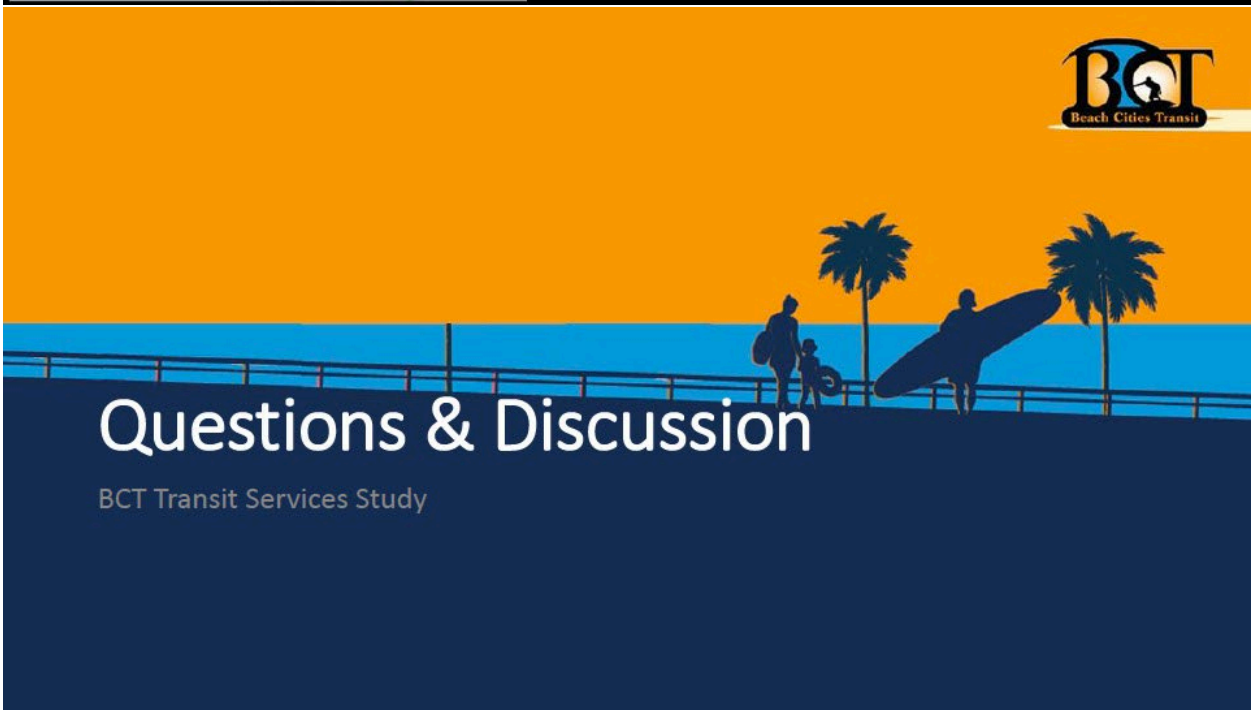


The WAVE

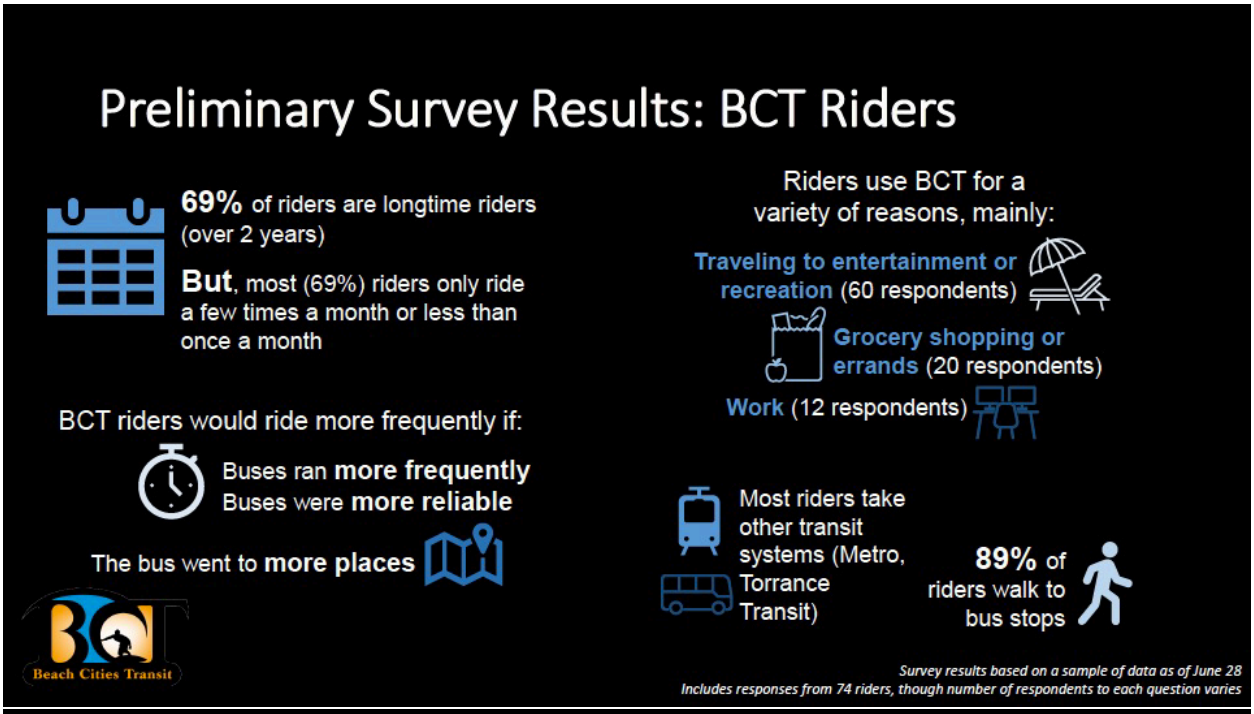
- Provides service to seniors (62+) and those with disabilities
- Serves qualifying residents of Redondo Beach, Hermosa Beach, and to specific satellite locations
- Service
  - Weekdays: 6am-8:30pm
  - Weekends: 8am-8:30pm
- 24 average weekday passenger trips in FY21-22 (compared to 51 daily trips pre-COVID)
- 75% of trips begin and end in Redondo Beach
  - 10% of trips begin and end in Hermosa Beach
  - 15% of trips begin and end in satellite locations

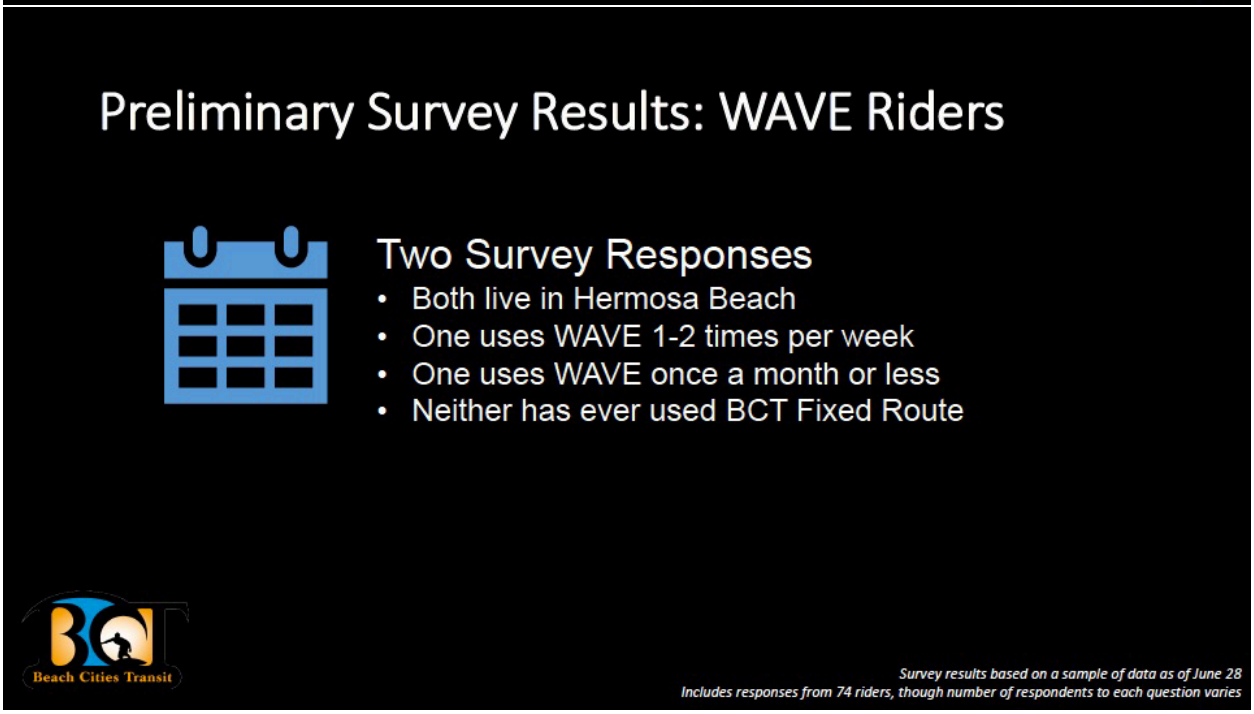
APPENDIX A-3: FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION

Preliminary Survey Results: Non-Riders (75 responses)

1. 77% Have Never Used Any BCT Service
2. 84% would consider BCT usage if typical mode of transportation unavailable
3. Top Factors that would Encourage Ridership
   - More information about BCT (43)
   - Trip time comparable to driving (37)
   - More bus destinations (32)
   - More frequent bus availability (31)

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Survey results based on a sample of data as of June 28
Includes responses from 74 riders, though number of respondents to each question varies

Discussion



- Your connection to & opinion of public transit, BCT & in general.
- Your familiarity with BCT's fixed route service & WAVE dial-a-ride.
- Non-rider? What would get you to ride?
- Have you ever seen any information about BCT?

Beach Cities Transit

APPENDIX A-3: FOCUS GROUP PRESENTATION

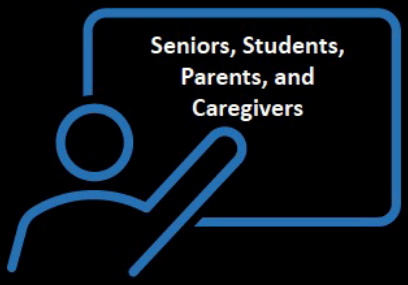
Discussion



- Tell us about your commute – from where & what's it like?
- Your thoughts about transit incentives.
- Any familiarity with local business promotions that reward ridership?
- Does your company provide any transit passes or subsidies for employees?
- What does BCT "get right", which is helping local businesses?
- Where can BCT improve services, which will help local businesses?

Beach Cities Transit

Discussion



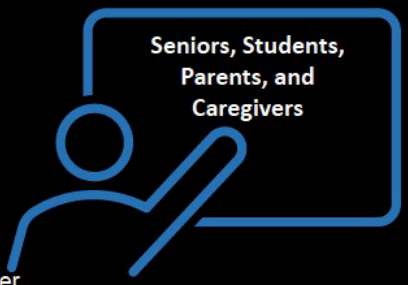
- Students:
  - Do you use BCT for other than for school?
    - What would make you try taking BCT more on the weekends or for recreation?
  - Will you continue using BCT after you graduate?
    - What would make you continue to use BCT?
  - What do you like about BCT? Any dislikes?
- Parents/Caregivers
  - Does your child use BCT?
  - Do you use BCT?
  - What do you like/dislike about it?

Beach Cities Transit

APPENDIX A-3: FOCUS GROUP PRESENTATION

Discussion

- Seniors/Caregivers: Do you use BCT fixed route or WAVE service?
  - WAVE: what do you like/dislike about it?
  - Fixed routes: what do you like/dislike about it?
  - What would make you try taking the WAVE or fixed routes more often?
  - Does the WAVE go to locations that appeal to senior and caregiver populations?
  - Would seniors and caregivers be interested in group trips to locations in the WAVE service area, such as the farmers' market or grocery stores?
  - What can be done to enhance the rider experience for older adults on both fixed route and WAVE?
  - Do the current schedules for fixed route and WAVE meet your needs?
  - Are there other things to consider for older adults?



Beach Cities Transit

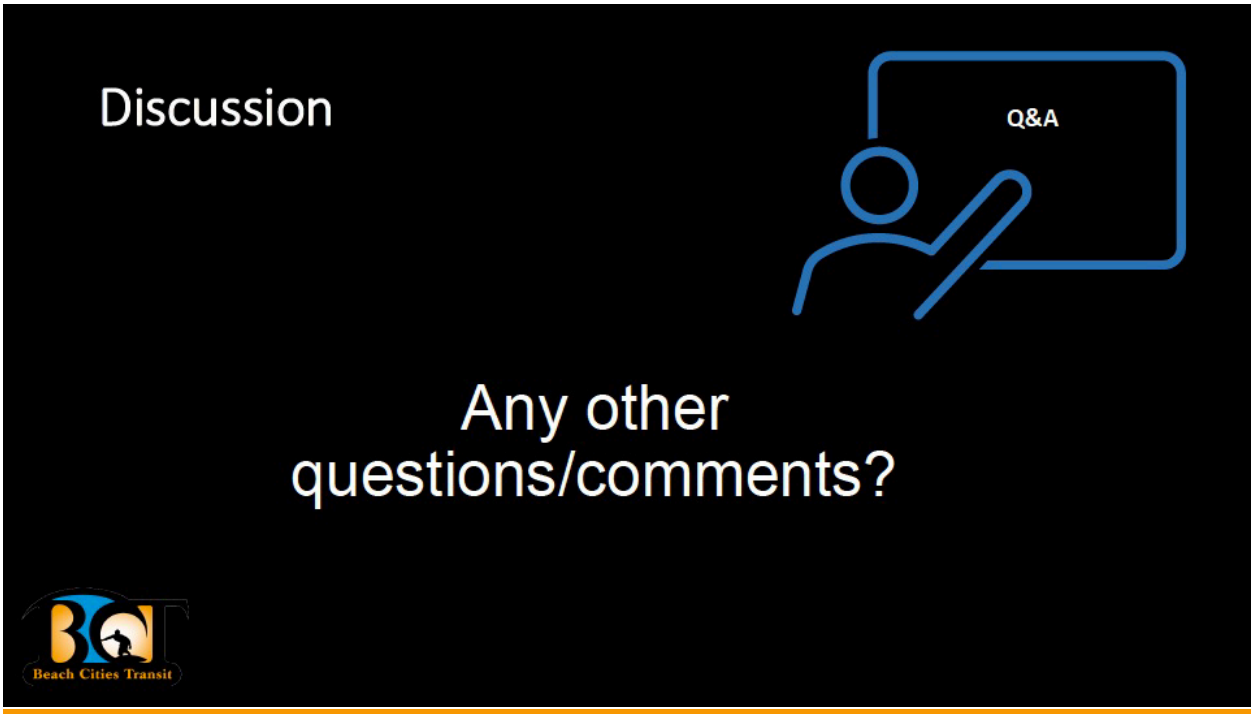
Discussion

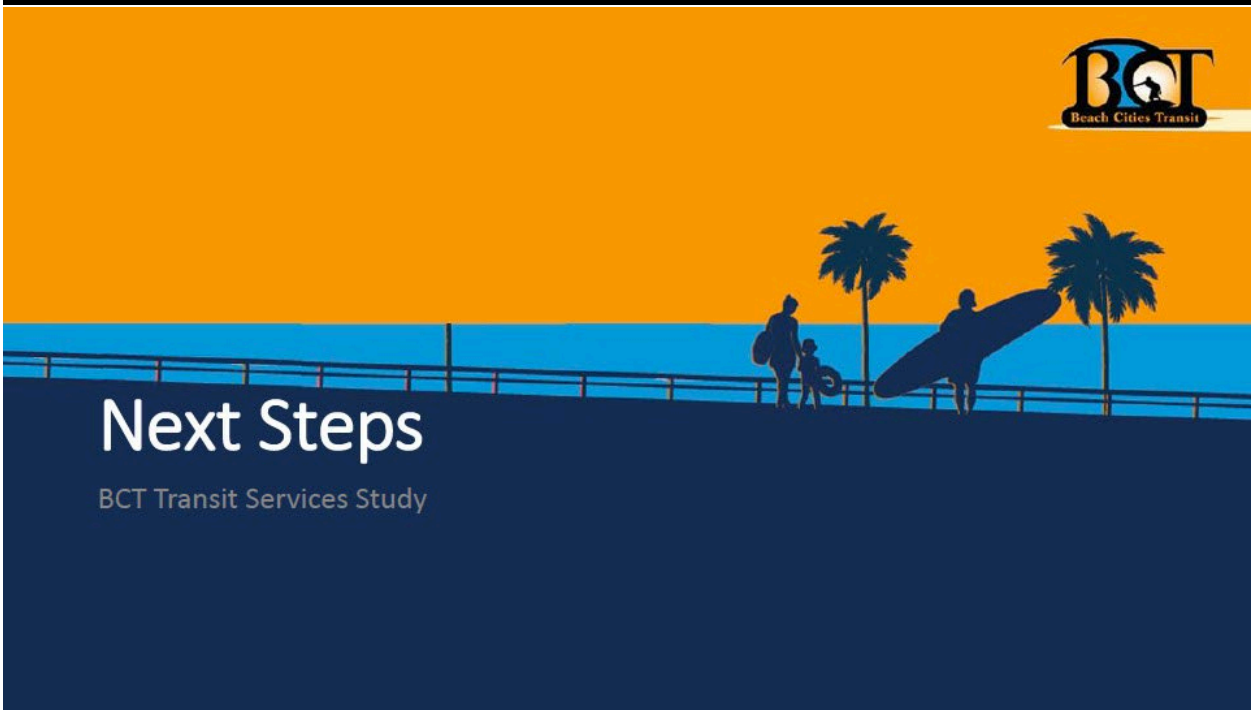
- Do the people you work with/represent use BCT?
- If so, what do they like and dislike about it?
- What would make them take BCT more often?
- What would make it easier for them to use BCT?
- Do the people you work with/represent know about the services offered by BCT?
- How can transit, and specifically BCT fixed route and the WAVE, complement the organization you represent?
- Does BCT fixed route or WAVE go to your organization?
- Do the current schedules for fixed route and WAVE meet the needs of your organization and their activities?
- Are there other things that are unique to you community as it relates to transit?



Beach Cities Transit

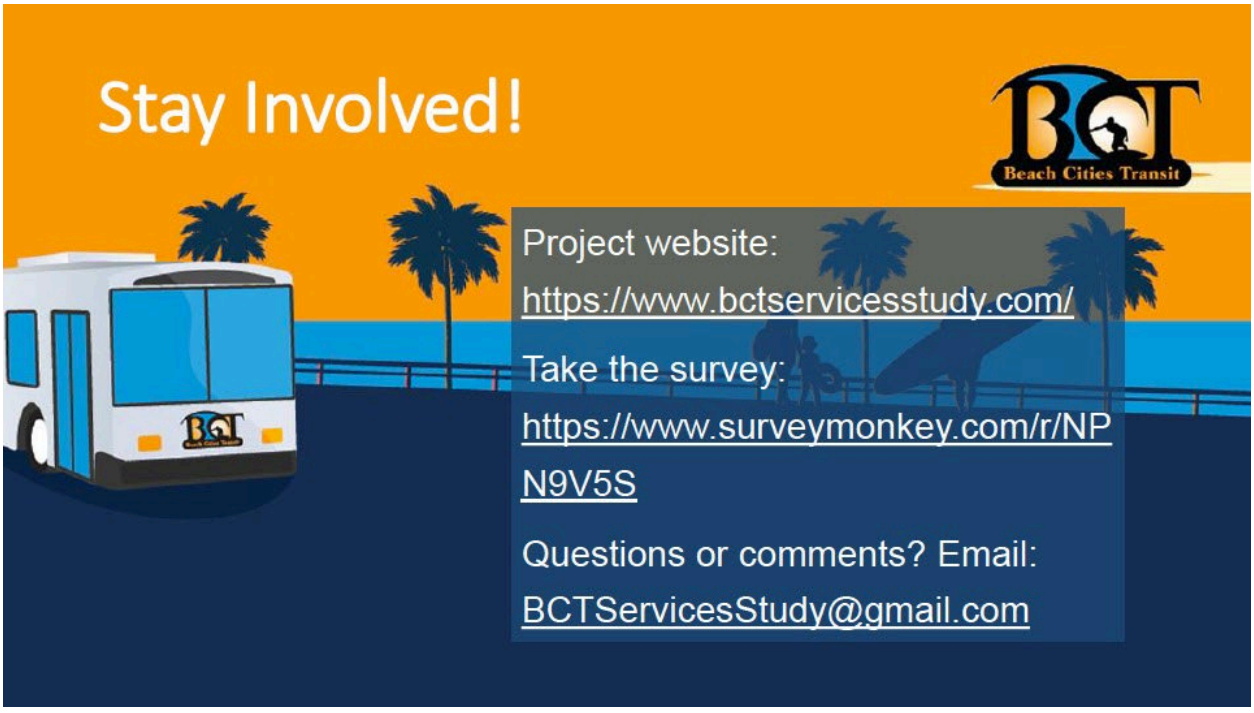
APPENDIX A-3: FOCUS GROUP PRESENTATION





APPENDIX A-3: FOCUS GROUP PRESENTATION

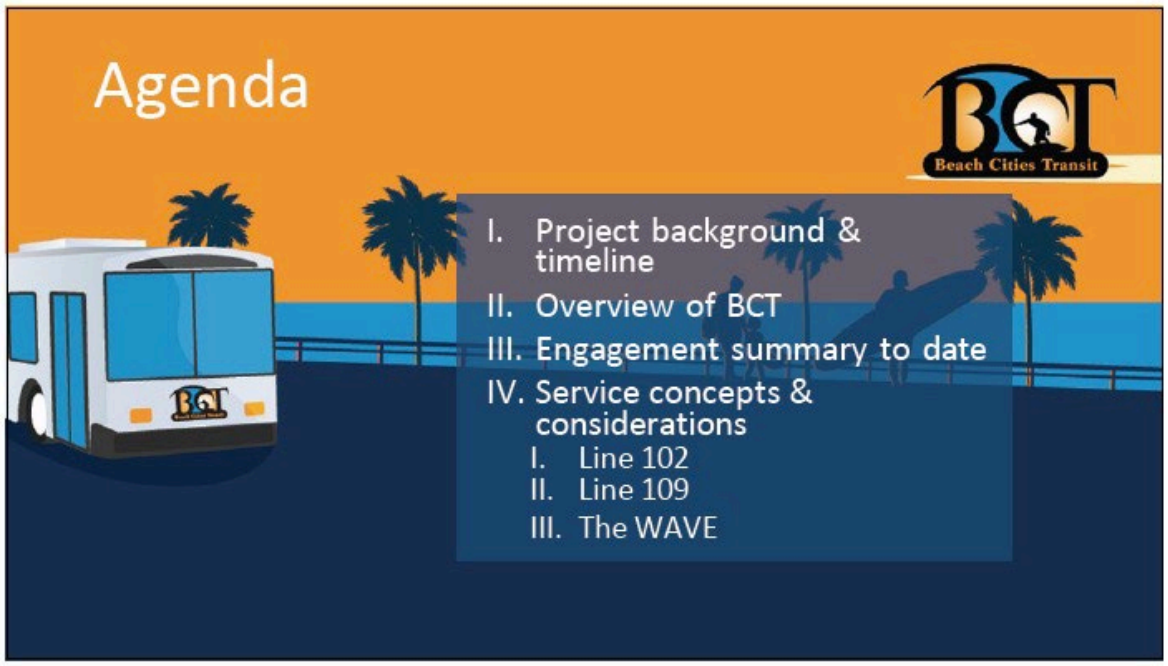




APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

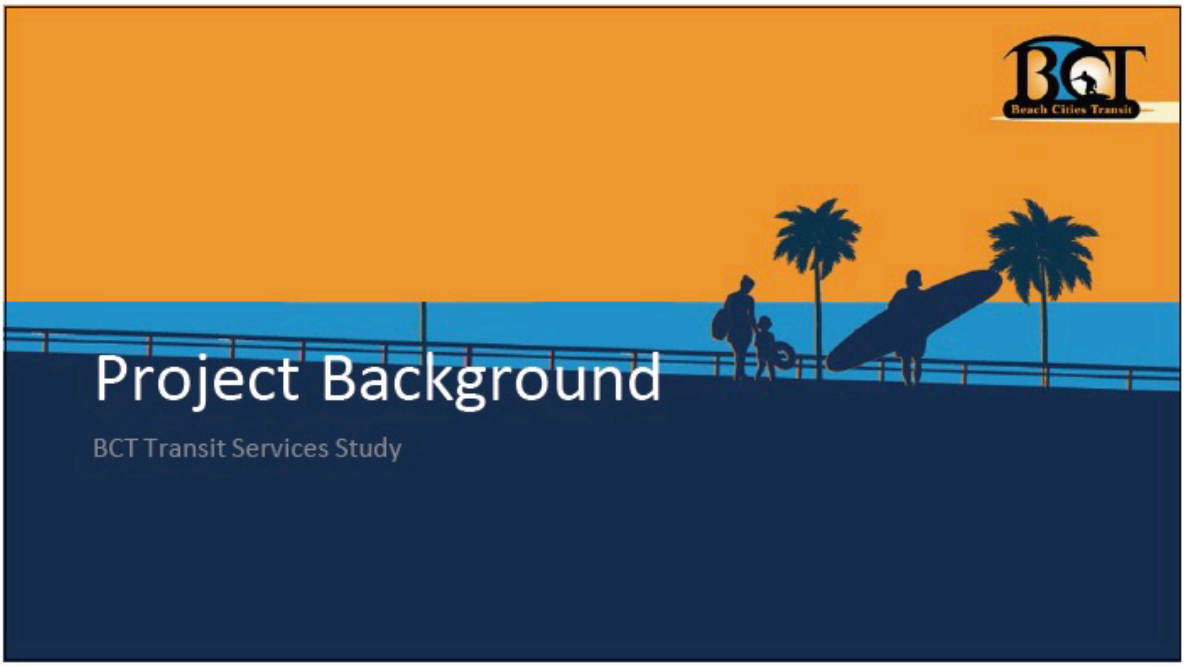


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



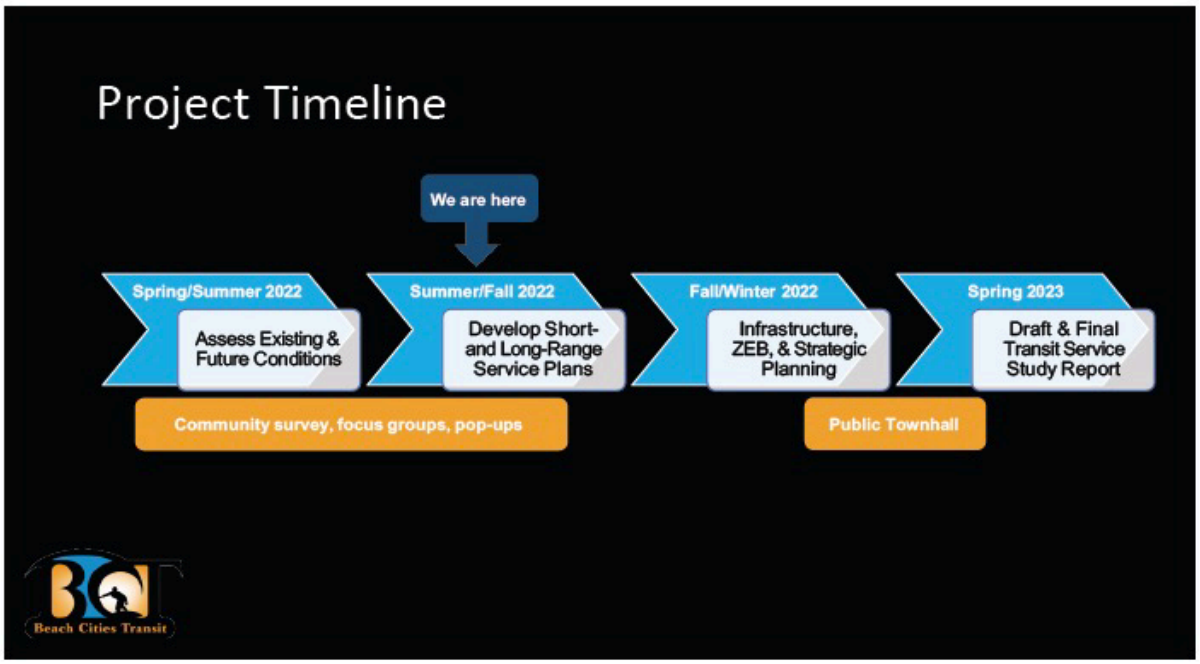
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Project Overview

- Comprehensive review of BCT's system and services operated by the City of Redondo Beach
- To prepare BCT services for upcoming transportation projects and new developments in the South Bay
- To develop short- and long-range service plans for BCT and identify capital planning needs
  - Short-range service plan: 3-5 years
  - Long-range service plan options: 5-15 years

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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

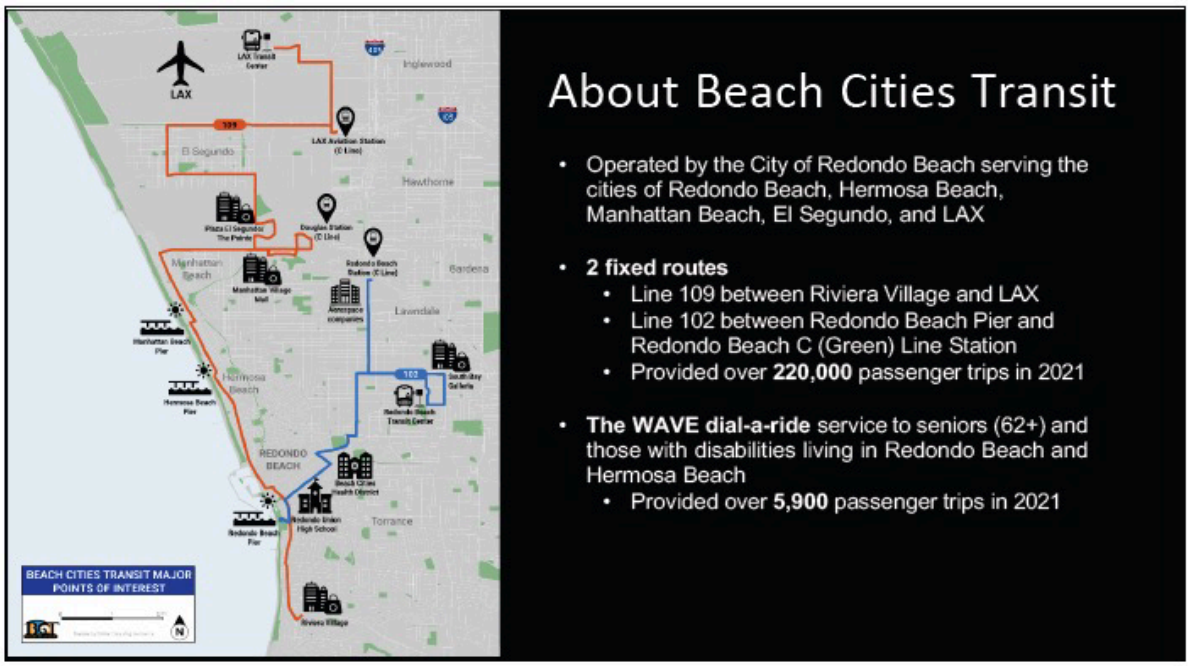


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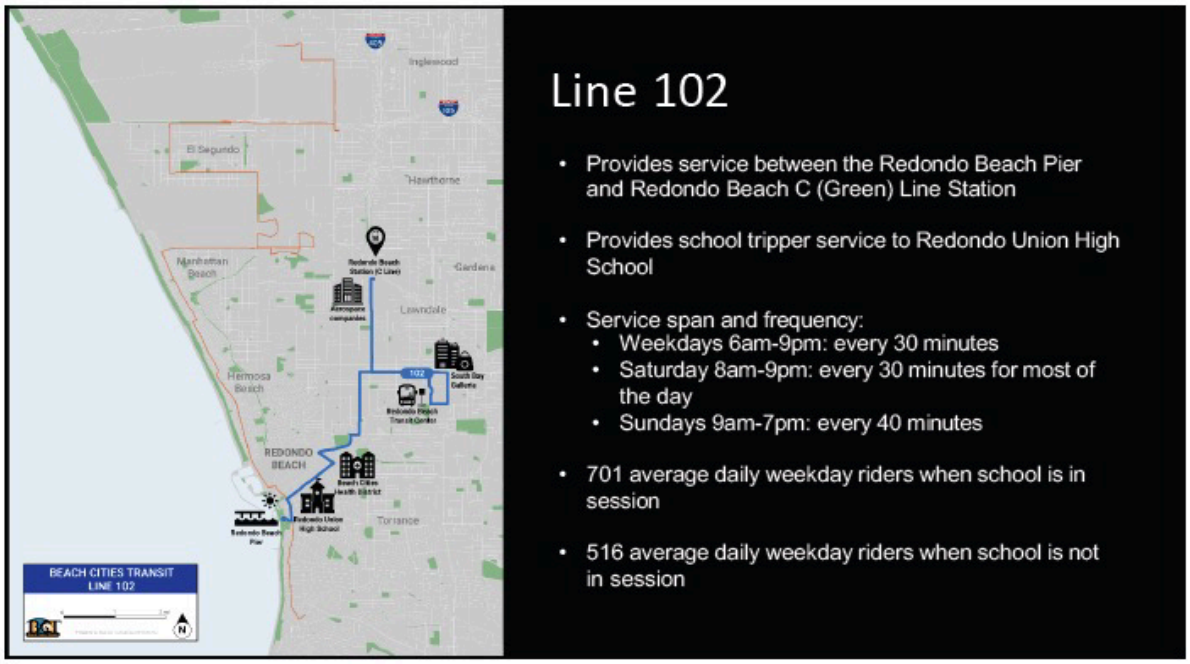


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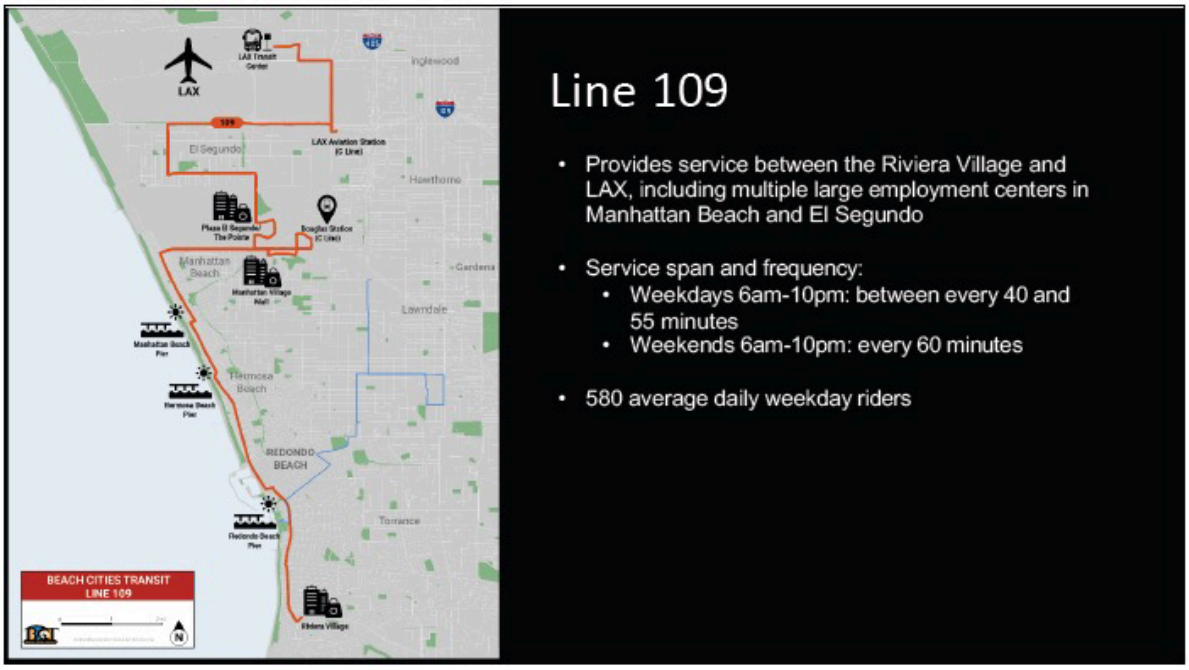


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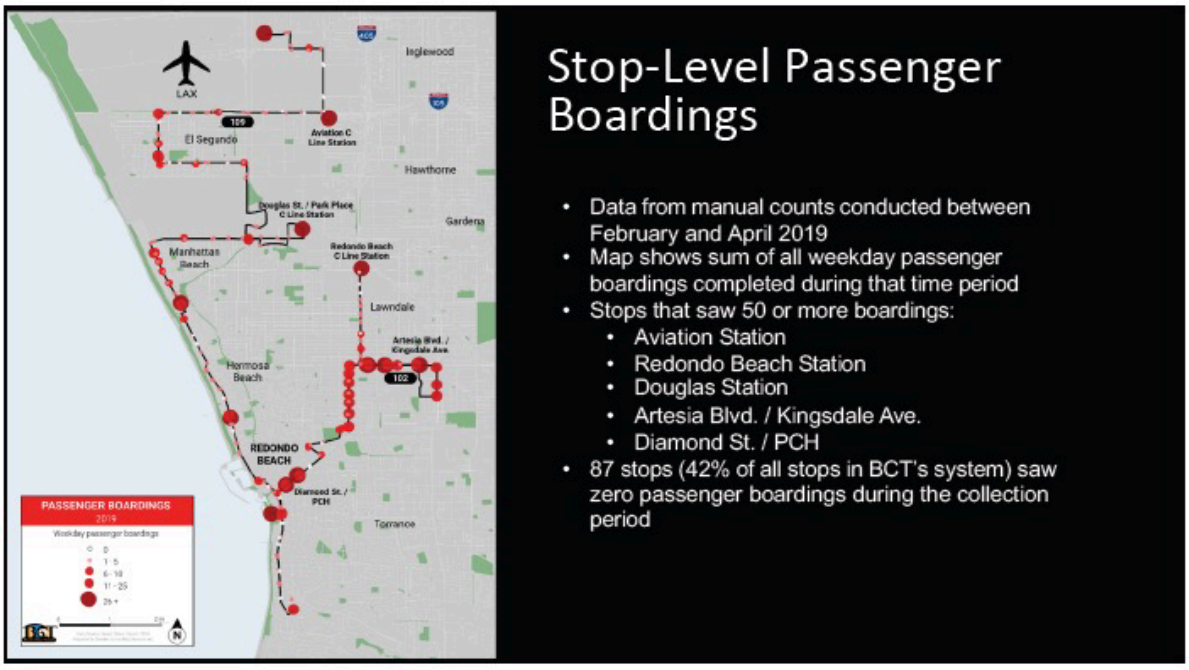


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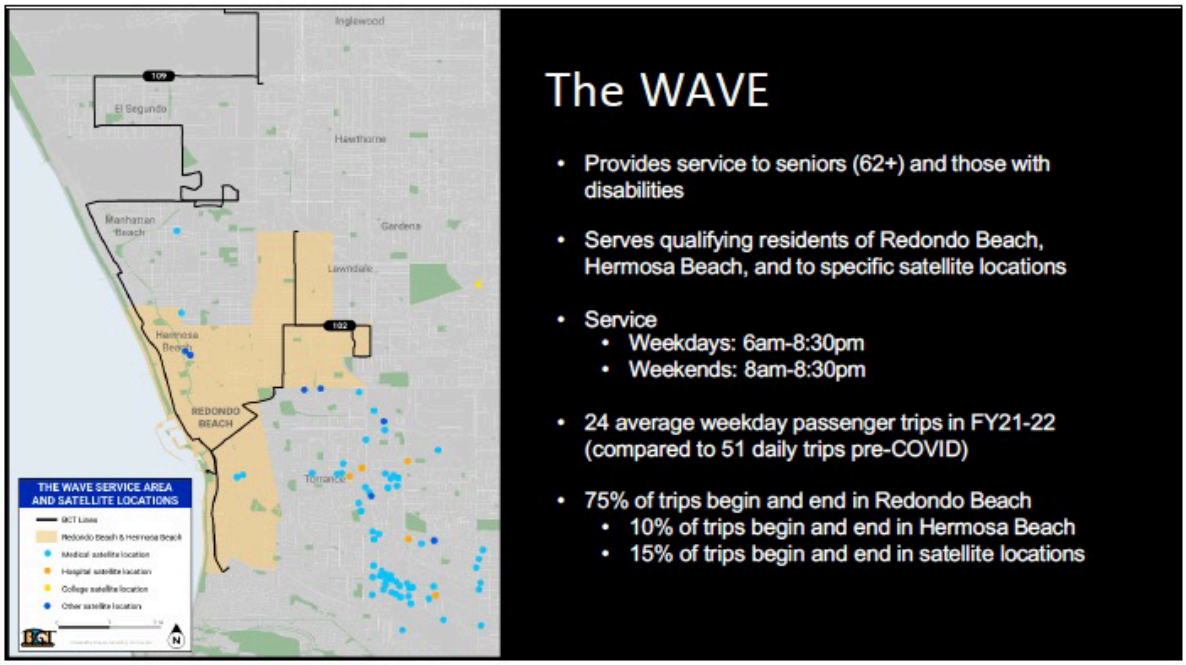


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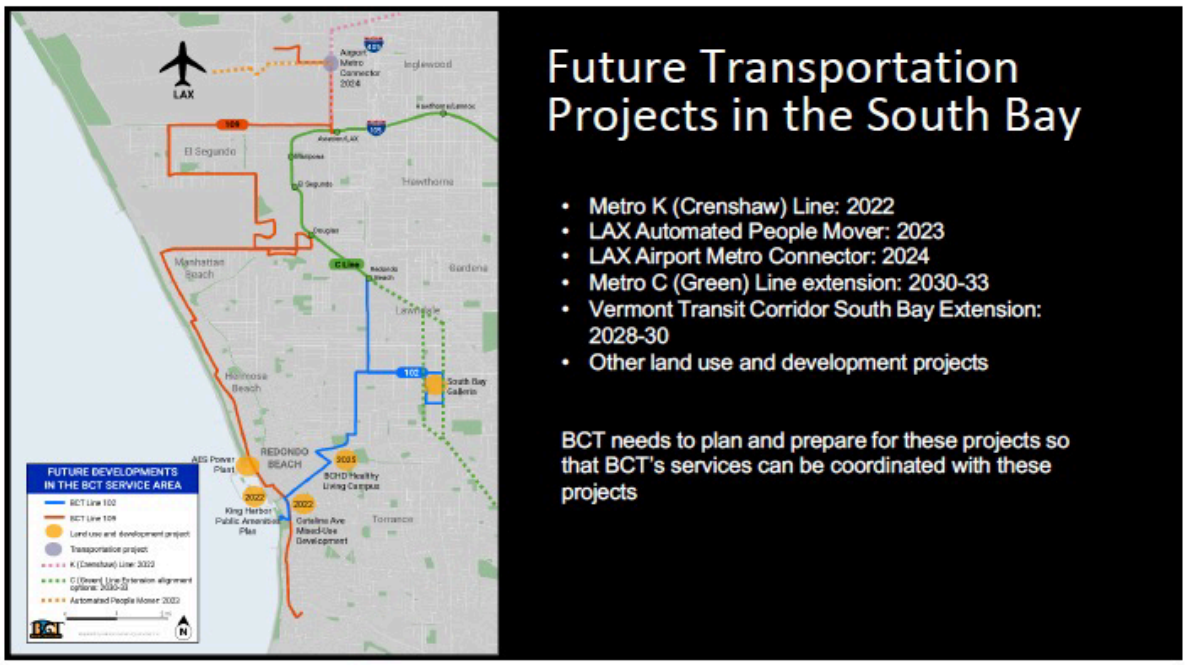


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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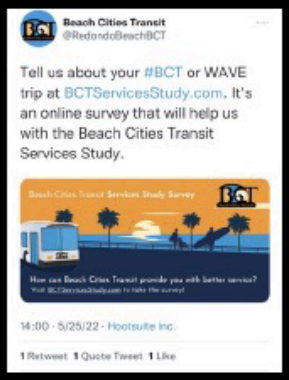
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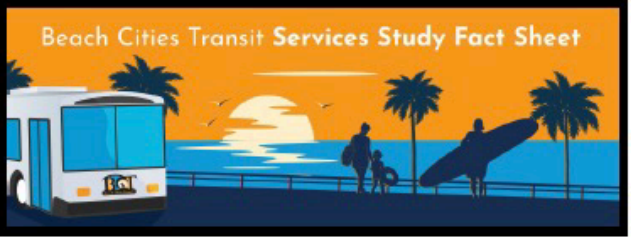
APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Engagement Methods

Other outreach and engagement methods employed:

- Redondo Beach and BCT Websites
- BCT Twitter, retweeted by other transit agencies and Beach Cities
- BCT buses
- Redondo Union High School student e-blast
- Easy Reader: 4-week full page ad & digital ads in June
- Community Services Instagram ads
- Community Services email list
- Direct emails to 109 city partners





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Preliminary Survey Results – BCT Riders

62% of riders are longtime riders (over 2 years)

But, most (66%) riders only ride a few times a month or less than once a month

BCT riders would ride more frequently if:

Buses ran **more frequently**
Buses were **more reliable**
The bus went to **more places**

Riders use BCT for a variety of reasons, mainly:

Traveling to entertainment or recreation (107 respondents)

Grocery shopping or errands (31 respondents)

Work (22 respondents)

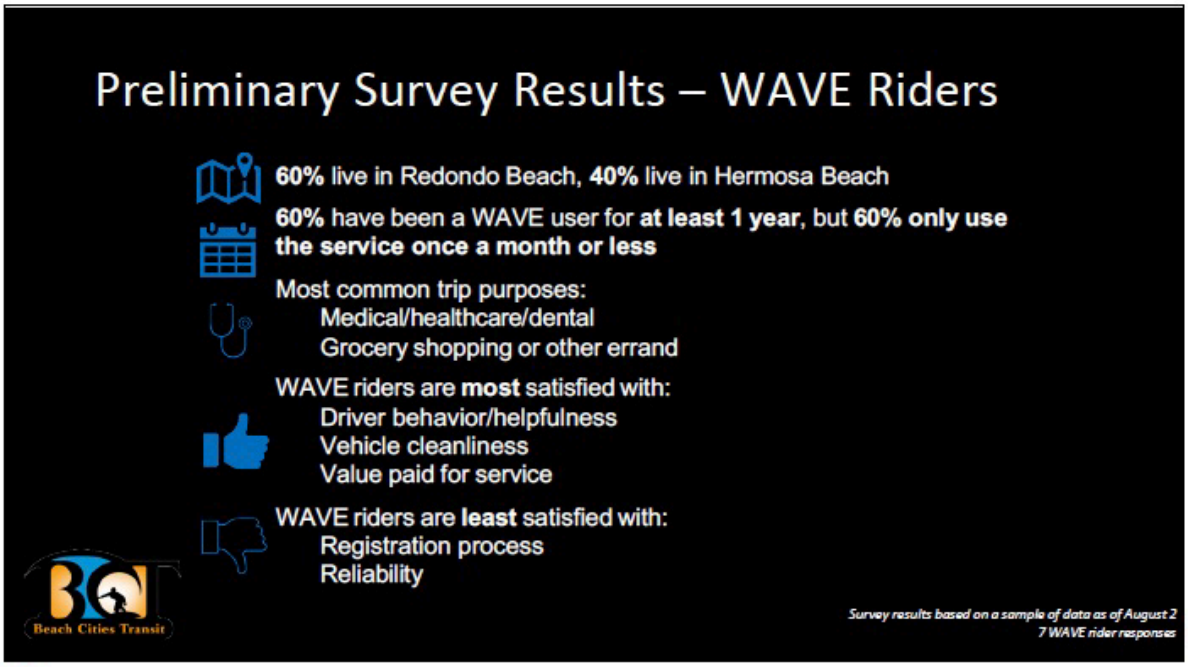
Most riders take other transit systems (Metro, Torrance Transit)

90% of riders walk to bus stops

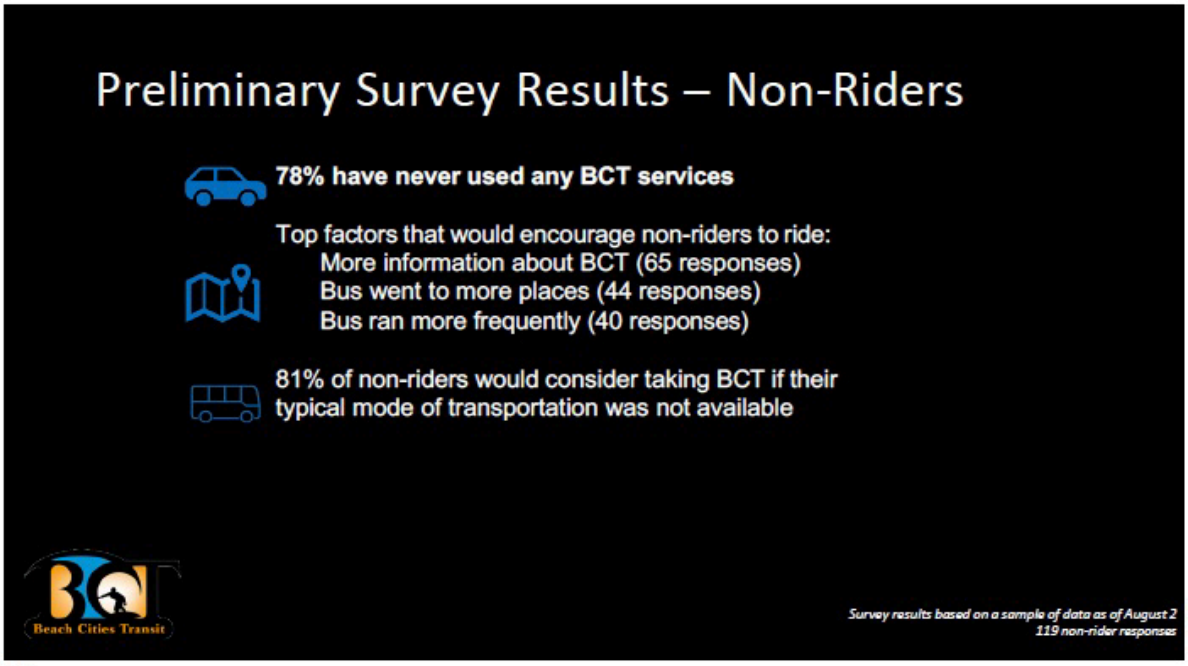
Survey results based on a sample of data as of August 2
144 rider responses

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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Focus Group Takeaways

- Heard from BCT riders, WAVE riders, non-riders/local community members, employers, City Council representatives, other transit operators, senior services, South Bay Bicycle Coalition, and other community stakeholders

Major findings and themes:

BCT fixed route	The WAVE
Strengths: • Courteous drivers • Clean • Safe	**Strengths:** • Helpful and friendly drivers • Current users very satisfied with service
Opportunities: • Reliability • Frequency • Service span • More direct/less circuitous (Line 109) • Lack of public awareness of BCT	**Opportunities:** • Interest from senior populations, but lack of information, lack of understanding of how to use it.

Beach Cities Transit

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Community Pop-Ups

July 14: Douglas C (Green) Line Station
July 21: Redondo Beach Farmer's Market

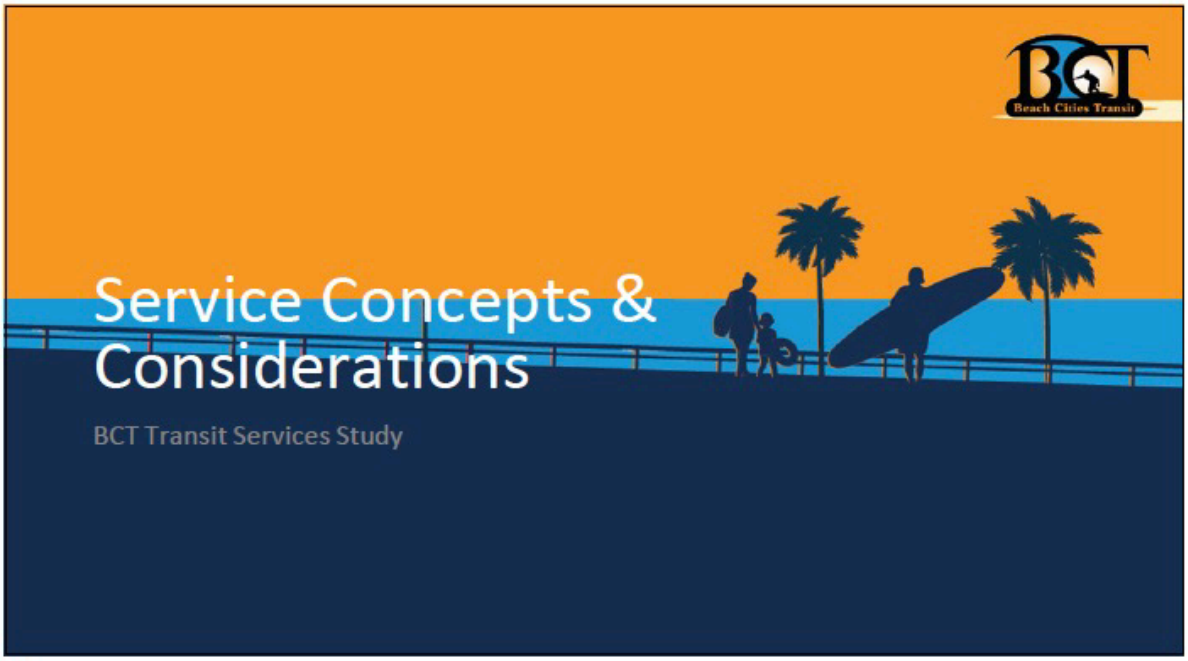
- What was heard:
  - General lack of information and awareness of BCT
    - Among non-riders, lack of information about where stops are and what destinations they can reach with BCT
  - Requests for more frequent service among riders
  - Requests for more bus stop amenities (benches, shade, shelters, lighting)
  - Older adults are very open to participating in mobility training for greater independence and improved quality of life



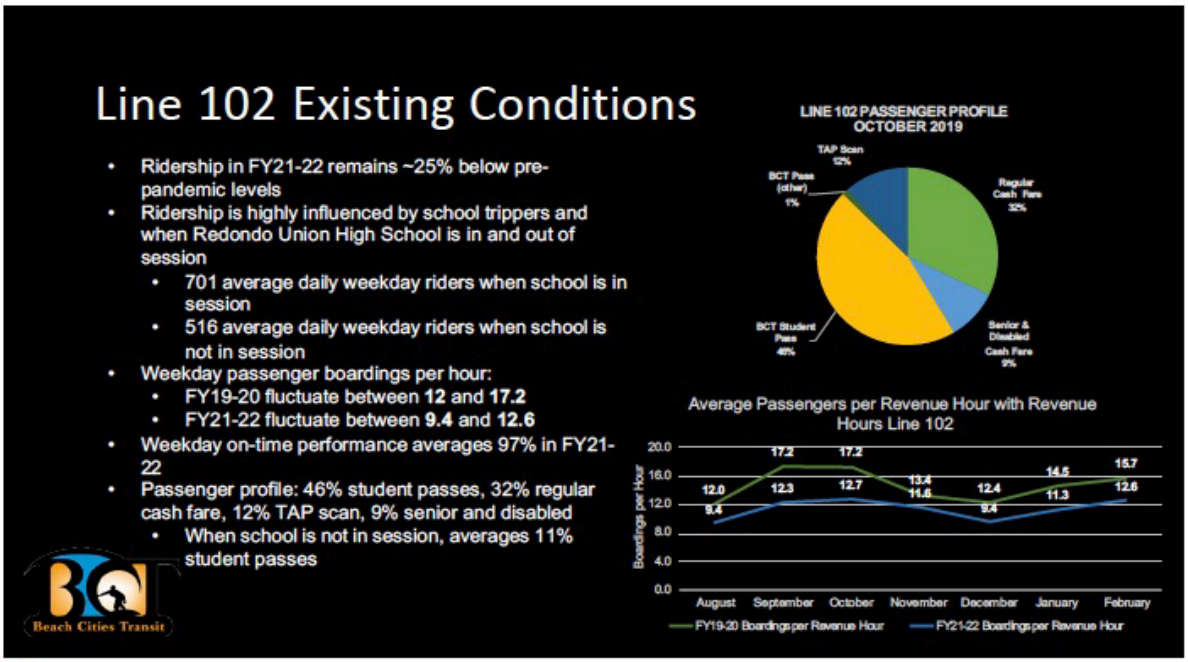
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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Line 102 Future Impacts

- Projects that will impact Line 102
  - Redondo Beach Transit Center (RBTC): 2022
  - South Bay Galleria redevelopment: phased, fully completed by 2026
  - Metro C Line Extension: 2030-33
    - Alternative 1 – along Metro owned ROW
    - Alternative 2 – along Hawthorne Blvd



Redondo Beach Transit Center



South Bay Galleria redevelopment

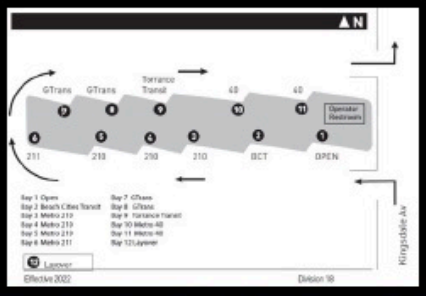


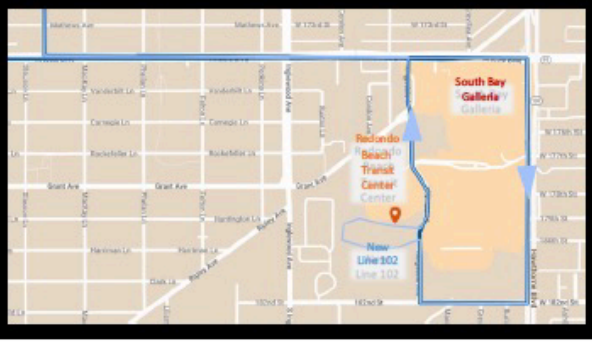
Metro C Line Extension options

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Line 102 Proposals

- Routing changes to serve Redondo Beach Transit Center
  - Immediate-term timeframe
  - Will also be served by Metro, GTrans, and Torrance Transit
  - Maintain service Along Artesia/Hawthorne to serve South Bay Galleria and other transit connections



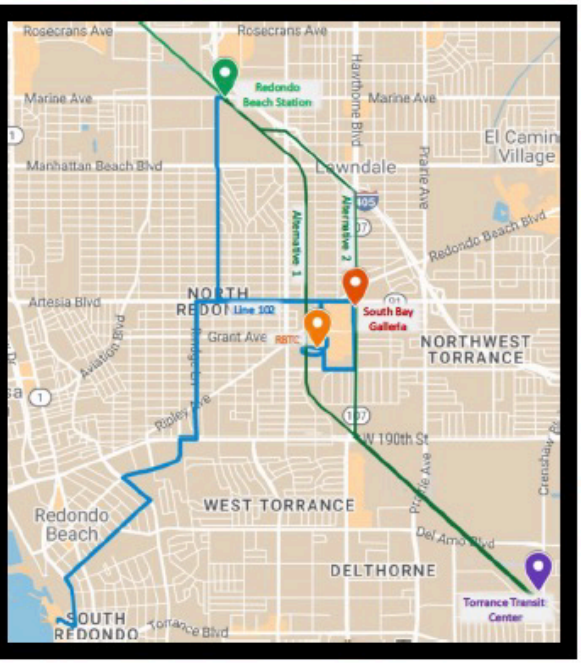


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Line 102 Proposals

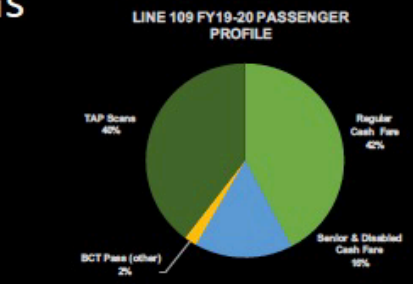
- Serve Metro C Line Extension whether alignment stops at Redondo Beach Transit Center or South Bay Galleria
  - If along Metro-owned ROW, stop at Redondo Beach Transit Center (already planned)
  - If along Hawthorne Blvd., stop at South Bay Galleria

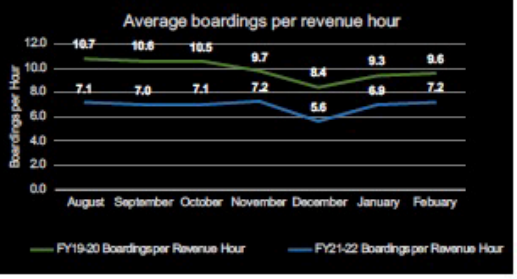


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Line 109 Existing Conditions

- Ridership in FY21-22 remains ~29% below pre-pandemic levels
- Currently sees 580 average daily weekday riders
- Weekday passenger boardings per hour:
  - FY19-20 fluctuate between **8.4** and **10.7**
  - FY21-22 fluctuate between **5.6** and **7.2**
- Weekend ridership is around 50% of weekday ridership
- Weekday on-time performance averages **88%** in FY21-22
  - OTP likely impacted by LAX construction and will improve after construction is completed
- Passenger profile: 42% regular cash fare, 40% TAP card, 16% senior and disabled
  - Of TAP scans, 24% are interagency transfers



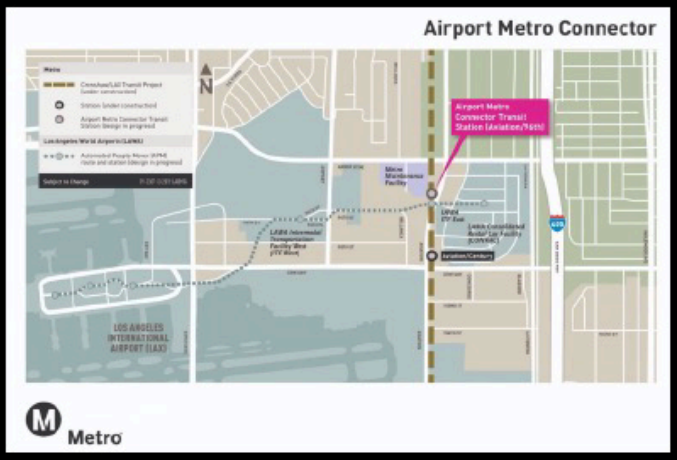


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Line 109 Future Impacts

- Projects that will impact Line 109
  - LAX Automated People Mover: 2023
  - Airport Metro Connector Station: 2024



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Line 109 Proposals

- Routing changes to serve AMC to connect to APM/LAX
  - Short-term timeframe
  - Maintain service along Century Blvd

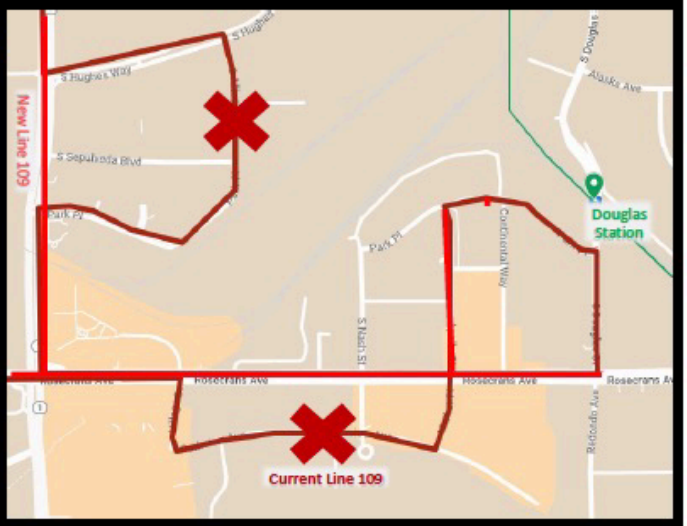


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Line 109 Proposals

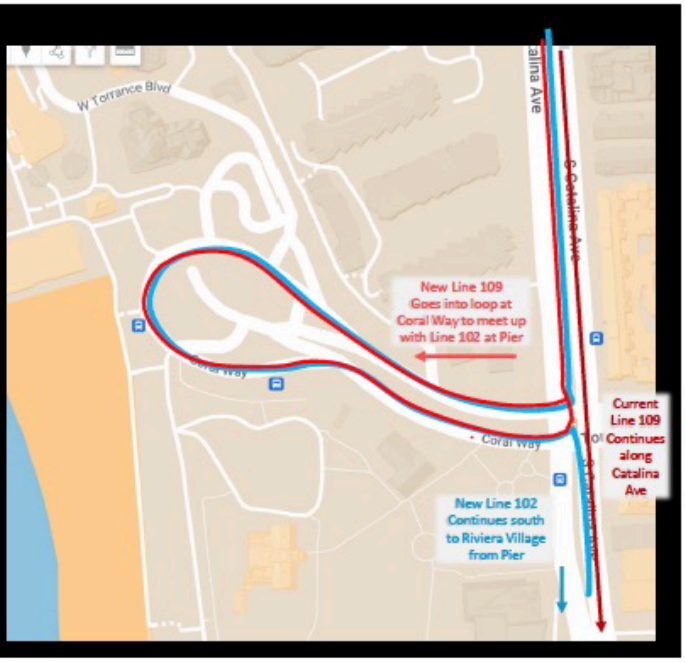
- Potential routing changes to simplify route around Douglas Station/The Point/Manhattan Village Mall
  - Maintain service to Douglas Station
  - Eliminate detours off of Rosecrans and Sepulveda
  - These stops see very few passenger boardings
    - Between February and April 2019: 3 total boardings at Manhattan Village Mall and 1 boarding at Plaza El Segundo/The Point
  - Addresses requests from riders to make the line more direct



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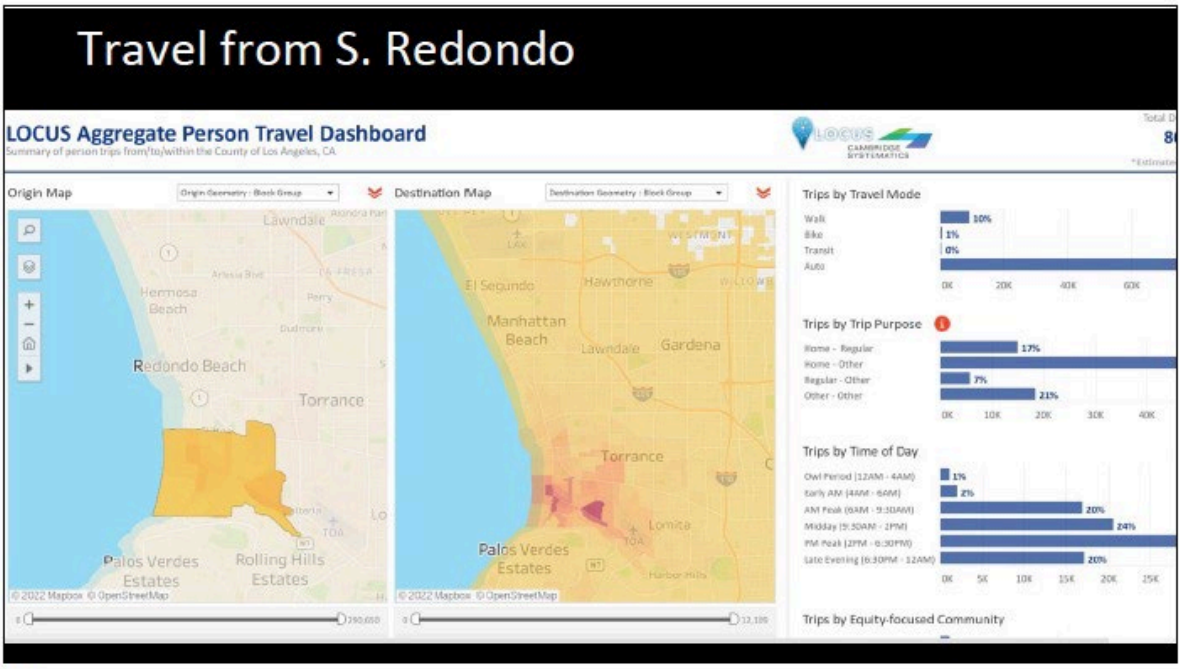
Line 109 Proposals

- New southern terminus of Line 109 at Redondo Beach Pier
- Line 102 absorbs Line 109 alignment between Redondo Beach Pier and Riviera Village
- Facilitates internal transfers and transfers to Torrance Transit from Line 109
- Easier access to Pier and Veterans Park Senior Center from Line 109

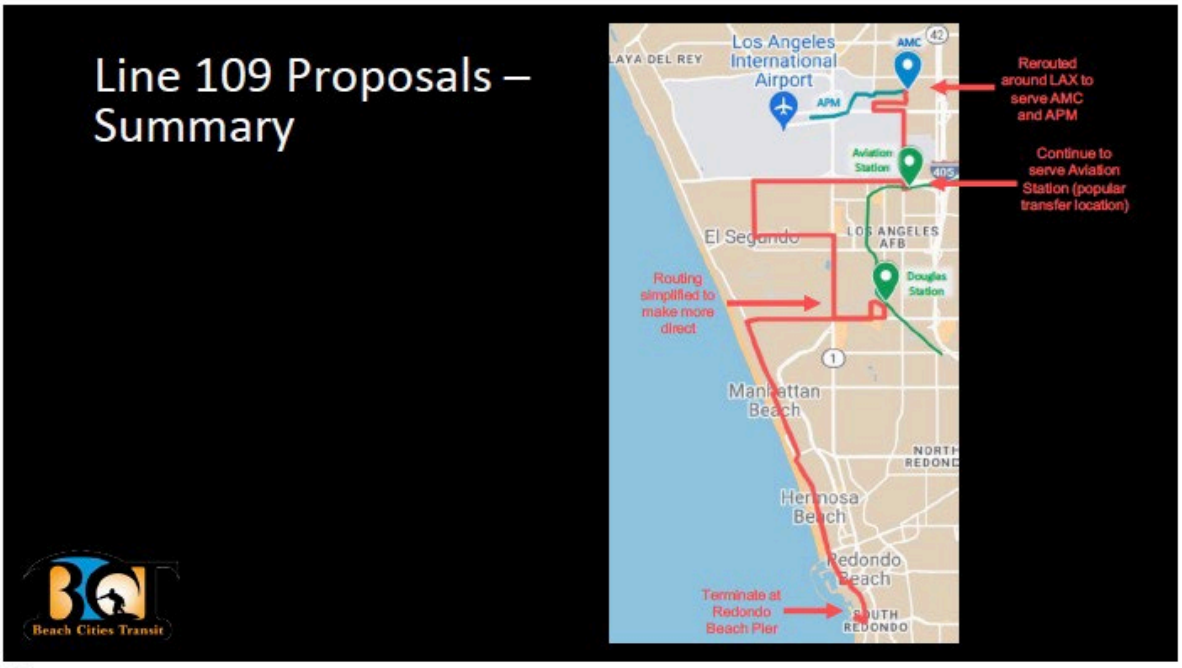


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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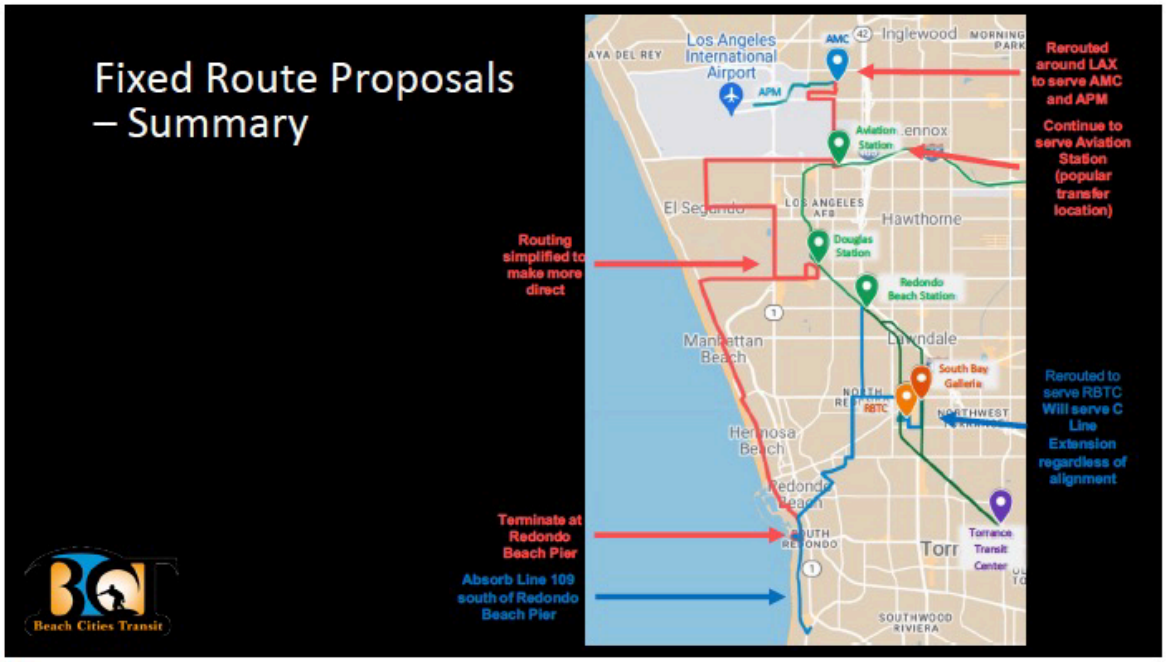


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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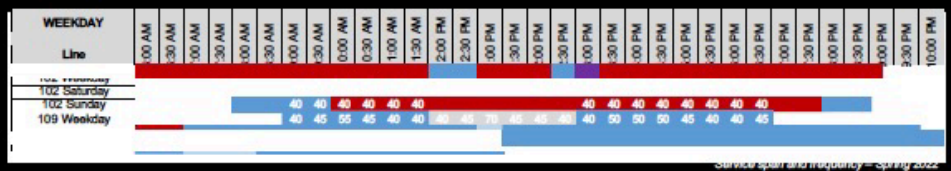


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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Other Service Proposals

- To grow ridership in the long-term, want to explore strategically improving frequency and service span
  - Phase in improvements over time
- **Line 102**
  - Address gap in Sunday service
  - 30-min weekday frequencies all day
  - Expanded weekend service span (6am-10pm)
  - More frequent weekend service
- **Line 109**
  - 30-min service during weekday AM and PM peaks
  - 30-min weekday frequencies all day (7am-7pm)
  - More frequent weekend service

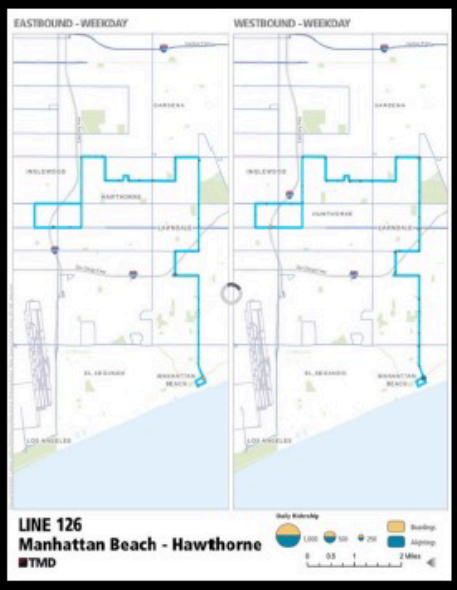


Beach Cities Transit

35

Other Service Proposals

- Identified a service gap, lack of East-West service through the Beach Cities along Manhattan Beach Blvd
- Previous Metro Line 126
  - Terminated as part of Next Gen study
  - Low ridership and productivity
  - *But*, line operated during weekday AM and PM peak only
- Opportunity to provide service along this corridor with more frequent service and attract more ridership than Metro Line 126
- Opportunity to pilot new line in different ways: seasonal service, during summer months only



Beach Cities Transit

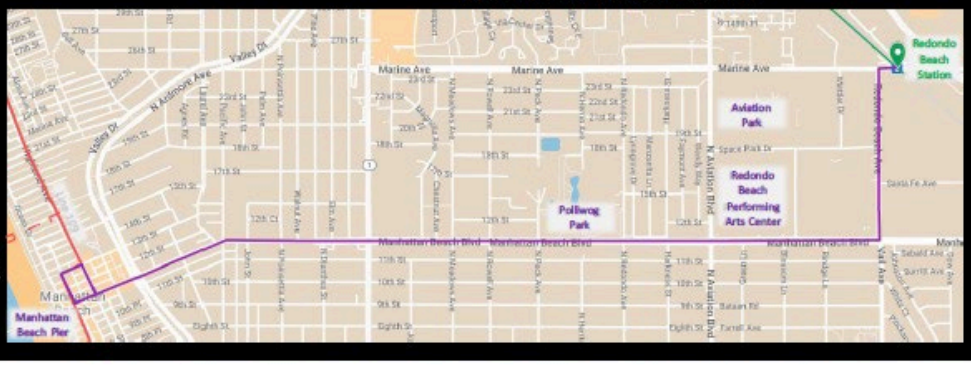
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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

Other Service Proposals

- Goal is to provide more local service and access to destinations along this corridor in addition to regional connections at the Redondo Beach C Line Station

- Manhattan Beach Pier
- Connections to Line 109
- Polliwog Park
- Redondo Beach Performing Arts Center
- Aviation Park
- Redondo Beach C Line Station



37

Other Service Proposals

- Another option is to route to serve Redondo Beach Transit Center and South Bay Galleria
- Permeates more into Redondo Beach
- Aviation Blvd
  - Service duplication with Torrance Transit Line 8
- Vail Ave
  - Service duplication with current Line 102
- Inglewood Ave
  - Residential, potentially fewer destinations
  - Service duplication with currently suspended Lawndale Beat

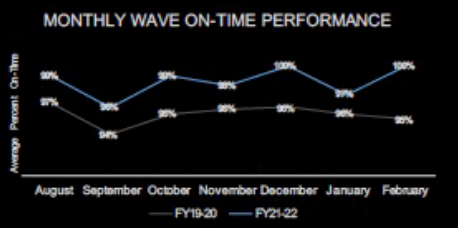


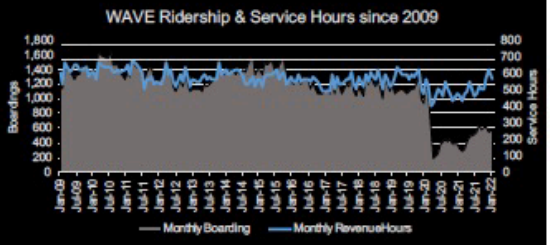
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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION

The WAVE Existing Conditions

- Ridership:
  - FY21-22 had an average of **24** riders per weekday compared to **51** pre-pandemic
- Origins and destinations:
  - 75% of trips start or end in Redondo Beach
  - 10% of trips start or end in Hermosa Beach
  - 15% of trips start or end at Satellite Locations
- Very high on-time performance, between 96% and 100% on time in FY21-22
- Ridership has stagnated as we continue to recover and reopen
  - Ridership on fixed route has rebounded to be closer to pre-COVID ridership
  - The WAVE ridership has stagnated at ~ 47% of pre-COVID ridership





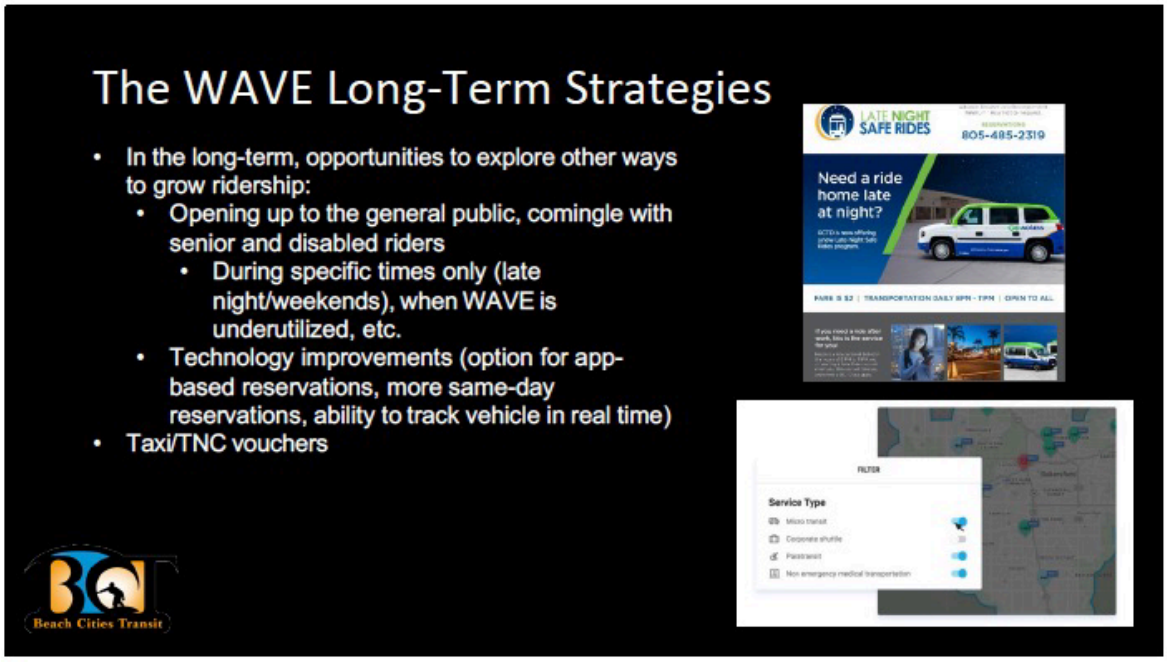
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The WAVE Short-Term Strategies

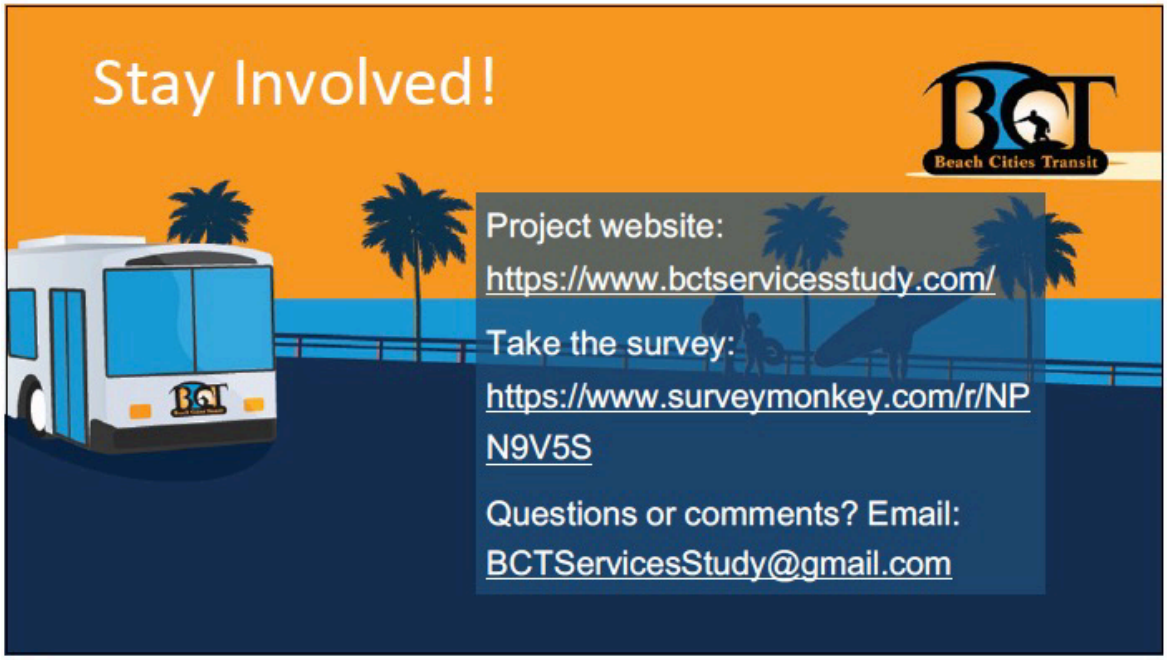
- Grow ridership of eligible populations (seniors and disabled)
  - Marketing and awareness
  - Travel training
  - Partnerships with senior services and other organizations to spread information and awareness
  - Best practices in growing dial-a-ride ridership
  - Partner with satellite locations to promote the WAVE

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APPENDIX A-4: TECHNICAL WORKING GROUP PRESENTATION



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APPENDIX A-5: FINAL STAKEHOLDER DATABASE

FINAL STAKEHOLDER DATABASE. Highlighted entries represent stakeholders who participated in outreach and engagement events and provided feedback.

- 1736 Family Crisis Center
- Alliance Health and Human Services
- Beach Cities Health District
- Behavioral Health Services, Inc.
- Best Western Plus Redondo Beach
- Breakwater Village
- Canyon Verde Adult Day Care
- Casa de Los Amigos
- City of El Segundo
- City of El Segundo Senior Housing
- City of Gardena - Community Development
- City of Gardena - Gtrans
- City of Gardena - Senior Housing
- City of Hawthorne - Planning Department
- City of Hermosa Beach
- City of Lawndale
- City of Los Angeles - Department of Transportation
- City of Manhattan Beach
- City of Redondo Beach
- City of Redondo Beach - Beach Cities Transit (Transp. Concepts)
- City of Redondo Beach - Community Development
- City of Redondo Beach - Community Services
- City of Torrance - Community Development
- City of Torrance - Torrance Transit
- El Segundo High School
- El Segundo Plaza Property Owner
- Galleria Mall Property Owner
- Harmony Court Apartments
- Heritage Pointe
- Hilton Garden Inn Redondo Beach
- Little Company of Mary Community Health
- Los Angeles Metropolitan Transportation Authority (LACMTA)
- Los Angeles World Airports APM-Automated People Movers
- Los Angeles World Airports Mobility Team
- Manhattan Village Mall Property Owner
- Mobility for People (ADA)
- North Redondo Beach Business Association
- Northrop Grumman Aerospace Systems
- Options For Life Agency, LLC
- P.S. I Love You Foundation
- Pacific Coast Inn Redondo Beach
- Patricia Dreizler Continuation High School - Redondo Beach
- Planned Parenthood So. Bay Center
- Portofino Hotel and Marina Redondo Beach
- Providence Family Medical Center
- Ramada Inn
- Raytheon- El Segundo
- Redondo Beach Hotel
- Redondo Beach Library Foundation (RBLF)
- Redondo Beach Unified School District
- Redondo Inn and Suites
- Redondo Pier Inn
- Riviera Village Business Improvement District
- Roland R. Mindeman Senior Residence
- Seaside Villa
- Seasons Senior Apartments (Salvation Army)
- Shade Hotel Redondo Beach
- Social Vocational Services, Inc.
- Sonesta Redondo Beach & Marina
- South Bay Adult Care Center
- South Bay Bicycle Coalition
- South Bay Children's Health Center
- South Bay Cities Council of Governments
- South Bay Coalition to End Homelessness
- South Bay Family Healthcare
- South Bay Latino Chamber of Commerce
- South Bay Workforce Investment Board
- South Bay YMCA - Gardena
- South Bay YMCA - Torrance
- South Bay Youth Project
- Sunrise Senior in Hermosa Beach
- The Point Property Owner
- Toyota Sports Center

APPENDIX A-5: FINAL STAKEHOLDER DATABASE

- Walk With Sally
- Workforce Development - South Bay

APPENDIX A-6: BCT SURVEY ENGAGEMENT

SURVEY RESULTS

1 BCT Survey Engagement

From June through August of 2022, an online survey was conducted to gather responses and insights from BCT riders of fixed-route and the WAVE dial-a-ride service, as well as from non-riders in the South Bay. Surveys were advertised in several ways, including digital and print media placements and direct emails to known stakeholders, as well as during eleven in-person engagement events across the South Bay.

Participants accessed the survey via a single link but were directed (through a logic tree) to one of three surveys that best suited their ridership profile; multiple surveys were also possible for people who ride both WAVE and fixed-route services. Of the 295 surveys collected, a total of 280 valid (completed) surveys were analyzed. Survey response counts are seen in Table 1. Slightly more than half of the respondents were BCT riders of the WAVE or fixed-route service, with the remaining respondents not BCT riders. Of the total rider responses, 143/154 or 93% were fixed-route and 7% were WAVE riders, which mirrors the breakdown of ridership across the two modes (97% of ridership in 2021[1] was on fixed-route, and 3% was on WAVE).

Table 1: Count of survey responses

Survey Type	Count	Percent of total surveys
Fixed-route rider survey responses	143	51%
WAVE survey responses	11	4%
Non-rider survey responses	126	45%
Total survey responses	280	100%
Total administered surveys	295[2]	

Overall respondent demographics skewed female (60%), white or Caucasian (63%), and over 35 years old with under 35 (Under 18, 18-24, and 25-34) making up only 21% of respondents. Respondents overwhelmingly indicated household incomes greater than $75,000 with only 15% indicating a household income below $75,000. This largely aligns with the demographics of the overall service area, where the majority of South Bay residents are over 35 years of age (with a median age of 40), 66% of residents identify as white or Caucasian, and median household income above $75,000 (specifically $125,000).

Along with findings from the existing conditions analysis and findings from other outreach and engagement activities, these survey results helped to directly inform the recommended service plans and supporting

[1] Based on 166,176 unlinked passenger trips as reported to NTD, 4,845 of which were taken on the WAVE

[2] After validating survey response, not all surveys administered were included due to incomplete or partial responses. Of the 295 surveys administered, 15 were determined invalid for a total of 280 surveys included in analysis.

recommendations. More detail on how outreach and the survey informed the service plans and supporting recommendations can be found in the body of TSS #2.

1.1 BCT Rider Survey

The BCT rider survey collected 143 valid responses. Survey information collected included rider profiles, how riders use the system, their overall satisfaction with different elements, and where riders would like to see system improvements or changes.

1.1.1 RIDER PROFILE AND USE

Most BCT survey respondents are casual riders, only taking the bus less than once a month[3]. Figure 1 illustrates that most (58%) respondents ride infrequently (a few times a month or less than once a month) and could be considered casual riders. The primary trip purpose, shown in Figure 2 supports this finding. The predominant trip purpose was leisure and recreational activities including entertainment, the beach, the gym, etc., as opposed to travel for work or school, where it is likely that riders would ride more frequently/regularly for these purposes. Respondents were also able to choose more than one trip purpose.

[3] Please note that the information in this section only pertains to survey respondents and may not be reflective of all BCT riders; for example, these results do not reflect the significant portion of BCT riders who are students utilizing the Line 102 School Tripper service.

Figure 1: Ridership frequency among BCT riders (118 responses)

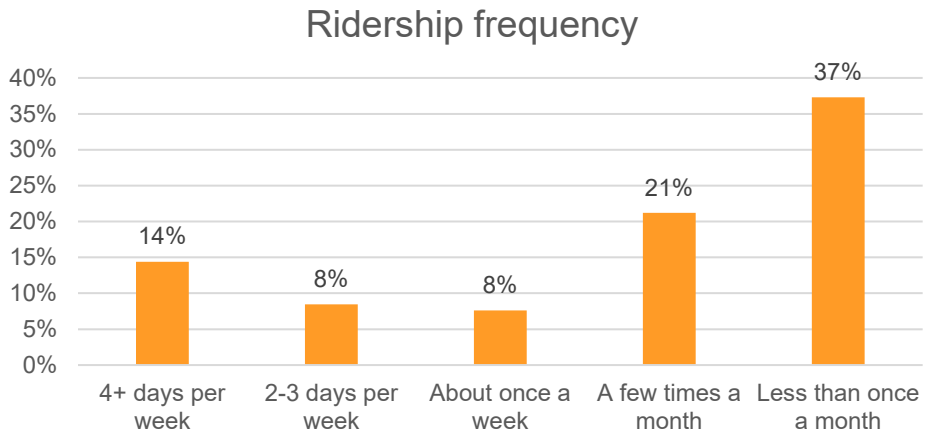
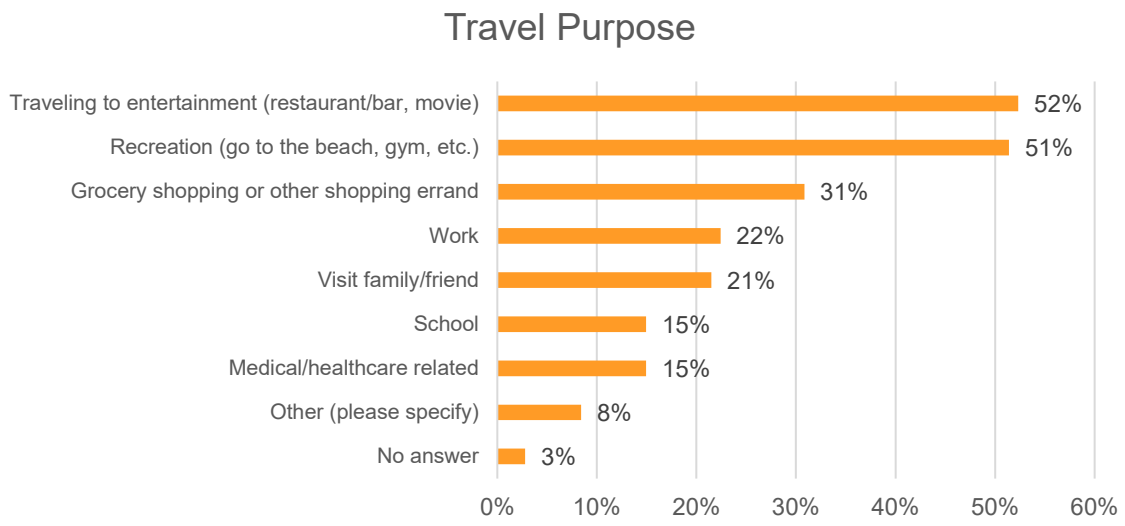


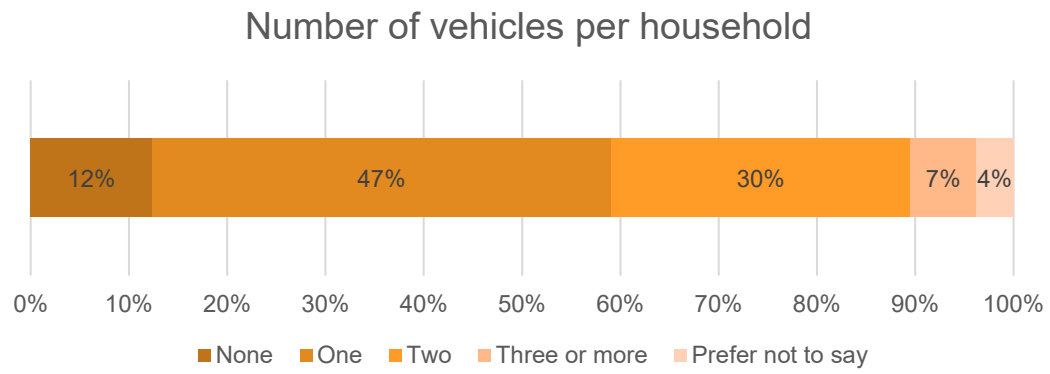
Figure 2: Trip purpose when traveling on BCT (multiple selections, 107 responses)



However, there is a notable portion of riders who frequently ride BCT services for work and school. Riders who indicated a higher frequency of BCT use (4+ days per week) were almost two times more likely to ride

to work and three times more likely to ride BCT to school. This 14% of high-frequency daily riders are reflected in Figure 3 where 12% of respondents who ride BCT do not have a vehicle “available” to them.

Figure 3: Vehicles per household of BCT riders (105 responses)



While 12% may not have a vehicle “available” to them, there was a larger portion of BCT riders who do not have a driver's license. As Figure 4 indicates, 17% of BCT riders could be considered “captive transit riders,” without the proper documentation to drive. Drilling down into this population, the dependence on BCT service is starkly illustrated in Figure 5 with 56% of this non-driving population riding BCT four or more days a week.

Figure 4: Percent of BCT rider respondents with a driver’s license (105 responses)

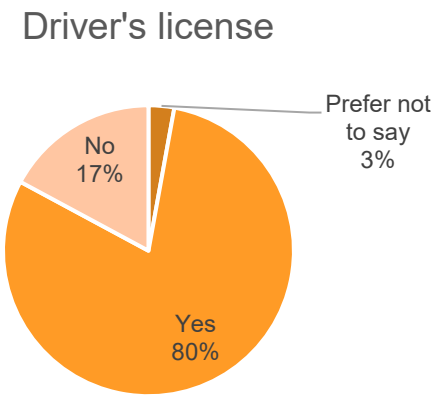
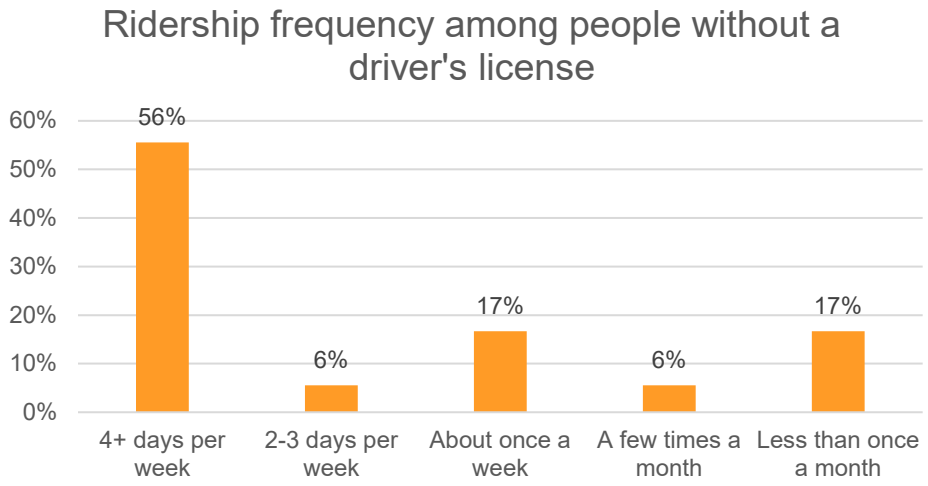
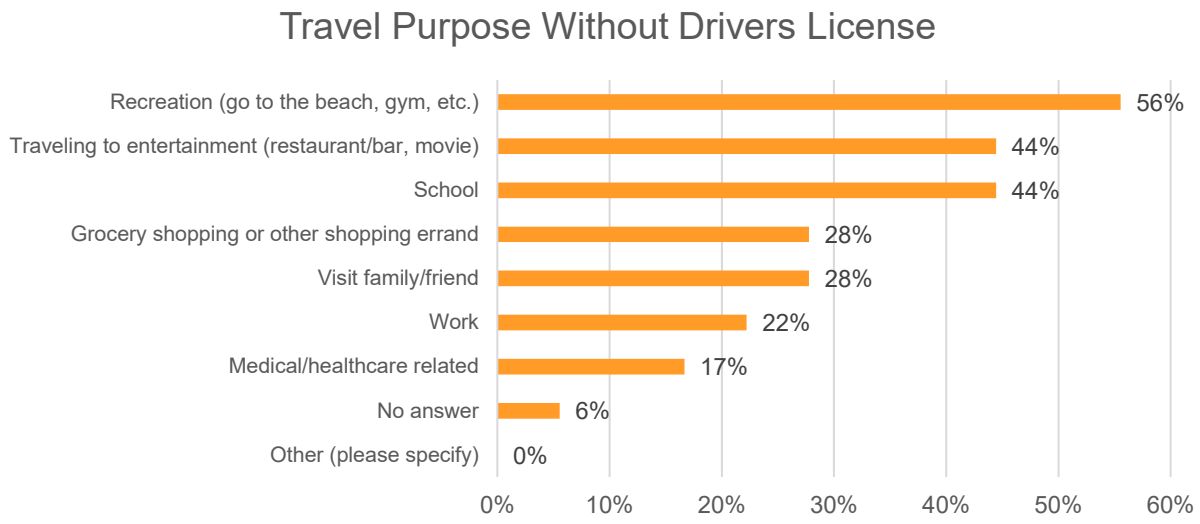


Figure 5: Frequency of ridership among people without a driver's license (18 responses)



Furthermore, the trip breakdown of the respondents without a driver's license (Figure 6) reveals that recreation and entertainment remain the predominant use for BCT. Expectedly, this demographic utilizes the bus for trips to school at a higher rate which accounts for the student population on BCT. Taken together, the analysis here reveals that most riders mainly ride BCT occasionally for leisure purposes, but of the riders who ride the most frequently, these riders use the bus almost every day for school as well as to leisure destinations.

Figure 6: Trip purpose of riders without a driver's license traveling on BCT (multiple selections, 18 responses)



Most riders access the bus (Figure 7) by walking with smaller populations biking or transferring from other services. Ridership (Figure 8) is predominantly on Line 109 with 60% of respondents indicating that as their primary BCT route.

Figure 7: First/list mile modes (multiple selections, 107 responses)

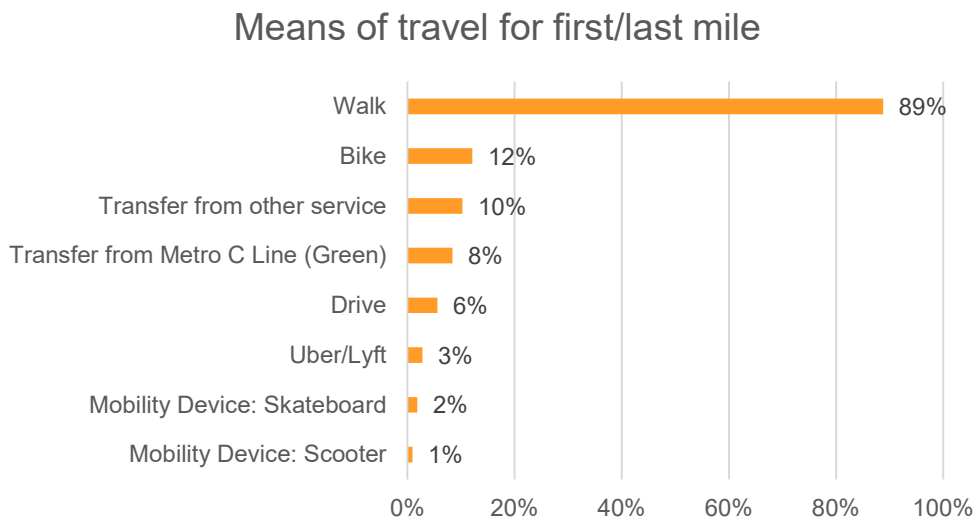
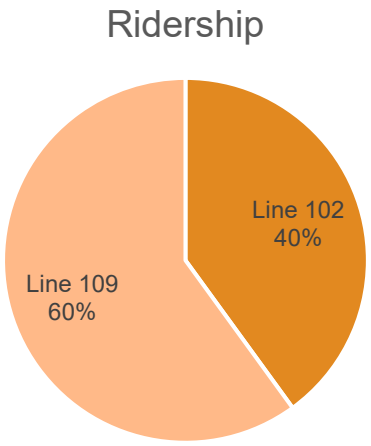
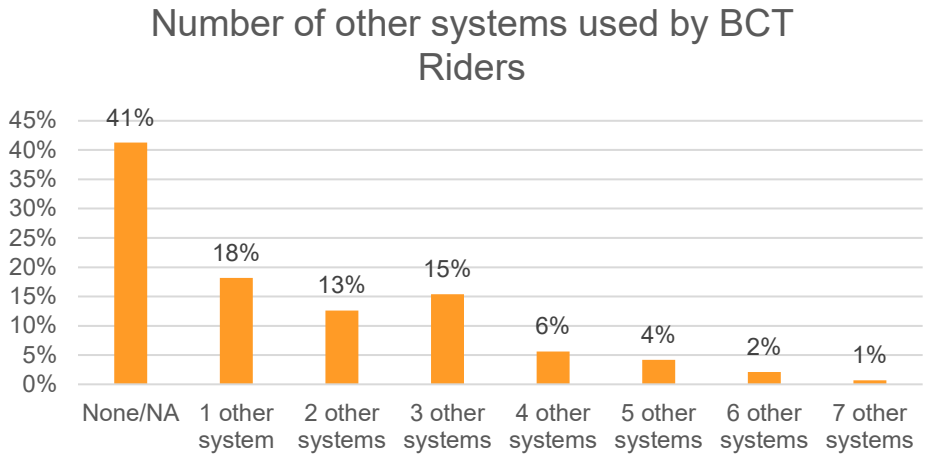


Figure 8: Primary route (130 responses)



A large portion of BCT riders also use other transit systems. Of the system options (Metro Bus, Metro Rail, Torrance Transit, LADOT, Commuter Express, GTrans, Lawndale Beat, Other (please specify) or None/NA), Metro Bus and Metro Rail were the most frequently used by respondents with 27% and 20%, respectively. Torrance Transit was also indicated frequently as a system used by BCT riders. Considering the service area of BCT, these three systems interface directly with BCT lines. Figure 9 shows that BCT riders who do use at least one other transit system represent 59% of respondents. Those who did not ride another system were the largest single response (41%).

Figure 9: Other systems used by BCT riders (multiple selections, 108 responses)

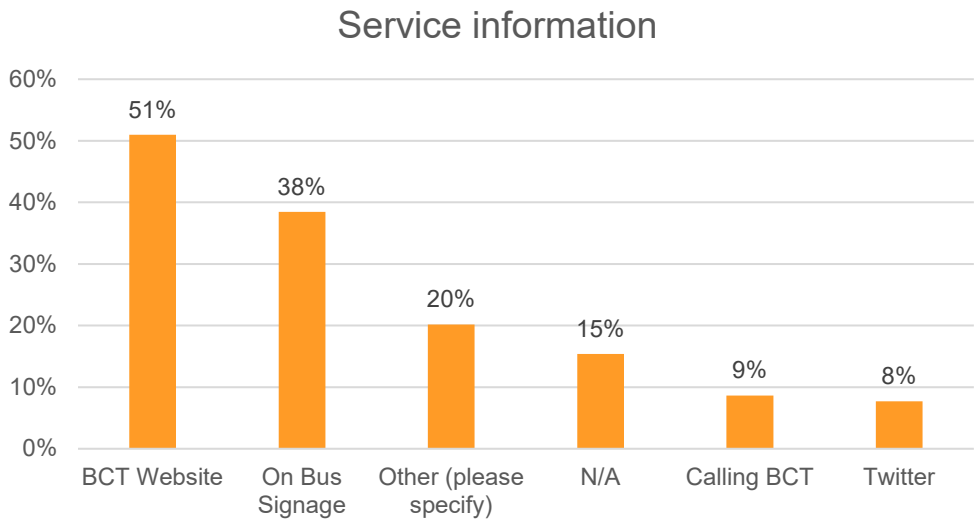


1.1.1.1 Information Sources

Respondents were asked several questions that pertain to how they plan and complete their trips. Responses showed that while digital sources of information (BCT website and real-time transit applications) are the predominant methods, in-person and physical means of navigating transit services are still very prevalent.

BCT disseminates information to its riders via several methods, namely its website and its Twitter account. Both platforms provide regular updates on service, but the website includes a host of other system information as well as a real-time bus tracker. Survey respondents were asked to indicate all methods they use to access information and service updates. Figure 10 provides a breakdown of those means, with BCT's website being the most popular source of information.

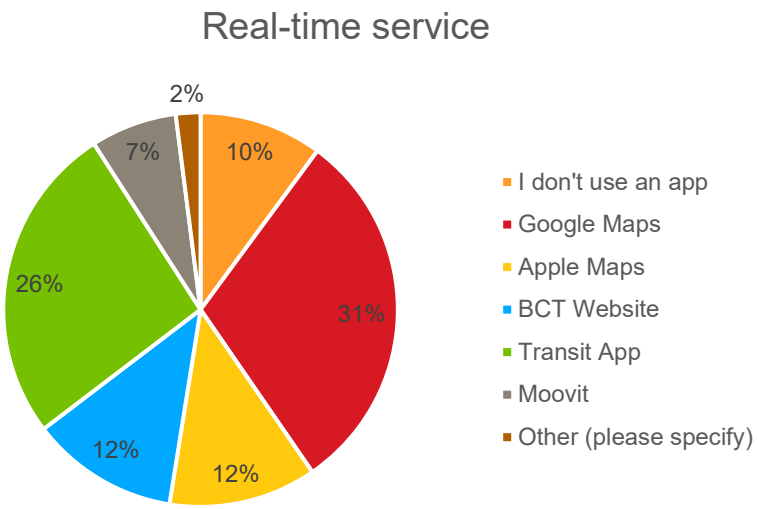
Figure 10: Sources for transit information (multiple selections, 104 responses)



The "Other (please specify)" answers indicated that trip planning and real-time transit apps like Google Maps and the Transit App are also valuable sources for trip information, accounting for 14% of "other" responses. Additional notable comments mention "city senior centers," "Chamber of Commerce," and "bus stop signage for schedule." These responses highlight the duality of transit information; both digital and physical sources remain important to BCT's riders.

As respondents indicated through the "Other (please specify)" selection in the previous question, real-time trip planning apps are very popular for accessing transit information. Respondents were then directly asked which apps they use, with the results shown in Figure 11. Google Maps and the Transit App were the most used by BCT riders. These results demonstrate that the effort by BCT to provide a modern trip-planning experience by publishing real-time information has had a significant impact on riders.

Figure 11: Real-time transportation planning app usage (multiple selections, 174 responses)

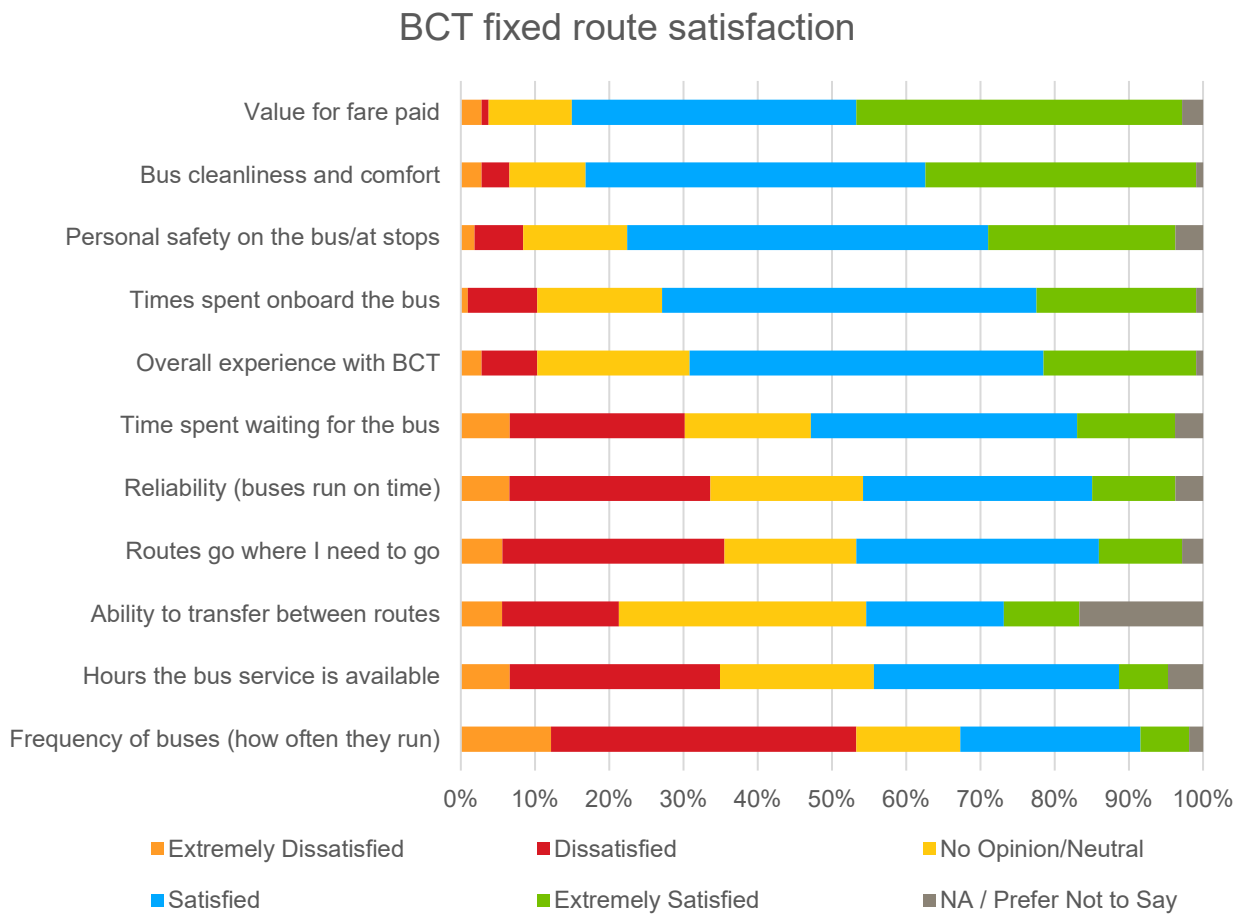


1.1.2 SYSTEM IMPROVEMENTS

Overall satisfaction with the fixed route system was high, with most responses indicating at least a satisfactory option for the overall BCT experience. Figure 12 displays rider satisfaction with different aspects of BCT service (listed from overall most satisfied to least satisfied), with riders particularly satisfied with the value of fare paid and the cleanliness of the bus. Attributes where BCT does not perform as well include time spent waiting for the bus, reliability, service area, and the hours fixed-route buses run.

Where BCT performs poorly in rider satisfaction is the frequency of buses. This attribute received the highest “extremely dissatisfied” response (percent) with over 50% of respondents not satisfied with how often the bus comes. BCT’s service area was another aspect where riders were overall less satisfied, but there was higher satisfaction and lower dissatisfaction compared to frequency. In the tradeoff between coverage and frequency, it appears that BCT riders prioritize frequency. Another key area of dissatisfaction is BCT’s service span with 35% of respondents either dissatisfied or very dissatisfied.

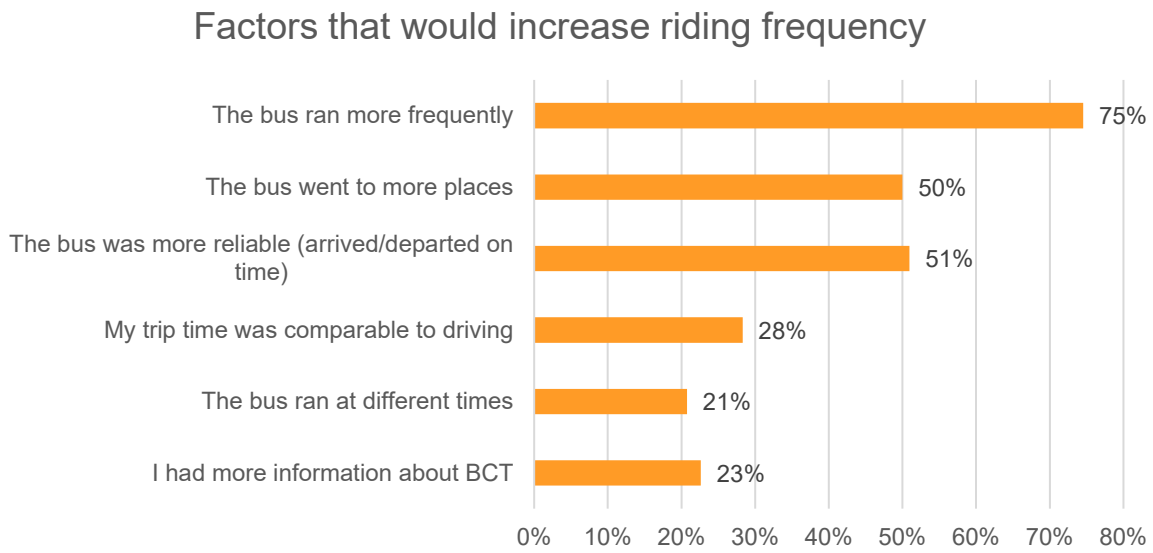
Figure 12: Rider satisfaction with aspects of BCT fixed-route service (107 responses)



1.1.2.1 Systemwide Improvements

Many of the areas BCT performed poorly in customer satisfaction were areas that would increase ridership from current riders. Figure 13 shows rider priority for frequency, service span, and reliability. Almost all respondents indicated that more frequent and more reliable service would encourage them to ride more often. Additionally, comfort when transporting children was not of major concern with only 2% indicating this response.

Figure 13: Factors that would increase riding frequency (multiple selections, 106 responses)



The ”Other (please specify)” category received several responses and included:

- Later service with buses running past 8 PM or earlier service on “non-school weekdays.” Service for summer concerts was also mentioned regarding later service.
- Access to LAX was requested, and given that BCT serves LAX, indicates a lack of access to information (or awareness) about BCT services.

Other opportunities for better information sharing were seen with requests for “real-time info” or an app to track when the next bus comes. Both services are available on BCT’s website as well as trip planning applications like Transit or Google Maps. This presents BCT with an opportunity for more robust outreach and marketing to inform the public that these services are available to them.

Locations Not Currently Served

Respondents were asked to describe locations not currently served by BCT and that they would like to see BCT provide service to. An open-ended question, answers ranged from specific locations to streets that should have a transit line, as well as general areas. Themes from this question include:

- Service to LAX was highly desired by riders. While Line 109 currently provides service to the LAX City Bus Center, information about this service is lacking. Some responses did indicate the desire for an express service to LAX which does differ from the current Line 109.
- Del Amo Mall was the most requested location by riders. While BCT does not currently provide service to Del Amo Mall, the previously operated Line 104 ran from Del Amo Mall to Palos Verdes,

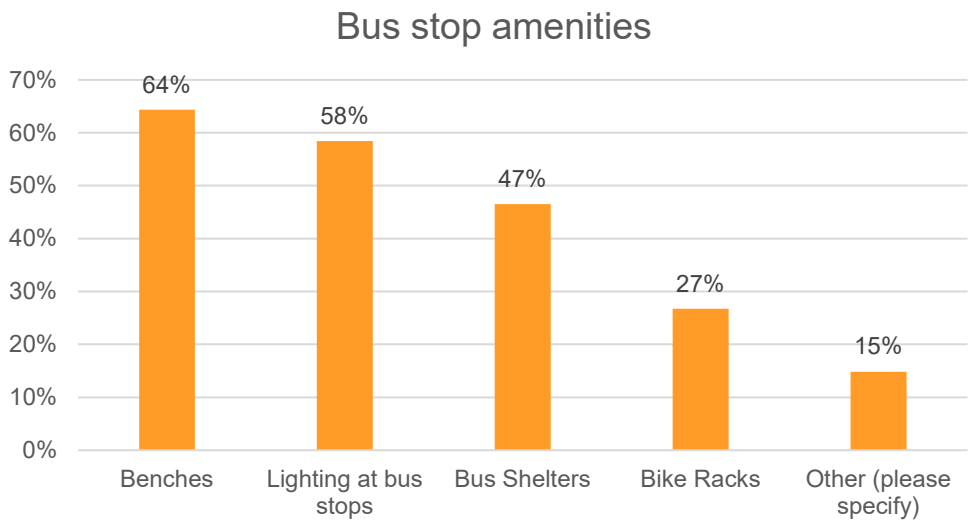
Riviera Village, and along Catalina Ave to Redondo Beach Pier. The line was eliminated due to low ridership. Additionally, Torrance Transit operates almost all its services centered around the Del Amo Mall. While the BCT system map shows all other transit routes, connections, and destination information, additional publications providing destinations and transfers could be designed in coordination with the other transit operators.

- Schools were a common response from non-riders, who wanted service to Mira Costa High School, Parras Middle School, and the South Bay Adult School. Additionally, El Camino College and generally 'middle schools' were mentioned by riders.
- Polliwog Park was mentioned several times by riders, often noting a desire for service along Manhattan Beach Blvd, North Redondo Beach, or the Metro C Line (Green) station.
- Streets were often requested by riders. These requests included: PCH, 190th, Aviation, Torrance Blvd as well as streets BCT already operates on like Hawthorne Blvd, Prospect Ave, and Artesia. While many of these streets have transit service by BCT or other providers like Metro Bus, GTrans, or Torrance Transit, respondents may want to emphasize their importance or were simply unaware.

Bus Stop Amenities

Riders were asked to indicate what amenities they would like to see on BCT services. Figure 14 shows that riders would generally like to see a variety of amenities. Themes of cleanliness and information availability were also mentioned by those who chose to specify. Along with benches, lighting, and shelter (shade specifically), riders would like to see cleaner bus stops with trash and recycling cans. Physical bus information like QR codes or real-time signage was mentioned to provide better arrival information.

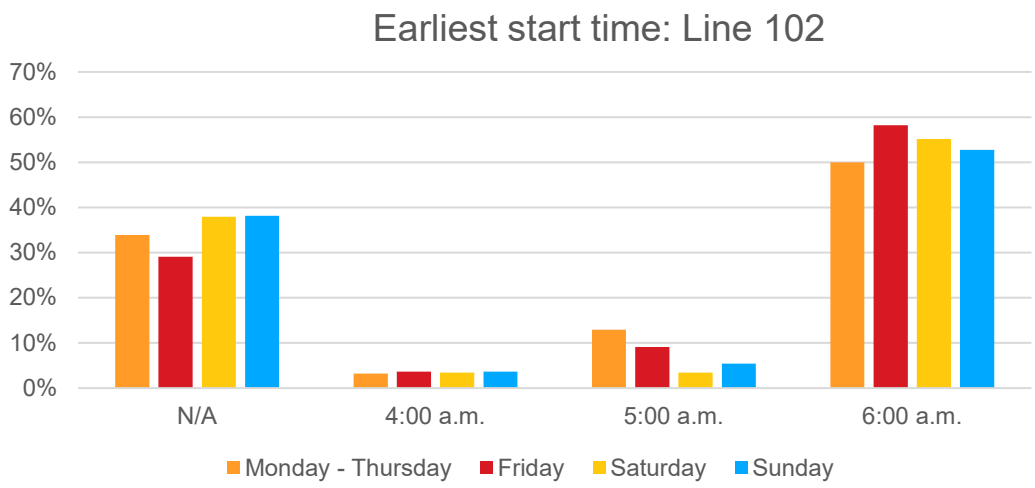
Figure 14: Bus stop amenities (multiple selections, 101 responses)



1.1.2.2 Line 102

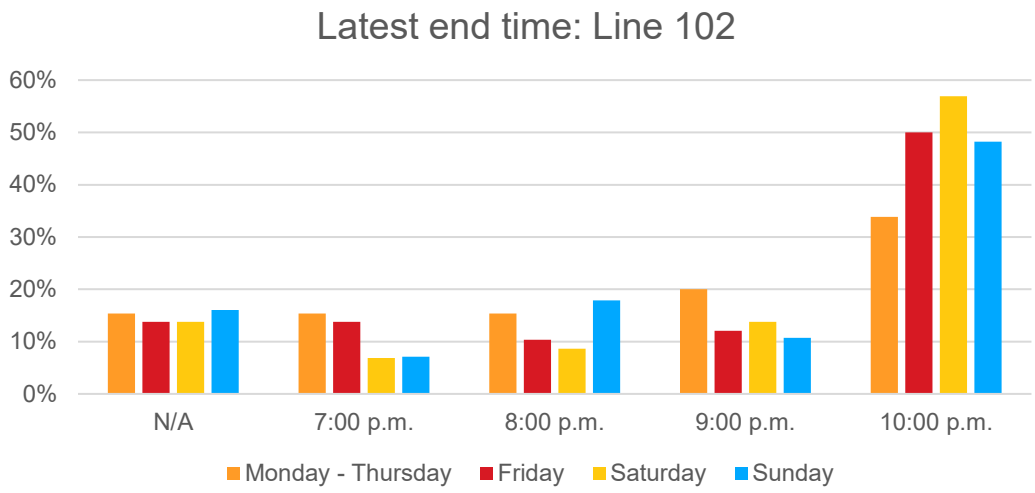
BCT currently operates Line 102 from 6:00 AM to 8:30 PM on weekdays, 8:00 AM to 9:15 PM on Saturdays, and 9:15 AM to 7:00 PM on Sundays. Respondents were asked to indicate the earliest and latest times they would utilize bus service on Monday through Thursday, Friday, Saturday, and Sunday individually. Figure 15 shows that riders were primarily interested in either the latest option for morning service or uninterested in morning service at all. Service starting at 5:00 AM did receive an increase of interest with 15% of respondents indicating that 5:00 AM service Monday-Thursday would be utilized. Considering the current service span and the relatively low interest in earlier trips, a change to the start times of Line 102 is not a priority.

Figure 15: Earliest times riders would utilize Line 102 service (62 responses)



There was strong support for later service times on Line 102, particularly on the weekends. Figure 16 indicates while later service is not as much of a priority for riders during the weekdays (Monday-Thursday), it is very important on Friday, Saturday, and Sunday.

Figure 16: Latest times riders would utilize Line 102 service (65 responses)

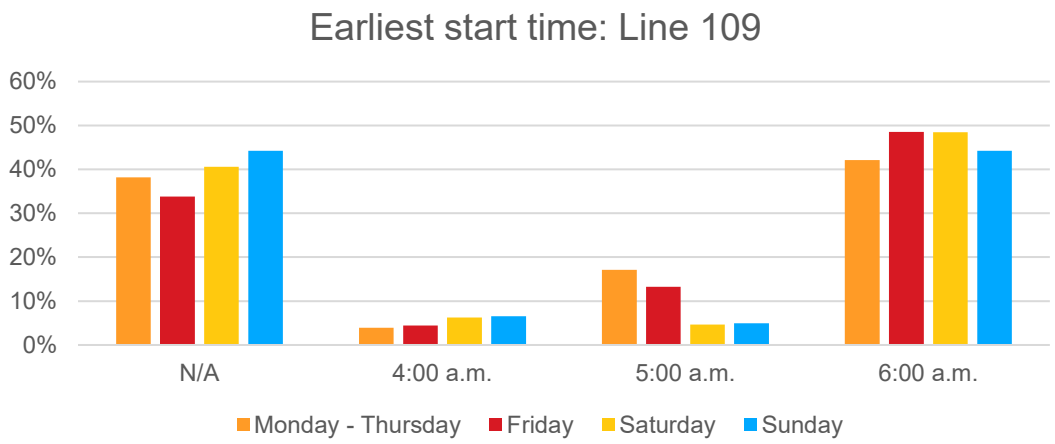


1.1.2.3 Line 109

Line 109 operates during a wider service span than Line 102 with buses running from 6:00 AM to 9:45 PM Monday through Friday and 6:00 AM to 10:15 PM Saturday and Sunday.

Riders indicated that similarly to Line 102, earlier service was not a priority. Figure 17 shows the same preference as Line 102, with riders favoring 6:00 AM service or not interested in morning service and responding N/A.

Figure 17: Earliest time riders would use Line 109 (76 responses)



The latest Line 109 operates is currently 10:15 PM on weekends. As Line 109 operates along the busier, nightlife areas of the Beach Cities, riders were asked to indicate their use of late-night service with buses operating until midnight.

Figure 18: Latest time riders would use Line 109 (79 responses)

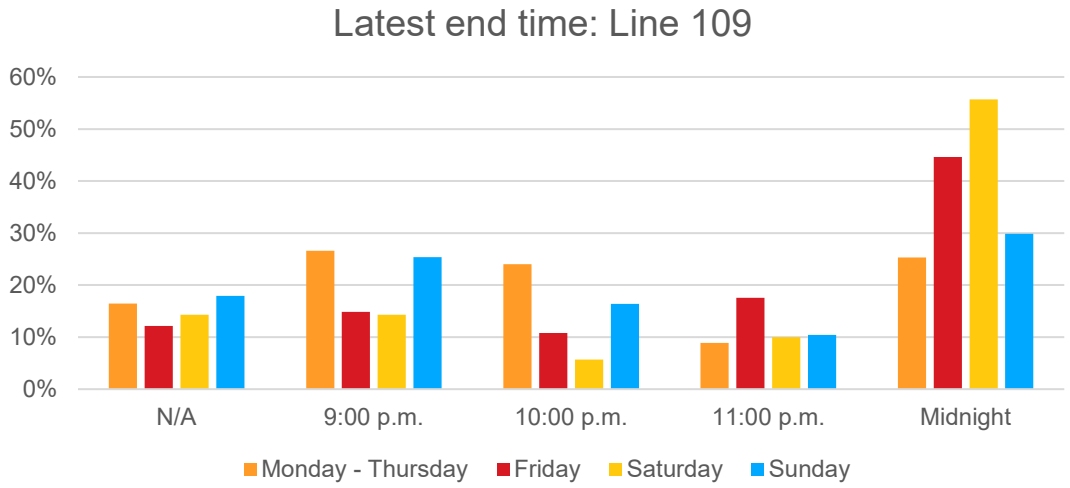


Figure 18 shows that riders overwhelmingly support later service on Friday and Saturday nights. Comments like, “If the 102/109 would run later in the day, past 8” and “Late night hours after summer concert ends”

indicate a desire for later service. This sentiment was additionally supported by comments that pointed to the dangers of drunk driving and the need for transit coming home from bars and other nightlife activities.

1.1.3 KEY TAKEAWAYS

Based on feedback from BCT riders, key themes surrounding the strengths and weaknesses of the fixed route service were identified. These include:

- The profile of BCT users responding to the survey is one that infrequently rides, traveling for leisure purposes but includes a subset of more frequent use, captive (non-driving) riders who travel to school at a higher rate than non-captive riders. Seeking reliable transportation to restaurants, bars, and other evening activities, riders highly favored later service on both Lines 109 and 102.
- Riding respondents were overall satisfied with the service BCT provides particularly the value of fare as well as the cleanliness and comfort of vehicles. Despite this, respondents desired improved reliability and increased frequency of bus service.
- Information is predominantly acquired at stops through signage and the use of real-time bus tracking apps like Google Maps or Transit App. Information about the system falls short concerning where BCT and other bus services operate (Line 109 to LAX, Torrance Transit around Del Amo Mall, etc.) and general knowledge about BCT services.
- Riders frequently desired more locations served by BCT. These often included those served by other transit agencies in the South Bay. This desire was complemented by a slight increase in dissatisfaction with the ability to transfer between systems.

1.2 WAVE Riders[4]

The WAVE survey collected 11 valid responses from South Bay residents that indicated previous use of the service. The low number of responses is unsurprising for a survey of dial-a-ride riders; currently, the WAVE saw 4,845 unlinked passenger trips in 2021 (NTD Agency Profile), or about 13 average daily WAVE riders, so these responses represent about 83% of daily riders. Questions included demographics, WAVE usage, fixed-route use, and opinions on the service and where it could improve.

1.2.1 RIDER PROFILE

Results from WAVE survey respondents who indicated their ZIP codes are seen in Table 2 and show an even split between the two cities served by the WAVE, Hermosa Beach, and Redondo Beach. Most respondents indicated their ethnicity to be white or Caucasian (Figure 19) and all identified as women.

[4] Please note that due to the low number of responses on the WAVE rider survey, survey results may not be indicative or reflective of actual WAVE riders.

Additionally, respondents indicated income ranges (Figure 20) for all categories except for $75,000 and above.

Table 2: Home ZIP code of WAVE riders (6 responses)

Zip Code	Percent	City
90254	50%	Hermosa Beach
90277	33%	Redondo Beach
90278	17%	N. Redondo Beach

Figure 19: WAVE ride ethnicity (multiple selections, 7 responses)

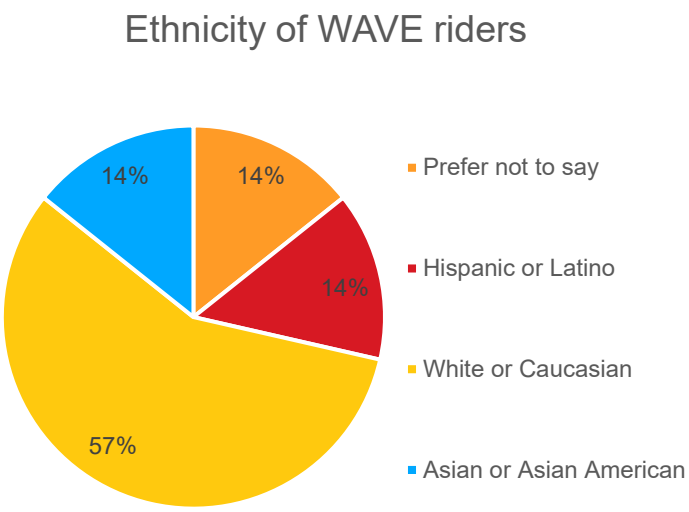
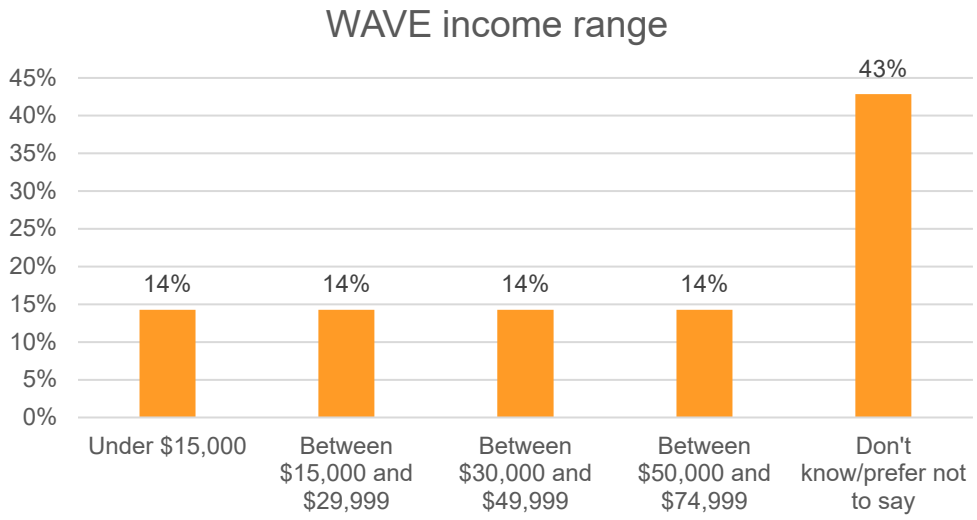
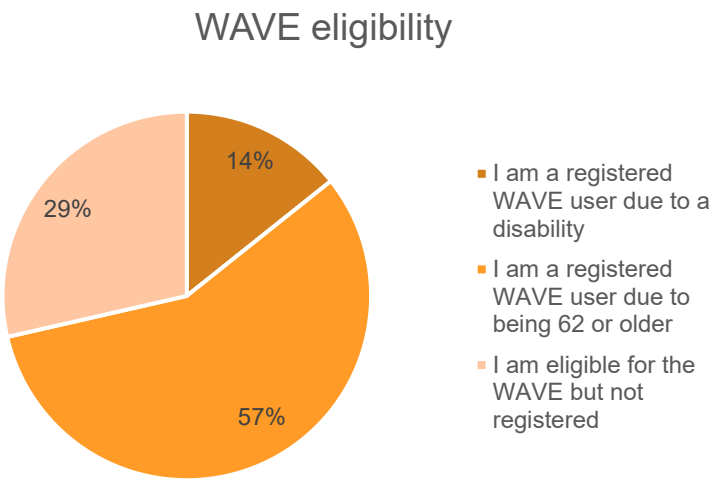


Figure 20: Income ranges of WAVE riders (7 responses)



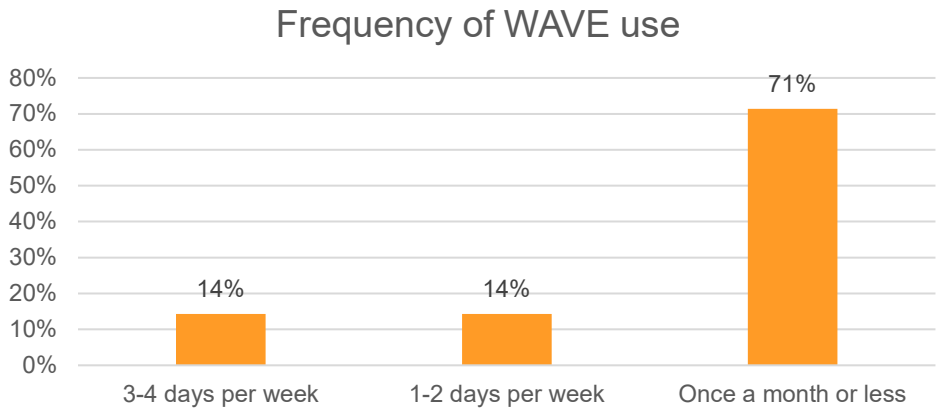
Responses regarding eligibility for WAVE services (Figure 21) indicate that age is the primary factor, rather than disability, in using dial-a-ride. A portion of respondents (29%) indicated that despite eligibility for WAVE services, they are not registered for the service.

Figure 21: WAVE eligibility and registration status (7 responses)



WAVE riders who responded to this survey are generally infrequent users (Figure 22) riding the WAVE less than once a month. No WAVE riders indicated they ride “five or more days a week” or selected the option for “once a week or less.”

Figure 22: Frequency of WAVE use (7 responses)



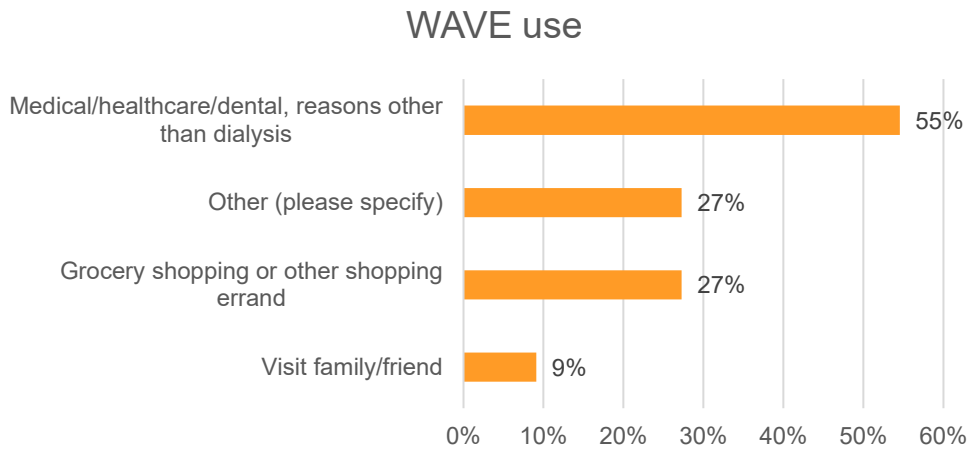
1.2.2 TRIP PURPOSE

The primary use for WAVE services was for rides to non-dialysis, medical appointments. Figure 23 shows that other trip purposes were errand or leisure-driven, with shopping and visiting families or friends indicated. The other category included:

- Childcare responsibilities (traveling with children)
- Traveling to dialysis

No respondents indicated they use the WAVE for school, work, or travel to entertainment or recreation.

Figure 23: WAVE trip purpose (multiple selections,11 responses)



Apart from WAVE usage, only 29% of respondents indicated they currently use Line 102 or 109 (Figure 24).

Figure 24: Fixed-route use among WAVE riders (7 responses)

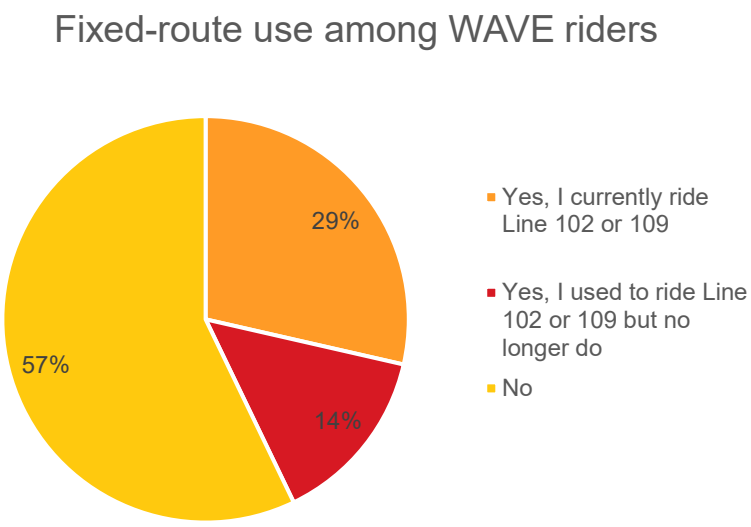
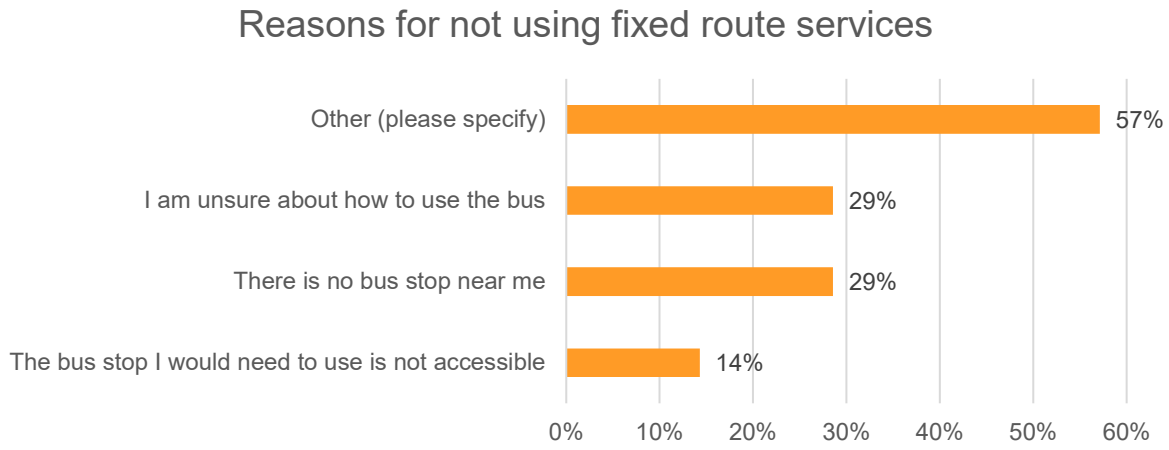


Figure 25: Factors that prevent fixed-route service use (multiple selections, 11 responses)



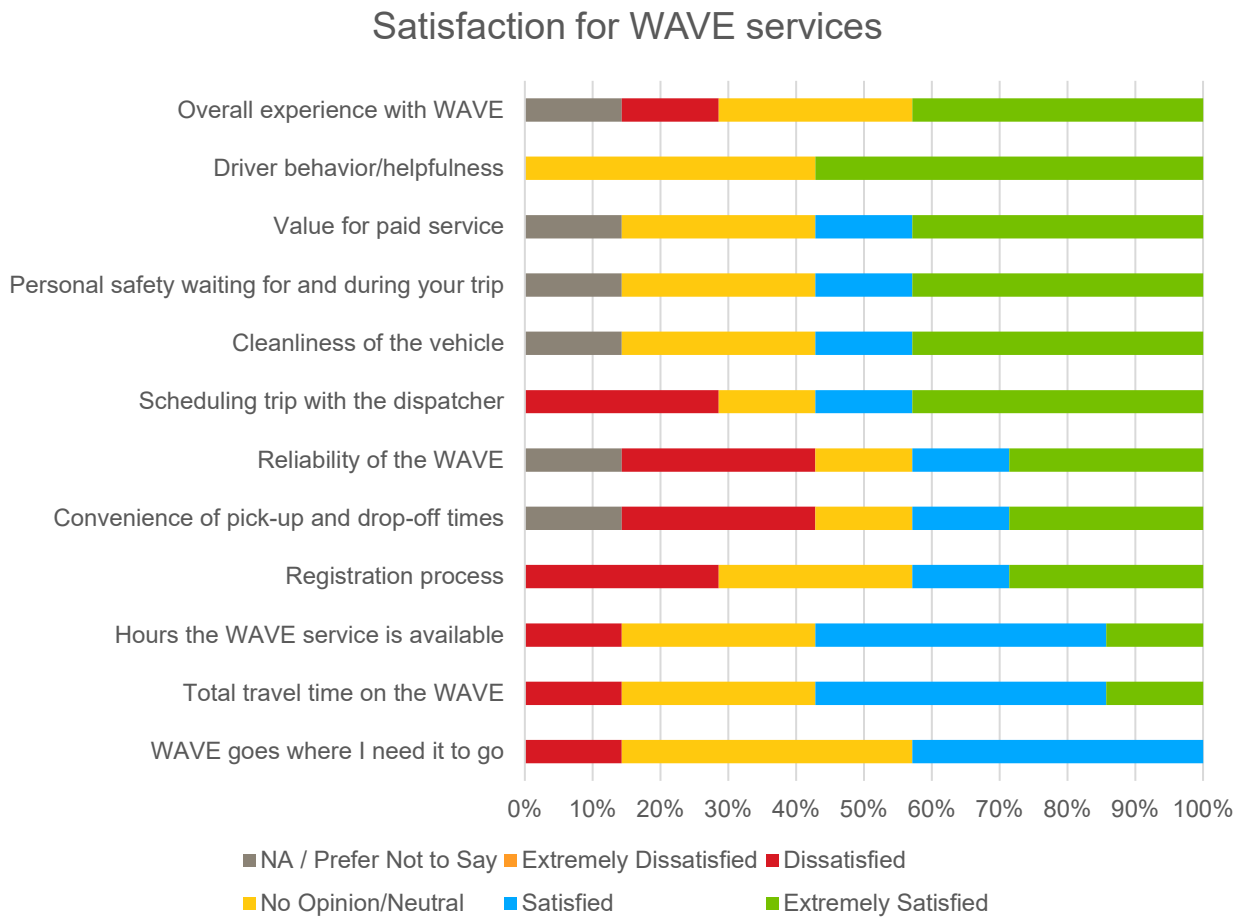
WAVE riders indicated their reasons for not using fixed-route services in Figure 25. While lack of information and proximity to a bus stop was indicated, most respondents preferred to describe their own limiting factor. Of the “Other (please specify)” category preferring to drive their own car was mentioned most often. While WAVE riders prefer to drive, they often indicated they would ride the WAVE due to an injury limiting or prohibiting them from driving. One WAVE rider summed that sentiment with the comment, “I drive my car unless I am injured, post-surgery, etc.” Other limitations included a lack of information about or infrequency of BCT fixed-route service.

1.2.3 SATISFACTION AND IMPROVEMENTS

WAVE riders were asked to provide feedback on their satisfaction with the dial-a-ride services provided by BCT. Figure 26 shows that overall riders are very satisfied with the service provided by the WAVE. While no riders express “extreme dissatisfaction” notable areas of improvement include:

- Ride delivery: scheduling, reliability, and convenience of pick-up/drop-off time.
- Registration process
- Service area

Figure 26: Satisfaction for WAVE services (5 responses)



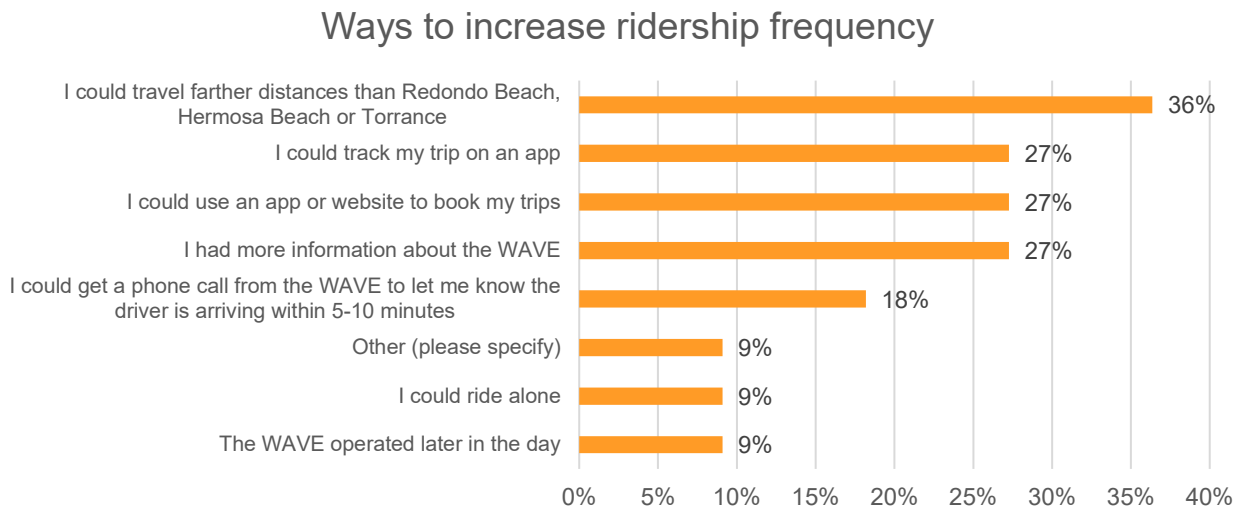
Survey respondents who ride the WAVE indicated their satisfaction with 43% expressing extreme satisfaction at the overall experience. Driver behavior and helpfulness were remarkably high with most

respondents extremely satisfied. As Figure 26 indicates other areas the WAVE excels at are the value, safety, and vehicle cleanliness. The areas where the WAVE service struggles -according to those who responded to the survey- are primarily before getting onto a vehicle. Lower satisfaction levels included the scheduling process, reliability, pick-up/drop-off times, and the registration process. While these areas did have more dissatisfied respondents, the satisfaction responses ranged from 43% to 57% for these areas.

Figure 27 displays the frequency at which WAVE rides indicated the likelihood of a service change to increase their ridership. The WAVE serving a larger area was the primary factor with a comment requesting service to the Costco in Torrance, but other areas of improvement included:

- Trip scheduling – riders would like to use the web or app-based services to schedule and be updated about their trips. Twenty-seven percent of respondents indicated a phone call (or potentially other forms of notification) was desired.
- Better information – a large portion of respondents (27%) didn't feel like they had enough information about WAVE services. This is summed up by the comment, "I didn't know we had it."
- Reliability – although not a selection, respondents commented that poor reliability turned them away. Comments included, "I quit when they did not show up for the third or fourth time," and "If they showed up. They no showed us 3 times and we switched to Uber,"

Figure 27: Service changes to increase the frequency of ridership (multiple selections, 11 responses)



1.2.4 KEY TAKEAWAYS

Respondents who ride the WAVE are generally satisfied with the service but would like to see expanded service and information. Notable areas from this feedback include:

- Based on survey responses, WAVE clients are generally infrequent riders who travel to medical appointments. All respondents indicated having access to a vehicle and preferring to drive. They would utilize the WAVE when something like an injury limited their ability to drive a personal vehicle. Supported by analysis of client data, it should be noted that the survey sample didn't capture frequent WAVE riders who rely on the service as a necessary means of transportation.
- WAVE riders were overall satisfied with BCT dial-a-ride service once they were onboard. The signup, scheduling, and pickup process solicited the most dissatisfaction from survey respondents. Although important aspects of the service were not as satisfactory to some, satisfaction was particularly high around drivers and included praise like, "The drivers on The WAVE are very courteous, kind, friendly, and helpful! They're great."
- Riders indicated some of the lowest satisfaction around the service area of the WAVE. Additionally, when asked to indicate ways to increase ridership frequency, the highest support from respondents was oriented towards traveling further distances than Redondo Beach, Hermosa Beach, and Torrance.
- Survey respondents indicated that information about WAVE services is lacking as comments like, "community needs more info" and "send eligible people info on this," demonstrate. Of the respondents, 29% indicated they're eligible for the WAVE but are not registered which points to a lack of access to information about the registration process. While WAVE information is available on the City website, at Senior Centers and libraries, and can be requested at City offices, overall, riders who have used the service feel they don't have access to enough information about the WAVE.

1.3 Non-Riders

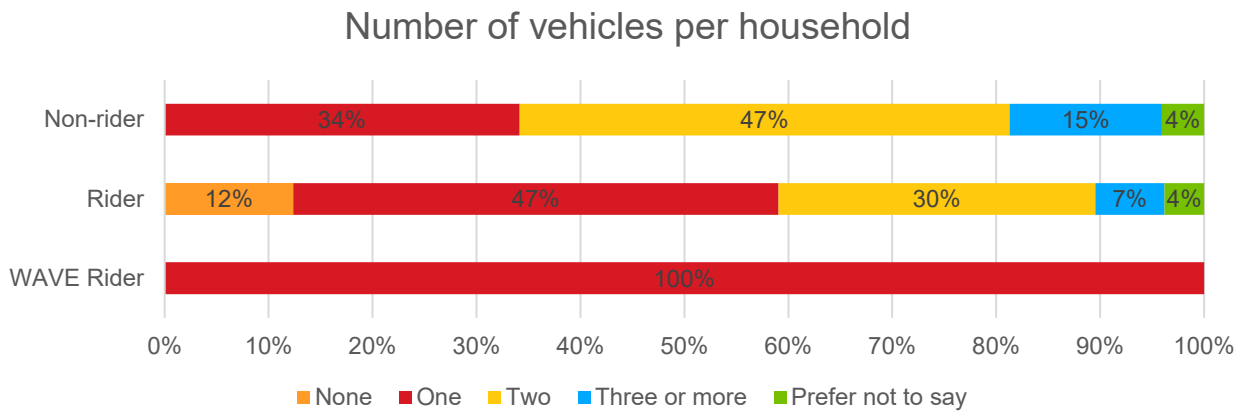
The non-rider survey collected 126 valid responses from residents of the Beach Cities and surrounding area. In addition to demographic questions, non-riders were asked to indicate their propensity to transit as well as changes to service that would encourage them to ride BCT services.

1.3.1 DEMOGRAPHIC COMPARISON

Comparing non-riders to riders of BCT services provides a more specific look at who is using and not using BCT fixed-route or WAVE dial-a-ride.

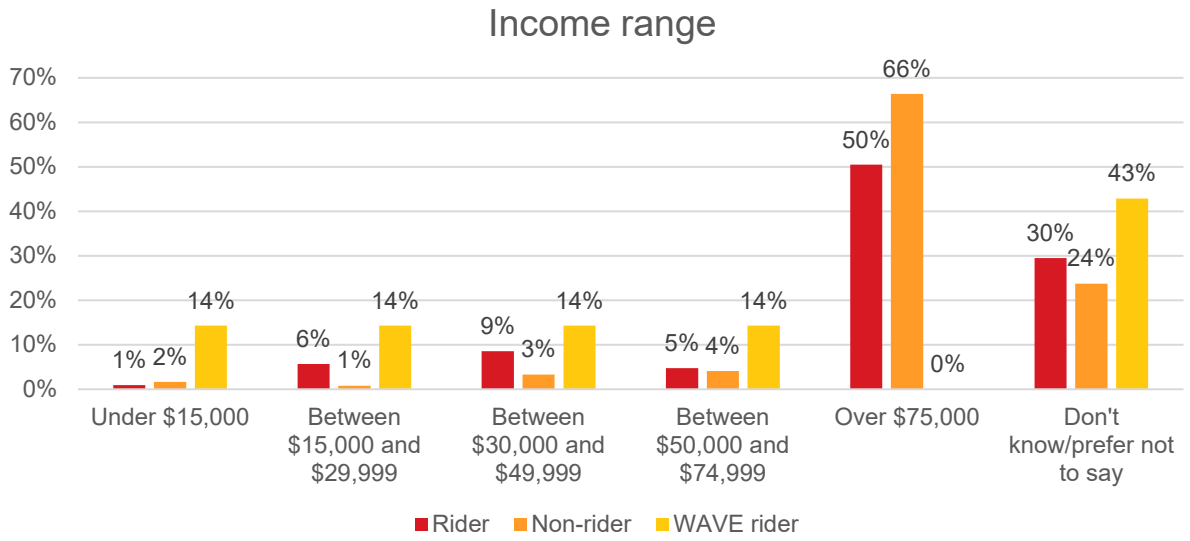
While most respondents had cars available in the household (Figure 28), zero-vehicle households were only present in the rider category. This is expected as non-drivers are often considered captive riders on transit. Additionally, WAVE riders indicated they would only use dial-a-ride services when an injury prevented them from driving but not due to lack of vehicle access.

Figure 28: Number of vehicles per household by survey (234 combined responses)



Generally, non-riders indicated higher incomes overall than other demographics, with 66% reporting incomes of $75,000 or higher (Figure 29), while this range was reported at 50% for riders and not at all for WAVE riders. The non-response (don't know/prefer not to say) was popular among all demographics, but the WAVE respondents chose this at a higher frequency than any other option.

Figure 29: Income ranges by survey (234 combined responses)



Survey responses were gathered from all the Beach Cities as well as the surrounding area. Table 3 shows that the largest segment of respondents came from Redondo Beach. Non-riders were less likely to live in North Redondo Beach than riders. Additionally, a large portion of the non-rider responses came from Torrance, which BCT (apart from WAVE satellite locations) does not serve.

Table 3: ZIP code responses for all three surveys (228 combined responses)

ZIP Code	Non-riders	Riders	WAVE riders	City
Prefer not to say	-	1%	-	
90245	5%	6%	-	El Segundo
90250	4%	2%	-	Hawthorne
90266		6%	-	Manhattan Beach
90274	4%	-	-	Rolling Hills/Palos Verdes
90254	-	20%	50%	Hermosa Beach
90277	42%	28%	33%	Redondo Beach
90278	14%	26%	17%	N. Redondo Beach
90503	28%	2%	-	Torrance
Other (please specify)	2%	10%	-	

1.3.2 PROPENSITY TOWARDS TRANSIT

The non-rider survey asked questions that sought to gauge the value non-riders had for BCT and what factors were present in them not riding. Figure 30 through Figure 32 provide a look at different factors non-riders were asked to gauge their propensity to transit use. Take-aways include:

- Less than a quarter of non-riders have had experience with BCT services. Of this subsect, only 10% would not consider riding BCT (Figure 31) and largely cited location as the limiting factor (BCT service area or ease of other modes).
- Transit is generally valued in the South Bay with 85% of non-riders supporting the statement, “Public transit is an important service to the community.” Most of the remaining responses strongly disagree with the statement which goes in line with the ~15% of respondents that adamantly opposed transit.

Figure 30: Non-rider previous use of BCT fixed-route or WAVE dial-a-ride (126 responses)

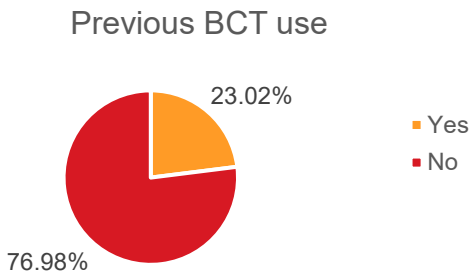


Figure 31: Likelihood of non-rider using BCT when regular mode unavailable (125 responses)

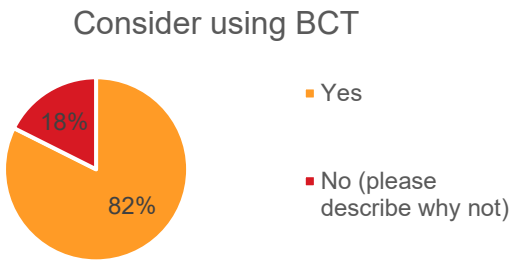
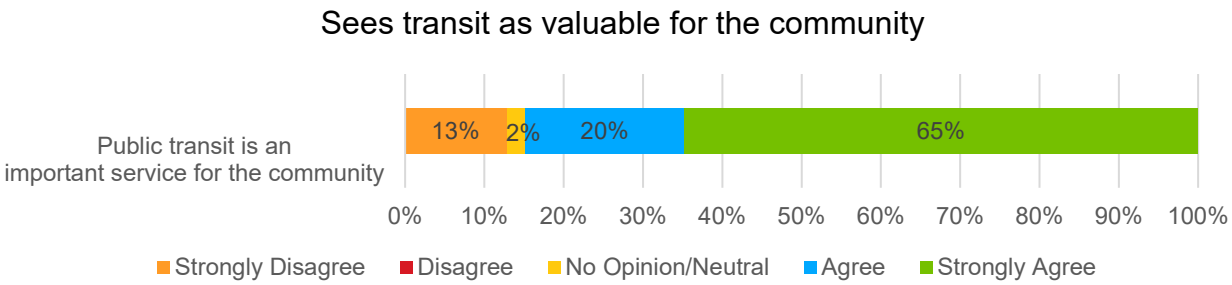


Figure 32: Non-rider opinion towards the value of transit for the community (125 responses)



Comments from South Bay residents not willing to consider BCT services (Figure 31) generally fell into one of three categories: safety, value, and information. These sentiments included:

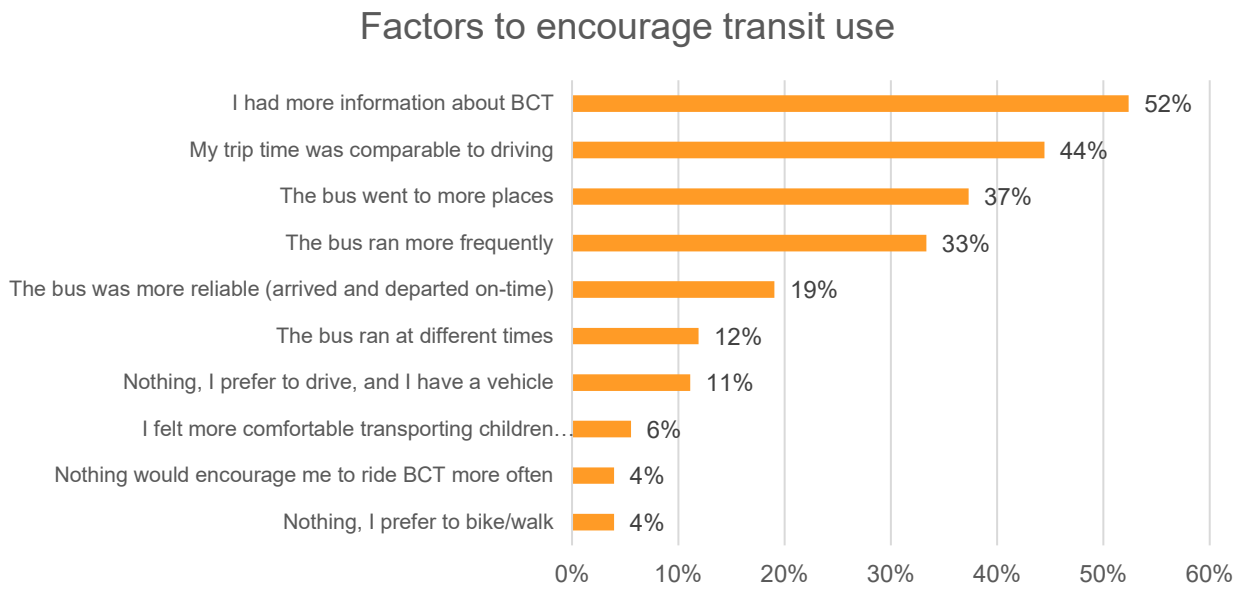
- Safety is a concern with words like “crime,” “homelessness,” and “dirty” associated with this opinion.
- Value was also noted in that the bus takes too long or “it’s easier to call a ride service,” and “I’d rather take my bike.”
- Lack of information and experience with BCT services was commonly noted. Some respondents put it simply with “I don’t know enough about it,” while others requested a bus to Manhattan Beach, demonstrating a lack of knowledge as Line 109 travels through Manhattan Beach.

1.3.3 SYSTEM IMPROVEMENTS

Figure 33 shows the factors that would encourage non-riders to ride more often or try riding. A frequent theme throughout the engagement, the lack of information about BCT is a large barrier to using the system. Other factors included:

- Comparability to driving – non-riders would like to see service that was available in more places and went to destinations quicker with minimal wait times.

Figure 33: Factors to encourage ridership among non-riders (multiple selections,126 responses)



Non-Rider Desired Locations for BCT Service

Non-riders generally asked for service to LAX and Del Amo Fashion Mall. LAX was by far the most requested location by non-riders indicating a fundamental lack of knowledge about the system. Some additional locations included:

- Schools including Parras Middle School, South Bay Adult School, and Mira Costa High School (serviced by Torrance Transit)
- Malaga Cove Plaza (Palos Verdes)
- Prairie and 190th Ave
- East-west service from Metro C Line (Green) Station to Manhattan Beach along Manhattan Beach Blvd.

1.3.4 KEY TAKEAWAYS

Representing over 50% of the survey responses, Beach Cities residents who don't ride transit are an interested population who lack the information to utilize transit. Among these findings, others included:

- Non-riders had a higher rate of access to personal vehicles, were more likely to live in Redondo Beach, and not be a student. This translated into only a quarter of non-riders having any previous experience with BCT.
- While 85% of non-riders agreed with the statement that “public transit is an important service for the community,” words like “crime”, “homelessness,” and “waste of time” are associated with why non-riders wouldn’t consider riding. Furthermore, a large portion of non-riders (82%) would be interested in riding, but the remaining 18% have an entrenched, low opinion of public transit.
- Lack of information: many of the barriers to transit use identified by non-riders, the bus doesn’t go where needed, unsure of the nearest BCT stop, what types of services are available, etc., would be addressed by improved outreach and information availability.

2 In-person engagement

Additional one-on-one conversations were conducted with BCT stakeholders outside of the engagements which were conducted via surveys, pop-ups, and focus groups. The following information was provided by stakeholders, most amplifying comments that the study team had previously heard.

2.1 Overview

A Participant stated that more easily accessible printed materials available in businesses (grocery stores were mentioned) regarding BCT services and bus schedules would encourage them to consider using BCT more often.

A Participant, like some stated in pop-up events, mentioned just generally having better line connections to places they may consider going. The “limitation” of the routes prevents them from exploring the region more by utilizing BCT.

A Senior stakeholder discussed their desire to start using the service regularly - both fixed line and possibly Dial-a-Ride - in the future. When the stakeholder was given a description of “travel training”, they stated that they would find it beneficial and they would definitely use a training.

An overarching and repeated theme in one-on-one discussions was a desire to have more general information about the lines. “Maybe if I knew more about the services I would consider using it more.” In a follow-up one-on-one conversation with a focus group member, they stated that they get most of their information about current events and civic affairs specifically from Facebook. When told that BCT did not have a presence on Facebook, the stakeholders stated that this may be the reason they know very little about BCT.

There were only two incoming email submissions beyond interactions with stakeholders who wished to attend a focus group session. One email submission stated, “I hope you continue to run the 109 service. I like the way it's coordinated and I’m looking forward to the airport connector (in reference to Los Angeles International Airport).

A longtime daily bus Rider attended not only all of the focus groups meetings but also had additional one-on-one comments. The Rider stated that they used BCT lines throughout high school (Redondo Beach Union) and now uses the line to commute to work and for general needs. The Rider shared input on current and future routes. What stood out in conversation with the Rider is this: though opportunities for improvement were stated, their overall satisfaction with the line was apparent and stated.

Another Senior stakeholder - who has never utilized public transportation but is now considering it - stated that they had no idea where to start their research until the conversation they had with the service study team. The Senior, who is an avid user of technology, stated that they have yet to use any municipal services that are targeted/marketed to Seniors ("I'm old but not 'that' kind of old") but anticipates needing transportation assistance/rides in the future. The Senior stated that they would need easily accessible information on the Internet to consider using Dial-a-Ride. "I'd rather waste my money on Uber than waste my time searching for info about public rides."

2.2 Themes from comments

From across the in-person engagement process, comments and impressions were compiled, providing a measure of the sentiment around BCT and transit in the South Bay. Below are highlighted comments that exemplify those conversations.

- WAVE – "I have recently called and got no answer and their Voice Mailbox was full"
- "I don't want elders on the road – not everyone can drive"
- "Public transit is good — but you cannot control the people who ride (Metro rider)
- "Clean up the homeless (Metro rider)
- "Police need more presence on trains and at stations. I am usually alone. It is depressing to see (Metro rider)
- "There is an unsafe perception. It's better with the Sherrifs (Metro rider)
- "BCT buses are clean
- "The only time I use the bus is to go to Dodger Stadium
- "I only use the line to go to the beach
- "Public transit should provide free parking lots if they want people to ride
- "I am a day laborer who just moved to CA from Texas. I use the Long Beach Park & Ride
- "We need faster headways.
- "I didn't even realize the 109 was part of BCT" (Spanish speaker)
- "I am not familiar with BCT at all."
- "I have never heard of BCT. I drove today and sometimes I use Metro"
- "The app is not synched up to the bus schedule"
- "Consistency of bus schedules is the key to me riding more"
- "We need better routes to City Centers"
- "I lived in Hong Kong for 2 years. Local transit is like a 3rd world country"
- "Give us a direct route to LAX during peak hour times!"

3 Conclusions

Collecting over 280 detailed opinions from the Transit Services Study Survey, and many more in-person and virtual impressions, South Bay communities gave feedback on and were informed about BCT services. Highlights from this process include conclusions regarding areas of improvement and continued success.

Information or the lack thereof was a theme across demographics and transit preferences. BCT ensures that information about its services is available through a variety of different sources and mediums, including on the BCT website, through Twitter, onboard buses, at bus stops, and local senior centers and other community centers. A repeated theme across survey results and from engagement is a sentiment that people do not have adequate information about BCT services, which signals a need to explore strategies that can connect people with information and raise public awareness about where information can be found. Insights regarding information availability include:

- Real-time apps were widely used by BCT riders and often their only source of information pertaining to service notifications.
- Bus stop improvements pointed to the desire for more and better information about the routes and system as a whole when at a bus stop.
- Among non-riders, access to more information was the biggest factor that would increase their use of transit. While BCT provides information through a variety of sources, these comments suggest that non-riders are unaware of where to find the information. Strategies to address this are discussed in greater detail in TSS 2, Section 6.4.

Those without access to a vehicle are more likely to take the bus. While this is to be expected, it bares pointing out that all non-riders indicated they had access to vehicles, whereas 12% of riders did not have access. BCT provides essential services to South Bay community members. Additionally, WAVE users (all who had access to a vehicle) indicated they used transit only when unable to drive due to an injury or some other reason.

Community members would generally like to see more frequent buses that run later into the evenings. Later trips were particularly desired on the weekends with supporting discussion about access to bars, restaurants, and entertainment. Additionally, there was a desire for more frequent bus service.

Community members who utilize WAVE services provided a smaller portion of feedback but did provide a clear perspective on where improvements in the service were needed. Core aspects of the service are where clients are most dissatisfied including service registration, scheduling, pick-up/drop-off times, and reliability. Once a rider is aboard the service, they are generally very satisfied with the service quality.

Overall, while BCT provides services that are valued and perceived as high quality by its riders, gaps are still present. Addressing the need for connecting the general public to information sources as well as riders

will go a long way in reinforcing BCT's services. This coupled with service modifications and improvements to better suit the desires of current riders could heighten the overall profile of BCT.

APPENDIX A-7: SURVEY – COMMENT LOG

Date	Event	City	Location
5/20/22	**Senior Fair**	**Manhattan Beach**	**MB Senior Fair**

1. We want the bus to go on Aviation to Mira Costa High School and the beach.
2. East-West connection on Aviation Boulevard.
3. Bus to the beach on either Manhattan Beach Boulevard or Marine Avenue.
4. Please make sure that there are printed Maps.
5. Manhattan Beach Boulevard extended to Highland to Artesia loop.
6. Beach bus weekend Express.
7. Express bus to LAX Airport.

Date	Event	City	Location
7/14/22	**Pop-up #1**	**El Segundo**	**Douglas Station**

1. Extend route to Westchester Parkway / Metro 115.
2. BCT bus is always late or never comes near airport.
3. Sometimes I don't see any detours on the real-time app. Real-time has been down.
4. I like G-Trans website and want the same from the BCT website.
5. Northrop discontinued the shuttle to the Douglas Station.
6. I take BCT at LAX bus station to Manhattan Beach.
7. I would like shuttles to the events such as Fiesta Hermosa.
8. I would like a beach bus to Fiesta Hermosa.
9. I want a beach bus to Manhattan Beach.
10. BCT schedule needs to match the Green Line schedule.
11. If I knew the routes, I might take the bus.
12. BCT bus goes too fast. Sometimes the drivers pass the bus stops. The schedule is always late.
13. I do not use the real time app because I take the same route to work every day.
14. I live in Hawthorne. I would like to go to concerts at Polliwog Park on Manhattan Beach Boulevard.
15. The price is good at $1. It is cheaper than buses in the Bay Area.
16. I want BCT to go from Manhattan Beach Boulevard to Manhattan Beach Pier.
17. You need a BCT website.
18. Detours are confusing. The app does not show where to pick up the bus.
19. I take Metro everywhere. Never tried BCT.
20. I called BCT and nobody answered the phone.
21. I work at El Segundo Plaza. Need a late bus around 10 p.m. I live in South Los Angeles.
22. Bus drivers are rude.
23. Why do bus detours not go to event destinations like Beach Festival Fiesta or concerts on the pier?

APPENDIX A-7: SURVEY – COMMENT LOG

Date	Event	City	Location	Comment
7/20/22	Senior Open House	Redondo Beach	Veterans Park	Add stop at Pacific Crest Cemetery in Redondo Beach. BCT service is appreciated.

Date	Event	City	Location
7/21/22	Pop-up #2	Redondo Beach	Redondo Beach Farmers Market

1. Can the WAVE go to the Farmers Market at 9 a.m. or 10 a.m. on a regular schedule?
2. Riviera Village to Redondo Beach Pier - Veterans Park is too far to walk with stuff.
3. Direct bus to LAX Airport with maybe three stops.
4. Where is the website for BCT? Not City website; it's hard to find information.
5. I come from the Valley to Redondo Beach on Access.
6. When will the Green Line open? Does BCT connect to the new station?
7. Make it easier to fill out the senior application.
8. LAX express bus with AM and PM Peak service hours.
9. Make Beach bus frequency every 15 minutes.
10. Beach bus to Manhattan Beach. Frequency every 15 minutes during the summer. The sand and beach is better in Manhattan Beach.
11. Why can't I transfer BCT buses at the Redondo Beach Pier?
12. Airport Express direct to and from LAX-Redondo Beach station.
13. Destinations LAX: DTLA from Riviera Village at Trader Joe's.
14. Line 102 riders need more transfers to Line 109.
15. Bus to concerts, especially Fiesta Hermosa.
16. Does the WAVE go to the Farmers Market every week?

APPENDIX A-7: SURVEY – COMMENT LOG

Date	Event	City	Location
7/22/22	**Farmers Market**	**Hermosa Beach**	**Hermosa Beach Farmers Market**

1. Events of the day should be posted on the website.
2. The route should be more than for "rich" areas, along the beach. Extend the route. Prospect Avenue (N/S) and Meadows Ave (N/S). Extend Aviation routes east and west.
3. Use visual photos instead of needing all languages for postings. Suggested art at the bus stop or on panels in the busses.
4. More frequent stops; bus every 15 minutes.
5. I would take the bus to Manhattan Beach farmers market if it came more often not every 30 minutes.
6. Need to cater to tourists taking Line 109 especially for the Olympics.
7. Need new express route on Marine Avenue.
8. No, I have never taken the bus because it is dangerous.
9. I think the bus should go to Fiesta Hermosa.
10. Is there a BCT website?
11. I took the bus in high school. Need more buses in the afternoon.
12. Keep the bus clean! Once I found a crack pipe on the bus when I took BCT in high school.
13. Bus doesn't go where you want to go. Why doesn't it go to the west side?
14. Thank you for being at the Farmers Market in Hermosa Beach. I take the bus to the beach.
15. Maybe Line 109 line should not be so long. I like local shuttles.
16. I never take the bus, but I will try BCT to Farmers Market.
17. New route suggestion: from Huntington Beach City Council, Grand to Vista Del Mar to Imperial. It will create access for the underserved community.
18. The challenge is to get to the west side.
19. I will try the bus from Hermosa to Redondo Beach. Never knew about it.
20. Reroute Line 109. The loops in Manhattan Beach & El Segundo - who does it serve?
21. Representative Aaron Forbuger suggested event bus to community events - concerts, seasonal service at peak hours.

Date	Event	City	Location
7/27/22	**Pop-up #3**	**Perry Park**	**Hermosa Beach Farmers Market**

1. I take Line 102 to the beach. Align Line 109 transfer at the pier would be good.
2. Where does the bus go? Will it take me here to Perry Park?
3. I would like to go to the LAX Express.
4. Promote bus lines at the senior centers. Interested in travel training.
5. I got the survey from the senior center email. The survey was confusing.
6. I take the WAVE to the Green Line and on to LAX Airport. Did a field trip with the senior center.

APPENDIX A-7: SURVEY – COMMENT LOG

7. BCT fixed route should go to Perry Park.

Date	Event	City	Location
8/11/22	**Farmers Market**	**El Segundo**	**El Segundo Famers Market**

1. I use MOOVIT app. It is accurate.
2. How about going to UCLA?
3. I did not know El Segundo had a bus system. I will try it for fun to go to the beach.
4. Is there a stop on Grand? There are lots of local stops.
5. Interested in going to the Manhattan Beach Mall.
6. Excited about connection to Crenshaw line. Also the regional connector to DTLA.
7. I use Google and Apple Maps not the BCT transit app. I go to work near Imperial Highway.
8. I use BCT for Manhattan Beach and Redondo Beach destinations for recreation.

Date	Event	City	Location
4/15/23	**Springfest**	**Redondo Beach**	**Aviation Park**

1. Expand as much as possible
2. We don't ride and probably never will
3. My mom rides BCT but we didn't know about WAVE
4. Keep a stop @ Recommendation "B"
5. Keep the stop at SB Galleria as you continue to plan
6. Domestic workers will use "C"
7. Please have stops around the South Bay Galleria
8. Micro transit for seniors to go door-to-door would be nice
9. Can I connect to C Line @ the new bus center?
10. We'd like a route to Mira Costa High School

APPENDIX A-7: SURVEY – COMMENT LOG

Summarized General Comments (throughout engagement)

1. WAVE – "I have recently called and got no answer and their Voice Mailbox was full"
2. "I don't want elders on the road – not everyone can drive"
3. "Public transit is good — but you cannot control the people who ride (Metro rider)
4. "Clean up the homeless (Metro rider)
5. "Police need more presence on trains and at stations. I am usually alone. It is depressing to see (Metro rider)
6. "There is an unsafe perception. It's better with the Sheriffs (Metro rider)
7. "BCT buses are clean
8. "The only time I use the bus is to go to Dodger Stadium
9. "I only use the line to go to the beach
10. "Public transit should provide free parking lots if they want people to ride
11. "I am a day laborer who just moved to CA from Texas. I use the Long Beach Park & Ride
12. "We need faster headways.
13. "I didn't even realize the 109 was part of BCT (Spanish speaker)
14. "I am not familiar with BCT at all.
15. "I have never heard of BCT. I drove today and sometimes I use Metro
16. "The app is not synched up to the bus schedule "
17. "Consistency of bus schedules is the key to me riding more
18. "We need better routes to City Centers
19. "I lived in Hong Kong for 2 years. Local transit is like a 3rd world country
20. "Give us a direct route to LAX during peak hour times!"
21. A Participant stated that more easily accessible printed materials available in businesses (grocery stores were mentioned) regarding BCT services and bus schedules would encourage them to consider using BCT more often.
22. A Participant, like some stated in pop-up events, mentioned just generally having better line connections to places they may consider going. The "limitation" of the routes prevents them from exploring the region more utilizing BCT.
23. A Senior stakeholder discussed their desire to start using the service regularly - both fixed line and possibly Dial-a-Ride - in the future. When the stakeholder was given a description of "travel training", they stated that they would find it beneficial and a training they would definitely use.

APPENDIX A-7: SURVEY – COMMENT LOG

Summarized General Comments (throughout engagement) con't

24. An overarching and repeated theme in one-on-one discussions was a desire to have more general information about the line. "Maybe if I knew more about the services, I would consider using it more." In a follow-up one-on-one conversation with a focus group member, they stated that they get most of their information about current events and civic affairs specifically from Facebook. When told that BCT did not have a presence on Facebook, the stakeholder stated that this may be the reason they know very little about BCT.
25. A longtime daily bus Rider attended not only all of the focus groups meetings but had additional one-on-one comments. The Rider stated that they used BCT lines throughout high school (Redondo Beach Union) and now uses the line to commute to work and for general needs. The Rider shared input on current and future routes. What stood out in conversation with the Rider is this: though opportunities for improvement were stated, their overall satisfaction with the line was apparent and stated.
26. Another Senior stakeholder - who has never utilized public transportation but is now considering it - stated that they had no idea where to start their research until the conversation they had with the service study team. The Senior, who is an avid user of technology, stated that they have yet to use any municipal services that are targeted/marketed to Seniors ("I'm old but not 'that' kind of old") but anticipates needing transportation assistance/rides in the future. The Senior stated that they would need easily accessible information on the Internet to consider using Dial-a-Ride. "I'd rather waste my money on Uber than waste my time searching for info about public rides."

APPENDIX A-8: PUBLIC MEETING POP UP PROJECT BOARDS

SEE PDF

Beach Cities Transit **Services Study**

Beach Cities Transit (BCT) serves the South Bay Region providing connections to Big Blue Bus, Commuter Express, Culver City Bus, GTrans, Lawndale Beat, Metro Bus and Rail, Palos Verdes Peninsula, and Torrance Transit. BCT's service area includes Redondo Beach, Hermosa Beach, Manhattan Beach, El Segundo and LAX. BCT serves Redondo Beach Pier, Civic Center, Redondo Union High School, Beach Cities Health District, South Bay Galleria, and more!

Beach Cities Transit Lines 102 & 109
with South Bay Connections



Redondo Beach Transit Center
Bus Services South Bay Regional Map



- Beach Cities Transit operates a fleet of **20 compressed natural gas (CNG) vehicles** for the fixed route and Dial-A-Ride.
- The service area for BCT is up to **200 miles a day** for approximately **180,000 people**.
- Over **1,300 people** ride each day. Students account for ~19% of ridership on a school day.
- BCT operates **two fixed lines** (102, 109) and **WAVE dial-a-ride service** for seniors (62+) and persons with disabilities
- Recently **opened a new transit center** near the South Bay Galleria as a new transit hub (map on right)

WAVE Dial-A-Ride

- Provides curb-to-curb service to seniors (62+) and people with disabilities
- Service area: Redondo Beach, Hermosa Beach, and specific satellite locations (mostly medical facilities)
- The WAVE carries **~35 riders** each day



Beach Cities Transit **Services Study**

What is a Transit Services Study?

- Review and optimization of transit service
- Planning effort separate from recent service changes
- Planning for zero-emission bus transition
- Opportunity for you to provide input for the future of BCT

Why are we doing this study?

Projects like the LAX People Mover, C Line Extension, and the South Bay Galleria Redevelopment will change how we travel and where we travel to in the South Bay. So we need to plan to align mobility services and bus lines to better meet the needs of current and potential riders.

Project timeline:

Spring 2022	*Assess Existing Conditions*
Spring/Summer 2022	*Prepare Needs Analysis*
Summer 2022	*Identify Service Opportunities*
Fall 2022	*Infrastructure and Zero Emission Bus Planning*
Spring 2023	*Public Outreach*
Summer 2023	*Final Report*

For more info:

BCTServicesStudy.com | BeachCitiesTransit.org | BCTServicesStudy@gmail.com

We found that:

- Fixed-route ridership since 2014 has been declining, and fixed-route ridership is ~80% of pre-COVID levels
- Ridership on Line 102 remains below pre-COVID on weekdays, but weekend ridership has surpassed pre-COVID levels. Ridership on Line 109 is still below pre-COVID levels both on weekdays and weekends indicating the potential for growth
- Routes are generally infrequent, indirect and can be hard to understand
- Metro eliminated Line 126 on Manhattan Beach Bl leaving a gap in east-west service
- WAVE ridership is about 70% of pre-COVID ridership levels, meaning the WAVE has additional capacity to carry more riders

We heard that:

- Most people are unfamiliar with BCT, its brand, its services, and where to ride (75% of non-riders have never used BCT)
- 75% of riders want more frequent service, 28% want faster service, and 55% want later weekend service
- People primarily ride for entertainment, recreation, and go to the beach, and taking the bus for shopping errands was also common among riders
- Those who don't ride indicated the bus doesn't come often enough or operate late enough

Key recommendations:

- More frequent service and straighter bus lines
- New summer bus line on Manhattan Beach Blvd
- Collaborate with neighboring beach cities to better align development and transit service
- More robust outreach and marketing of BCT and WAVE services to raise awareness and ridership
- No service changes recommended for the WAVE
- Increase travel training opportunities to broaden transit appeal
- Transition to an entirely zero-emission fleet by 2040. This can eliminate 1,400 tons of CO_2 each year--equivalent to removing 304 cars on the road each year!



Beach Cities Transit **Services Study**

We want to hear from you! Please provide your feedback to Recommendations A-E: *Green* = ***support*** *Red* = ***oppose***



A — **Re-route Line 109 to serve the LAX Automated People Mover and Airport Metro Connector Station in 2025**

WHY? Provide direct connection to LAX and other transit services at the new Connector Station.

B — **Straighten Line 109 along Rosecrans and Sepulveda around Manhattan Village Mall**

WHY? Addresses rider requests for more direct service, straighter lines mean that travel times will be shorter to reach LAX, few riders use stops on these segments. Line 109 still provides access to The Pointe, Plaza El Segundo, and businesses along Rosecrans Ave.

C — **Consider new summer bus service along Manhattan Beach Blvd, between the Redondo Beach C Line Station and the Manhattan Beach Pier**

WHY? Fills in gap after Metro discontinued Line 126, addresses requests from the public to provide service along Manhattan Beach Blvd, serves destinations like Polliwog Park, Performing Arts Center, and other recreation areas on Manhattan Beach Blvd.

D — **Extend Line 102 south from the Redondo Beach Pier to Riviera Village and re-route Line 109 to terminate at the Pier**

WHY? Creates a new transfer hub at the Pier, enabling easier transfers between 102 and 109 and Torrance Transit, provides easier access to the Pier and Veterans Park Senior Center from Line 109, creates one-seat ride for South Redondo students, and improves access to the newly opened Redondo Beach Transit Center and South Bay Galleria.

E — **Maintain the Dial-A-Ride services for Redondo Beach and Hermosa Beach with increased marketing and awareness (travel training) programs**

WHY? There were no substantial comments about the Dial-A-Ride. The curb to curb system adequately services the cities.

We're proposing to make service more frequent and convenient! Over the next 5 years…

102 will have **more frequent** weekday service, **more frequent** Sunday service, and **operate longer** on Sundays

109 will have **more frequent** weekday service during AM and PM peak periods

APPENDIX B: LIST OF SENIOR HOUSING COMPLEXES WITHIN REDONDO BEACH AND HERMOSA BEACH

1. **Redondo Beach**

    a. Casa de Los Amigos
    123 S. Catalina,
    Redondo Beach, 90277

    b. Cresta Mobile Park
    2345 190th St,
    Redondo Beach 90278

    c. Salvation Army – Mindeman Senior Residence
    125 W. Beryl St.
    Redondo Beach, 90277

    d. Heritage Pointe
    1801 Aviation Way
    Redondo Beach, 90278

    e. Seaside Villa
    319 N. Broadway
    Redondo Beach, 90277

    f. Seasons Senior Apartments
    109 S. Francisca Ave
    Redondo Beach, 90277

    g. Breakwater Village
    2750 Artesia Blvd
    Redondo Beach 90278

2. **Hermosa Beach**

    a. Marineland Mobile Home Park
    531 Pier Avenue
    Hermosa Beach 90254

    b. Sunrise of Hermosa Beach
    1837 E. PCH
    Hermosa Beach, 90254

APPENDIX C: SPACE NEEDS PROGRAM

See attached PDF.

Stantec

City of Redondo Beach, Beach Cities Transit

Operations and Maintenance Facility Space Needs Program

Stantec Project No.: 2073016510
Updated: 6/7/2023

SPACE CATEGORY	SPACE NAME	FUNCTION	SPACE STANDARD W x L x H	MIN SIZE SQFT	PROGRAM QUANTITY TOTAL STAFF	SHIFTS	VISITORS	PEAK	SPACE	AREA SQFT	ADJACENCY PRIMARY	SECONDARY	Equipment / Furniture	Special Requirements	NOTES
MAINTENANCE	Maintenance Manager	Admin for Maintenance; private office		150	1	1	0	1	1	150	View of Shop	Maint Super	Workstation, File Cabinets		
	Maintenance Supervisor	Admin for Maintenance; private office		120	1	1	0	1	1	120	Direct view of Shop floor		File Cabinets; Security Moniton, Workstation		
	Shop / Accounting Clerk	Receive parts, invoicing; open office suite w/ access to exterior		120	1	1	0	1	1	120	adjacent to OH receivnging door		File Cabinets, Workstation w/ receiving counter		
	File / Office Storage	General office/supply storage room for maintenance dept only		100					1	100	Maint Offices, Clerk		File cabinets, open shelves		
	Mechanics / Utility Workers	*Program Line for staffing only; see Restrooms/Lockers in Shared Department for Restrooms)*		0	8	2	1	9	0	0	-				Staff: 5 mechanics, 2 utility, + 1 future mech (general 0.5% growth in staff qty)
	Uniform Storage	Alcove for clean uniform rack and dirty bin		25	0	0	1	1	1	25	ADJ to Locker Rooms		Closet Rod and Shelves		
	Techician Counter, Library	Technicians counter/workstation: Parts ordering; entering work order data into computerized		100					1	100	open to shop, adjacent to maint offices and parts storage		Storage Shelves, file cabinets, small workstation		
	Repair Bays	Bays w/ bus hoists to perform any maintenance or service function; Fall-protection in one bay for rooftop access	20 x 50 x 20	1,000					3	3,000	Common Work Area, Portable Equipment Storage, Maintenance staff offices		Work bench w/ vice at each bay, other mobile equipment and tool boxes; Platform lift for minimum of one bay; fall protection system in min of one bay; tailpipe exhaust system for all bays	OH Repair Jobs Require: one bay with roof top work requiring fall protection (line or gantry); Roof top antennas, A/C and batteries.	
	Common Work Area	Space to perform minor fabrications		300					1	300	Repair Bays		grinder, drill press, work bench, weld table, welding equip., etc.		
	Tire Shop and Storage	Space to store new and used tires on multi-tier racks.	20 x 15	300					1	300			Multi-tier racks for 50 tires total (new and used)		
	Battery Cabinet	Enclosed cabinet for battery storage	6 x 10	60					1	60	Repair Shop		Exterior rated battery charging cabinet, self-contained with lighting and ventilation	emergency wash needed adjacent to cabinet	Accessed by Pallet Jack
	Electronics Shop	Maintenance/Repair of onboard eletrical equipment	10 x 15	150					1	150	Adjacent to repair bays		Work bench, task lighting, storage racks/shelving	Does NOT require special clean-room requirements	Repair functions include multiplex wiring; electronic fareboxes, GPS-based automatic vehicle location system; Destination signs
	Lube / Compressor Room	Enclosed room to house bulk fluid tanks	15 x 20	300					1	300	Close to maintenance bays, needs exterior access for delivery vehicle		Fluid tanks for: engine oils, Coolant, Transmission oils, Gear oil, Waste Oil; Air Compressor	Fire Rating (TBD), exhausted	
	Parts Storage	Space to store parts (engine/transmission blocks, windshields, seats/covers, wheel-rims, misc parts, cleaners, flam cabinets, etc.)	25 x 60 x 20	1,500					1	1,500	Adjacent to Repair Shop, access through exterior receiving OH Door; Maintenance Supervisor		Storage racks and High-density storage equipment	Space does not need to be walled-off, chainlink fencing would be sufficient.	Includes 12ft x 12ft allowance for parts receiving space. Contains large and small parts storage racks/shelving. Space for future clerk. Space for receiving table or counter. Additional storage on Mezzanine above (TBD)
	Tool Crib (Shop Tools Storage)	Secure Cabinet or Cage for tool storage	6 x 6	36					1	36	Shop Foreman, Repair Bays		Secure storage cabinet		
	Mobile Equipment Storage	Storage of mobile equipment	10 x 20	200					1	200	Repair Bays		Mobile lifts, ladders, platforms, manual pallet manual; DOES NOT INCLUDE STORAGE FOR FORKLIFT OR MOBILE LIFTS		
	Hazardous Material Storage	Space for hazardous gas cylinders, chemicals (paint thinners, etc.)	5 x 10	50					1	50			Exterior storage cabinet or caged area with roof		
	Tool Box Storage	Designated space for tool boxes space	4 x 5	20					6	120				power receptacles	(1) full-size tool box + (1) cart per mechanic
		MAINTENANCE SUMMARY:			**11**	**3**	**2**	**13**	**24**	**6,631**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**15%**						**995**					
		MAINTENANCE TOTAL:								**7,626**					
FACILITY MAINT / BUILDING UTILITIES	FM Storage			100					1	100					
	Custodial			120	1	1	0	1	1	120					
	Main Electrical Room			250					1	250					
	Main IT/Data Room	Central IT room for entire facility.		150					1	150	Centrally located in office areas		IT racks, etc. as required	dedicated spilit AC system	
	Main Plumbing Room			100					1	100					
	Fire Riser Room			50					1	50					
		FM/UTILITY SUMMARY:			**1**	**1**	**-**	**1**	**6**	**770**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**20%**						**154**					
		SERVICE TOTAL:								**924**					
VEHICLE SERVICING / UTILITY	Wash Bay	Manual, covered, drive-in/back-out Bus Wash operation	20 x 55 x 20	1100	-	-	-	-	1	1,100	Enclosed bay		Mechanical ventilation with corrosion resistant ductwork and equipment		
	Chassis Wash / Steam Bay	Exterior covered space for pre-inspection/repair under-carriage bus-wash	20 x 60 x 20	1200	-	-	-	-	0	0					Chassis wash bay not proposed
	Wash Equip Room	Equipment for vehicle wash system	10	650	-	-	-	-	0	0					Equipment room not required, wash equipment can be located within the bay for manual washing functions.
	Fare / Revenue Room	Fare Vault room, include fare vault IT equip		100	-	-	-	-	0	0					Not included in proposed program
	Cleaning Storage Room	Cleaning supplies, etc.		100	-	-	-	-	1	100	Adjacent to Wash Bay		washer + dryer for wash cloth; rags.		
	Electrical Room	Elec for wash equipment		100	-	-	-	-	0	0					Not required for the proposed configuration
		VEHICLE SERVICING SUMMARY:			**-**			**-**	**2**	**1,200**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**20%**						**240**					
		SERVICE TOTAL:								**1,440**					

SPACE CATEGORY	SPACE NAME	FUNCTION	SPACE STANDARD W x L x H	MIN SIZE	PROGRAM QUANTITY					AREA	ADJACENCY		Equipment / Furniture	Special Requirements	NOTES
				SQFT	TOTAL STAFF	SHIFTS	VISITORS	PEAK	SPACE	SQFT	PRIMARY	SECONDARY			
OPERATIONS	General Manager	Typical office		150	1	1	0	0	1	150			Workstation, File Cabinets		
	Operations Manager	Typical office		150	1	1	0	0	1	150	Dispatch suite and Lead Super		Workstation, File Cabinets		
	Operations Assistant	Typical office		150	1	1	0	0	1	150			Workstation, File Cabinets		
	Training Manager	Typical office		150	1	1	0	0	1	150	Training Room		Workstation, File Cabinets		
	Supervisors Office	Office for supervisors		150	2	2	0	2	1	150	Dispatch	Drivers Room	Two workstations, File Cabinets	Window into Dispatch and Drivers Room	
	Dispatch Suite	Office space with counter/window with direct access to operators.		200	1	2	0	1	1	200	Direct view of bus yard and Operator Entry/Exit	Drivers Room	Adjustable Height Workstations, file storage; IT equip: large security monitors mounted high on wall	receptacles for large monitors, IT closet closeby	
	Dispatch Vestibule	Adjacent to Dispatch Counter, space for two drivers at counter							1	120	Dispatch Suite	Break Room	Counter w/ storage for paperwork, tackboards, notice boards		
	Payroll Clerk	Shared office with Disptach		0	1	1	0	1	1	0	Dispatch	Ops Manager	Workstation, File Cabinets		
	Lost & Found Storage	Space to store lost and found items. Lost bikes may be stored outside.		75					1	75	Disptach	Supervisors	Open storage shelves	Increased ventilation due to potential for soiled items being stored in room.	
	General Storage Room			200					1	200	Dispatch Suite		File cabinets, open shelving		
	Operators' Lockers	(35) Lockers 2-tier configuration	1 x 2 x 3	2	35	2	0	24	1	70	Break Room	Restrooms	3-tier Lockers: 12W x 12D x 24H EA		
		OPERATIONS SUMMARY:			**43**	**2**	**-**	**28**	**11**	**1,415**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**20%**						**283**					
		OPERATIONS TOTAL:								**1,698**					
ADMINISTRATION	Offices	Typical private office	10 x 12 x 9	150	5	1	2	7	5	750	admin department		Workstation, file storage		
	Cubicles	Typical open cubicle	12 x 12 x 9	144	4	1	0	2	2	288	admin offices		open cube workstation for 2 persons each, file storage		
	Small conference room	Sized for 4		150					1	150	within admin suite		tables/chairs, Typical AV		
	Files / Storgae Room			200					1	200	within admin suite		Shelving, cabinets; step ladder		
	Copy / Production Area	Space for general office supplies, copy/printing functions		150					1	150	Admin Offices		Copy machine, counters, open/closed shelving		could be combined with File/Storage Room
	Restrooms	Gender neutral toilet room		75					1	75	away from offices				
	Break room			150					1	150	within admin suite		Small kitchenette: Cabinets w/ Sink, Refrigerator; table and seating for 4		
		ADMINISTRATION SUMMARY:			**9**	**1**	**2**	**9**	**12**	**1,763**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**20%**						**353**					
		ADMINISTRATION TOTAL:								**2,116**					
SHARED SPACES	Unisex RR/Shower	Centrally located and for use by all staff		90					1	90					Separate from Ops, Maint, and Admin
	Lactation Room	Secure Room, 'Wellness Room'		65					1	65			Sink, counter, mini-refrigerator, chair		Space required by CA labor code
	Break Room	Central break room/lounge space to be used by all staff.		300					1	300	Exterior Patio	Dispatch	Tables and chairs, drinking fountain w/ bottle filler, notice/bulletin boards, TV	Connection for cable TV	Connected to all dept., direct connection to exterior; space for 15+ people during large events
	Kitchen	Open kitchen space integrated with Break Room, mix of seating options		100					1	100	Connected to Break Room		refridgerator, vending machines, ice maker, microwaves, garbage disposal, etc.		
	Quiet Room	Separate quiet break room away from larger Break Room		65					1	65	Away from Break Room		lounge furniture		
	Large Conference Room	Sized for 12 to 14		350					1	350	near admin office suite		tables/chairs, Typical AV		
	Training Room	Flexible, large room with movable furniture		400					1	400	Trainer Office	Admin Suite	movable training tables/chairs; monitors on multiple walls	Connections for AV and Monitors	
	Training Storage	Storage specifically for training function		80					1	80	Access through Training Room		Storage shelving, stackable rolling chair racks		
	Mens RR/Lockers	Toilet room, lockers, and shower		350					1	350			Full-height locker 24x24 w/ boot drawer, integral bench		Lockers for Maintenance staff
	Womens RR/Lockers	Toilet room, lockers, and shower		250					1	250			Full-height locker 24x24 w/ boot drawer, integral bench		Lockers for Maintenance staff
		SHARED SUMMARY:			**-**	**-**	**-**	**-**	**10**	**2,050**					
		Grossing Factor (Circ, Elec, Mech, Struct):		**20%**						**410**					
		SHARED TOTAL:								**2,460**					

SPACE CATEGORY	SPACE NAME	FUNCTION	SPACE STANDARD W x L x H	MIN SIZE	PROGRAM QUANTITY					PROGRAM AREA	ADJACENCY		Equipment / Furniture	Special Requirements	NOTES
				SQFT	TOTAL STAFF	SHIFTS	VISITORS	PEAK	SPACE	SQFT	PRIMARY	SECONDARY			
EXTERIOR SPACES	Employee Patio	Partially covered space connected directly to Break Room; BBQ area (size dependent of space configuration), landscaping	-	1000					1	1,000	Break Room	Employee Entry	Exterior tables/chairs; patio furniture; BBQ		Space should be close to where employees will enter and should be visually separate and secured from visitor/public entry
	Designated Smoking Area	Covered space at least 25 feet from building openings for smoking		100					1	100					
	Trash Enclosure	City/County standard enclosure	10 x 25	250					1	250					
	Misc Ext Storage	FM, Utility, Bus Stops		500					1	500			delivery access		
	Electrical Utility	XMFR, Switchgear, etc.		500					1	500					
		EXTERIOR SPACE SUMMARY:			-	-	-	-	5	2,350					
		Grossing Factor (Circulation):		0%						-					
		EXTERIOR SPACE TOTAL:								2,350					
PARKING	**PARKING WITHIN MAINTENANCE YARD:**														
	Bus Parking	30' buses	12 x 35	420					15	6,300			Min: (12) plug-in connections, (6) 120kW charging cabinets Ideal: (16) plug-in connections, (8) 120kW charging cabinets		
	Cutaway Bus	25' bus	12 x 30	360					3	1,080			Chargers shared between cutaways and vans: Min: (6) plug-in connections, (3) 120kW charging cabinets Ideal: (8) plug-in connections, (4) 120kW charging cabinets		
	Passenger Vans		10 x 20	200					5	1,000					
	Non-Revenue Vehicle		10 x 20	200					3	600					
	Down Bus Parking		12 x 40	480					1	480					
								FLEET SUBTOTAL:		**9,460**					
	PARKING WITHIN EMPLOYEE / VISITOR LOT:														
	Employee Parking		9 x 18	162					50	8,100			Level 2 chargers where required, electrial infrastructure required for EV capable stalls		CalGreen Bldg Code: (13) EV capable w/ (3) EV charging stations (EVCS), one of which can be accessible EV stall
	Visitor Parking		9 x 18	162					2	324	Third closest to main entry				
	Accessible Parking		15 x 18	270					3	810	As close as possible to main visitor and employee entries				QTY: As required by CA Bldg Code (11B-208.2) for 51-75 space provide (3) accessible spaces, including (1) van space
	Accessible EV		17 x 18	306					1	306	Second closest to main entry		Level 2 charger		QTY: As required by CA Bldg Code (11B-228.3.2.1.) for 1 - 4 EVCS, one van accessible space required.
								EMPLOYEE PARKING SUBTOTAL:		**9,540**					
	Long-tern Bike Parking		3 x 6	18					3	50	Behind security fence				QTY: As required by 2022 CalGreen Building Code 5.106.4.1.2: Provide 5% of employee parking
	Short-term Bike Parking		2 x 6	12					1	12	Outside of security fence				QTY: As required by 2022 CalGreen Building Code 5.106.4.1.1.: Provide 5% of visitor parking, but not less than (1) two-bike rack
		PARKING SUMMARY:			-	-	-	-	87	19,062					
		Grossing Factor (Circulation):		75%						14,296					
		PARKING SPACE TOTAL:								33,358					

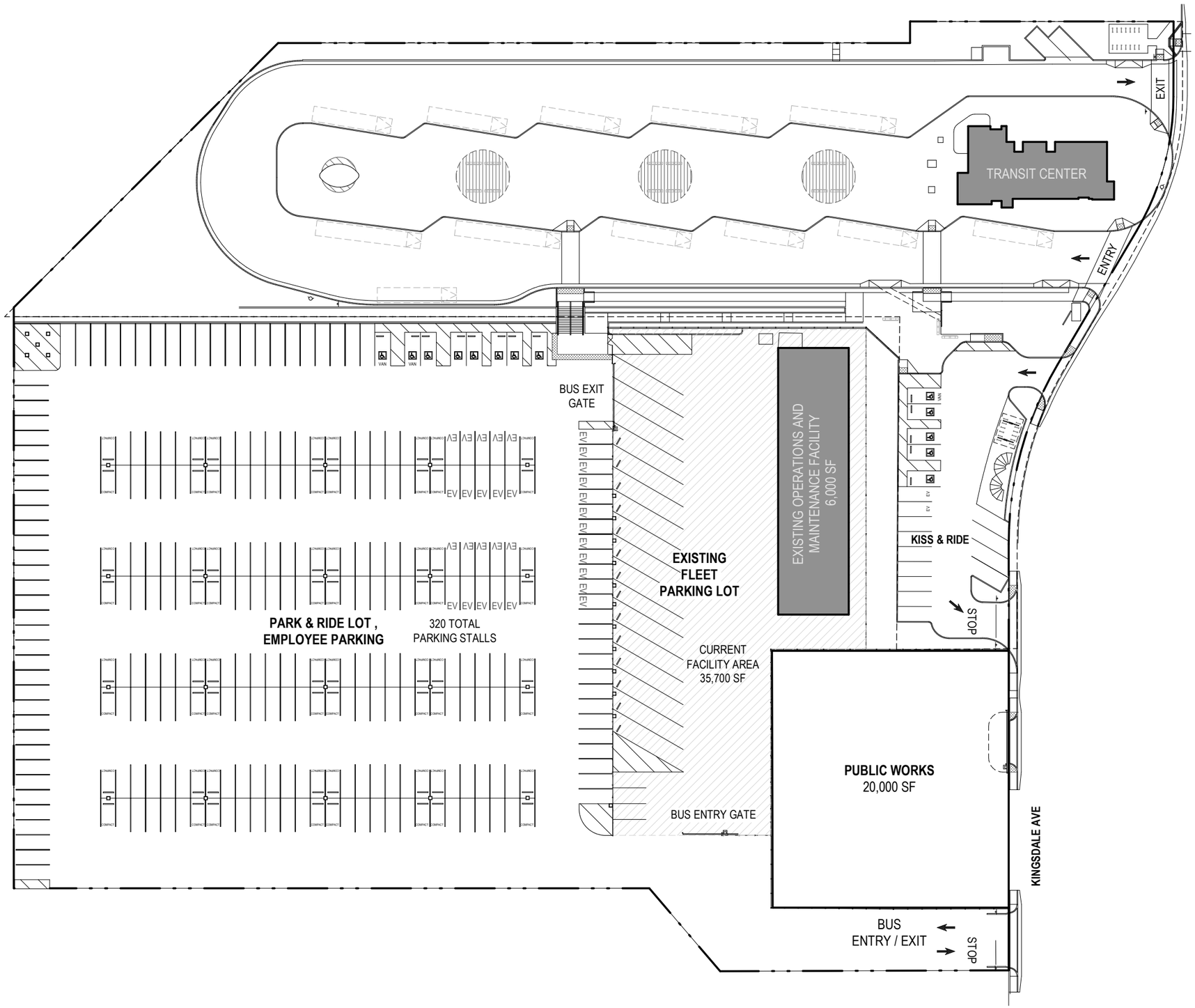
PROGRAM TOTALS	PROGRAM SUMMARY QUANTITY: TOTAL STAFF	SHIFTS	VISITORS	PEAK	SPACE	PROGRAM SUMMARY AREA: SQFT
GRAND TOTALS:	63	2	4	50	n/a	AREA
TOTAL BUILDING & SPACE AREA:						16,263
TOTAL SITE AREA:						35,708
SITE FACTOR: 5%						1,785
TOTAL PROGRAM AREA:	**1.23 ACRES**					**53,756**

APPENDIX D: SITE PLANS

See attached PDF.

Stantec

Stantec Proj No:
2073016510



CITY OF REDONDO BEACH, BEACH CITIES TRANSIT
OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN

EXISTING CONDITIONS

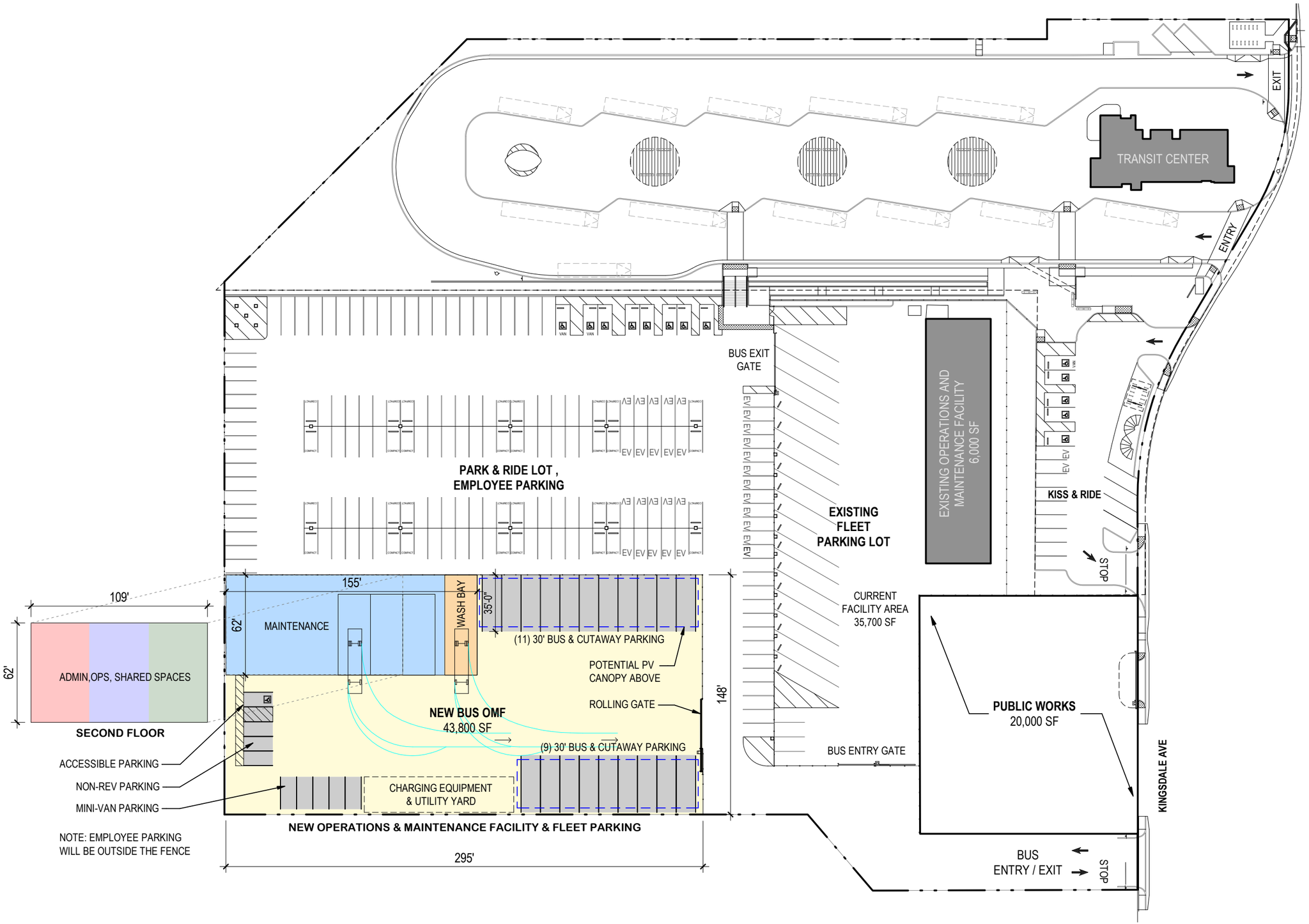
DATE:
05/16/23

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1.0

Stantec

Stantec Proj No:
2073016510



CITY OF REDONDO BEACH, BEACH CITIES TRANSIT
OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN

NEW BUS OMF CONCEPT

DATE:
05/23/23

DWG:

1.1

Stantec

Stantec Proj No:
2073016510

TRANSIT CENTER

EXIT

ENTRY

19

EXISITING ACCESSIBLE PARKING TO REMAIN

15

24'

37

24'

37

KISS & RIDE

PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL | PARALLEL STALL

10

37

7

12 12

STOP

16

17

NEW BUS OMF
TWO-STORY BUILDING

9

4

EXISTING FACILITY,
FENCING, ETC.
TO BE DEMOLISHED

NEW OPERATIONS & MAINTENANCE FLEET PARKING
-133 STALLS

PUBLIC WORKS
20,000 SF

7 9

STOP

14

KINGSDALE AVE

STOP

EXISTING PARKING =	320 STALLS
NEW BUS OMF =	-133 STALLS
DEMO OF EXISTING OMF & RESTRIPING OF P&R =	+83 STALLS
FINAL PARKING TOTAL =	**~ 270 STALLS**

(7) ACCESSIBLE SPACES REQUIRED
(1) ACCESSIBLE VAN PARKING SPACE
(54) EV CAPABLE SPACES REQUIRED
W/ (14) EV CHARGING STATIONS
[CALGREEN TABLE 5.106.5.3.1]

0' 30' 60' 120'

N

CITY OF REDONDO BEACH, BEACH CITIES TRANSIT
OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN

NEW PARK & RIDE PARKING LAYOUT CONCEPT

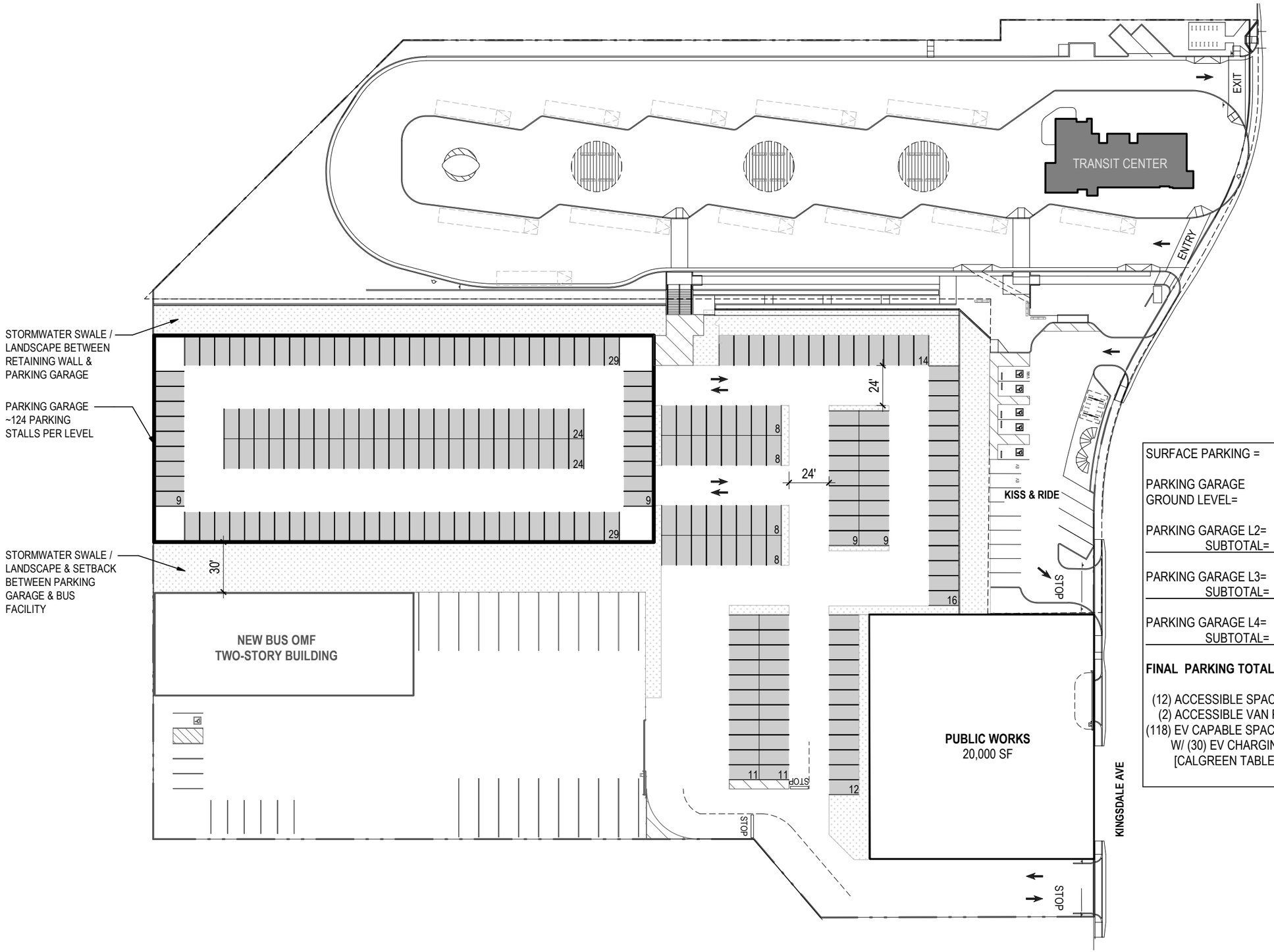
DATE:
05/23/23

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Stantec

Stantec Proj No:
2073016510



SURFACE PARKING =	114 STALLS
PARKING GARAGE GROUND LEVEL=	100 STALLS
PARKING GARAGE L2=	124 STALLS
SUBTOTAL=	338 STALLS
PARKING GARAGE L3=	+124 STALLS
SUBTOTAL=	462 STALLS
PARKING GARAGE L4=	+124 STALLS
SUBTOTAL=	586 STALLS
FINAL PARKING TOTAL =	**~ 586 STALLS**

(12) ACCESSIBLE SPACES REQUIRED
(2) ACCESSIBLE VAN PARKING SPACE
(118) EV CAPABLE SPACES REQUIRED
W/ (30) EV CHARGING STATIONS
[CALGREEN TABLE 5.106.5.3.1]

CITY OF REDONDO BEACH, BEACH CITIES TRANSIT
OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN

NEW PARK & RIDE PARKING LAYOUT CONCEPT

DATE:
05/23/23

DWG:

1.3

APPENDIX E: FINANCIAL CONSIDERATIONS AND INPUTS

The table below presents a description and sources for the cost inputs (in 2023$) presented in Section 11: Financial Plan.

Category	Item	Description	Inputs	Source and Comments
Capital	Bus purchase price	Purchase price of a bus/vehicle inclusive of options and taxes and extended warranty.	CNG 30 ft: $521,438 CNG cutaway: $189,175 CNG van: $56,948 BEB 30 ft: $935,375 BE cutaway: $275,943 BE van: $215,896	Source: BCT; BOS survey, checked with industry values from CalDGS and MBTA/CalACT. Extended warranty added as additional 6.54% of purchase price.
Capital	Infrastructure and facility modifications	Site demolition, new OMF, new administration and ops building, equipment costs, soft costs, charging infrastructure, with escalation.	Total opinion of probable cost with escalation plus equipment costs and soft costs: $31,738,902	Independent cost estimate (Appendix D)
Operating	Operating cost estimates	Operating cost estimates for the five-year service plan paid to an O&M contractor to operate and maintain service.	Fixed monthly rate: $101,627 Fixed hourly rate: $47.69	BCT; Transportation Concepts contract RFP Plan Year 1 with annual CPI increase of 3%.

APPENDIX F: COST ESTIMATE

See attached PDF.

CITY OF REDONDO BEACH
BEACH CITIES TRANSIT

OPERATIONS and MAINTENANCE FACILITY MASTER PLAN

CONCEPTUAL DESIGN
OPINION OF PROBABLE COST

JYI# C2677A-R1

June 13, 2023
Revised: June 14, 2023

PREPARED FOR:

STANTEC

BY:

JACOBUS & YUANG, INC.
330 N. Lantana Street, Ste 28, #220
Camarillo, CA 93010
Tel (213) 688-1341 or (805) 339-9434

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN **JOB #: C2677A-R1**

LOCATION: REDONDO BEACH, CA **DATE: 13-Jun-23**

CLIENT: STANTEC **REVISED: 14-Jun-23**

DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - COST SUMMARY

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST SUB CONTRACT	UNIT COST W/ PRORATES	TOTAL ESTIMATED COST
	SUMMARY OF ESTIMATE					**$**
	SITE DEMOLITION	153,790	SF	1.95	2.93	450,351
	PARK & RIDE LOT / EMPLOYEE PARKING	109,820	SF	3.67	5.50	604,309
	OMF SITEWORK	33,845	SF	160.46	240.92	8,153,797
	ADMIN-OPS & MAINTENANCE FACILITY (EQ. SEPARATE)	17,256	SF	352.79	529.67	9,139,965
	SUB TOTAL					**18,348,422**
	TOTAL OPINION OF PROBABLE COST WITHOUT ESCALATION	**17,256**	**SF**		**1,063.31**	**18,348,422**
	ESCALATION	**21.57%**				**3,957,755**
	TOTAL OPINION OF PROBABLE COST WITH ESCALATION	**17,256**	**SF**		**1,292.66**	**22,306,177**
	EQUIPMENT COSTS					
	MAINTENANCE / BUS WASH EQUIPMENT COST					
	- C.F.C.I. EQUIPMENT, INCLUDING INSTALLATION COST	1	LS	1,000,000		1,000,000
	SUB TOTAL					1,000,000
	ADD: PRORATES PER BASE ESTIMATE W/O CONTINGENCY	17.12%				171,213
	ADD: ESCALATION COST	21.57%				252,631
	TOTAL EQUIPMENT COST W/O CONTINGENCY PLUS ESCALATION					**1,423,843**
	TOTAL OPINION OF PROBABLE COST WITH ESCALATION PLUS EQUIPMENT COST					**23,730,020**

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN **JOB #: C2677A-R1**

LOCATION: REDONDO BEACH, CA **DATE: 13-Jun-23**

CLIENT: STANTEC **REVISED: 14-Jun-23**

DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - COST SUMMARY

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST SUB CONTRACT	UNIT COST W/ PRORATES	TOTAL ESTIMATED COST
	SOFT COSTS					
	ARCHITECTURAL/ENGINEERING FEES	15.0%				$3,559,503
	ENVIRONMENTAL CONSULTING (CEQA/NEPA)	0.75%				$177,975
	CONSTRUCTION CONTINGENCY	5.0%				$1,186,501
	CONSTRUCTION MANAGEMENT FEES	8.0%				$1,898,402
	SURVEYS & THE LIKE	5.0%				$1,186,501
	TOTAL OPINION OF PROBABLE COST WITH ESCALATION, EQUIPMENT & SOFT COSTS	**17,256**	**SF**		**1,839.30**	**31,738,902**

ESCALATION CALCULATION

BASE MONTH	Jun-23
CONSTRUCTION START MONTH	Jan-28
CONSTRUCTION DURATION (MONTHS)	18.0
MID POINT OF CONSTRUCTION	Oct-28
% ANNUAL ESCALATION	3.75%
ALLOWANCE FOR ESCALATION (TO MIDPOINT OF CONSTRUCTION)	21.57%

GENERAL NOTES:

1 COSTS ARE BASED ON PREVAILING WAGE RATES
2 ESTIMATED COSTS ASSUME AT LEAST 4 TO 5 COMPETITIVE RESPONSIVE BIDS SHALL BE RECEIVED
3 ALL WORK IS ASSUMED TO BE PERFORMED DURING REGULAR WORKING HOURS
4 NO ALLOWANCE IS INCLUDED IN THE ESTIMATE FOR LOOSE FURNITURE, FIXTURES & EQUIPMENT OTHER THAN THOSE PART OF EQUIPMENT ALLOWANCE ON SUMMARY SHEET
5 MAINTENANCE AND BUS WASH EQUIPMENT COSTS ARE **NOT** SUBJECTED TO DESIGN CONTINGENCY AS COSTS ARE BASED ON COST DRAWN FROM SIMILAR, MOSTLY COMPLETED, PROJECTS.
6 THE OPINION OF PROBABLE COST IS PREPARED BASED ON MASTER PLAN DIAGRAMS DATED 04/20/2023 AND SPACE PROGRAMS DATED 02/24/2023 PREPARED BY STANTEC, AND RECEIVED 04/21/2023

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN	**JOB #: C2677A-R1**
LOCATION: REDONDO BEACH, CA	**DATE: 13-Jun-23**
CLIENT: STANTEC	**REVISED: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - COST SUMMARY	

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST SUB CONTRACT	UNIT COST W/ PRORATES	TOTAL ESTIMATED COST

SPECIFIC EXCLUSIONS:

1 OFF SITE IMPROVEMENTS
2 F, F & E (GROUP II EQUIPMENT), EXCEPT AS NOTED IN THE ESTIMATE DETAIL.
3 PROJECT MANAGEMENT FEES
4 ALLOWANCES FOR GEOTECHNICAL & HYDROLOGY TESTING, UTILITY INVESTIGATION & ENVIRONMENTAL ASSESSMENT
5 GUARD SHACK
6 OFFICE EQUIPMENT AND FURNISHINGS
7 BREAKROOM / KITCHENETTE EQUIPMENT
8 DEEP CLEANING BAY
9 FARE REVENUE, CLEANING STORAGE, AND ELECTRICAL ROOM REMOTE BUILDING

SPECIFIC INCLUSIONS:

1 ALLOWANCE FOR ARCHITECTURAL DESIGN FEES & OTHER TYPICAL SOFT COSTS BEYOND REGULAR GENERAL CONTRACTOR COSTS
2 SITE DEMOLITION
3 HAZARDOUS MATERIAL ABATEMENT ALLOWANCE RELATED TO BUILDING DEMOLITION
4 PARK & RIDE LOT AND EMPLOYEE PARKING RE-STRIPING
5 FENCING AND GATES
6 PV CANOPY STRUCTURE
7 ADMIN-OPS AND MAINTENANCE BUILDING WITH ADJACENT BUS WASH FACILITY
8 TRASH ENCLOSURE
9 PRIMARY AND SECONDARY POWER SERVICE
10 SITE LIGHTING
11 INCOMING COMMUNICATIONS
12 SITE SECURITY
13 PV PANELS WITH CIRCUITRY AND INVERTER
14 (11) 120kW CHARGER CABINETS WITH (22) PLUG-IN DISPENSERS
15 PLUMBING UTILITIES RELATIVE TO OMF SITE

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN	**JOB #: C2677A-R1**
LOCATION: REDONDO BEACH, CA	**DATE: 13-Jun-23**
CLIENT: STANTEC	**REVISED: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - COST SUMMARY	

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST SUB CONTRACT	UNIT COST W/ PRORATES	TOTAL ESTIMATED COST

DEFINITIONS

OPINION OF COST

An Opinion of Cost is prepared from a survey of the quantities of work-items prepared from written or drawn information provided at the Conceptual or Schematic stage of design.

Historical costs, information provided by contractors and suppliers, plus judgmental evaluation by the Estimator are used as appropriate as the basis for pricing.

Allowances as appropriate will be included for items of work which are not indicated on the design documents, provided that the Estimator is made aware of them, or which in the judgement of the Estimator are required for completion of the work.

JYI cannot, however, be responsible for inclusion of items or work of which we have not been informed.

BID

An offer to enter a contract to perform work for a fixed sum, to be completed within a limited period of time.

SPECIAL NOTE - MARKET CONDITIONS

In the current market conditions for construction, our experience shows the following results on competitive bids, as a differential from JYI final estimates:

Number of bids	Percentage Differential
1.....	+ 25 to 50%
2-3.....	+ 10 to 25%
4-5.....	+ 0 to 10%
6-7.....	+ 0 to - 5%
8 or more....	+ 0 to -10%

Accordingly, it is extremely important to ensure that a minimum of 4-5 valid bids are received

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN **JOB #: C2677A-R1**
LOCATION: REDONDO BEACH, CA **DATE: 13-Jun-23**
CLIENT: STANTEC **REVISION: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - ESTIMATE DETAIL

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST	SUB CONTRACT TOTAL	% CONTIN-GENCY	DESIGN CONTINGENCY AMOUNT	GENERAL CONDITIONS/ REQUIREMENTS	PHASING FACTOR	BONDS	GC FEE	**CONSTRUCTION TOTAL**
						20.00%		12.50%	2.50%	2.00%	6.50%	
	SUMMARY OF ESTIMATE											$
1.0	SITE DEMOLITION	153,790	SF	2.93	299,960	20.0%	59,992	44,994	10,124	8,301	26,980	450,351
2.0	PARK & RIDE LOT / EMPLOYEE PARKING	109,820	SF	5.50	402,505	20.0%	80,501	60,376	13,585	11,139	36,203	604,309
3.0	OMF SITEWORK	33,845	SF	240.92	5,430,909	20.0%	1,086,182	814,636	183,293	150,300	488,476	8,153,797
4.0	ADMIN-OPS & MAINTENANCE FACILITY (EQ. SEPARATE)	17,256	SF	529.67	6,087,755	20.0%	1,217,551	913,163	205,462	168,479	547,556	9,139,965
	ESTIMATED OPINION OF PROBABLE COST WITHOUT ESCALATION	**17,256**	**SF**	1,063.31	**12,221,129**		2,444,226	1,833,169	412,464	338,220	1,099,214	**18,348,422**

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN — **JOB #: C2677A-R1**
LOCATION: REDONDO BEACH, CA — **DATE: 13-Jun-23**
CLIENT: STANTEC — **REVISION: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - ESTIMATE DETAIL

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST	SUB CONTRACT TOTAL	% CONTIN-GENCY	DESIGN CONTINGENCY AMOUNT	GENERAL CONDITIONS/ REQUIREMENTS	PHASING FACTOR	BONDS	GC FEE	**CONSTRUCTION TOTAL**
						20.00%		12.50%	2.50%	2.00%	6.50%	
1.0	**SITE DEMOLITION**											**$**
	SITE DEMOLITION (HAULING INCLUDED)											
	REMOVE/HAUL (E) OPERATIONS & MAINTENANCE FACILITY STRUCTURE INCLUDING SLAB & FOUNDATION, COMPLETE	6,000	SF	12.00	72,000	20.0%	14,400	10,800	2,430	1,993	6,476	108,099
	SAWCUT/REMOVE (E) ASPHALT PAVEMENT & BASE @ 5'-0" BEYOND FOOTPRINT OF EXISTING OPS-MAINTENANCE FACILITY	2,000	SF	5.18	10,360	20.0%	2,072	1,554	350	287	932	15,554
	SAWCUT/REMOVE (E) ASPHALT PAVEMENT & BASE @ OMF AREA	43,745	SF	3.58	156,660	20.0%	31,332	23,499	5,287	4,336	14,091	235,204
	REMOVE (E) WHEELSTOP	72	EA	43.50	3,132	20.0%	626	470	106	87	282	4,702
	SANDBLAST/REMOVE (E) LINE STRIPING	6,383	LF	2.00	12,766	20.0%	2,553	1,915	431	353	1,148	19,166
	SANDBLAST/REMOVE (E) CHEVRON STRIPING	1,486	SF	2.00	2,972	20.0%	594	446	100	82	267	4,462
	SANDBLAST/REMOVE (E) PAVEMENT MARKINGS	90	EA	31.58	2,842	20.0%	568	426	96	79	256	4,267
	REMOVE (E) FENCE & GATES	374	LF	12.00	4,488	20.0%	898	673	151	124	404	6,738
	REMOVE & CAP (E) UTILITIES U/S BUILDING & 5' BEYOND	8,000	SF	0.45	3,600	20.0%	720	540	122	100	324	5,405
	HAZARDOUS MATERIAL ABATEMENT - BUILDING	6,000	SF	3.50	21,000	20.0%	4,200	3,150	709	581	1,889	31,529
	MISC. SITE DEMO WORK	1	LS	10,140.00	10,140	20.0%	2,028	1,521	342	281	912	15,224
	SUBTOTAL				**299,960**		**59,992**	**44,994**	**10,124**	**8,301**	**26,980**	**450,351**
2.0	**PARK & RIDE LOT / EMPLOYEE PARKING**											$
	SITE PARAMETERS - IMPROVEMENTS											
	NEW PAVEMENT	8,000	SF									
	NEW PARKING STALLS & DRIVE AISLE	94,300	SF									
	EXISTING PARKING STALLS	7,520	SF									
	GROSS SITE AREA	**109,820**	**SF**									
	SITE PREPARATION											
	SITE CLEARING	109,820	SF	0.25	27,455	20.0%	5,491	4,118	927	760	2,469	41,220
	ROUGH / FINE GRADING	8,000	SF	1.00	8,000	20.0%	1,600	1,200	270	221	720	12,011
	REMOVE & EXPORT (E) DIRT, +/-5'D	1,481	CY	46.11	68,313	20.0%	13,663	10,247	2,306	1,891	6,144	102,563
	DIRT IMPORT + BACKFILL & COMPACT	1,481	CY	75.00	111,111	20.0%	22,222	16,667	3,750	3,075	9,994	166,819
	EROSION CONTROL	8,000	SF	0.30	2,400	20.0%	480	360	81	66	216	3,603
	HARDSCAPE											
	ASPHALT PAVING + BASE, MATCH EXISTING	8,000	SF	5.83	46,667	20.0%	9,333	7,000	1,575	1,292	4,197	70,064
	RE-SEAL (E) ASPHALT PAVING - ALLOWANCE	94,300	SF	1.00	94,300	20.0%	18,860	14,145	3,183	2,610	8,482	141,579
	SITE MISCELLANEOUS											
	PARKING STALL STRIPING - STANDARD	253	EA	65.00	16,445	20.0%	3,289	2,467	555	455	1,479	24,690
	STOP SIGN + LIMIT LINE STRIPING	2	EA	750.00	1,500	20.0%	300	225	51	42	135	2,252
	WALK-AISLE STRIPING (CHEVRON)	1,350	SF	1.75	2,363	20.0%	473	354	80	65	213	3,548
	DASH LINE STRIPING	125	LF	2.25	281	20.0%	56	42	9	8	25	422
	REFRESH (E) ADA PARKING STALL STRIPING & LOGO	8	EA	150.00	1,200	20.0%	240	180	41	33	108	1,802
	REFRESH (E) STD PARKING STALL STRIPING	21	EA	50.00	1,050	20.0%	210	158	35	29	94	1,576
	REFRESH (E) WALK-AISLE STRIPING (CHEVRON)	1,800	SF	1.25	2,250	20.0%	450	338	76	62	202	3,378
	MISC. SITE IMPROVEMENTS / SIGNAGE ALLOWANCE	1	LS	19,170.00	19,170	20.0%	3,834	2,876	647	531	1,724	28,781
	SUBTOTAL				**402,505**		**80,501**	**60,376**	**13,585**	**11,139**	**36,203**	**604,309**

PROJECT: CITY OF REDONDO BEACH, BEACH CITIES TRANSIT - OPERATIONS AND MAINTENANCE FACILITY MASTER PLAN — **JOB #: C2677A-R1**
LOCATION: REDONDO BEACH, CA — **DATE: 13-Jun-23**
CLIENT: STANTEC — **REVISION: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - ESTIMATE DETAIL

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST	SUB CONTRACT TOTAL	% CONTIN-GENCY	DESIGN CONTINGENCY AMOUNT	GENERAL CONDITIONS/ REQUIREMENTS	PHASING FACTOR	BONDS	GC FEE	**CONSTRUCTION TOTAL**
						20.00%		12.50%	2.50%	2.00%	6.50%	
3.0	**OMF SITEWORK**											$
	SITE PARAMETERS - IMPROVEMENTS											
	GROSS SITE AREA	**43,745**	**SF**									
	BUILDING FOOTPRINTS:			DIMENSIONS	AREA + 5'-0" BEYOND							
	- ADMIN / MAINTENANCE FACILITY FOOTPRINT	8,492	SF	64' x 132.70'	10,042							
	- WASH BAY + EQUIPMENT ROOM FOOTPRINT	1,408	SF	64' x 22 '	1,650							
	SITE AREAS											
	- DESIGNATED SMOKING AREA	105	SF									
	- TRASH ENCLOSURE	263	SF	12' x 22'	544							
	- MISC. EXTERIOR STORAGE	525	SF									
	- CHARGING EQUIPMENT & UTILITY YARD	2,134	SF									
	- PARKING & DRIVE AISLE	27,666	SF									
	NET SITE AREA	**33,845**	**SF**		14,573.30							
	SITE PREPARATION											
	SITE CLEARING	43,745	SF	0.25	10,936	20.0%	2,187	1,640	369	303	984	16,419
	ROUGH / FINE GRADING	43,745	SF	1.00	43,745	20.0%	8,749	6,562	1,476	1,211	3,935	65,677
	BUILDING PAD OVEREXCAVATION (ASSUME 5'-0"D) INCLUDING WASH BAY & DEEP CLEANING BAY	2,422	CY	20.00	48,442	20.0%	9,688	7,266	1,635	1,341	4,357	72,729
	BUILDING PAD OVEREXCAVATION (ASSUME 3'-0"D) FOR FARE/REVENUE & TRASH ENCLOSURE	166	CY	20.00	3,320	20.0%	664	498	112	92	299	4,985
	SCARIFY/ COMPACT - U/S SITE PAVING	30,430	SF	0.56	16,906	20.0%	3,381	2,536	571	468	1,521	25,382
	EROSION CONTROL	43,745	SF	0.30	13,124	20.0%	2,625	1,969	443	363	1,180	19,704
	HARDSCAPE											
	CONCRETE PAVEMENT/BASE, ASSUME 6"/ 4" - CHARGING EQUIPMENT & UTILITY YARD	2,134	SF	12.02	25,648	20.0%	5,130	3,847	866	710	2,307	38,507
	ASPHALT PAVEMENT/BASE, ASSUME 6"/ 4"	31,449	SF	6.93	217,810	20.0%	43,562	32,672	7,351	6,028	19,591	327,013
	EXTRA FOR CURBS, GUTTERS, V-GUTTERS	1	LS	8,520.00	8,520	20.0%	1,704	1,278	288	236	766	12,792
	SITE STRUCTURE, COMPLETE											
	DEEP CLEANING BAY											N.I.C.
	FARE/REVENUE, CLEANING STORAGE, & ELECT'L ROOM											N.I.C.
	TRASH ENCLOSURE	263	SF	60.00	15,780	20.0%	3,156	2,367	533	437	1,419	23,692
	FENCING											
	PERIMETER FENCING (SOUTH & WEST EXCLUDED)	250	LF	80.00	20,000	20.0%	4,000	3,000	675	554	1,799	30,027
	40'L ROLLING GATE + MOTOR	1	EA	20,250.00	20,250	20.0%	4,050	3,038	683	560	1,821	30,403
	UTILITY YARD FENCE/GATE	142	LF	80.00	11,360	20.0%	2,272	1,704	383	314	1,022	17,056
	EXTERIOR STORAGE FENCE/GATE	92	LF	80.00	7,360	20.0%	1,472	1,104	248	204	662	11,050
	PV CANOPY STRUCTURE											
	NORTH/SOUTH CANOPIES, COMPLETE (NO METAL DECK)	6,600	SF	60.00	396,000	20.0%	79,200	59,400	13,365	10,959	35,618	594,542
	SITE MISCELLANEOUS											
	PARKING STALL STRIPING - ADA + SIGNAGE	1	EA	1,225.00	1,225	20.0%	245	184	41	34	110	1,839
	PARKING STALL STRIPING - NON REVENUE	3	EA	75.00	225	20.0%	45	34	8	6	20	338
	PARKING STALL STRIPING - MINI VAN	5	EA	75.00	375	20.0%	75	56	13	10	34	563
	PARKING STALL STRIPING - CUT AWAY BUS	20	EA	90.00	1,800	20.0%	360	270	61	50	162	2,702
	MISC. SITE IMPROVEMENTS / SIGNAGE ALLOWANCE	1	LS	43,140.00	43,140	20.0%	8,628	6,471	1,456	1,194	3,880	64,769
	PLUMBING UTILITIES											
	STORM DRAINS (W/ BIO RETENTIONS)	33,845	SF	5.00	169,225	20.0%	33,845	25,384	5,711	4,683	15,221	254,069
	DOMESTIC WATER	33,845	SF	1.20	40,614	20.0%	8,123	6,092	1,371	1,124	3,653	60,977
	FIRE WATER	33,845	SF	1.50	50,768	20.0%	10,154	7,615	1,713	1,405	4,566	76,221
	SEWER	33,845	SF	1.30	43,999	20.0%	8,800	6,600	1,485	1,218	3,957	66,059

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CLIENT: STANTEC — **REVISION: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - ESTIMATE DETAIL

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST	SUB CONTRACT TOTAL	% CONTIN-GENCY	DESIGN CONTINGENCY AMOUNT	GENERAL CONDITIONS/ REQUIREMENTS	PHASING FACTOR	BONDS	GC FEE	**CONSTRUCTION TOTAL**
						20.00%		12.50%	2.50%	2.00%	6.50%	
	ELECTRICAL UTILITIES											
	PRIMARY / SECONDARY POWER SERVICE	33,845	SF	1.50	50,768	20.0%	10,154	7,615	1,713	1,405	4,566	76,221
	NORMAL POWER (BUILDING SWITCHBOARD, BEB CHARGER SWITCHBOARD, FEEDERS, UTILITY PADS, COMPLETE)	33,845	SF	25.00	846,125	20.0%	169,225	126,919	28,557	23,417	76,104	1,270,346
	EMERGENCY POWER (ATS, GENSET, & FEEDERS, COMPLETE)	33,845	SF	17.50	592,288	20.0%	118,458	88,843	19,990	16,392	53,273	889,243
	BEB CHARGERS & FEEDERS											
	- 120 kW CHARGING CABINET, COMPLETE	11	EA	80,482.50	885,308	20.0%	177,062	132,796	29,879	24,501	79,628	1,329,174
	- PLUG-IN DISPENSERS, COMPLETE	22	EA	37,366.88	822,071	20.0%	164,414	123,311	27,745	22,751	73,940	1,234,232
	- 120kW FEEDER, COMPLETE	11	EA	10,909.09	120,000	20.0%	24,000	18,000	4,050	3,321	10,793	180,164
	- 60kW FEEDER, COMPLETE	22	EA	15,272.73	336,000	20.0%	67,200	50,400	11,340	9,299	30,221	504,460
	- EXTRA FOR BOLLARD	44	EA	1,250.00	55,000	20.0%	11,000	8,250	1,856	1,522	4,947	82,575
	PV PANELS											
	- PV PANELS + CIRCUITRY/INVERTER, COMPLETE - ASSUME (1) PV PANEL/MODULE @ 420W @ 24.10 SF = 274 MODULES @ 115.08kW TOTAL	6,600	SF	61.03	402,780	20.0%	80,556	60,417	13,594	11,147	36,228	604,721
	SITE LIGHTING	33,845	SF	2.00	67,690	20.0%	13,538	10,154	2,285	1,873	6,088	101,628
	SITE SECURITY	33,845	SF	0.50	16,923	20.0%	3,385	2,538	571	468	1,522	25,408
	INCOMING COMMUNICATIONS	33,845	SF	0.75	25,384	20.0%	5,077	3,808	857	703	2,283	38,111
	SUBTOTAL				**5,430,909**		**1,086,182**	**814,636**	**183,293**	**150,300**	**488,476**	**8,153,797**
4.0	**ADMIN-OPS & MAINTENANCE FACILITY (EQ. SEPARATE)**											$
	BUILDING PARAMETERS											
	BUILDING GFA (PROGRAMMED)	**17,256**	**GSF**	DIMENSIONS								
	MAINTENANCE FACILITY	8,492	SF	64' x 132.70'								
	WASH BAY & EQUIPMENT ROOM	2,490	SF	64' x 45.90'								
	ADMIN-OPS (2ND FLOOR)	6,274	SF	64' x 98'								
	EMPLOYEE PATIO (2ND FLOOR, NOT PART OF GSF)	1,050	SF									
	SUBSTRUCTURE											
	FOUNDATION	17,256	GSF	13.26	228,792	20.0%	45,758	34,319	7,722	6,332	20,578	343,501
	SLAB ON-GRADE - MAINTENANCE	8,492	SF	10.39	88,222	20.0%	17,644	13,233	2,978	2,442	7,935	132,454
	SLAB ON-GRADE - BUS WASH	2,490	SF	16.43	40,901	20.0%	8,180	6,135	1,380	1,132	3,679	61,407
	EXTRA FOR REPAIR BAY PIT	3	EA	60,000.00	180,000	20.0%	36,000	27,000	6,075	4,982	16,190	270,246
	EXTRA FOR WASH BAY PIT/HOLDING PIT	1	EA	40,000.00	40,000	20.0%	8,000	6,000	1,350	1,107	3,598	60,055
	EXTRA FOR ELEVATOR PIT	1	EA	15,000.00	15,000	20.0%	3,000	2,250	506	415	1,349	22,521
	STRUCTURE											
	STEEL STRUCTURE	17,256	GSF	72.00	1,242,432	20.0%	248,486	186,365	41,932	34,384	111,749	1,865,349
	METAL DECK + TOPPING - 2ND FLOOR	6,274	SF	12.11	75,994	20.0%	15,199	11,399	2,565	2,103	6,835	114,095
	METAL DECK + TOPPING - 2ND FLOOR PATIO	1,050	SF	12.11	12,718	20.0%	2,544	1,908	429	352	1,144	19,094
	METAL DECK, NO TOPPING - ROOF	9,932	SF	6.61	65,675	20.0%	13,135	9,851	2,217	1,818	5,907	98,602
	ENCLOSURE											
	VERTICAL ENCLOSURE	17,256	GSF	36.00	621,216	20.0%	124,243	93,182	20,966	17,192	55,875	932,674
	HORIZONTAL ENCLOSURE	17,256	GSF	20.00	345,120	20.0%	69,024	51,768	11,648	9,551	31,041	518,152
	INTERNALS											
	INTERNALS, VERTICAL	17,256	GSF	15.00	258,841	20.0%	51,768	38,826	8,736	7,163	23,281	388,616
	INTERNALS, HORIZONTAL	17,256	GSF	9.00	155,304	20.0%	31,061	23,296	5,242	4,298	13,969	233,169
	INTERIOR BUILD-OUTS (INCLUDES CABINETRIES, SPECIALTIES, FURNISHINGS, ETC.)											
	MAINTENANCE OFFICES & SUPPORT AREAS	707	SF	10.50	7,426	20.0%	1,485	1,114	251	206	668	11,149
	ADMIN-OPS OFFICES & SUPPORT AREAS	2,950	SF	12.50	36,870	20.0%	7,374	5,531	1,244	1,020	3,316	55,355
	SMALL CONFERENCE ROOM	180	SF	20.00	3,600	20.0%	720	540	122	100	324	5,405

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CLIENT: STANTEC **REVISION: 14-Jun-23**
DESCRIPTION: CONCEPTUAL DESIGN OPINION OF PROBABLE COST - ESTIMATE DETAIL

ITEM NO.	DESCRIPTION	EST QTY	UNIT	UNIT COST	SUB CONTRACT TOTAL	% CONTIN-GENCY	DESIGN CONTINGENCY AMOUNT	GENERAL CONDITIONS/ REQUIREMENTS	PHASING FACTOR	BONDS	GC FEE	**CONSTRUCTION TOTAL**
						20.00%		12.50%	2.50%	2.00%	6.50%	
	LARGE CONFERENCE ROOM	420	SF	20.00	8,400	20.0%	1,680	1,260	284	232	756	12,612
	TRAINING ROOM	576	SF	20.00	11,520	20.0%	2,304	1,728	389	319	1,036	17,296
	KITCHEN / BREAKROOM	660	SF	35.00	23,100	20.0%	4,620	3,465	780	639	2,078	34,682
	RESTROOM / SHOWER	198	SF	50.00	9,900	20.0%	1,980	1,485	334	274	890	14,864
	MEN'S / WOMEN'S RESTROOM W/ LOCKERS	720	SF	80.00	57,600	20.0%	11,520	8,640	1,944	1,594	5,181	86,479
	OPS STORAGE / OPERATOR'S LOCKERS	414	SF	15.00	6,210	20.0%	1,242	932	210	172	559	9,324
	LACTATION / QUIET ROOM	156	SF	30.00	4,680	20.0%	936	702	158	130	421	7,026
	CUSTODIAN	144	SF	12.00	1,728	20.0%	346	259	58	48	155	2,594
	MAINTENANCE PARTS STORAGE	1,725	SF	7.50	12,938	20.0%	2,588	1,941	437	358	1,164	19,425
	MAINTENANCE SHOPS	1,341	SF	7.50	10,057	20.0%	2,011	1,509	339	278	905	15,099
	REPAIR BAYS	3,450	SF	7.00	24,150	20.0%	4,830	3,623	815	668	2,172	36,258
	LUBE COMPRESSOR	345	SF	7.00	2,415	20.0%	483	362	82	67	217	3,626
	UTILITY ROOMS	780	SF	5.00	3,900	20.0%	780	585	132	108	351	5,855
	WASH BAY / WASH EQUIPMENT ROOM	2,940	SF	3.00	8,820	20.0%	1,764	1,323	298	244	793	13,242
SUPPORT ITEMS												
	MISC. ROUGH CARPENTRY	17,256	GSF	0.40	6,902	20.0%	1,380	1,035	233	191	621	10,362
	MISC. METALS	17,256	GSF	1.00	17,256	20.0%	3,451	2,588	582	478	1,552	25,908
	MISC. CAULKING/SEALANTS	17,256	GSF	0.35	6,040	20.0%	1,208	906	204	167	543	9,068
	MISC. FIREPROOFING/FIRESTOPPING	17,256	GSF	0.30	5,177	20.0%	1,035	777	175	143	466	7,773
MAINTENANCE EQUIPMENT												
	SEE SUMMARY											
BUS WASH EQUIPMENT												
	SEE SUMMARY											
CONVEYING												
	METAL PAN STAIR, SWITCHBACK, COMPLETE	1	FLT	37,500.00	37,500	20.0%	7,500	5,625	1,266	1,038	3,373	56,301
	PASSENGER ELEVATOR, 2-STOP	1	EA	190,000.00	190,000	20.0%	38,000	28,500	6,413	5,258	17,089	285,260
FIRE PROTECTION												
	FIRE PROTECTION	17,256	GSF	7.05	121,575	20.0%	24,315	18,236	4,103	3,365	10,935	182,529
PLUMBING												
	PLUMBING, COMPLETE (INCLUDES +/-28 FIXTURES)	17,256	GSF	16.23	280,000	20.0%	56,000	42,000	9,450	7,749	25,184	420,383
	EXTRA FOR WASH BAY PLUMBING	2,160	SF	10.00	21,600	20.0%	4,320	3,240	729	598	1,943	32,430
	EXTRA FOR PROCESS PIPING - LUBE COMPRESSOR SHOP	345	SF	18.00	6,210	20.0%	1,242	932	210	172	559	9,324
HVAC												
	HVAC SYSTEM, COMPLETE	17,256	GSF	41.10	709,160	20.0%	141,832	106,374	23,934	19,626	63,785	1,064,711
ELECTRICAL												
	ELECTRICAL	17,256	GSF	42.46	732,700	20.0%	146,540	109,905	24,729	20,277	65,902	1,100,053
	COMMUNICATIONS	17,256	GSF	8.59	148,204	20.0%	29,641	22,231	5,002	4,102	13,330	222,509
	FIRE ALARM	17,256	GSF	7.07	122,086	20.0%	24,417	18,313	4,120	3,379	10,981	183,296
	SECURITY	17,256	GSF	4.63	79,816	20.0%	15,963	11,972	2,694	2,209	7,179	119,833
	SUBTOTAL				**6,087,755**		**1,217,551**	**913,163**	**205,462**	**168,479**	**547,556**	**9,139,965**

APPENDIX G: FINAL STAKEHOLDER COMMENTS

Prior to approval by Redondo Beach City Council, Hermosa Beach, Manhattan Beach, and El Segundo Staff were provided a draft final copy of the Beach Cities Transit Study Report to provide comments. Manhattan Beach was the only beach city to provide comments on the Draft Study Report.

13.1 Manhattan Beach

Manhattan Beach Staff provided comments to the draft of the Beach Cities Transit Study Report. While Staff "generally support the overall goals and comprehensive nature of its [the TSS Report] recommendations" they "offer[ed] several comments and observations… to consider for inclusion in the Final Report and Implementation Plan." Below includes those comments with additional context or references to the pertinent pieces of the TSS.

13.1.1 General Comments

Initial comments from Manhattan Beach Staff pertained to Appendix B: List of Senior Housing Complexes Within Redondo Beach and Hermosa Beach and included:

> *"The Transit Study Report should identify the existing senior facilities within the City of Manhattan Beach in* Appendix B: List of Senior Housing Complexes Within Redondo Beach and Hermosa Beach *when considering transit service planning, including*":
>
> **3. <u>Manhattan Beach</u>**
>
> a. Manhattan Village Senior Villas
> 1300 Parkview Ave,
> Manhattan Beach, 90266
>
> b. Manhattan Terrace
> 3400 N Valley Dr
> Manhattan Beach, 90266
>
> *"The Transit Study Report should incorporate the City of Manhattan Beach's General Plan Mobility Element inclusive of its goals and objectives into its Background Document Review"* (Section 3.1).

13.1.2 Service Plan

Manhattan Beach Staff provided comments on the service plan with specific comments relating to Line 109 (Section 7.2.2) and the Manhattan Beach Blvd (Section 7.2.4). The comments are as follows:

> *"Staff supports the short –range and long-range service planning recommendations with attention on providing alternative transportation to seniors and other transit dependent users."*

Citing recommendations for Line 109 outlined in the Service Plan section of the Executive Summary (Section 1.4) Manhattan Beach Staff "support the Line 109 service plan, as noted below:"

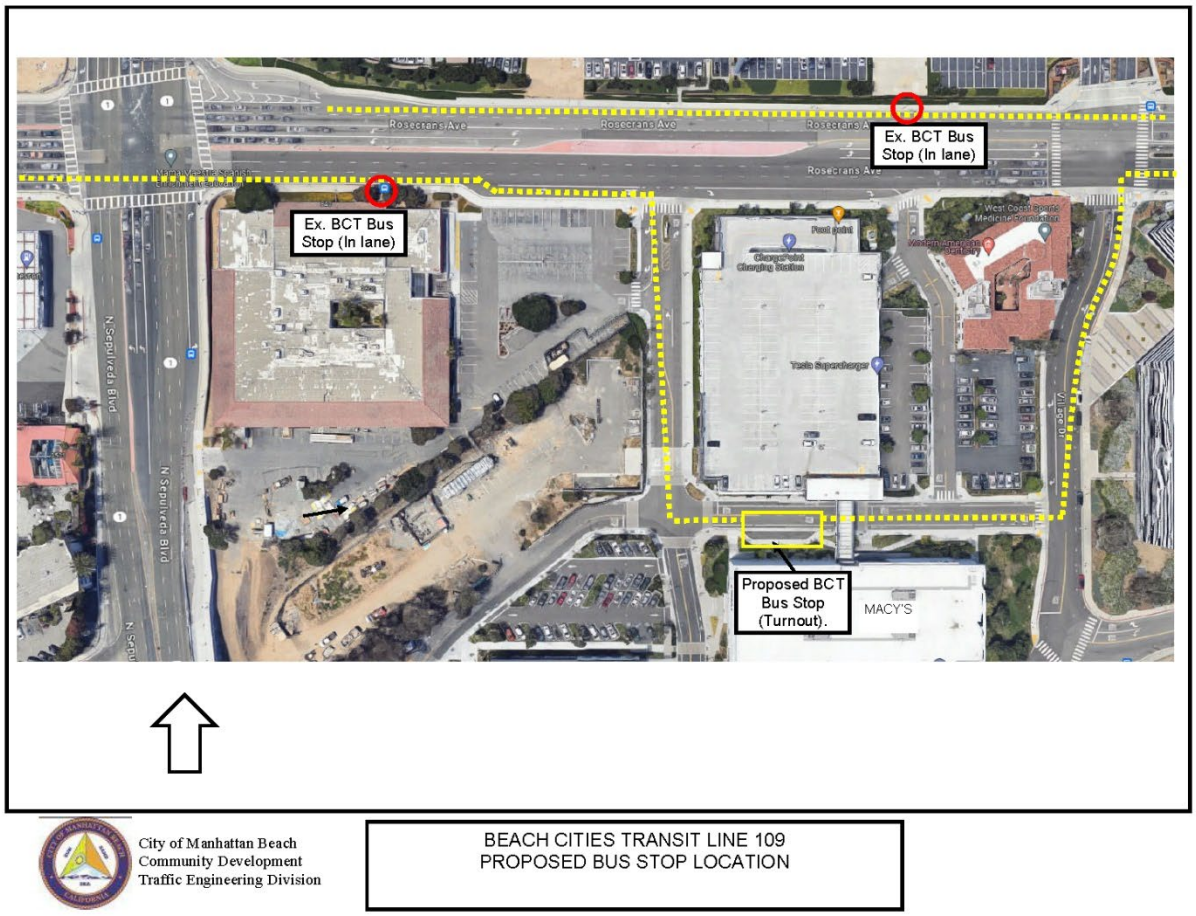
- FY23-24 (Plan Year 1): re-route Line 109 around Manhattan Village Mall and Plaza El Segundo to provide more direct service, reduce travel time, and eliminate stops with very low ridership that are not pedestrian-friendly.

Comments pertaining to this recommendation included:

"We specifically request that BCT seriously consider the existing bus turnout on Saunders Way (by Macy's) as the eastbound bus stop that serves the Manhattan Village Shopping Center, and by its proximity, the Manhattan Village Senior Apartments and The Pointe. This bus turnout provides a safe location with existing amenities that is protected from high speed vehicles and closer to the users' destinations. It has an easy right turn in-right out configuration using Cedar Way and Village Drive respectively with very little added travel time. See attached sketch." (Figure G-1)

- FY24-25 (Plan Year 2): adjust routing around LAX to serve the AMC to provide a direct connection to LAX APM and other transit operators at the AMC.
- FY24-25 (Plan Year 2): terminate Line 109 at the Pier and extend Line 102 south from the Pier to Riviera Village to enable easier transfers, provide easier access to the Pier and Veterans Park Senior Center, and better reflect travel patterns in South Redondo.
- FY26-27 (Plan Year 4): improve weekday AM and PM peak hour service to every 35 minutes to provide a better experience for riders who use Line 109 during peak hours.

Figure G-1: Bus Turnout on Saunders Way Serving the Manhattan Village Markup Provided by Manhattan Beach Staff



13.1.3 ZEB Rollout Plan

Manhattan Beach Staff supported the ZEB Rollout Plan (Section 8) with the following comment:

> *"Staff supports the ZEB rollout plan and strategy to help BCT achieve a 100% ZEB fleet by 2040 as required by the California Air Resources Board (CARB) Innovative Clean Transit mandate."*

13.1.4 Infrastructure and Facility Needs

Commenting on the Infrastructure Planning (Section 9) Manhattan Beach staff said,

> "*Staff supports the ZEB rollout plan and strategy to help BCT achieve a 100% ZEB fleet by 2040 as required by the California Air Resources Board (CARB) Innovative Clean Transit mandate*."

Specific comments regarding the Conceptual Master Plan Layout of New Facility (Section 9.1.1.2), provided the following comment regarding proposed elimination of park-n-ride spaces:

> "*We recommend that the number of park-n-ride spaces be maintained at the current level, and not reduced to make room for the OMF. Additionally, if a parking structure replaces the current surface lot, we would recommend that the first three levels be constructed, with the built-in structural capability to add a fourth (or fifth) level in the future if deemed necessary. The parking lot/structure should be outfitted with solar panels to provide power for the OMF and public EV charging stations, and to provide shade for all-day parking."*

The above comment also proposes the installation of a photovoltaic system in addition to what is discussed in Section 9.1.2.4. For further information on the infrastructure planning associated with the TSS, Appendix D: Site Plans, provides a detailed site plan of the proposed OMF.

13.2 Redondo Beach City Council

The Draft Final TSS was presented to Redondo Beach City Council on December 5, 2023. After a presentation walking through the service recommendations, ZEB transition plan, and facility considerations, City Council and the public had opportunities to comment on the Study. Comments ranged from costs to specific stops or alignment but generally supported the service recommendations.

13.2.1 Service Plan

The proposed realignment of the southern portion of Line 102 and 109 to extend Line 102 down to the Riviera Village (Section 7.2) was supported by Council Members as well as public comment.

- Council Member Nehrenheim indicated his support for the realignment and encouraged BCT to engage with students and parents on this realignment.
- Two Redondo Beach citizens (one in person and one via Zoom) indicated their support for realignment. On citizen submitted comments on the realignment and indicated their strong opposition to this change; no justification was given.

Operating east-west along Manhattan Beach Blvd, the proposed new line (Section 7.2.4) would operate initially during the summer months. Council Members and citizens supported this recommendation.

- During the presentation, Council Member Behrendt was interested as to which populations requested the addition of the pilot bus route. Staff indicated that was not apparent in the data but was supported by Manhattan Beach Mobility Plan.

- Two citizens indicated their support for the recommendation via comments on the TSS Council Agenda item.

Regarding increased service frequency, community members were in strong support. Commentors (one in person, one via Zoom) indicated that increased frequency was very important. One indicated that increased frequency was of high importance and that City Council should prioritize this recommendation.

Council Member Kaluderovic was interested in the addition of a stop near Adams Middle School along Line 109. Staff indicated this could be further explored.

Council Member Behrendt asked if there were, “any downside, any potential problems, any issues at all with this service plan?” Staff reassured him that there were not but that increases in service could warrant additional funding. This included discussion of how service changes are proposed and that although BCT is currently well funded, there are opportunities to request additional funding from the Beach Cities.

13.2.2 ZEB Transition

The cost implications were an important part of comments from the Redondo Beach City Council. Regarding the change is fuel costs from CNG to electric, Council Member Behrendt inquired about the cost difference from transitioning to BEBs. Staff responded by referring to the TSS for a full breakdown of costs (Section 11.1), but that modeling showed a reduction in fuel costs once transitioned to electric (Appendix F: Cost Estimate). A follow up to this question included whether there “currently are grants or funding sources to cover the electricity costs?” Staff responded with the reality that most grants and funding sources are for capital procurement (Section 11.5), not operating funds.

Community Members indicated their support for the ZEB Transition Plan through written comments:

- Writing in a letter of supper, one Redondo Beach citizen indicated their strong support for the transition due to the reduction in tailpipe emissions from transportation.

Concluding the presentation and Stakeholder comments, Redondo Beach City Council received and filed the report and directed Staff to proceed with Final Report. The resolution was passed 4-0 with all present Council Members in favor.