LINK21

CONNECT NORTHERN CALIFORNIA

PRELIMINARY BUSINESS CASE REPORT

DRAFT FINAL

August 2024

Prepared By:
Link21 Program Management Consultants (PMC)

BART

CAPITOL CORRIDOR

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Issue and Revision Record

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Acronyms and Abbreviations

ACRONYM/ABBREVIATION	DEFINITION
BART	San Francisco Bay Area Rapid Transit District
CCJPA	Capitol Corridor Joint Powers Authority
Bay Area	San Francisco Bay Area Region
Bay Bridge	San Francisco-Oakland Bay Bridge
MTC	Metropolitan Transportation Commission
TDLU	travel demand and land use
UPRR	Union Pacific Railroad

Link21 Program Team Names

TEAM NAME	TEAM MEMBERS
Program Management Consultants (PMC)	The HNTB Team
Program Management Team (PMT)	BART/CCJPA + PMC
Consultants	Consultants supporting program identification/ project selection
Link21 Team	PMT + Consultants

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Glossary of Terms

TERM	DEFINITION
Baseline	The Baseline is a future scenario against which benefits, costs, and risks of the Crossing Project over the project life cycle are evaluated. The Baseline adopts future planning assumptions relating to demographics, transportation networks, and policies that are consistent with the adopted regional transport plans of the six metropolitan planning organizations within the Northern California Megaregion (such as *Plan Bay Area 2050*).
BART (technology/track type)[1]	The technology and track type that is used by BART within its own closed system of facilities and right-of-way. From an infrastructure perspective, BART is a single-level vehicle on broad-gauge tracks that is powered by electricity using a third rail system. BART uses this technology/track type to provide Urban | Metro rail services.
BART Crossing Concept	A new transbay passenger rail crossing concept that uses BART technology. If the crossing uses BART technology, it should connect, at a minimum, to existing BART infrastructure in the East Bay and serve downtown San Francisco. A BART crossing concept may have improvements to the Regional Rail[2] network.
Blue Line	BART Dublin/Pleasanton – Daly City service
Branch	A physical subdivision of railway that diverges from the rest of the network. The BART network currently has four branches in the East Bay to Richmond, Pittsburg/Bay Point; Dublin/Pleasanton, and Berryessa/North San Jose.
Capital Cost Indicator (Round 2)	The Capital Cost Indicator used in the Round 2 evaluation was based on a level of design definition consistent that is with the Association for the Advancement of Cost Engineering Class 5, which is a rough order of magnitude estimate that is developed in a primarily stochastic or parametric approach that is appropriate for 0-2 % design development. The cost estimate includes allocated contingency costs at 35% and an additional unallocated contingency for unforeseen conditions at 10%. Given the early stages of development of the Crossing Project, the concept definition is subject to material change, and there are inherent deliverability risks in a project of this size that could influence the base cost estimate to go up or down. The cost estimate excludes finance charges.

[1] Specific BART lines are referred to directly (e.g., Yellow Line) with a geographic description if there is any ambiguity (e.g., in the East Bay). Note that 'lines' refer to the specific services operated, as opposed to the physical track infrastructure.
[2] It could include intercity, commuter, or high-speed rail.

TERM	DEFINITION
Corridor Identification and Development (Corridor ID) Program	A new intercity passenger rail planning and development program established as part of the Bipartisan Infrastructure Law. Led by the Federal Railroad Administration, it provides federal funding for planning studies to help guide intercity passenger rail development and create a pipeline of rail projects ready for implementation. The key initial focus of the planning studies is developing a phased program of projects to achieve planned service levels in a corridor, documented in a service development plan. Nine corridors in California, including Capitol Corridor, San Joaquins, and California High-Speed Rail Phase 1, were selected to enter the program in December 2023.
Crossing Project	A new transbay passenger rail crossing between San Francisco and Oakland, including connections back to the existing rail network on either side of the San Francisco Bay and additional improvements away from the crossing to provide higher levels of train service in the crossing as needed.
East Bay	The area adjacent to the eastern shores of the San Francisco Bay and San Pablo Bay from Richmond/Hercules in the north to Fremont/Berryessa/North San Jose in the south.
Exploratory Concept (Exploratory Round)	Early definitions of concepts for the Exploratory Evaluation. Exploratory Concepts were refined based on the Exploratory Evaluation results before becoming Initial Concepts that were evaluated in Round 1.
Exploratory Evaluation	High-level evaluation of a series of Exploratory Concepts that uses the Initial Travel Demand and Land Use (TDLU) Tool and select key metrics, to understand the relative performance of concept features and to generate Initial Concepts that were evaluated in Round 1.
Gauge	The distance between the two rails of a train track. Broad gauge (tracks that are 5 feet, 6 inches apart) is used on the BART network, and standard gauge (tracks that are 4 feet, 8.5 inches apart) is used on the Regional Rail network. The two gauges are incompatible with one another.
Green Line	BART Berryessa/North San Jose – Daly City service
Initial Concept (Round 1)	A developed idea, consisting of a new transbay passenger rail crossing with an identified rail vehicle technology, markets accessed through existing or potential new stations, conceptual service plan, and associated infrastructure required. Concepts were evaluated in Round 1 to inform the development of the Representative Concepts to be evaluated in Round 2 and Options considered following Stage Gate 2.

TERM	DEFINITION
Initial TDLU[3] Tool	Initial travel demand forecasting tool that was used to generate high-level results for some metrics in the Exploratory Evaluation and Round 1 Evaluation. In the Round 2 Evaluation, it was used to estimate benefits for trips between the modeled areas of the Refined TDLU Tool (nine-county Bay Area) and the remaining areas in the Northern California Megaregion.
Intercity | Express Rail Service	A type of service for medium to long trips that connects regions and urban and rural communities at lower frequencies and higher average speeds compared with Urban | Metro rail services. Operators like Capitol Corridor, San Joaquins, Altamont Corridor Express, and others provide this service on shared Regional Rail/standard gauge tracks sometimes owned by private freight rail operators.
Justice40 Initiative	Justice40 is a new federal goal that states 40% of the overall benefits of certain federal investments (including clean transit) flow to communities that are marginalized, underserved, and overburdened by pollution.
North Branch (for Regional Rail)	The area north of downtown Oakland in the East Bay that is along the Capitol Corridor alignment, including the Emeryville, Berkeley, and Richmond corridor.
Northern California Megaregion	The 21-county area that comprises Alameda, Contra Costa, El Dorado, Marin, Merced, Monterey, Napa, Placer, Sacramento, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Sutter, Yolo, and Yuba counties.
Options	Includes Initial Concepts that have not been formally screened out and could be subject to further development and detailed evaluation. Options advanced at Stage Gate 2 include those associated with the Representative Concepts of the identified technology in the crossing and any supplemental improvements to the other system.
Orange Line	BART Berryessa/North San Jose – Richmond service
Peninsula	The areas south of San Francisco that are adjacent to the San Francisco Bay, including San Mateo County and the northwestern parts of Santa Clara County.
Perceived Rail Travel Time	Includes in-vehicle travel times, wait times, transfers, access/egress time components, and the inconvenience of each component as perceived by passengers; it is also expressed in units of time.

[3] The Initial TDLU Tool did not have land use model capabilities.

TERM	DEFINITION
Preliminary Project	The improvements to be recommended for advancement at Stage Gate 2 that consist of an identified rail technology in the crossing (BART or Regional Rail) for service delivery, and a set of options that will frame forthcoming feasibility studies and engagement with communities, stakeholders, and the public. Once identified, it will form the basis for work to define a Proposed Project (and the identification of any Alternatives) that is ready for environmental review at Stage Gate 3. Preliminary Project is to be used for the concept that is recommended at Stage Gate 2 and advanced to further development, but not for the sets of improvements evaluated before Stage Gate 2; those improvements are still to be referred to as concepts.
Priority Populations	Census tracts where people are most impacted by negative economic, mobility, community, and health and safety outcomes. Further details can be found in the document Priority Populations - An Updated Definition for Link21.
Proposed Project	A project sufficiently defined to be advanced to state and/or federal environmental review processes. It is planned that following the Stage Gate 2 resolution, the Preliminary Project will be further refined and developed into the Proposed Project. The Proposed Project is planned to be approved at Stage Gate 3 for potential advancement into the state and/or federal environmental review processes.
Red Line	BART Richmond – Millbrae + SFO (San Francisco International Airport) service
Refined TDLU Tool	Refined travel demand and land use forecasting tool that was used to generate results for some metrics in the Round 2 Evaluation. The Refined TDLU Tool modeled the nine-county Bay Area.
Regional Rail (technology/track type)	A technology and track type used by multiple agencies on an interconnected rail network throughout the Megaregion. From an infrastructure perspective, Regional Rail is a single- or bi-level vehicle on standard-gauge tracks that is sometimes powered by electricity using an overhead catenary system. Regional Rail infrastructure is owned in some cases by the passenger operator (e.g., Caltrain from San Francisco to San José) and in other cases a freight operator (e.g., Capitol Corridor mostly operates on Union Pacific Railroad right-of-way). On this technology and track type, operators provide two types of service: Intercity | Express and Urban | Metro. Several types of train vehicles can operate on this network, but BART cannot.

TERM	DEFINITION
Regional Rail Crossing Concept	A new transbay passenger rail crossing concept that uses Regional Rail (standard gauge) technology. If the crossing uses Regional Rail technology, it should connect, at a minimum, to existing Regional Rail infrastructure in San Francisco and the East Bay. A Regional Rail concept may have improvements to the BART network.
Representative Concept (Round 2)	A high-performing concept that is a reasonable representation of the crossing technology. Representative Concepts are subject to detailed evaluation in Round 2 to inform the identification of a crossing technology, then further advanced to a Preliminary Project for Stage Gate 2.
Round 1	The evaluation of the Initial Concepts to develop (one or more) high-performing Representative Concept(s) for each crossing technology to be evaluated in Round 2.
Round 2	The evaluation of Representative Concepts to inform the recommendation to identify a Preliminary Project (and potential alternatives) to advance at Stage Gate 2.
South Branch (for Regional Rail)	The area south of downtown Oakland in the East Bay that is along the Capitol Corridor alignment, including the Jack London and Coliseum corridors.
Stage Gate	Key points in the development and delivery of the Link21 Program that provide fundamental strategic definition to Link21's progress. They memorialize the actions made at the appropriate governance levels based upon staff recommendations. Among the many actions that must be made over Link21's life cycle, stage gates capture the foundational guidance that determine the program's direction, effectively closing one part of the life cycle, opening the next, and confirming support for continued investment and progress of the program to the next stage gate.
Stage Gate 2	At Stage Gate 2, the Link21 Program will reach the milestone of identifying the recommended train technology for the crossing. This will enable the identified Preliminary Project to be refined, with continued community, stakeholder, and public engagement, into a Proposed Project ready for environmental review.
Transbay	Refers to crossing the San Francisco Bay, specifically between San Francisco and Oakland.
Urban | Metro Rail Service	A type of service that operates within metro regions at higher frequencies and medium average speeds. BART currently provides this service. Caltrain will provide this type of service with its modern, electrified trains starting in 2024.
Variant	Variants are concepts that are similar to the Exploratory Concepts, Initial Concepts, or Representative Concepts, but they have minor differences to specific features, such as service, markets, and/or infrastructure.

TERM	DEFINITION
Yellow Flag	Yellow flags represent environmental risks that may result in substantial challenges for design to address during environmental review and permitting, and/or require extensive mitigation to address. A yellow flag is not necessarily a fatal flaw or something that will prevent a project concept from being advanced through environmental review or approval. It is a notification of potential risk to inform other factors included in the business case analysis.
Yellow Line	BART Antioch – SFO (San Francisco International Airport) + Millbrae service

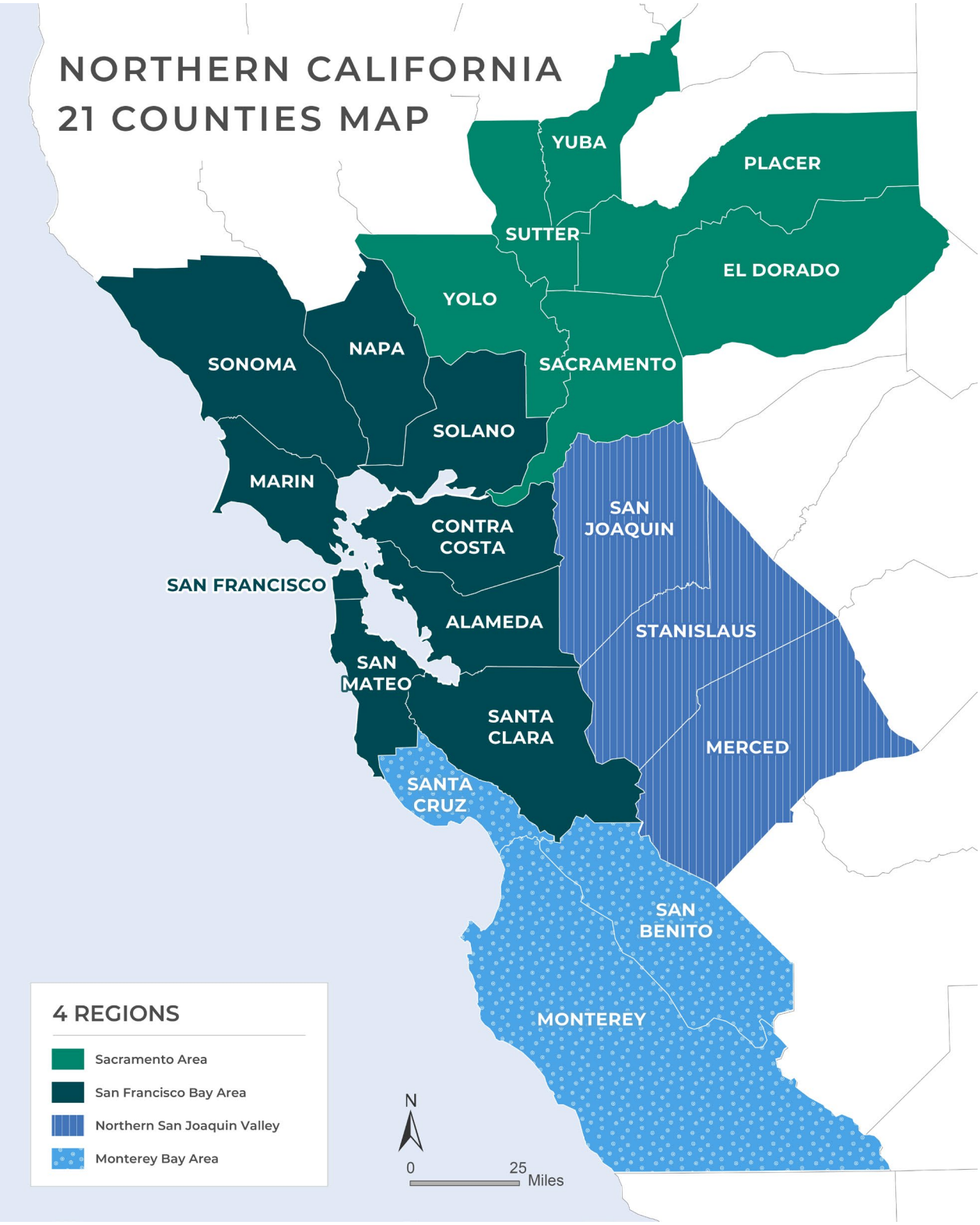
1. Introduction

1.1. Link21 Program

The Link21 Program (Link21) is a generational initiative with the vision to transform the Megaregion passenger rail network “into a faster, more integrated system that provides a safe, efficient, equitable, and affordable means of travel” for everyone.

Link21 is sponsored by the San Francisco Bay Area Rapid Transit District (BART) and Capitol Corridor Joint Powers Authority (CCJPA) with support from the California State Transportation Agency and other partners. The 21-county area of the Northern California Megaregion (Megaregion) is presented in **Figure 1-1**.

Figure 1-1. Northern California Megaregion



1.2. Crossing Project

At the core of Link21 is the **Crossing Project** — a new transbay passenger rail crossing between San Francisco and Oakland. This will feature a new tunnel under the San Francisco Bay for either BART or Regional Rail trains, connections back to the existing rail networks on either side of the San Francisco Bay, and additional improvements away from the crossing to provide higher levels of train service in the crossing as needed.

The Crossing Project could unlock transformational economic, environmental, and quality of life benefits for residents and businesses in the Megaregion. It is a key element of the vision to transform passenger rail in the California State Rail Plan (2023).

1.3. Purpose and Audience

The purpose of the Preliminary Business Case is to present analyses and findings to inform the identification of the **train technology** — either BART or Regional Rail — in the new crossing. Both differ in their service provisions, track types, power sources, and train car designs, making them fundamentally distinct and non-interoperable.

The technology in the crossing **fundamentally determines** how services can connect to the existing rail network. Each enables different types of services, serving different markets, and consequently meets the Link21 goals and objectives in different ways. The choice of technology in the crossing will influence the services Link21 can reasonably provide and will shape the nature of the rail experience for decades to come.

The purpose of the Preliminary Business Case is **not** to define the exact details of a future Crossing Project, like station locations or alignments, but to inform the **strategic decision** of which technology is best suited to meeting Link21's goals and objectives. This will enable the scope of the Crossing Project to be refined and prepare for subsequent formal environmental review.

The Preliminary Business Case includes evaluating both a BART and Regional Rail crossing against a no-build alternative to understand the broad benefits, costs, and key considerations of the different investment options. Further details on how the Preliminary Business Case sits within the Link21 planning process and informs key milestones is set out in Section 2.1.

This document has a broad intended audience, including Board members, agency stakeholders, and members of the public as it articulates the key benefits and considerations of the Crossing Project.

1.4. Structure of this Document

The remainder of this document is structured as follows:

- **Background (Chapter 2):** Summary of the Link21 planning process, business case process, and policy context and a description of the existing Northern California rail network.
- **Strategic Context (Chapter 3):** Summary of the key challenges Link21 is intended to address (Problem Statement) and the accompanying Vision Statement and Goals and Objectives.
- **Investment Options (Chapter 4):** High-level description of the concepts being evaluated and how they were developed.
- **Evaluation Approach (Chapter 5):** Overview of the approach and methodology used to evaluate concepts and develop the analyses and findings presented in this document.
- **Evaluation Findings (Chapters 6 to 9):** Evaluation results and findings supported by the analyses, particularly those that helped differentiate between the two technologies. Organized by the four business cases: Strategic, Economic, Financial, and Deliverability.
- **Limitations (Chapter 10):** Discussion of the potential limitations of the evaluation approach and findings.
- **Evaluation Summary and Findings (Chapter 11):** High-level summary of findings and the key differentiators between technologies, as presented in Chapters 6 through 10, and next steps.

Alongside the main body of this report are several appendices that provide further details as follows:

- **Exploratory Evaluation and Round 1 Evaluation reports (Appendix A and Appendix B, respectively)** describe the early concepts evaluated, evaluation approach adopted, and findings from previous evaluation rounds leading up to the current Round 2. They include the high-level evaluation of concepts that included two new crossings — a BART and a Regional Rail crossing.
- **Concept Development Process Report (Appendix C)** summarizes how the data collection, early concepts that were identified and evaluated, and previous rounds of evaluation helped define the crossing concepts evaluated in Round 2. It includes a brief description of the early ideas and rationale for not progressing them for further evaluation as part of the Crossing Project.
- **Round 2 Evaluation Methodology and Assumptions Report (Appendix D)** builds on Chapter 5 and provides further details on the approach and assumptions used to evaluate concepts. It includes a summary of key assumptions that underpin the future Baseline scenario the concepts were evaluated against, such as population

and employment assumptions, fare policies, and rail and transit improvements. It summarizes the intent of each evaluation metric and any key parameters (e.g., value of time, discount rates).

- **Round 2 Evaluation Supporting Information Report (Appendix E)** provides additional information that underpins the evaluation results presented in this report. It includes a selection of detailed outputs and analyses from various models and tools that were used in the evaluation, such as maps illustrating the geographical distribution of travel time savings and volume to capacity ratios of key links. It also provides the full narrative of qualitative metrics (e.g., reliability and environmental risks).
- **Problem Statement Review Report (Appendix F)** summarizes a high-level, technical review of the key themes relevant to Link21's Problem Statement, taking into consideration changes since the pandemic (e.g., crowding) to determine the extent to which the problems described in the Problem Statement remain valid.

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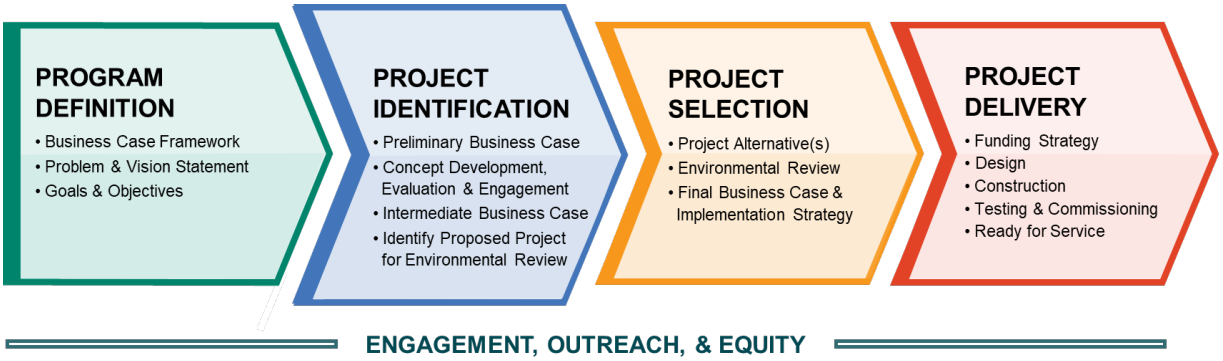
2. Background

2.1. Planning Process

Link21 is a multi-phase, long-range planning initiative that includes close coordination with megaregional agency partners, community stakeholders, and the public throughout each phase of work. Link21 uses a **Stage Gate Process**, which is an international best practice, to improve decision-making and better manage risk throughout the program.

The Link21 planning process is organized into four separate phases (**Figure 2-1**).

Figure 2-1. Planning Process Phases



These phases are separated by reviews and signoffs at specific **stage gates** (which occur at key milestones) that memorialize decisions and ensure the program's readiness to advance.

The **Program Definition** phase established several Link21 foundational elements, including the problem and vision statements and goals and objectives, which are summarized in Chapter 3. This informed the structure, steps, and timeline for the business case process and the key assumptions to be used in subsequent evaluation steps. This phase concluded in spring 2022.

The current **Project Identification** phase, which this Preliminary Business Case is a critical part of, focuses on developing and refining project ideas. The goal of this phase is to identify a **Preliminary Project**, consisting of an identified rail technology in the crossing (BART or Regional Rail) for service delivery, and a set of options that will frame forthcoming feasibility studies and engagement with communities, stakeholders, and the public. Once identified, it will form the basis for work to define a **Proposed Project** (including any potential Alternatives) that is ready for environmental review.

This Preliminary Business Case Report provides the analyses and considerations for both a BART and Regional Rail crossing to inform the identification of a crossing technology (and a Preliminary Project). At Stage Gate 2, Link21 will reach the key milestone of identifying the recommended train technology for the crossing. This will enable the identified Preliminary Project to be refined, with continued community,

stakeholder, and public engagement, into a Proposed Project ready for environmental review.

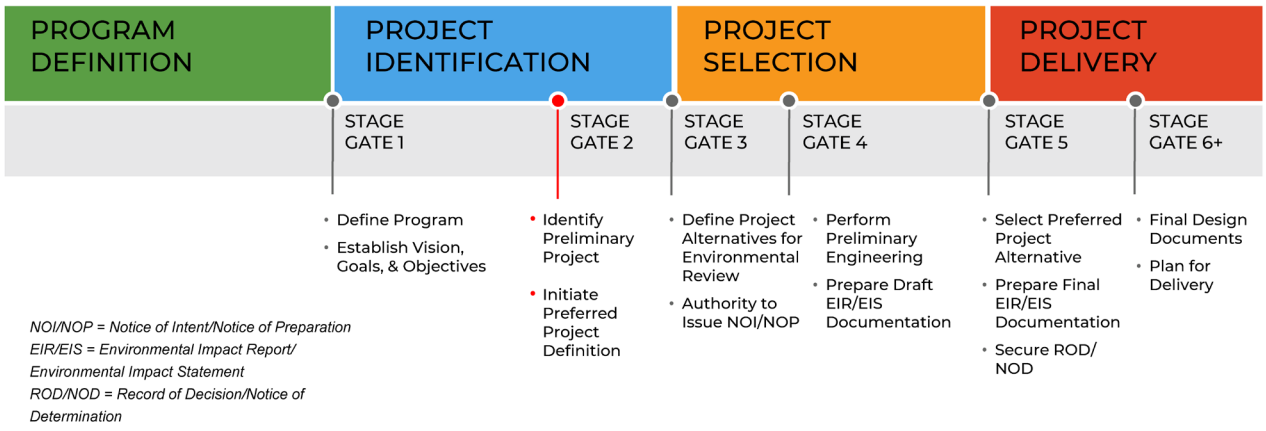
A subsequent Intermediate Business Case will support further evaluation to inform the identification of a Proposed Project (and any potential Alternatives) for environmental review in accordance with the National Environmental Policy Act and/or California Environmental Quality Act.

The **Project Selection** phase will identify a Project Alternative that will be evaluated within the environmental processes of the National Environmental Policy Act/California Environmental Quality Act. A Final Business Case will assess, in detail, the benefits and costs for the Project Alternative(s) and provide analyses for justifying investment. The Project Alternative(s) in the Final Business Case will correspond with the selected alternative(s) evaluated under the National Environmental Policy Act/California Environmental Quality Act.

The **Project Delivery** phase will focus on implementing the approved project using design and construction packages. Future milestones in this phase will be developed as the Preferred Project Alternative is selected and advanced towards project delivery.

Figure 2-2 illustrates the Link21 stage gates and summarizes how they relate to the four project phases.

Figure 2-2. Link21 Stage Gates



2.2. Business Case Process

Link21 is using a **business case process** to guide decision-making throughout the program. It is an approach to consider a comprehensive, organized collection of analyses that establishes the rationale for why a problem or opportunity should be addressed, and it makes the case for doing so through investment. The process ensures benefits, costs, and risks of such investments are sufficiently evaluated alongside strategic considerations when considering the case for investment.

The process for developing a business case supports decision-makers, planners, analysts, and designers in the planning and ultimate delivery of infrastructure projects and other large investments by providing a comprehensive framework to identify, evaluate, and compare potential concepts. Business cases can identify key tradeoffs; however, they do not eliminate the need for decision-makers to carefully consider and weigh the benefits, costs, and risks before decisions are made.

2.3. Existing Passenger Rail Network

Rail services in Northern California perform different roles in connecting people and places across the Megaregion. Services are categorized in two groups: **Urban | Metro** and **Intercity | Express**.

Urban | Metro is a type of service for short to medium trips that operates within metro regions at high frequencies and medium average speeds. BART provides this service today, and Caltrain will provide this type of service[4] with its modern electric trains starting in 2024:

- More frequent trains (every 2 to 15 minutes)
- More stops/shorter distances between stations (1 to 5 miles apart)
- Medium average speeds (20 to 40 miles per hour)

Intercity | Express is a type of service for medium to long trips that connects regions and urban and rural communities at lower frequencies and higher average speeds. Operators like Capitol Corridor, Amtrak, San Joaquins, Altamont Corridor Express, and others provide service on shared tracks that are typically owned by private freight rail operators:

- Less frequent trains (every 30 to 60+ minutes)
- Fewer stops/longer distances between stations (5+ miles apart)
- Higher average speeds (40+ miles per hour)

Rail services in the Megaregion are primarily provided by **two systems**: BART and Regional Rail. These systems differ in their track types, power sources, and train car design, making them fundamentally distinct and non-interoperable.

2.3.1. BART System

BART is a passenger rail network within the San Francisco Bay Area (Bay Area) that features fast, electric trains that currently serve a total of 50 stations. It operates as a 'closed system,' which means it operates on its own dedicated set of broad-gauge

[4] Starting in 2024, Caltrain will introduce new electric trains that are capable of faster and more frequent service. Every station will receive at least a half-hourly off-peak service with up to 4 trains per hour in the peak, which is considered Urban | Metro service.

tracks that are not shared with other passenger or freight operators. It was exclusively designed for providing reliable, high frequency **Urban | Metro** service.

BART connects San Francisco and San Mateo counties to Contra Costa, Alameda, and Santa Clara counties via the existing Transbay Tube. The BART Silicon Valley Phase II project, which is currently under development, will extend BART service 6 miles from the Berryessa/North San Jose Station to downtown San Jose and Santa Clara.

Before the onset of the pandemic, BART experienced significant crowding during traditional commuter peak periods, often operating at or near capacity through the Transbay Tube, especially for trips to and from downtown San Francisco. Although passenger demand reduced considerably post-pandemic, demand is expected to gradually recover. Evening and weekend ridership has recovered more strongly than traditional commute hours, although it is still less than pre-pandemic levels. Continued population and employment growth, alongside increasing congestion on the Bay Bridge, is expected to increase rail demand and crowding over the long term.

BART plans to expand capacity with the implementation of the Core Capacity Program, which will allow it to operate up to thirty 10-car trains per hour in each direction through the existing Transbay Tube, compared to the current 24 trains per hour. Nonetheless, the existing Transbay Tube remains the key constraint in the system by limiting the ability to further increase BART transbay service frequency to and from the East Bay. In addition, there is no rail alternative to the Transbay Tube, making BART riders susceptible to considerable delays in the event of any disruption and constraining the ability to offer extended service hours.[5]

2.3.2. Regional Rail System

Regional Rail provides service within the Bay Area and across the broader Megaregion, with an extensive geographic coverage of interoperable standard-gauge tracks. The Regional Rail network is less developed, some routes operate with low service frequencies and poor reliability, and passenger trains often share tracks with freight and other operators. It has the potential to support a wide range of passenger rail services, including both **Urban | Metro** and **Intercity | Express**, through shared interoperability.

Regional Rail provides **Intercity | Express** services across the broader Megaregion, and it will provide **Urban | Metro** services along the Peninsula[6] in 2024 after the completion of the Caltrain Electrification Project (and related service improvements).

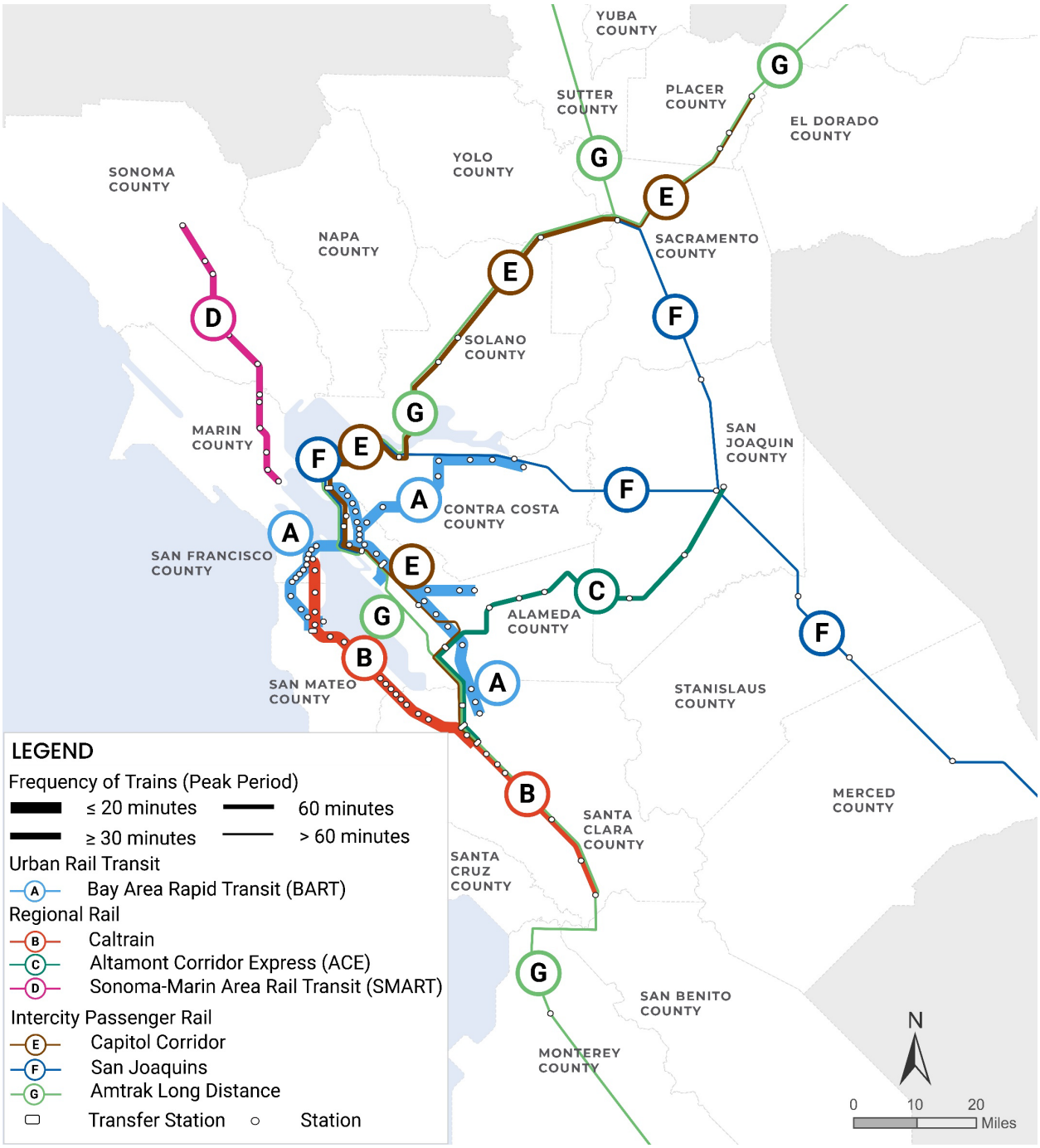
Figure 2-3 illustrates where Regional Rail operators provide service within the Megaregion and their existing frequencies.Urban rail transit service, provided by BART,

[5] Although longer service hours in the evening and overnight periods are predominately policy and operator driven, the lack of an alternative transbay crossing limits the ability to maintain transbay rail service while implementing localized track outages to maintain the network.

[6] The areas south of San Francisco that are adjacent to the San Francisco Bay, including San Mateo County and the northwestern parts of Santa Clara County.

has the highest frequency at one train every 20 minutes or less. Regional rail service, provided by Caltrain, ACE, and SMART, has more variable frequency at one train between every 20 and 60 minutes. Intercity passenger rail service, provided by Capitol Corridor, San Joaquins, and Amtrak Long-Distance, generally has the lowest frequency at one train every 60 minutes or more.

Figure 2-3. Map of Existing Rail Services in the Megaregion



Although the Regional Rail network is extensive, several key constraints limit the ability to provide fast, frequent, and reliable Regional Rail service:

- **Shared right-of-way** with passenger and freight trains sharing the same tracks and frequent at-grade crossings reduce the capacity and frequency of passenger services and have a negative impact on reliability.
- **The absence of a transbay crossing creates a gap in the network**, which effectively isolates the Regional Rail networks in the East and West bays from each other. This limits connectivity between San Francisco/the Peninsula and the East Bay, Sacramento Area, and Northern San Joaquin Valley.
- **Various other major capacity and operating constraints**, including the drawbridge crossing of the Carquinez Strait, are a significant source of delay for train services.

There are extensive plans to improve the current Regional Rail network to help address these constraints, as outlined in the *California State Rail Plan*.

These include:

- Projects currently **under construction**, such as the electrification of Caltrain services, that will bring faster and more frequent service to the Peninsula.
- Projects **included within adopted regional transportation plans,**[7] many of which are fully or partly funded, such as The Portal (formerly known as the Downtown Rail Extension or DTX), that will bring Regional Rail services from the Peninsula to downtown San Francisco at the Salesforce Transit Center.
- Longer-term projects in **preliminary planning**, such as a new rail crossing of the Carquinez Strait, that will enable faster, more frequent, and more reliable rail services along the Capitol Corridor.

Table 2-1 summarizes the key differences between BART and Regional Rail infrastructure/train technology.

[7] A regional transportation plan (RTP) is a fiscally constrained long-term blueprint of a region's transportation system, typically updated every four years for a 30-year planning horizon, which identifies the transportation improvements for its metropolitan area and creates a framework for prioritizing transportation investments. Further detail is set out in Section 2.4.4.

Table 2-1. Characteristics of BART and Regional Rail Infrastructure/Train Technology

CHARACTERISTICS	BART TECHNOLOGY	REGIONAL RAIL TECHNOLOGY
Example vehicle		
Service type	• Urban | Metro services	• Urban | Metro services • Intercity | Express services
Track	• Broad gauge: 5 feet, 6 inches apart • Dedicated tracks not shared with operators other than BART	• Standard gauge: 4 feet, 8.5 inches apart • Often shared with freight and passenger rail operators
Vehicle characteristics	• Lighter, single level, more room for standees	• Heavier, single or bi-level, typically more seating for longer distance travel
Speed[8]	• Up to 80 miles per hour	• Current: Up to 79 miles per hour • Future: Up to 125 miles per hour
Propulsion	• Electric Multiple Unit powered by electrified third rail	Current: • Diesel locomotive • Diesel Multiple Unit (Sonoma-Marin Area Rapid Transit only) Future: • Electric Multiple Unit powered by overhead system or battery[9] • Hydrogen Multiple Unit powered by hydrogen
Performance	• Quick acceleration and deceleration, ideal for frequent Urban | Metro service stops	Future: • Ability to accelerate and decelerate quickly for Urban | Metro services • Ability to attain high speeds for Intercity | Express services

[8] Average speeds are lower and depend on the number of and distance between stops and the availability of straight track.

[9] Caltrain services along the Peninsula will operate with new, electric trains starting in September 2024, after completion of the Caltrain Modernization Program. The *California State Rail Plan* outlines proposals for the entire Regional Rail network to be operated by zero-emission (electric or hydrogen) trains by 2035.

2.4. Policy Context

Several state, regional, and local policy documents and technical studies have included a new transbay passenger rail crossing and/or informed the Link21 planning work to date, including the development of the business case. The following sections present an overview of these documents and studies.

2.4.1. Infrastructure Investment and Jobs Act

The Infrastructure Investment and Jobs Act,[10] also known as the Bipartisan Infrastructure Law, provides unprecedented federal funding for rail improvement projects in the United States between 2022 and 2026. It involves greatly expanding existing Federal Railroad Administration programs and creating new programs to enhance the country's rail network. It provides $102 billion in total rail funding, including $66 billion from advanced appropriations and $36 billion in authorized funding.

2.4.2. California State Rail Plan

The California State Rail Plan was adopted by Caltrans and the California State Transportation Agency in public draft form in March 2023, and it proposes a vision of a unified, integrated statewide rail and transit network that delivers on California's ambitious economic, environmental, and equity goals. It is aligned to wider policy within the state, including Caltrans' California Transportation Plan 2050 and the California State Transportation Agency's Climate Action Plan for Transportation Infrastructure (2021).

California State Rail Plan Vision

California will have a customer-focused, fully integrated rail system serving as a preferred mode of choice for both passengers and shippers. The rail system will enhance economic growth, improve quality of life, advance equity of the State's most vulnerable and impacted communities, while being a force in meeting California's ambitious climate goals.

The *California State Rail Plan* consists of almost $100 billion in rail and transit capital investments that will combine to form a unified, integrated statewide network, that is categorized by various time horizons (short, medium, and long term) and service types (**Intercity | Express** and **Urban | Metro**, alongside integrated bus). The network envisioned under the *California State Rail Plan* aims to serve up to 6.5 million daily

[11] Section 3.4.3 Long-Term (~2050) Investments, *California State Rail Plan* Public Draft, 2023.

passengers and increase rail and transit mode share to 14%, and in turn achieve the California Air Resources Board's goal of a 20% reduction in vehicle miles traveled.

A second transbay crossing using Regional Rail (standard gauge) technology is required to achieve the plan's future service goals and forms a core element of the Vision. The plan stresses how its vision for a zero emission, integrated rail corridor between the Peninsula and Sacramento would not be possible without a second crossing, and notes how it could help enable an integrated rail network in the Bay Area:

> Future rail service in the Bay Area is highly dependent on a second Transbay crossing managed and led through the Link21 Program. The zero emission and integrated rail corridor between the San Francisco Peninsula and Sacramento identified in the Vision would not be possible without a second bay crossing.
>
> This possible long-term improvement provides an opportunity to extend conventional electrified rail services, including HSR [high-speed rail] from Southern California and regional electric service between San Jose and San Francisco, across the Bay to Oakland; and to connect electrified passenger rail service from Sacramento directly to San Francisco and San Jose along the Peninsula Corridor.[11]

2.4.3. Corridor ID Program

The Corridor Identification and Development (Corridor ID) Program, launched by the Federal Railroad Administration in 2022 and authorized by the Bipartisan Infrastructure Law, provides a new source of federal funding for intercity passenger rail planning and development studies. It is intended to help guide intercity passenger rail development throughout the country and create a project pipeline that is ready for implementation.

The Corridor ID Program will develop planned enhancements to several key **Intercity | Express** service corridors in Northern California's Regional Rail network:

- **Capital Corridor** between San Jose and Auburn, with a potential extension to San Francisco, that is delivered through Link21, and to Salinas, Novato, and Reno/Sparks (Nevada).
- **San Joaquins Valley Corridor** between Sacramento/Oakland and Merced, with a potential extension north from Sacramento to Chico and Redding.
- **California High-Speed Rail Phase 1 Corridor** between San Francisco, San Jose, the Central Valley, and Los Angeles/Anaheim.

Each corridor will develop a service development plan that will identify the key enhancements and phasing of infrastructure components. Since all three corridors adopt standard-gauge/Regional Rail technology, adopting Regional Rail technology for

[11] Section 3.4.3 Long-Term (~2050) Investments, *California State Rail Plan* Public Draft, 2023.

the Crossing Project could mean Link21 forms an integral part of this connected network.

Following Stage Gate 2, and after the train technology for the crossing has been identified, it is expected to adopt a more integrated planning approach across both programs, ensuring their collective goals and objectives can be achieved. This is especially true for a Regional Rail crossing, which would have strong inter-dependencies with planned enhancements to the Capital Corridor and San Joaquins Valley Corridor.

2.4.4. Plan Bay Area 2050 and Other Metropolitan Planning Organization Regional Transportation Plans

The Megaregion has six metropolitan planning organizations that encompass the following counties:

- **Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments:** Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties
- **Sacramento Area Council of Governments:** El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba counties[12]
- **Association of Monterey Bay Area Governments:** Monterey, San Benito, and Santa Cruz counties
- **San Joaquin Council of Governments:** San Joaquin County
- **Stanislaus Council of Governments:** Stanislaus County
- **Merced County Association of Governments:** Merced County

Each metropolitan planning organization is federally mandated to produce a regional transportation plan, which is a long-term blueprint of a region's transportation system, typically every four years for a 30-year planning horizon. While individual metropolitan planning organizations may have slightly varying goals for their respective regional transportation plans, at its core a regional transportation plan identifies the transportation needs for its metropolitan area and creates a framework for prioritizing transportation investments.

MTC's latest regional transportation plan, Plan Bay Area 2050, was adopted in October 2021. It includes Link21 as a major planned investment and the "anchor of a plan for rail in the Bay Area" that would enable an "expanded and modernized regional rail network."

[12] Note that El Dorado and Placer counties also have their own transportation planning agencies that work alongside the Sacramento Area Council of Governments and the separate Tahoe metropolitan planning organization (the Tahoe Regional Planning Agency).

Plan Bay Area 2050, along with other megaregional metropolitan planning organizations' regional transportation plans, also describes each metropolitan planning organization's most realistic assessment of future conditions in their respective jurisdictions, including population and employment growth and a list of planned or programmed future transportation investments. These future conditions in each of the six megaregional regional transportation plans are a key informant of Link21's future Baseline,[13] as described in Section 5.3.

2.4.5. Other Regional and Local Studies

Beyond the MTC's Plan Bay Area 2050, several other regional and local studies over the past decade have contributed to the conclusion that a new transbay passenger rail crossing is needed. These include:

- The Megaregional Case for a New Transbay Rail Crossing (2021) is a report that was issued by the Bay Area Council Economic Institute that sets out the travel time, service delivery, economic, and environmental benefits of a new transbay passenger rail crossing.
- An MTC-led perspective paper titled Crossings: Transformative Investments for an Uncertain Future (2019) that explores the merits of various transbay crossing alternatives, including road bridge crossings. It concludes that a rail or transit-only crossing should be considered for further analysis and confirms that a new rail crossing would deliver substantial benefits to the nine-county Bay Area.
- The Bay Area Core Capacity Transit Study (2017) is a multi-agency study that was led by MTC and that identified, among other issues, a growing disparity between rail and transit demand and capacity in the Transbay Corridor between San Francisco and Oakland.
- Older documents and studies, including the San Francisco Bay Crossings Study Update (2012) and San Francisco Bay Area Regional Rail Plan (2007).

[13] The Baseline is a future scenario benefits, costs, and risks over a project life cycle are evaluated against. The Baseline adopts future planning assumptions relating to demographics, transportation networks, and policies that are consistent with Plan Bay Area 2050 and other adopted RTPs in the Megaregion.

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3. Problem and Vision Statement, Goals and Objectives

3.1. Introduction

For the Megaregion to continue growing and prospering, and for this prosperity to be inclusive, equitable, and sustainable, it needs **reliable, fast, and accessible transportation** that connects cities and communities across the San Francisco Bay and beyond.

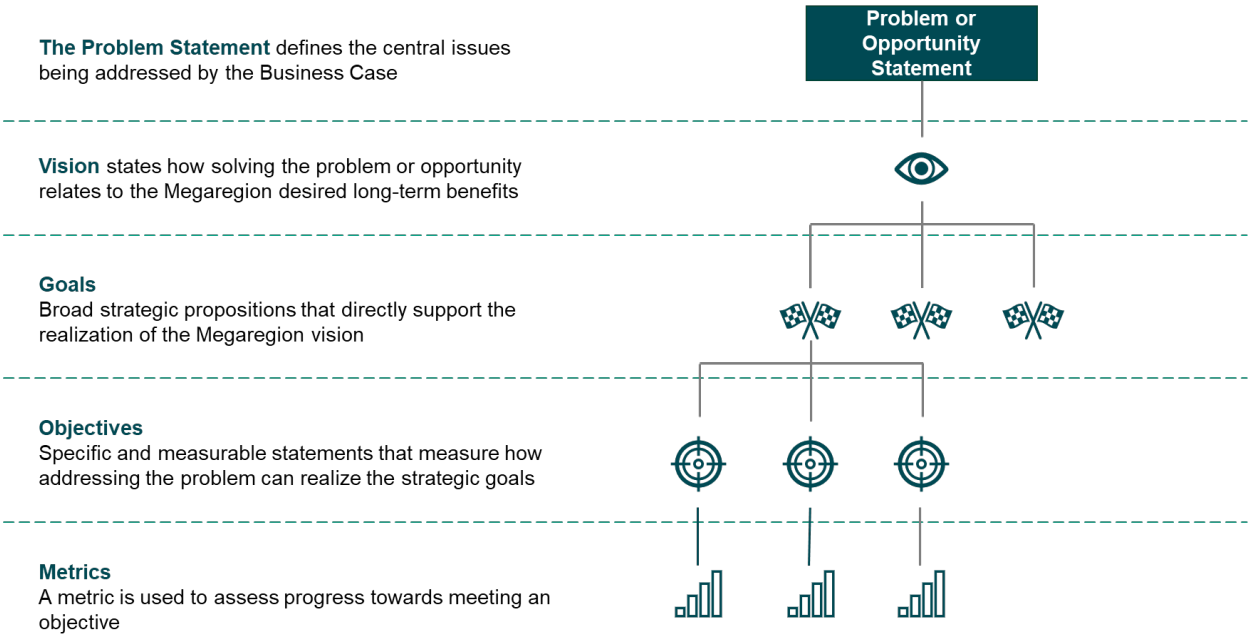
This need is particularly critical in the **Transbay Corridor** (Bay Bridge and Transbay Tube) between Oakland and San Francisco. It is one of the most congested corridors in the country, but it has the potential to unlock substantial improvements in mobility and opportunity in the Megaregion.

Without investment, the regional transportation system will suffer higher levels of congestion and crowding, reduce the quality of life and economic opportunities, and create more pollution. These **negative outcomes will not affect everyone equally**. Priority populations will likely bear the greatest disproportionate impact.

3.2. Strategic Case Framework

The business case is underpinned by a set of foundational elements that collectively articulate the rationale for investment, as set out in the Problem and Vision Statement & Goals and Objectives (in short form) and the Strategic Case Framework (in long form with accompanying analyses). **Figure 3-1** is a high-level illustration of the *Strategic Case Framework*.

Figure 3-1. Link21 Strategic Case Framework Overview



3.3. Problem Statement

The Problem Statement defines key challenges in the Megaregion that could have transportation, quality of life, economic, and environmental impacts on residents and workers Link21 is intended to help address. It established three key problems that threaten the performance of the transportation system and, more broadly, the promotion of equity and livability, economic opportunity, and environmental and public health across the Megaregion:

1. Insufficient rail access, and unreliable and unaffordable service, leaves residents with inadequate options beyond driving with many struggling to access jobs and other key destinations and opportunities by rail.
2. Roadway and railroad capacity is insufficient in key travel corridors.
3. Priority populations face particularly difficult challenges related to transportation (including fare affordability), housing, job accessibility, and other factors.

The Problem Statement was originally developed prior to the COVID-19 pandemic, which brought about significant change in working preferences and travel patterns. A review of the Problem Statement was undertaken to ensure the challenges identified remain pertinent and to provide additional analysis of post-pandemic travel demand. This is presented in *Appendix F: Problem Statement Review Technical Memorandum*.

Both the pre-pandemic **Problem at a Glance**, from the adopted Strategic Case Framework, together with the findings of the Problem Statement Review, are set out in the following sections.

3.3.1. Adopted Problem at a Glance

The current transportation network cannot meet the needs of a growing Megaregion.

The 21-county Northern California Megaregion, encompassing a vast area of over 24,000 square miles, is home to over **12.5 million people** and is the **fifth largest U.S. megaregional economy**. These numbers have increased significantly over the last 30 years and population is expected to reach **16 million by 2050.**[14]

Along with this growth and prosperity, the Megaregion has experienced increasing income inequality and displacement. Many residents struggle to live affordably within easy reach of work, school, shopping, and recreation. Road and freeway congestion is among the nation's worst, and opportunities for roadway expansion are greatly limited and inconsistent with state and regional goals. The existing and proposed future BART and Regional Rail (including commuter, intercity, and high-speed rail) network, and in particular the Transbay Corridor between Oakland and San Francisco, is **unable to effectively meet the growing needs of the Megaregion**. The lack of multiple reliable transportation choices will undermine community stability and limit opportunities for the Megaregion's residents and businesses for years to come.

In the Transbay Corridor, BART trains are frequently **overcrowded**, and with **limited alternate routes** any disruption to service negatively impacts travelers regionwide. In several areas, transit and rail are either unavailable, unaffordable, or undependable due to **infrequent or unreliable service**; lack of evening, weekend, and late-night availability; and long travel times requiring multiple transfers and fares. The lack of Regional Rail connectivity greatly limits its effectiveness as an accessible and practical alternative to congested freeway corridors.

Without investments in the current systems to enable a robust passenger rail network and vibrant, stable communities, most trips in these corridors and around the Megaregion will continue to be made by car, **contributing to increased congestion and greenhouse gas emissions, unreliable travel times, and damage to the environment and public health.** Transit-dependent and reliant communities will also suffer from continued inadequate access, crowded rides, and slow and inefficient routes.

3.3.2. Problem Statement Review

Despite the significant ongoing changes to population, employment, and travel behaviors that were initiated by the COVID-19 pandemic, the analysis undertaken as part of the review concluded that most transportation problems identified in the original

[14] Note that figure adopts pre-pandemic California Department of Finance projections, which envisaged higher levels of population growth than are currently forecast. The implications of slower population growth on the evaluation results were examined through a specific 'stress test', as reported in Appendix E.

Problem Statement (2021) remain relevant and pertinent. The traveler experience remains worse for rail than auto travelers in several aspects — in particular, rail service frequency and reliability have deteriorated since 2021. Even with reduced demand for transbay rail travel, the demand for total transbay travel could still exceed available capacity by 2050 if not sooner.

In the long term, the combination of a constrained transportation network and high housing and transportation costs could have far-reaching consequences for the Megaregion, chief among them limited population and employment growth. Without major investments in the rail network to improve service quality, connectivity, and coverage, cars will remain the most feasible and attractive mode of travel, contributing to increased congestion and greenhouse gas emissions, unreliable travel times, and other adverse outcomes.

On the other hand, rail and transit provide a more sustainable alternative that facilitates more sustainable megaregional growth. New connections between homes, jobs, and other key destinations could be made, and transit-dependent and priority populations could benefit from significantly improved access and service levels. Greater rail and transit usage will continue to help the Megaregion meet its ambitious livability, economic, and environmental goals.

3.4. Vision Statement

The **Vision Statement** builds on the challenges identified in the Problem Statement to describe the ideal future with implementation of Link21.

Link21 Vision Statement

The Link21 Program and its partners will transform the BART and Regional Rail (including commuter, intercity, and high-speed rail) network in the Northern California Megaregion into a **faster**, more **integrated** system that provides a **safe**, **efficient**, **equitable**, and **affordable** means of travel for all types of trips.

This program, including a new transbay passenger rail crossing between Oakland and San Francisco, will enhance environmental quality, livability, and economic opportunity while protecting against community instability and displacement in the Megaregion as it improves the travel experience. With key investments that leverage the existing rail network and increase capacity and system reliability, rail and transit will better meet the travel needs of residents throughout the Megaregion.

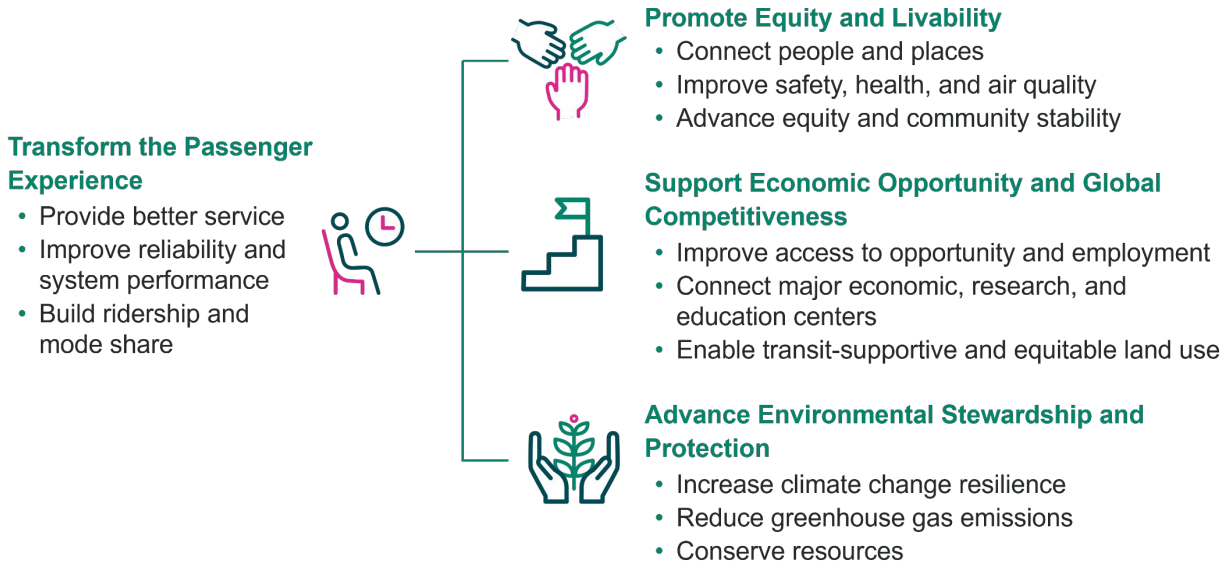
Similar to the Problem Statement, while its core themes and principles are enduring over the life of Link21, it can be refined and made more specific as Link21 matures.

3.5. Goals and Objectives

Goals and objectives are action-oriented statements that are derived from the problem and vision statements. Goals are broad descriptions of how Link21 can address elements of the problem statement, achieve elements of the vision statement, and deliver benefits across the Megaregion. Each goal is then broken down into more specific, lower-level outcomes known as objectives. These goals and objectives were developed based on the aspirations of agencies across the Megaregion and input from stakeholders and the general public.

The Link21 goals and objectives are summarized in **Figure 3-2.**

Figure 3-2. Link21 Goals and Objectives



Note: Link21 goals are capitalized bold headings. Objectives are listed below each goal.

The goals and objectives are presented at two levels with the delivery of transportation benefits as a foundational goal, which in turn will enable the delivery of a broad range of societal benefits, such as promoting equity and livability, economic opportunity, and environmental stewardship.

The goals and objectives underpin key decisions made during the Project Identification phase, including the development and evaluation of concepts, and the identification of a Preliminary Project (and potential alternatives) for further consideration. The problem statement, vision statement, and goals and objectives can be found in the Strategic Case Framework. The expected outcomes from the goals and objectives are summarized in **Table 3-1**.

Table 3-1. Goals and Expected Outcomes

GOAL	BENEFIT/OUTCOME
Transform the passenger experience	Link21 could change how passengers perceive and use rail travel, better connecting cities and communities across the San Francisco Bay and beyond. By enhancing frequency and capacity, enabling new one-seat rides, and improving transfers and the ability for extended service hours, it could reduce crowding and travel times. This, and an alternative transbay rail route, could create a more reliable and efficient rail network, transforming it into a more dependable mode of transportation across the Megaregion.
Promote equity and livability	Central to Link21 is its commitment to equity and livability. It looks to provide a more equitable distribution of benefits to communities that have been marginalized, including increasing rail ridership and improving access to important community resources and jobs. The shift from car to rail travel is expected to reduce congestion, improve air quality, and promote healthier, more active lifestyles. Collaboration with local land use jurisdictions and communities could enable more equitable, transit-supportive land use and help avoid potential burdens like displacement.
Support economic opportunity and global competitiveness	Link21 is set to boost the economy and the global competitiveness of the Megaregion by forging new connections and improved access between homes and workplaces. This could open up job opportunities and support economic growth, enhancing productivity and innovation throughout the Megaregion.
Advance environmental stewardship and protection	Link21 offers a sustainable alternative to car travel, supporting state environmental goals to reduce greenhouse gas emissions and energy use. It also contributes to environmental resilience, helping the Megaregion face climate change challenges like sea level rise.

These goals and objectives guided the development of the draft *Preliminary Purpose and Need* for the Crossing Project. The final Purpose and Need statement will be presented in the Environmental Impact Statement and Environmental Impact Report, and it will underpin the development of the Crossing Project after Stage Gate 2.

Advancing equity is central to Link21. While it is part of a broader goal of promoting equity and livability, equity is a cross-cutting theme with the aim to ensure priority populations would be provided with benefits throughout all four goals and their corresponding objectives.

How Link21 Can Help Address These Challenges

Link21 can help address these existing challenges by enabling the transformation of the Megaregion's rail service, providing future transbay capacity and reliability to meet travelers' needs, and addressing equity concerns. With a more integrated and complementary rail system, Link21 could help foster a more livable, economically vibrant, and environmentally sustainable Northern California.

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4. Investment Options

4.1. Overview of Investment Options

This chapter describes the three investment options considered in this report and the decisions to be made at Stage Gate 2. The investment options are:

1. **No-build:** Continuing with a **no-build** approach that does not introduce a new transbay passenger rail crossing between San Francisco and Oakland. This would not address the goals and objectives for the program, and it would not transform mobility or build a more equitable region. The Link21 vision, set out in Section 3.4, would not be achieved.
2. **BART Crossing:** Introducing a new transbay passenger rail crossing between San Francisco and Oakland (and wider network improvements) using **BART (broad gauge) technology** in the crossing. This would directly connect to existing East Bay BART infrastructure and enable increased transbay BART service frequencies.
3. **Regional Rail Crossing:** Introducing a new transbay passenger rail crossing between San Francisco and Oakland and wider network improvements with **Regional Rail (standard gauge) technology** in the crossing. This would bridge the existing gap in the Regional Rail network across the San Francisco Bay and directly align with the *California State Rail Plan* vision for a unified, integrated statewide network, with a strong interdependency with the Corridor ID Program.

The train technology in the crossing **fundamentally determines** how services connect to the existing rail network. Each technology enables different types of services that serve different markets and meet Link21's goals and objectives in different ways.

Link21 previously considered a dual-gauge crossing with tracks that could be used by BART and Regional Rail trains. After a technical examination, Link21 concluded that a dual-gauge crossing would trigger safety and regulatory requirements, which would present a major risk to successful delivery and likely limit the number of trains that could operate through the new crossing.

Further exploratory studies indicated that a new crossing with broad- and standard-gauge tracks would provide more capacity than is needed to meet forecast future transbay demand. Therefore, the Link21 Team's efforts have focused on prioritizing **a single technology** for this initial crossing but not precluding constructing a third crossing in the future as megaregional needs evolve.

4.2. Overview of Evaluation Scenarios

These **three investment options** are represented by **three evaluation scenarios** — the Baseline and two specific Representative Concepts — that are described in more detail in the rest of this section.

4.2.1. Baseline

A key principle of business cases is that the benefits, costs, and risks of a project are evaluated against a future no-build (or business as usual) approach over the evaluation period (which is assumed to be up to 60 years after service commences). This no-build approach is represented by the **Baseline** evaluation scenario, against which the benefits, costs, and risks of a BART and Regional Rail crossing are evaluated.

The Baseline scenario includes specific assumptions of the Megaregion's future growth, and the investment and projects that are assumed to be delivered without Link21. It assumes additional services from projects specified in megaregional regional transportation plans without the introduction of a new transbay passenger rail crossing and related wider network improvements.

The Baseline adopts future planning assumptions relating to demographics, transportation networks, and policies that are consistent with Plan Bay Area 2050 and other adopted regional transportation plans in the Megaregion.

The Baseline scenario includes the existing and planned future transportation network, which is summarized in Section 2.3 and Section 4.3, respectively. Further information on the Baseline can be found in Section 5.3 and *Appendix D: Round 2 Evaluation Methodology and Assumptions Report*.

4.2.2. Representative Concept Scenarios

The **Representative Concept** scenarios include all additional rail services and planning assumptions included in the Baseline with the addition of a new transbay passenger rail crossing (and related wider network improvements). Two Representative Concepts were developed, one for each of the two crossing technology options (BART and Regional Rail) to:

- Evaluate their performance for the purpose of the business case evaluation.
- Identify and assess factors that would shape the ongoing development and refinement of the Crossing Project.

Each Representative Concept is a **conceptual representation** of a technology option, including a service plan, alignment, and infrastructure requirements. However, they **do not** represent the definition of the final Crossing Project, which will **likely differ** from the two Representative Concepts. The definition of the Crossing Project will continue to evolve through the planning process. Options to be considered following Stage Gate 2

include other potential alignments, station locations, engineering designs, and service plans.

Each Representative Concept is associated with a list of potential options and the **definition of the crossing concept, in terms of infrastructure, markets, and service; therefore, it is subject to change**. Further information on the concept development process that resulted in the two Representative Concepts can be found in *Appendix C: Concept Development Process Report*. It describes how the Link21 Team identified, developed, considered, and evaluated potential concepts to determine the Representative Concepts that were adopted for the Preliminary Business Case evaluation.

The Crossing Project will be planned and delivered in a way that delivers a similar high-quality experience for riders, regardless of the crossing technology. In particular, BART and Regional Rail Urban | Metro services are assumed to have **the same mileage-based fares** in line with the fare integration policy that is included in *Plan Bay Area 2050*,[15] which is a change from the current fare structure.

4.3. Future Baseline Rail Network

The rail network in the Megaregion is expected to continue expanding and improving with the construction of new systems, line extensions, and new stations and the implementation of service and infrastructure improvements to improve the user experience and attract new users.

Only projects **included within adopted regional transportation plans** (many of which are fully or partly funded) are included in the Baseline passenger rail network, with the **exception** of a new transbay crossing.

Key improvements in the Baseline that are most relevant to a new transbay passenger rail crossing include:[16]

- **The Portal** that extends Caltrain services from the 4th and King Station to the Salesforce Transit Center.
- **BART Silicon Valley Phase II** that extends BART service 6 miles from the Berryessa/North San Jose Station to downtown San Jose and Santa Clara with four new stations at 28th Street/Little Portugal, Downtown San Jose, San Jose Diridon, and Santa Clara.

[15] Policy T4 of Plan Bay Area 2050 sets out to **reform regional transit fare policy**, including to "streamline fare payment and replace existing operator-specific discounted fare programs with an integrated fare structure across all transit operators."

[16] Full details of future rail improvements included in the Baseline are provided in *Appendix D: Round 2 Evaluation Methodology and Assumptions Report.*

- **The BART Core Capacity Program** that will allow BART to operate up to thirty 10-car trains per hour in each direction through the existing Transbay Tube compared to the current 24 trains.
- **Caltrain Electrification** on the Peninsula that will provide faster, more frequent train services from San Francisco to San Jose Diridon, Tamien, and Gilroy.
- **California High-Speed Rail Phase 1** that will deliver new, direct high-speed rail service from San Francisco and San Jose to the Central Valley and Los Angeles.

Figure 4-1 and **Figure 4-2** illustrate the 2050 future Baseline rail network and service, respectively. The netgraph in **Figure 4-3** is a simplified schematic diagram of the train services and frequencies assumed in the 2050 future Baseline.

Details about the rail network changes included in the Baseline can be found in the *Link21 Concept Planning and Engineering Report* and *Appendix D: Round 2 Evaluation Methodology and Assumptions Report.*

Figure 4-1. 2050 Baseline Passenger Rail Network Overview Map

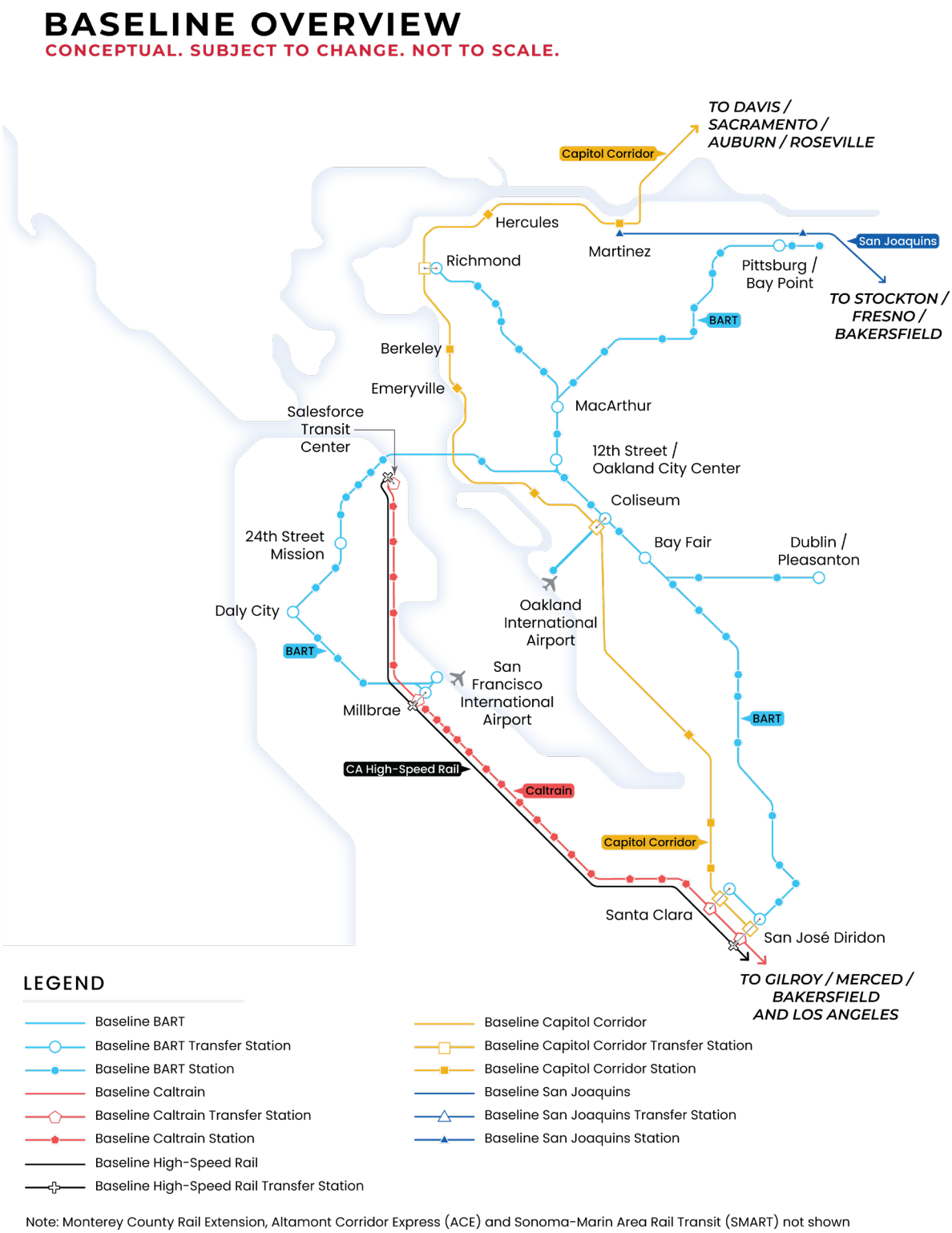


Figure 4-2. 2050 Baseline Passenger Rail Network Service Map

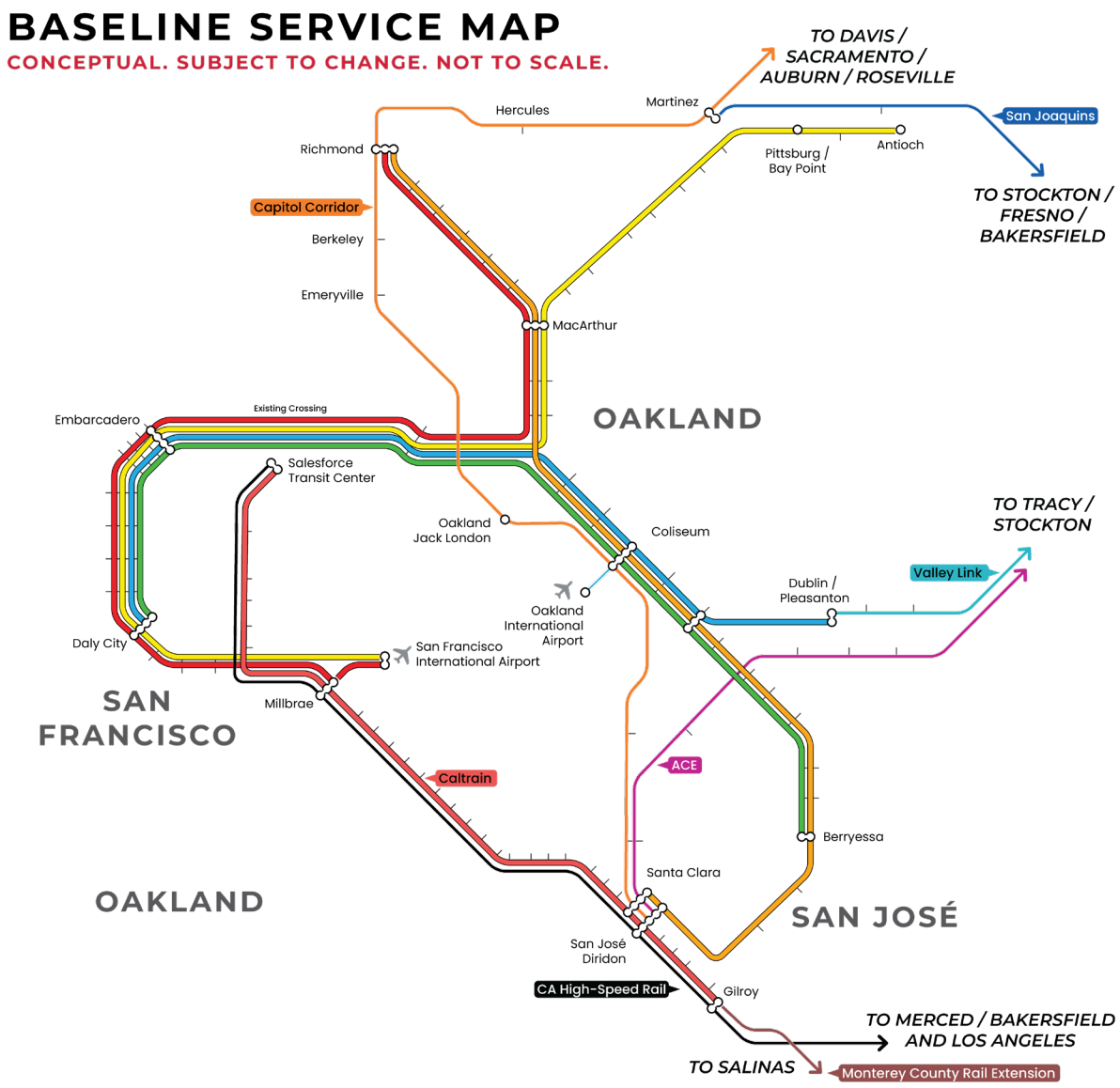


Figure 4-3. 2050 Baseline Service Plan Netgraph

4.3.1. Baseline Rail Network Constraints

However, even with these improvements, the passenger rail network will still face **several service constraints**.

These include:

- BART service frequencies in the East Bay will remain constrained by the Transbay Tube (even with the Core Capacity Program).
- Regional Rail services outside the Peninsula Corridor will continue to operate with low frequencies and without direct connectivity to San Francisco.

Therefore, at a megaregional level, there are **bold ambitions** for further rail investment, such as a rail extension to western San Francisco and a new rail crossing of the Carquinez Strait, which would complement a new transbay passenger rail crossing. Many of these ambitions are set out in the *California State Rail Plan*, and they will be subject to further study through the Corridor ID Program. However, these are not included in the Baseline as they are not featured in *Plan Bay Area 2050*.[17] This forms an important assumption of the analysis, as the definition of which projects are and are not included in the Baseline can influence the evaluation findings.

Further information on the existing and planned future rail network in the Megaregion and how Link21 can leverage other rail investments not included in the Baseline can be found in the *Link21 Megaregion Program Report.*

4.4. BART Representative Crossing Concept

4.4.1. Background

A **BART crossing concept** uses broad-gauge BART technology in the new transbay passenger rail crossing. It connects with the existing BART system and Urban | Metro services operating across the new crossing to destinations on the existing BART network.

A BART crossing would add a second connection between Oakland and San Francisco. It would provide **additional new transbay passenger rail capacity** and enable **frequency enhancements in the East Bay** through the increased use of existing BART infrastructure and by capitalizing on the existing infrastructure. It could add new stations to unlock new rail markets and would deliver improvements to better integrate the BART and Regional Rail networks, including a new transfer station in Oakland.

Since the BART network is already well-developed, a BART crossing would require only modest investment away from the transbay crossing to ensure its new capacity can be

[17] The definition of projects included in the Baseline is based on those included in the six metropolitan planning organizations' regional transportation plans within the Megaregion. *Plan Bay Area 2050* is the regional transportation plan for the MTC and Association of Bay Area Governments.

utilized effectively. It has **limited interdependency** with other projects and programs, including potential Regional Rail enhancements being developed under the Corridor ID Program.

The BART Representative Concept is the **specific definition** of the BART crossing that is assumed **only** for the purpose of the evaluation and is described in the following sections. Information on the other BART crossing concepts considered to date is in *Appendix C: Concept Development Process Report.*

4.4.2. Concept Overview

The BART Representative Concept provides a BART crossing from downtown San Francisco at 3rd and Mission streets to Oakland via Mission Bay and Alameda. It would connect to the existing BART Urban | Metro services near the MacArthur Station (Red and Yellow lines) and south of the Lake Merritt Station (Blue and Green lines).

The key service improvements offered by the BART Representative Concept include:

- Frequency increases on BART services between downtown San Francisco, downtown Oakland, and the 33 stations currently served by the Red, Yellow, Blue, and Green lines in the East Bay.
- A new BART/Regional Rail transfer station in Oakland,[18] so riders on Capitol Corridor and San Joaquins to and from Sacramento and Stockton can transfer to BART and have faster and easier access to downtown San Francisco and the Peninsula.
- A new BART/Regional Rail transfer station at a future 4th and Townsend BART station, so riders on Caltrain or California High-Speed Rail services can transfer to BART and have faster and easier access to the East Bay compared to transferring at the Salesforce Transit Center.
- Two new stations in Alameda and Mission Bay that serve new markets in areas not currently served by BART.

Other BART options not included in the Representative Concept could include changes in service patterns and frequencies, different potential stations, and/or an extension to western San Francisco.

4.4.3. Infrastructure

The BART Representative Concept includes a new BART tunnel under the San Francisco Bay between San Francisco (Mission Bay and SoMa [South of Market] neighborhoods) and Alameda that continues to Oakland. In San Francisco, it terminates at a potential new underground SoMa (3rd and Mission) station with turnback tracks extending west along Geary Street. Transfers between the potential new BART station

[18] The BART Representative Concept assumes this transfer is at a relocated Jack London Square station.

at 3rd and Mission and the existing Montgomery BART Station would be facilitated with an underground pedestrian concourse.

From downtown San Francisco, the concept extends through potential new underground stations at 4th and Townsend (with a transfer to Regional Rail) and Mission Bay/University of California, San Francisco (UCSF), before crossing under the San Francisco Bay to a potential new underground station at Alameda-Main/Atlantic. It then travels north to a potential new underground Jack London BART station, which would provide a transfer opportunity to a relocated Regional Rail station in Jack London Square (Howard Terminal).

The route would then split in the north and south directions. The northern route would continue to a potential new underground downtown Oakland station and onward to tie into the existing line south of the existing MacArthur BART Station. The southern route would connect to the existing BART line near the San Antonio neighborhood of Oakland. The Representative Concept also includes a new turnback track just north of the existing Pleasant Hill/Contra Costa Centre BART Station (between Bancroft and Oak Grove roads) to enable increased frequencies on the BART Yellow Line to and from the new BART crossing.

Table 4-1 summarizes the infrastructure route miles for the BART Representative Concept.

Table 4-1. BART Representative Concept Infrastructure Route Miles

CHARACTERISTIC	INFRASTRUCTURE ROUTE MILES (APPROXIMATE)
Underground	13
At grade	2
Aerial	<1
Total	**16**

4.4.4. Service and Markets

The new BART crossing in the Representative Concept would nearly double the capacity of BART across the San Francisco Bay, increasing peak service from 30 trains per hour on four transbay routes to 54 trains per hour across eight transbay routes. Off-peak service would increase from 16 trains per hour on four transbay routes to 32 trains per hour across eight transbay routes. All BART branches in the East Bay would connect to the new crossing. The existing non-transbay, intra-East Bay (Orange Line) route would be retained. BART would serve new markets in Mission Bay and Alameda, and there would be new stations in downtown Oakland, Jack London Square, Alameda, and Mission Bay/UCSF.

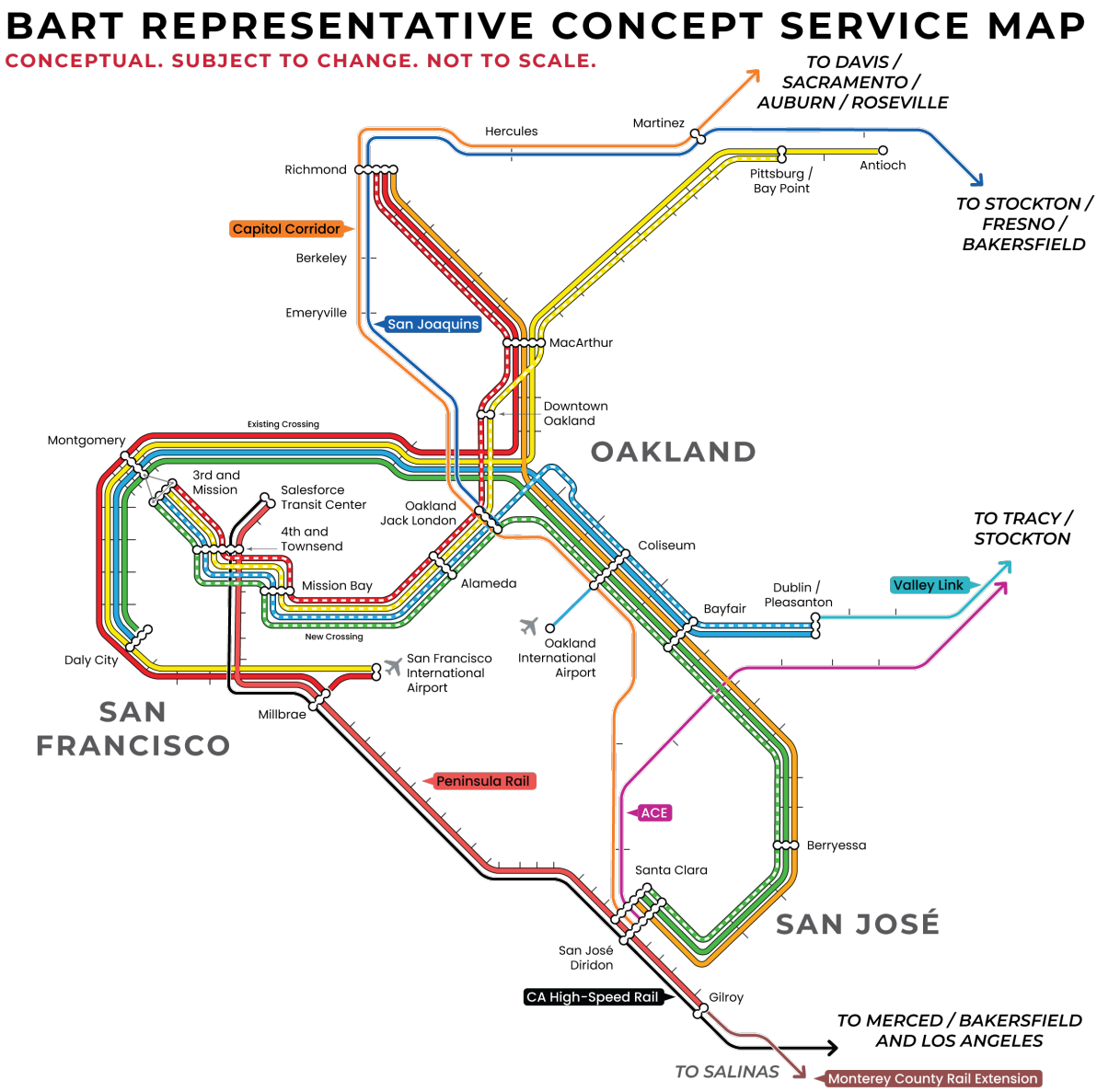
Connectivity between BART and Regional Rail would be improved with new transfer opportunities in Jack London Square and at 4th and Townsend and an improved transfer experience at the Coliseum Station.

For planning and evaluation purposes, it was assumed that Alstom's Fleet of the Future 10-car trainsets would be used to operate additional services in the BART Representative Concept. Each trainset is assumed to have 548 seats and a total capacity of 1,650 passengers. The concept will require an additional 616 BART and seven Regional Rail vehicles.[19]

Figure 4-4 illustrates these proposed services in the BART Representative Concept. The netgraph in **Figure 4-5** is a simplified schematic diagram of these assumed train services and frequencies.

[19] The BART Representative Concept includes one Regional Rail trainset for additional San Joaquins services.

Figure 4-4. BART Representative Concept Service Map



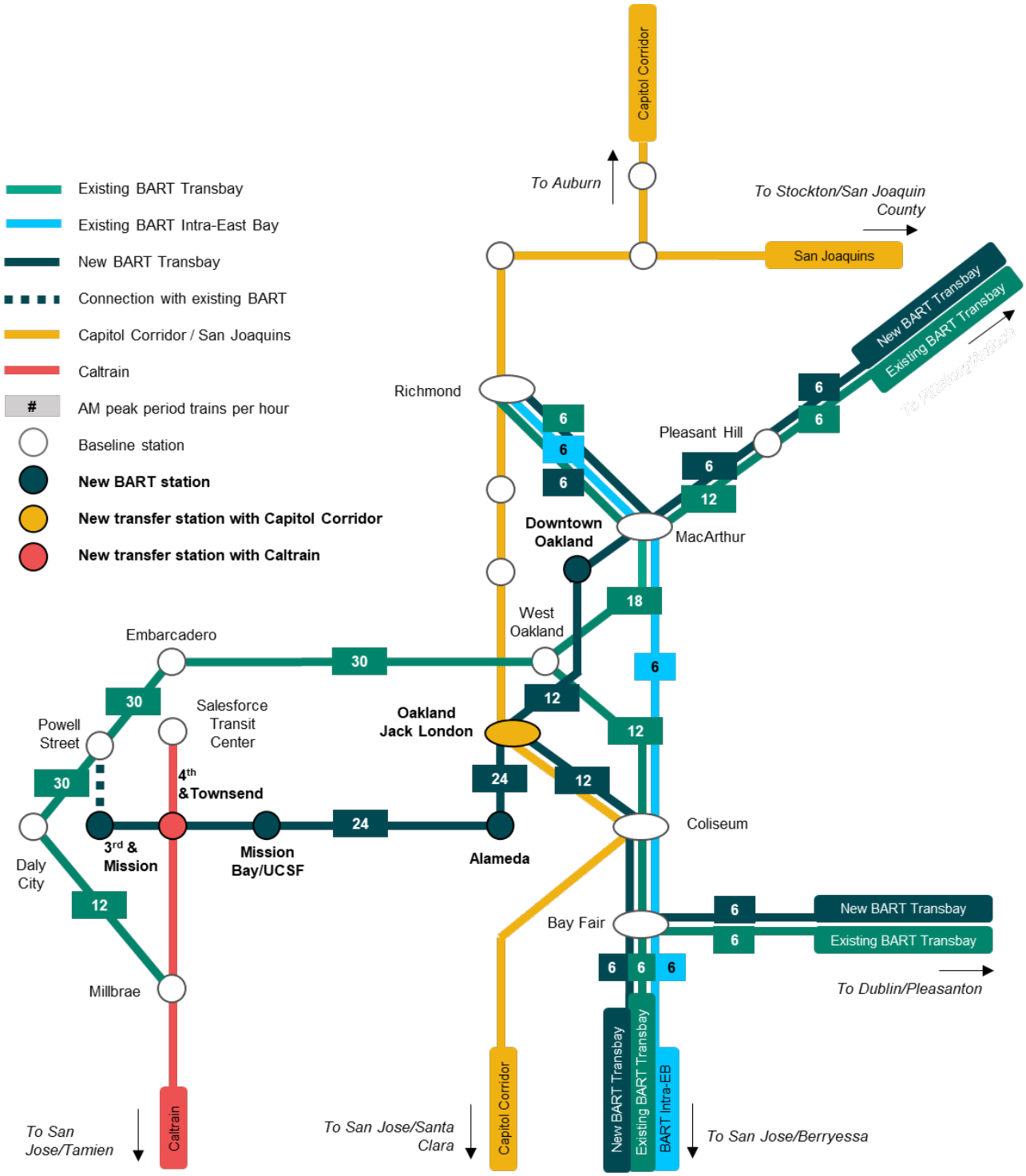
Urban | Metro Service Routes

- BART Concept (3rd and Mission - Richmond)
- BART Concept (3rd and Mission - Pittsburg / Bay Point)
- BART Concept (3rd and Mission - Dublin / Pleasanton)
- BART Concept (3rd and Mission - Santa Clara)
- BART (Millbrae - Richmond)
- BART (SFO Airport - Antioch)
- BART (Daly City - Dublin / Pleasanton)
- BART (Daly City - Berryessa)
- BART (Richmond - Santa Clara)
- Peninsula Rail

Intercity | Express Service Routes

- California High-Speed Rail
- Capitol Corridor
- San Joaquins
- Valley Link
- Altamont Corridor Express (ACE)
- Monterey County Rail Extension
- ∞ Transfer Station Between Service Providers

Figure 4-5. Simplified Netgraph of the BART Representative Concept



4.4.5. Complementary Improvements

The BART Representative Concept also includes several complementary improvements to improve connectivity to the Regional Rail network, as follows:

- The existing Regional Rail station at Jack London Square would be relocated to the west (to Howard Terminal) to facilitate direct transfers with BART.
- San Joaquins services to and from Stockton and Bakersfield would be extended to the relocated Jack London Square Regional Rail Station,[20] reducing the number of transfers for many riders.
- Improvements to the existing pedestrian connections between the BART and Regional Rail stations at the Coliseum Station to better facilitate transfers (including to the Oakland Airport Connector).

4.5. Regional Rail Representative Crossing Concept

4.5.1. Background

A **Regional Rail crossing concept** uses standard gauge and electrified Regional Rail technology in the new transbay passenger rail crossing. It extends electrified Caltrain services to and from downtown San Francisco through the new crossing to the East Bay, providing a combination of Urban | Metro and Intercity | Express services. It could include new stations to unlock new rail markets, and it would include improvements to better integrate the Regional Rail and BART networks, including a new transfer station in Oakland.

A Regional Rail Crossing Project would bridge the existing gap in the Regional Rail network between Oakland and San Francisco to provide an integrated rail system, enhancing the role of Regional Rail and complementing the existing BART system. The Regional Rail crossing concept is integral to and underpins the *California State Rail Plan* vision to connect major city centers in the Megaregion with one-seat rides.

Since the Regional Rail network is less developed than the BART system, a Regional Rail crossing would require significant investment in supporting infrastructure, away from the transbay crossing, to fully realize its capabilities and ensure its new capacity can be used effectively.

It would have a **strong interdependency** with the planned enhancements for the Capitol Corridor and San Joaquins being developed under the Corridor ID Program and complement planned enhancements being delivered for California High-Speed Rail

[20] Although San Joaquins trains currently operate from Jack London Square, the Baseline assumes San Joaquins services to and from Stockton and Bakersfield would start and end at Martinez. Under the BART Representative Concept, these services would be extended from Martinez to Jack London Square.

Phase 1. Several key elements of a Regional Rail crossing could be developed independently through the Corridor ID Program, each as **separate projects** with their **own benefits**, prior to completing a transbay crossing. The crossing could be viewed as the key element of a larger investment strategy outlined in the *California State Rail Plan*, and potentially developed and scoped through the Corridor ID Program.

The Regional Rail Representative Concept is the **specific definition** of the Regional Rail crossing assumed **only** for the purpose of the evaluation and is described in the following sections. Information on the other Regional Rail Crossing Concepts considered to date is in *Appendix C: Concept Development Process Report*.

4.5.2. Concept Overview

The Regional Rail Representative Concept provides a Regional Rail crossing from the Salesforce Transit Center to Oakland via a potential new station in Alameda, enabling expanded Urban | Metro services within the Bay Area and Intercity | Express services across the greater Megaregion. It unlocks the key constraint separating the Regional Rail network on the Peninsula from the East Bay while providing new transbay passenger capacity. This concept would introduce an electrified railway in the East Bay between Richmond, central Oakland, and the Coliseum Station.

The key service improvements offered by the Regional Rail Representative Concept include:

- New fast, frequent, and electric **Urban | Metro service** between Richmond, the Coliseum Station, downtown Oakland, San Francisco, and the Peninsula.
  - Those traveling from Emeryville/Berkeley/Richmond to downtown San Francisco and the Peninsula would be able do so without transferring. Emeryville and West Berkeley would be served by direct Urban | Metro services to downtown San Francisco for the first time.
  - Those traveling from the Peninsula to downtown Oakland, Richmond, and the Coliseum Station would be able do so without transferring.
- New direct **Intercity | Express service** between San Francisco and Sacramento, Stockton, and other major cities in the greater Megaregion.
- Service frequency increases between the Peninsula[21] and downtown San Francisco.
- Access improvements for journeys to and from Alameda would be enabled by a new station in this area that is not currently served by rail.

[21] For evaluation purposes only, the Regional Rail Representative Concept assumes frequency increases on the Peninsula from Millbrae to downtown San Francisco.

- A new BART/Regional Rail transfer station in Oakland[22] that provides riders on Capitol Corridor with faster, easier access to downtown Oakland or to transfers for other destinations on BART.

Other Regional Rail options not included in the Representative Concept could include alternative service patterns and frequencies, different potential stations, and/or an extension to western San Francisco.

Note that any Regional Rail service improvements or modifications would need to be approved by the owners of the host railroad right-of-way. Depending on the location of the improvements, this could include Union Pacific Railroad (UPRR), BNSF Railway, or the Peninsula Corridor Joint Powers Board (Caltrain).

4.5.3. Infrastructure

The Regional Rail Representative Concept would involve the construction of a new tunnel under the San Francisco Bay between San Francisco and Oakland. On the Peninsula, Regional Rail would connect to the Salesforce Transit Center and continue south to the Peninsula.

The Representative Concept includes Regional Rail infrastructure improvements on the Peninsula that are informed by the *Caltrain Business Plan*.[23] The tunnel would continue east under the San Francisco Bay to a potential new underground station in Alameda at the proposed Alameda-Main/Atlantic station location.

In Oakland, the route would split in the north and south directions. The northern route would continue in a tunnel and then surface south of the potentially modified Emeryville Station and continue aboveground to the existing Berkeley Station and a potential modified station at Richmond. The southern route would continue in the tunnel to a potential modified underground station at 12th St./Oakland City Center with direct transfers to the existing BART station. The route would continue south in tunnels, surface in Oakland's San Antonio neighborhood, and continue aboveground on dedicated tracks to the existing Coliseum Station. Both the crossing itself and the East Bay extents (to Richmond and the Coliseum Station) would be electrified, building on the Caltrain electrification on the Peninsula.

Transfers between BART and Regional Rail would be available at the Salesforce Transit Center, including an underground pedestrian concourse that connects to the existing Embarcadero BART Station. Improvements would be made to transfers to BART at the potentially modified Richmond Station and existing Coliseum Station.

[22] The Regional Rail Representative Concept assumes this transfer station is at 12th St./Oakland City Center.
[23] For evaluation purposes only, the Regional Rail Representative Concept includes the Pennsylvania Avenue Extension project from 4th and Townsend streets to near Army Street in San Francisco and Regional Rail infrastructure improvements between San Francisco and Millbrae.

The aboveground extents of the Representative Concept between Emeryville and Richmond and downtown Oakland to the Coliseum Station extend outside of the existing UPRR right-of-way. This is to avoid modifications to existing UPRR tracks that would require additional right-of-way to accommodate the dedicated Regional Rail facilities. Extensive coordination would be required with UPRR to determine the extent of new rail improvements they would allow to be located within (or partially within) their existing right-of-way in these two areas. Subject to further design work and negotiations with UPRR, there are potential options that involve Link21 services sharing tracks with UPRR that could deliver a better outcome overall.

The Portal is being advanced by the Transbay Joint Powers Authority to provide a train tunnel from the potential new 4th and Townsend station to the Salesforce Transit Center. This project is included in the Baseline scenario for Link21; therefore, it is not part of the Regional Rail Representative Concept. The benefits and costs from introducing The Portal are not included in the business case evaluation.

Note that development of the Regional Rail Representative Concept predates the Corridor ID Program; therefore, it assumes that all additional infrastructure described over and above the Baseline is funded and delivered through Link21. With the arrival of the Corridor ID Program, some elements of the scope of a Regional Rail Representative Concept could instead be delivered as separate, independent projects, prior to completing a transbay crossing. This would mean these projects could be included in a future Baseline and not included in the definition of the Crossing Project.

Table 4-2 summarizes the infrastructure route miles for the Regional Rail Representative Concept.

Table 4-2. Regional Rail Representative Concept Infrastructure Route Miles

CHARACTERISTIC	INFRASTRUCTURE ROUTE MILES (APPROXIMATE)
Underground	15
At grade	11
Aerial	2
Retained fill	3
Total (estimated by the Link21 Team)	**31**
4th and Townsend to Millbrae (estimate by others)	14
Overall Total	**45**

4.5.4. Service and Markets

The new Regional Rail crossing included in the Representative Concept would increase rail capacity across the San Francisco Bay. It would be a combination of Urban | Metro rail service (operating in metro regions at higher frequencies and medium speeds) and Intercity | Express rail service (long regional trips at lower frequencies and higher speeds) that provides 16 trains per hour during peak hours, compared to a maximum theoretical capacity in the new crossing of 24 trains per hour.

It would provide a significant change in Regional Rail connectivity with direct one-seat rides across the Megaregion (e.g., from San Francisco to Sacramento and Palo Alto to the Coliseum Station). Caltrain stations on the Peninsula would have direct service to the East Bay for the first time and East Bay Regional Rail stations would have new, high frequency, electric Urban | Metro transbay service. It would create new markets around a potential new station at Alameda and between Emeryville and Berkeley (Capitol Corridor) to downtown San Francisco.

The infrastructure improvements on the Peninsula would support service that is consistent with the Caltrain High Growth Scenario described in the *2040 Caltrain Service Vision* (2019). Some Peninsula rail (e.g., Caltrain) services would operate through the Salesforce Transit Center to the East Bay, including to Richmond, Berkeley, Emeryville, and Oakland. Regional Rail also would provide an Urban | Metro service in the East Bay between the potential modified Richmond and existing Coliseum stations. Intercity | Express service (e.g., Capitol Corridor) would directly service downtown San Francisco and the Peninsula.

For planning and evaluation purposes, it is assumed that Stadler KISS Electric Multiple Unit bi-level seven-car trainsets, similar to those being introduced on the Caltrain Peninsula services, are used to operate additional services in the Regional Rail Representative Concept. The concept is estimated to require an additional 240 Regional Rail vehicles,[24] each with 673 seats and a total capacity of 1,633 passengers.

Figure 4-6 illustrates these proposed services in the Regional Rail Representative Concept. The netgraph in **Figure 4-7** is a simplified schematic diagram of these assumed train services and frequencies.

[24] The Regional Rail Representative Concept assumes all BART trainsets would be lengthened to 10-car trains.

Figure 4-6. Regional Rail Representative Concept Service Map

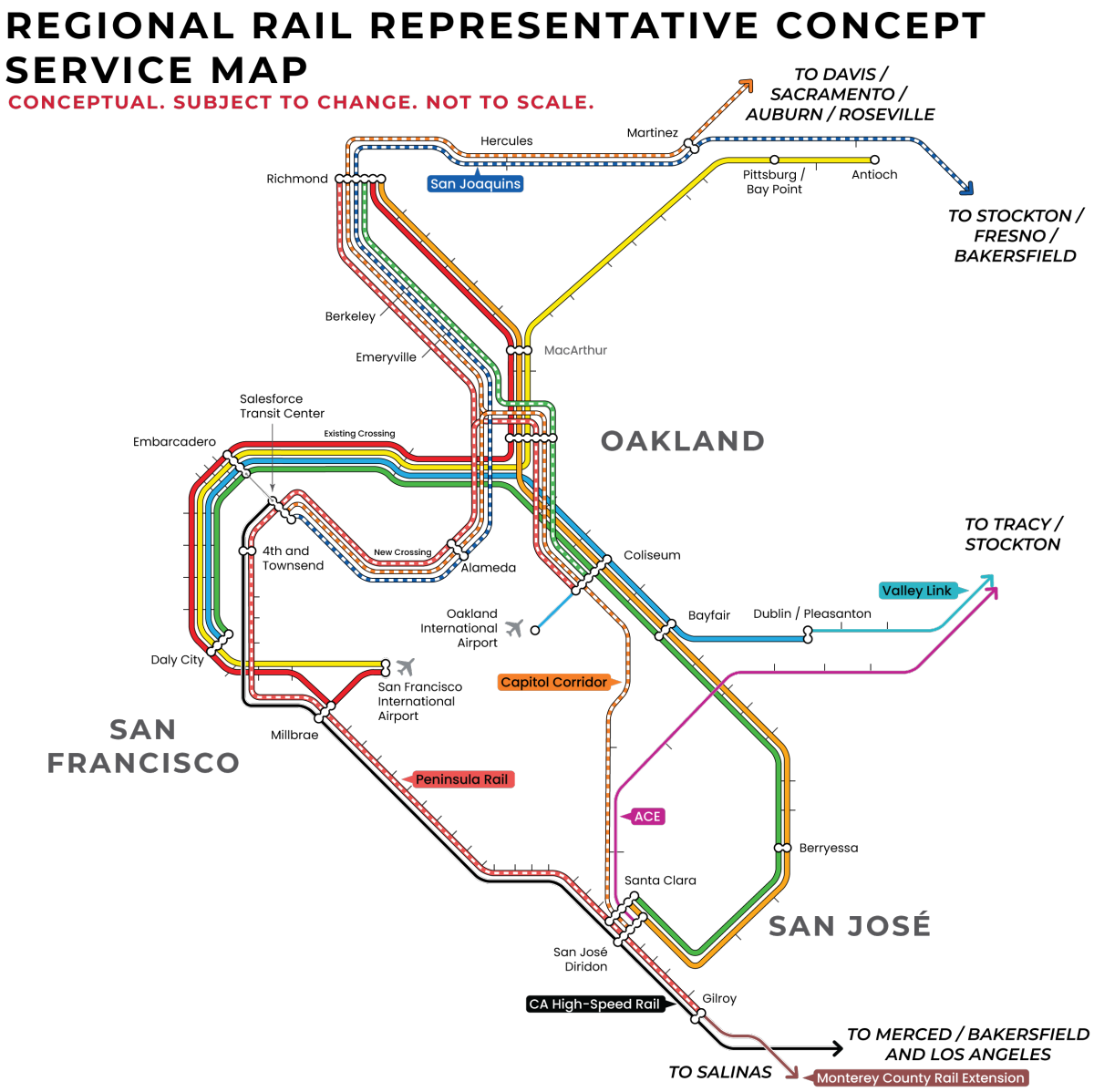
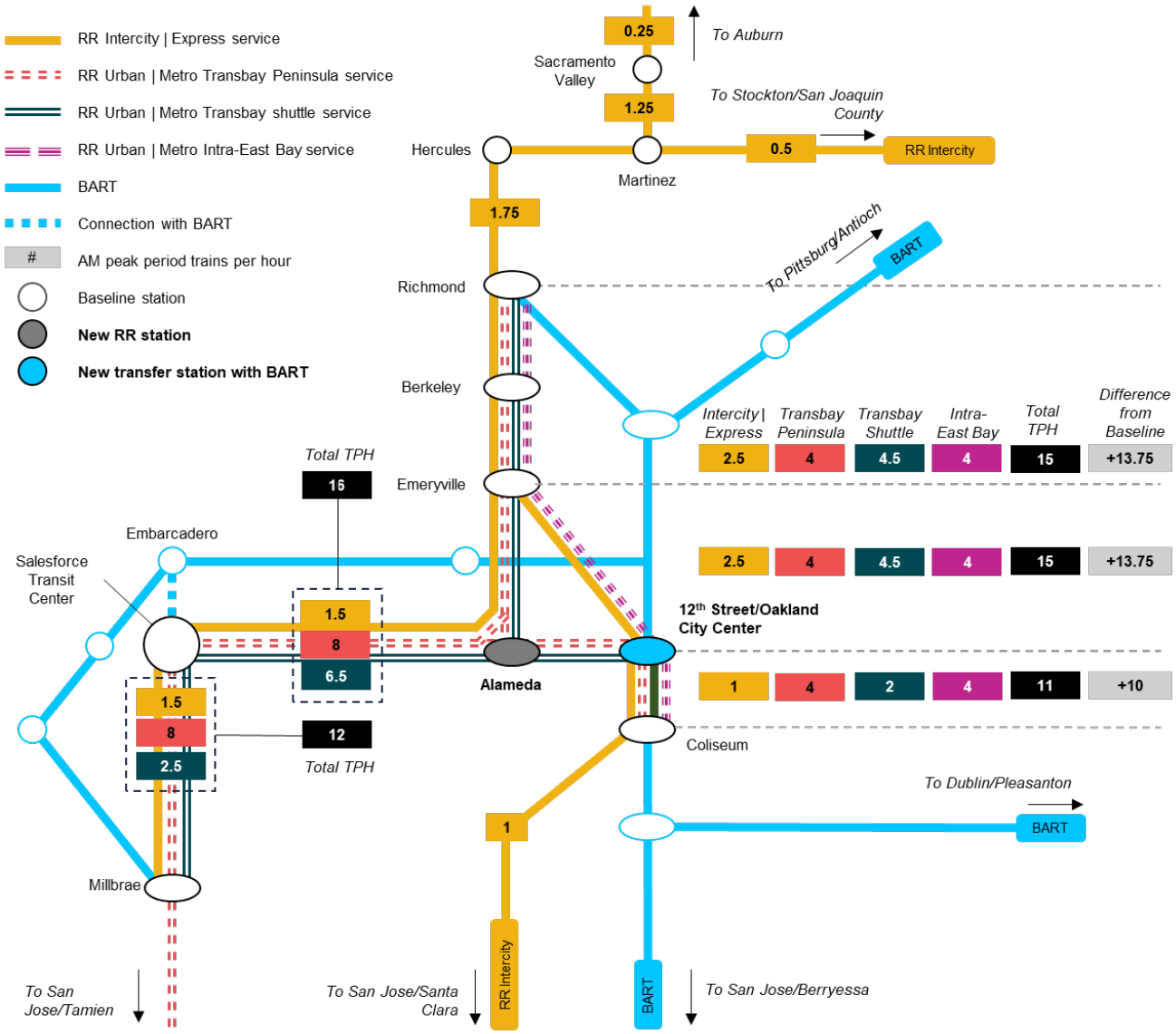


Figure 4-7. Simplified Netgraph of the Regional Rail Representative Concept



4.5.5. Complementary Improvements

The Regional Rail Representative Concept includes complementary improvements to the BART network with existing pedestrian connections between BART and Regional Rail improved at the following stations:

- Coliseum/Oakland Airport Connector
- 12th St./Oakland City Center
- Salesforce Transit Center

5. Business Case Approach

5.1. Introduction

At its conception, Link21 adopted a business case approach to advance Link21 from high-level strategic planning to delivery and operation. The business case for Link21:

- Identifies the benefits, costs, and risks throughout Link21's life cycle that are aligned with those sought by stakeholders and expressed in the program's vision statement and goals and objectives.
- Makes efficient use of constrained resources to plan, design, and deliver a new investment by adopting a staged approach that screens out low-performing concepts during the early phases of Link21.
- Evaluates concepts in a transparent, consistent, and analyses-based manner against a predefined set of goals and objectives for the public, stakeholders, and decision-makers to understand.
- Supports program designers to refine and improve concepts by providing analyses on the potential benefits and outcomes of each concept.
- Documents the key impacts of the concepts and provides an audit trail of the rationale for decision-making throughout Link21's life cycle.

Link21 employs this business case approach to inform concept development, concept evaluation, and decision-making. This involves using criteria from the four cases: Strategic, Economic, Financial, and Deliverability, to evaluate concepts for their alignment with the Link21 vision, goals, objectives, and broader program considerations.

The vision, goals, and objectives were developed by building upon other plans in the Megaregion and incorporating key inputs from BART, CCJPA, stakeholders, and community members. Section 2.4 explains the federal, state, and multiregional policy context relevant to Link21's purpose, goals, and objectives that are described in Section 3.5.

This section explains the evaluation approach in more detail including:

- The four cases and the inputs and analyses that feed into the evaluation.
- An overview of the future Baseline scenario impacts are evaluated against.
- The metrics used to measure performance and how they align with the four cases.

Additional details are in *Appendix D: Round 2 Evaluation Methodology and Assumptions Report*.

5.2. The Four Cases

The business case approach guides Link21's concept development and evaluation through four cases:

- **Strategic Case:** Identifies how the Crossing Project meets Link21's vision statement and addresses the goals and objectives described in Section 3.5.
- **Economic Case:** Identifies the monetized benefits to transportation users, other economic benefits, and provides the cost-benefit analysis.
- **Financial Case:** Identifies key financial considerations, including capital and operating costs, funding sources, revenue generation, and financial sustainability over the Crossing Project's life cycle.
- **Deliverability Case:** Identifies key deliverability risks, including environmental yellow flags, engineering and displacement risks, and other considerations, such as governance and stakeholder support.

This report focuses on the **Strategic Case** to inform the strategic recommendation whether to use BART or Regional Rail technology in the crossing. This includes assessing the strategic benefits of each crossing technology, how they address the challenges in the Megaregion, and their alignment with Link21's goals and objectives.

The other three cases — **Economic, Financial, and Deliverability** — have been evaluated more broadly. Their performance is analyzed to identify key considerations and opportunities facing delivery of a future Crossing Project, such as cost-effectiveness and the ability to secure funding. These aspects will be explored in greater detail in future stages as details of the Crossing Project are further refined.

This rounded approach to evaluation includes qualitative and quantitative metrics to measure the benefits, costs, and risks of each concept against the four cases, capturing the full range of anticipated impacts. Evaluating each concept against the same future Baseline creates a fair comparison.

5.3. Baseline Assumptions

As mentioned in Section 4.2, the Baseline is a future scenario the benefits, costs, and risks over the Crossing Project's life cycle are evaluated against. The Baseline adopts future planning assumptions relating to demographics, transportation networks, and policies that are consistent with *Plan Bay Area 2050* and other adopted regional transportation plans in the Megaregion.

The Crossing Project is currently planned to be fully operational in 2040. The future Baseline establishes assumptions about population, employment, propensity to travel, the future transportation network (excluding Link21), transportation policies such as tolls and transit fares, and land use policies in the forecast years of 2040 and 2050, setting the no-build conditions against which concepts are evaluated and compared.

At a high level, the future Baseline assumptions include:

- Population growth of 36% in the Bay Area and 38% in the remaining Megaregion between 2015-2050.
- Employment growth of 40% in the Bay Area and 36% in the remaining Megaregion between 2015-2050.
- Significant new rail infrastructure project and services, such as the Caltrain extension via The Portal and California High-Speed Rail,[25] as mentioned in Section 4.3.
- Integrated regional rail and transit fares that would reduce fares for most Regional Rail services and apply a 50% discount for low-income transit users.
- Highway tolls and a cordon charge for cars entering downtown San Francisco.[26]

Further details on the Baseline assumptions are provided in Chapter 3 of *Appendix D: Round 2 Evaluation Methodology and Assumptions Report*. Details of the rail enhancements assumed in the Baseline can be found in the *Link21 Concept Planning and Engineering Report*.

Additional analyses were conducted on the BART and Regional Rail Representative Concepts to test how different assumptions about the future influence the evaluation results. Three specific stress tests were undertaken to assess the impact of the following future conditions on new rail trips:

1. **Sustained Higher Teleworking and Lower Transit Preference:** Assumed higher remote and hybrid work (as measured by telecommuting rate) was sustained and assumed a lower traveler preference to use rail and transit.
2. **Slower Population Growth:** Used Caltrans' 2022 revised population and employment forecasts as modeling inputs instead of *Plan Bay Area 2050's* forecasts.
3. **Reduced Tolling:** Removed assumed cordon pricing in downtown San Francisco and reduced distance-based tolling values across the model geography.

The approach to and findings from this additional testing are described in greater detail in *Appendix E: Round 2 Evaluation Supporting Information Report*.

[25] A full list of projects assumed in the Baseline can be found in the *Link21 Concept Planning and Engineering Report.*

[26] This includes per-mile tolling on congested freeways with rail and transit alternatives and a specific cordon charge for traffic crossing a defined boundary surrounding downtown San Francisco.

5.4. Evaluation Metrics

Evaluation metrics are used to measure the relative impact of concepts and the extent to which they meet Link21's goals and objectives and other criteria. These metrics are measured either **quantitatively** (e.g., through modeling of rail demand or accessibility) or **qualitatively** (e.g., a narrative informed by qualitative analysis).

A total of 68 metrics have been used for the Round 2 evaluation. These metrics were designed to measure the performance of concepts against Link21's goals and objectives (which form the Strategic Case) and other evaluation criteria in the Economic, Financial, and Deliverability cases. The scope, intent, and measurement of these metrics were subject to engagement and the product of co-creation.[27] They built on metrics from prior rounds of evaluation, as some metrics have been refined and others have been added over time.

Outputs from the **Refined Travel Demand and Land Use Tool** (Refined TDLU Tool)[28] are used to assess most quantitative metrics in the Strategic, Economic, and Financial cases pertaining to ridership, including new rail trips, access to stations, and monetized benefits. This is supported by outputs from technical studies and analysis, such as capital, operational, and maintenance cost estimates.

Some metrics are not readily measurable and/or require disproportionate resources to estimate quantitively. These are instead assessed qualitatively against pre-defined criteria and supported by an evaluation narrative:

- Where it is appropriate to do so, a qualitative score[29] is used (e.g., reliability).
- Where it is not yet possible to determine potential implications, only a narrative is provided (e.g., environmental yellow flags).

Equity performance, in terms of the share and absolute benefits to priority populations, was evaluated for several metrics as indicated in **Table 5-1**. It provides the metrics used for the Strategic Case evaluation and the type of metric, as indicated by a "**Y**" (i.e., whether it is a quantitative or qualitative metric, an equity performance, and the metric is scored or not), which indicates a "yes" against the inclusion of each type of assessment for each metric. Further details on the methodology of each metric can be found in *Appendix D: Round 2 Evaluation Methodology and Assumptions Report*.

[27] Equity metrics were developed through the co-creation process and informed by the equity poll (e.g., engagement with the Equity Advisory Council led to the inclusion of "opportunity jobs" as a new metric).
[28] Further information about the Refined TDLU Tool can be found in the *Detailed Tools Model Documentation: Travel Demand Model* and *Detailed Tools Model Documentation: Land Use Model*.
[29] Scores are based on a scale ranging from 5 to -5 relative to the Baseline, where 0 represents no impact relative to the Baseline, positive values represent a benefit, and negative values represent a disbenefit. Negative impacts, such as capital costs, are scored using a negative scale, where -5 represents the highest cost.

Table 5-1. Overview of Round 2 Metrics: Strategic Case

CASE AND OBJECTIVE	METRIC	QUANTITATIVE ASSESSMENT	QUALITATIVE ASSESSMENT	EQUITY PERFORMANCE	SCORED METRICS[30]
GOAL A: TRANSFORM THE PASSENGER EXPERIENCE					
A1: Provide better service	Rail travel times	Y		Y	
	Support for extended transbay service hours		Y		
	Transit crowding	Y			
	New direct journeys and improved rail connectivity	Y			
A2: Improve reliability and system performance	Potential to improve network connectivity		Y		Y
	Reliability improvement		Y		Y
	Capacity to meet future growth	Y			Y
	Expected recovery times from incidents		Y		Y
	Ease of maintaining existing and new infrastructure		Y		Y
	System redundancy during closure of Transbay Crossing and other events		Y		Y
A3: Build ridership and mode share	Potential new rail trips	Y		Y	
	Transit mode share	Y			
	Vehicle miles traveled reduction[31]	Y			

[30] A number of metrics adopt a scoring convention.
[31] Vehicle miles traveled reduction does not have priority populations values. Equity performance is assessed through the incremental benefits to the whole population.

CASE AND OBJECTIVE	METRIC	QUANTITATIVE ASSESSMENT	QUALITATIVE ASSESSMENT	EQUITY PERFORMANCE	SCORED METRICS[30]
GOAL B: PROMOTE EQUITY AND LIVABILITY					
B1: Connect people and places	Access to stations for residents	Y		Y	
	Commute trips on network	Y			
	Access to jobs	Y			
	Access to opportunity jobs	Y		Y	
	Non-work trips on network	Y			
	Access to important community resources	Y		Y	
B2: Improve safety, health, and air quality	Air pollution	Y			
	Auto-involved crashes	Y			
	Walk and bicycle access to rail	Y			
B3: Advance equity and protect against community instability and displacement	Proportion of incremental benefits to priority populations	Y	Y	Y	
	Absolute incremental benefits to priority populations	Y	Y	Y	
	Displacement risk	Y		Y	Y
GOAL C: SUPPORT ECONOMIC OPPORTUNITY AND GLOBAL COMPETITIVENESS					
C1: Improve access to opportunity and employment	Employee access to stations	Y			
	Access to potential employees for businesses	Y			
	Commute trips on network	Y			
C2: Connect major economic, research, and education centers	Travel times between major destinations	Y			
C3: Enable transit-supportive and equitable land use	Local land use policies consistent with Link21 land use policies	Y			Y
	Potential for future land uses within station catchment areas	Y			Y

CASE AND OBJECTIVE	METRIC	QUANTITATIVE ASSESSMENT	QUALITATIVE ASSESSMENT	EQUITY PERFORMANCE	SCORED METRICS[30]
GOAL D: ADVANCE ENVIRONMENTAL STEWARDSHIP AND PROTECTION					
D1: Increase climate change resilience	Viability under different sea level rise inundation scenarios		Y		
D2: Reduce greenhouse gas emissions	Greenhouse gas emissions from vehicles	Y			
	Embodied carbon from construction	Y			
D3: Conserve resources	Energy consumption for transportation	Y			

Table 5-2 provides the metrics used for the Economic, Financial and Deliverability case evaluation and the type of metric, as indicated by a "Y" (i.e., whether it is a quantitative or qualitative metric, an equity performance, and the metric is scored or not), which indicates a "yes" against the inclusion of each type of assessment for each metric.

Table 5-2. Overview of Round 2 Metrics: Economic, Financial, and Deliverability Cases

CASE	METRIC	QUANTITATIVE ASSESSMENT	QUALITATIVE ASSESSMENT	EQUITY PERFORMANCE	SCORED METRICS[32]
Economic Case	Transit and auto user benefits (including crowding)	Y			
	Air pollution	Y			
	Auto-involved crashes	Y			
	Greenhouse gas emissions	Y			
	Health improvements due to increased walking and bicycling	Y			
	Wider economic impacts		Y		Y
	Capital cost indicator	Y			
	Operating and maintenance costs	Y			
	Renewal costs	Y			

[32] A number of metrics adopt a scoring convention.

CASE	METRIC	QUANTITATIVE ASSESSMENT	QUALITATIVE ASSESSMENT	EQUITY PERFORMANCE	SCORED METRICS[32]
	Residual value	Y			
	Benefit-cost ratio	Y			
	Travel times between major destinations	Y			
	Access to labor supply	Y			
Financial Case	Farebox revenues	Y			
	Capital cost indicator	Y			
	Operations and maintenance costs	Y			
	Renewal costs	Y			
	Farebox recovery ratio	Y			
	Present value of revenue and costs	Y			
	Affordability of the project, funding, and finance		Y		Y
Deliverability Case	Project planning and risk management		Y		
	Governance		Y		
	Procurement		Y		
	Engagement and consultation		Y		
	Alignment with stakeholder aspiration		Y		
	Design/construction risk		Y		Y
	Transportation network risk during construction		Y		Y
	Transportation network risk after construction		Y		Y
	Environmental yellow flags		Y		
	Anti-displacement policy provision	Y			Y
	Indirect displacement risk	Y			Y
	Affordable housing provision	Y		Y	Y
	Potential direct displacement: construction and right-of-way acquisition		Y	Y	Y

6. Strategic Case

The Strategic Case considers how the BART and Regional Rail Representative Concepts contribute towards the vision for Link21 and address the goals and objectives described in Section 3.5. It presents the assessment of the two concepts against each of the 12 objectives and the key differentiators between BART and Regional Rail.

The evaluation results reflect specific assumptions for each Representative Concept, which reflect the current stage of development, such as assumed service frequencies and the inclusion of potential stations, such as Alameda. The results and conclusions presented in the following sections will evolve as the concepts are developed and refined in the future.

6.1. Goal A: Transform the Passenger Experience

6.1.1. Objective A1: Provide Better Service

This objective is measured through metrics that assess how the concepts improve the **availability** and **quality** of rail service. Both concepts significantly improve transbay rail service by reducing travel times, increasing frequencies, reducing potential future crowding, and providing direct one-seat rides. Both concepts provide direct connectivity between the BART and Regional Rail networks via new and/or improved transfer stations on either side of the San Francisco Bay. Both concepts have the potential to facilitate extended transbay service hours (subject to policy decisions). Overall, both concepts have positive contributions towards this objective.

BART Crossing

A BART crossing enables **incremental** transportation benefits (predominately shorter wait times) to largely well-served markets throughout the East Bay BART network and larger benefits to potential new markets (e.g., Mission Bay). It delivers better service by improving and expanding services across the existing BART network and corridors, which generates **small travel time improvements per rider, but for a relatively larger number of riders** in areas already served by BART.

A BART crossing could improve the passenger experience by doubling transbay service frequencies to/from Richmond, Dublin/Pleasanton, Pittsburg/Bay Point, and Santa Clara. Although the travel time savings per rider are relatively modest, all BART riders to or from a destination in the East Bay, including non-transbay trips, would benefit. Therefore, travel time savings are 26% greater for a BART crossing compared to a Regional Rail crossing, largely due to greater BART ridership.

A BART crossing could reduce potential future crowding to many existing BART markets (an average 15% reduction in AM peak riders in the existing crossing) by directly alleviating crowding on the most congested BART routes. Journey time benefits are concentrated around BART's existing and extended corridors in the Bay Area. If travel patterns and the propensity to use rail and transit does not recover to pre-pandemic levels, the additional value of providing more capacity on the established network (where a good level of service is already available) could be limited.

A BART crossing could provide direct one-seat rides between 290 station pairs by connecting new stations to the existing BART network. However, it does not provide any new direct connectivity for interregional journeys to destinations outside the Bay Area.

Regional Rail Crossing

A **Regional Rail** crossing enables **transformational** transportation benefits (primarily through travel time savings) to focused areas currently with poorer service (e.g., Emeryville) and less established interregional markets. It would enable the introduction of new transbay Urban | Metro and Intercity | Express services that could provide direct one-seat rides between 370 station pairs by:

- Directly connecting the Regional Rail network across the San Francisco Bay between downtown San Francisco and the Peninsula to the wider megaregional network.
- Providing new connections to new stations, such as Alameda.
- Providing direct, interregional connections and transforming the travel experience, whereas BART is limited to the Bay Area. Notable journeys with new one-seat rides include:[33]
  - Direct interregional journeys between downtown San Francisco and Sacramento, Stockton, and the Central Valley (e.g., the travel time from Sacramento to downtown San Francisco decreases from 145 to 120 minutes with one fewer transfer).
  - Direct, faster, and more frequent regional transbay journeys between the East Bay, like downtown Oakland or Berkeley (Capitol Corridor), and destinations on the Peninsula, like Palo Alto and Redwood City (e.g., the travel time from Emeryville to Redwood City decreases from 105 minutes to 60 minutes with two fewer transfers).
  - Direct, faster, and more frequent regional transbay journeys between Emeryville or Berkeley (Capitol Corridor) and downtown San Francisco (e.g., the travel time

[33] Note these travel times include in-vehicle and waiting times (estimated from half the service combined headway at departure and transfer stations) and assume the faster combination of public transportation modes, including bus where appropriate. Travel times are rounded to the nearest five minutes. Assumed stations for downtown San Francisco are the Salesforce Transit Center (for a Regional Rail crossing) or BART Montgomery St. (for the Baseline).

from West Berkeley to downtown San Francisco decreases from 50 minutes to 20 minutes with one fewer transfer).

A Regional Rail crossing could provide fast, frequent, and electric Urban | Metro services to areas like Emeryville and West Berkeley, thereby improving access to rail service to new or less developed markets. Few people currently make these journeys by rail due to a variety of reasons, including poor connectivity, low service frequencies, and high fares. The market analysis indicated there is significant unmet potential for rail travel.

Regional Rail helps unlock these markets for rail, delivering **large travel time improvements but to a relatively smaller number of riders**. Travel time benefits for Regional Rail riders are focused along two existing rail corridors: Caltrain from San Francisco to San Jose along the Peninsula, and Capital Corridor between Sacramento, Richmond, Oakland, and the Coliseum (and onwards to San Jose). A Regional Rail crossing would complement existing BART service and help reduce potential future crowding, delivering an 11% reduction in AM peak riders in the existing Transbay Tube.

Table 6-1 summarizes the evaluation results for this objective. A metric that is specifically measured for priority populations is indicated by the metric name being preceded by "***PP***" throughout this report.

Table 6-1. Evaluation Results for Objective A1: Provide Better Service

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Rail travel times (minutes saved per rail trip)	-1.7	-1.4
PP *Rail travel times for priority populations (minutes saved per rail trip)*	*-2.5*	*-2.1*
Support for extended transbay service hours (score out of 5)	3	3
Transit crowding (average perceived minutes due to crowding)	-1.3	-0.9
New direct journeys and improved network connectivity (new one-seat rides between station pairs)	+290	+370

6.1.2. Objective A2: Improve Reliability and System Performance

This objective is measured through metrics that assess how the concepts improve the **reliability** and **resilience** of the megaregional rail network into one that passengers can depend on. Reliability refers to the day-to-day, on-time performance of the rail network, and the resilience of the network to respond to planned and unplanned service disruptions and minimize delays for passengers.

By providing an alternative transbay passenger rail crossing, both concepts significantly improve system resilience, providing the ability to handle passengers in the event of a disruption to the Transbay Tube and reduce the time needed to recover. Both concepts also improve the ability to maintain existing and new infrastructure while minimizing disruption to passengers. Both concepts provide a near doubling of transbay passenger capacity, providing significant spare capacity that is able to accommodate passenger growth in the future.

Since the BART network is completely segregated from other rail operations, it already delivers highly reliable services. A BART crossing would not provide any further reliability improvements to the BART network or to the Regional Rail network where reliability challenges are more acute. Although a BART crossing provides better connectivity to Regional Rail riders via a transfer to the BART network, it does not provide a direct network connectivity benefit to Regional Rail.

A Regional Rail crossing would deliver a significant improvement in day-to-day reliability for its system, providing new dedicated, grade-separated tracks for passenger rail between Richmond and the Coliseum Station, reducing delays caused by freight trains. However, it is important to note that this separation, especially at-grade sections between Emeryville and Richmond, could come with significant right-of-way acquisition-related direct displacement risks and cost implications, which would need to be studied further. A Regional Rail crossing also improves passenger rail network connectivity by integrating multiple operators on either side of the San Francisco Bay into a more seamless and integrated megaregional network.

Additionally, Regional Rail capitalizes on existing and planned improvements, such as the Caltrain electrification and The Portal, enhancing the value of each investment. It would facilitate and capitalize on potential future improvements as envisioned in the *California State Rail Plan*, such as a new rail bridge across the Carquinez Strait, to improve connectivity more broadly across the Megaregion. Comprehensive investment in the megaregional rail network, in tandem with a Regional Rail crossing, is essential to realize the *California State Rail Plan*'s vision. However, it is important to note that further investment would be required to unlock these benefits in the long term.

Table 6-2 summarizes the evaluation results for this objective.

Table 6-2. Evaluation Results for Objective A2: Improve Reliability and System Performance

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Potential to improve network connectivity (score out of 5)	0	4
Reliability improvement (score out of 5)	0	2
Capacity to meet future growth (score out of 5)	5	5
Expected recovery time from incidents (score out of 5)	1	2
Ease of maintaining existing and new infrastructure (score out of 5)	1	1
System redundancy during closure of the transbay crossing and other events (score out of 5)	3	2

6.1.3. Objective A3: Build Ridership and Mode Share

This objective is measured through metrics that assess the ability for the concepts to increase rail ridership within the Megaregion, especially among priority populations. Building ridership and generating mode shift acts as the key enablers for the equity and livability, economic opportunity, and environmental benefits described in the rest of the Strategic Case.

Both BART and Regional Rail have the potential to increase rail ridership, including priority populations and transbay trips. Ridership levels are closely linked to the number and locations of new stations in high demand areas, such as San Francisco.

The BART Representative Concept serves three BART stations in San Francisco at 3rd and Mission, 4th and Townsend, and Mission Bay. It is forecast to generate 130,000 new daily rail trips in 2050, of which 58,000 are transbay. Additionally:

- The previous Round 1 evaluation (presented in Appendix B) indicated that the number of new rail trips in 2050 is 16% lower if it serves the Salesforce Transit Center in San Francisco only, rather than 3rd and Mission, 4th and Townsend, and Mission Bay.[34] This test indicates that a BART crossing with only one station in San Francisco could generate approximately 110,000 new daily rail trips in 2050.
- A Round 2 evaluation sensitivity test (presented in Appendix E) included adding a further BART station in the San Antonio neighborhood of Oakland to the

[34] This 16% figure is derived from the results of the Round 1 evaluation, which indicated a ridership score (one-way rail trips) of 3.7 for the Round 1 BART Salesforce Transit Center concept and 4.4 for the BART Mission Bay concept.

Representative Concept. This indicates that a BART crossing serving three stations in San Francisco and an additional San Antonio station could generate 140,000 new daily rail trips in 2050.

The Regional Rail Representative Concept serves four existing and planned Regional Rail stations[35] in San Francisco, and it is forecast to generate 90,000 new daily rail trips in 2050, of which 54,000 are transbay. A sensitivity test was performed (presented in Appendix E), and it indicated that adding a further Regional Rail station in the Bayview neighborhood of San Francisco to the Representative Concept would increase ridership to 115,000 new daily rail trips in 2050. Future analyses may consider the inclusion of stations in other high-potential areas, such as Mission Bay, western San Francisco, and central Oakland.

These results reflect how:

- The BART Representative Concept increases frequency at every existing East Bay BART station and offers a greater number of new stations, such as Mission Bay and Jack London Square, that serve new markets and improve access to jobs and places.
- The evaluation assumes that the frequency in the new crossing is 50% higher for a BART compared to Regional Rail crossing. Further enhancements to the Regional Rail network, potentially developed through the Corridor ID Program, could enable up to 24 transbay trains per hour for a Regional Rail crossing, comparable to that of a BART crossing,[36] potentially increasing ridership.
- Regional Rail travel time benefits are concentrated in a smaller number of markets (predominantly on the Urban | Metro service operating between the Peninsula and Richmond/Coliseum Station, which includes markets that currently lack good rail service).

The BART concept achieves a greater mode shift than the Regional Rail concept by providing a greater reduction in vehicle miles traveled and an increase in transit mode share. However, the Regional Rail concept delivers a greater increase in potential interregional trips beyond the Bay Area with 1,800 additional daily trips in 2050 versus 1,400 for the BART concept.

Serving additional new markets (through new stations) and increasing frequency could improve the ridership potential of both concepts. This is achieved by increasing the

[35] Existing and planned stations served by the Regional Rail Representative Concept are the Salesforce Transit Center, 4th and Townsend, 22nd Street, and Bayshore.

[36] The Regional Rail Representative Concept includes 16 trains per hour at peak service compared to a maximum theoretical operating capacity of 24 trains per hour in the crossing. The BART Representative Concept includes 24 trains per hour at peak service compared to a maximum theoretical operating capacity of 30 trains per hour in the crossing. Capacity constraints on either side of the San Francisco Bay, such as terminals, junctions, and line capacities on the BART and Regional Rail networks, mean that not all theoretical operating capacity can be utilized without additional investment for either crossing technology.

number of people who can access rail services and providing new travel opportunities by rail.

Priority Populations

BART is forecast to generate 52,000 potential new priority populations rail trips, largely within areas already served by the existing East Bay BART system. Regional Rail is forecast to generate 38,000 potential new priority populations rail trips, largely to areas that currently lack access to good rail service, such as Emeryville. The proportion of new priority populations rail trips (of all new rail trips) is similar for both concepts.

Table 6-3 summarizes the evaluation results for this objective.

Table 6-3. Evaluation Results for Objective A3: Build Ridership and Mode Share

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Potential new rail trips (linked trips[37] on the average weekday in 2050)	+132,000	+92,000
Potential new rail transbay trips (linked trips on the average weekday in 2050)	+58,000	+54,000
***PP** Potential new rail trips for priority populations (linked trips in the average weekday in 2050)*	*+52,000*	*+38,000*
Transit mode share (change in transit mode share in the Megaregion)	+0.31%	+0.22%
Vehicle miles traveled reduction (million vehicle miles per annum in 2050)	-500	-300

6.2. Goal B: Promote Equity and Livability

6.2.1. Objective B1: Connect People and Places

This objective is measured through metrics that assess the ability of the two concepts to create new and improved rail connections to key destinations, including cultural, recreational, educational, healthcare, and social service institutions and residential, employment, and retail hubs. Both concepts help make these destinations more accessible but in different ways and in different locations.

The BART concept focuses on improving connectivity along existing East Bay BART lines and at new stations at Mission Bay and in Alameda. The Regional Rail concept

[37] A 'linked trip' refers to an entire journey an individual makes, which could involve individual trip stages. For example, if an individual uses a bus to access transit and then catches transit to their final destination, this would be one 'linked trip' (by bus and transit from origin to destination) despite including two separate trip stages on different modes.

improves interregional connectivity across the wider Megaregion (such as to Stockton) and connectivity within the Bay Area through new (or upgraded) stations at Alameda, Emeryville, and Berkeley.

The Regional Rail concept contributes further towards improved access to rail service. An additional 37,000 residents would live within 0.5 miles of a rail station with an Urban | Metro service under the Regional Rail concept compared to an additional 28,000 residents under the BART concept. This reflects the population around the stations that are included within each Representative Concept: Regional Rail provides a new, frequent Urban | Metro service to Alameda, Emeryville, and Berkeley (Capitol Corridor) stations,[38] compared to just Alameda and Mission Bay for BART.

Reflecting BART's higher overall ridership potential, it serves a greater number of commute and non-work trips. Both concepts provide a similar improvement in access to jobs, and BART has slightly higher improved access to important community resources due to the geographies it serves.

Table 6-4 summarizes the evaluation results for this objective.

Table 6-4. Evaluation Results for Objective B1: Connect People and Places

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Access to stations for residents (within 0.5 miles of existing or new rail stations)	+28,000	+37,000
PP *Access to stations for priority populations residents (within 0.5 miles of existing or new rail stations)*	*+12,000*	*+10,000*
Commute trips on network (linked trips on the average weekday in 2050)	+76,000	+52,000
Access to jobs (average accessible by rail in 60 minutes)	+44,400	+44,000
PP ***Access to opportunity jobs*** *(jobs accessible by rail in 60 minutes for priority populations)*	+10,100	+10,400
Non-work trips on network (linked trips on the average weekday in 2050)	+55,000	+38,000
Access to important community resources (resources accessible by rail in 60 minutes)	+0.77	+0.61
PP *Access to important community resources for priority populations residents (resources accessible by rail in 60 minutes)*	*+1.2*	*+1.2*

[38] Emeryville and Berkeley (Capitol Corridor) are considered new stations under this analysis due to their infrequent service in the Baseline. Population figures around these existing stations are not included in the Baseline.

6.2.2. Objective B2: Improve Safety, Health, and Air Quality

This objective is measured through metrics that assess the ability to encourage mode shift from auto to rail and that:

- **Improve safety** by reducing the number of auto crashes in the Megaregion.
- **Improve health** by:
  - **Improving air quality** by reducing polluting emissions (nitrous oxides, sulfur oxides, PM2.5[39]).[40]
  - **Increasing active transportation** (walking and bicycling) as a means to access the rail network.

BART performs more strongly against these metrics as it generates higher ridership and a greater scale of mode shift to transit.

Table 6-5 summarizes the evaluation results for this objective.

Table 6-5. Evaluation Results for Objective B2: Improve Safety, Health, and Air Quality

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Air pollution (in tons of nitrous oxides, sulfur oxides, and PM2.5 over the evaluation period[41])	-200	-120
Auto-involved crashes (fatalities over the project's life cycle)	-360	-220
Walk and bicycle access to rail (miles walked and bicycled on an average weekday in 2050)	+69,000	+53,000

6.2.3. Objective B3: Advance Equity and Protect Against Community Instability and Displacement

This objective is measured through metrics that assess the ability for the concepts to increase the range of transportation options available to priority populations and, consequentially, the benefits that accrue to priority populations.

In both concepts around 40% of benefits accrue to priority populations, on average, which is consistent with the Justice40 goal of having 40% of the overall benefits flow to communities that are marginalized, underserved, and overburdened by pollution. It is

[39] Particulate Matter 2.5 microns or smaller in diameter
[40] Note that the Baseline assumes Regional Rail services in the Bay Area are electrified, so there is no air quality benefit assumed from the propulsion of rail services.
[41] The evaluation period is assumed to cover the period up to 60 years from service commencing.

worth noting that fares for BART and Regional Rail are assumed to be the same for comparable journeys (consistent with *Plan Bay Area 2050*), which is a change from the current fare structure. This means there is no difference in the affordability of fares between the two technologies.

This distribution of benefits is achieved through increasing the range of transportation options available to priority populations and reducing barriers to rail access and usage. However, the two concepts advance equity in different places:

- BART generates more **incremental** benefits to priority populations across the existing East Bay BART system.
- Regional Rail generates more **transformational** benefits to priority populations along the existing Regional Rail network, which are focused along two existing rail corridors: Caltrain from San Francisco to San Jose along the Peninsula and Capital Corridor between Sacramento, Richmond, Oakland, and the Coliseum Station (and onwards to San Jose). This includes areas where priority populations currently lack good access to rail service.

Both concepts carry a moderate level of displacement risk. Displacement risks are presented in detail in Section 9.2.

Table 6-6 summarizes the evaluation results for this objective.

Table 6-6. Evaluation Results for Objective B3: Advance Equity and Protect Against Community Instability and Displacement

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
PP *Rail travel times (minutes saved per trip for priority populations)*	*-2.5*	*-2.1*
PP *Rail travel times (share of benefit to priority populations)*	*48%*	*50%*
PP *Potential new rail trips for priority populations (linked trips on the average weekday in 2050)*	*+52,000*	*+38,000*
PP *Potential new rail trips (share of benefit to priority populations)*	*39%*	*41%*
PP *Access to stations for priority populations residents (within 0.5 miles of existing or new rail stations)*	*+12,000*	*+10,000*
PP *Access to stations for residents (share of benefit to priority populations)*	*42%*	*27%*
PP *Access to opportunity jobs for priority populations (jobs accessible by rail in 60 minutes)*	*+10,100*	*+10,400*
PP *Access to opportunity jobs (share of benefit to priority populations)*	*57%*	*58%*

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
PP *Access to important community resources for priority population residents (resources accessible by rail in 60 minutes)*	*+1.2*	*+1.2*
PP *Access to important community resources (share of benefit to priority populations)*	*50%*	*63%*
Vehicle miles traveled reduction (million vehicle miles per year in 2050)	-500	-300
Displacement risk (score out of 5 where 5 equals the most risk)	-2.4	-2.8

6.3. Goal C: Support Economic Opportunity and Global Competitiveness

6.3.1. Objective C1: Improve Access to Opportunity and Employment

This objective is measured through metrics that assess the ability of two concepts to better connect people and jobs, providing new access from residential areas to key employment areas. Both concepts provide new rail access for both employees and businesses. Expanding the number and variety of jobs accessible to residents would support the Megaregion's competitiveness and accommodate projected economic growth in the future.

BART provides greater access to employment than Regional Rail, since it provides more rail service to destinations with planned high employment growth, such as Mission Bay. Therefore, the BART concept generates a greater number of additional commuter trips. Conversely, Regional Rail provides new Urban | Metro services in relatively residential areas, such as Berkeley and Emeryville, and, as a result, does not provide as much access to stations for employees.

Table 6-7 summarizes the evaluation results for this objective.

Table 6-7. Evaluation Results for Objective C1: Improve Access to Opportunity and Employment

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Employee access to stations (jobs within 0.5 miles of existing or new rail stations)	+37,000	+26,000
Access to potential employees for businesses (Potential employees within 60 minutes of businesses by rail)	+41,000	+39,000

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Commute trips on network (linked trips on the average weekday in 2050)	+76,000	+52,000

6.3.2. Objective C2: Connect Major Economic, Research, and Education Centers

This objective is measured through metrics that assess how the concepts could stimulate increased productivity and innovation by better connecting major destinations. Both concepts provide at least five minutes of travel time savings between major destinations and transportation hubs, such as downtown San Francisco, Berkeley City Center, and the San Francisco International Airport.

BART provides more evenly distributed time savings between major destinations and transportation hubs by increasing frequency on all East Bay BART lines. The greatest time savings are to/from the areas surrounding the new stations at Alameda and Mission Bay. Travel time savings are comparable to destinations on East Bay BART lines, such as downtown Berkeley, Contra Costa Centre, and Walnut Creek, as each station benefits from a similar frequency increase.

Regional Rail provides greater but more focused time savings with fewer major destinations and transportation hubs experiencing greater savings. The greatest time savings are to Emeryville-West Berkeley and Richmond, existing Caltrain stations on the Peninsula, and megaregional destinations, such as Sacramento.

Table 6-8 summarizes the evaluation results for this objective.

Table 6-8. Evaluation Results for Objective C2: Connect Major Economic, Research, and Education Centers

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Travel times between major destinations and transportation hubs (in minutes)	-4.0	-4.3

6.3.3. Objective C3: Enable Transit-supportive and Equitable Land Use

This objective is measured through metrics that assess how the concepts, in conjunction with planning policy, could facilitate transit-supportive and equitable land use around stations to support communities' stability and livability, economic, and environmental goals.

Currently, local land use policies around BART stations areas are more aligned with Link21 transit-oriented development and MTC transit-oriented community policy goals

than for Regional Rail. Such land use policies would drive more new residential development and inclusionary units (due to assumed transit-oriented development policies that may be triggered by Link21), enabling more sustainable, transit-orientated growth in the long term.

Under the BART concept, most potential new and improved stations meet Link21 transit-oriented development policy goals and MTC transit-oriented community policy goals for increased residential development. Jack London Square and Alameda stations do not meet Link21 transit-oriented development policy goals while Alameda Station also does not meet MTC transit-oriented community policy goals.

Under the Regional Rail Representative Concept, several potential new and improved stations do not meet Link21's transit-oriented development policy goals for increased residential development, including Alameda, Berkeley, Coliseum, Richmond, and Millbrae. Alameda, Berkeley, and Millbrae stations do not meet MTC's transit-oriented community policy goals.

The Link21 Team will continue to facilitate transit-supportive and equitable land use around stations by creating partnerships with municipalities to proactively plan and rezone to support communities' stability and livability, economic, and environmental goals, particularly in areas adjacent to rail stations.

Table 6-9 summarizes the evaluation results for this objective.

Table 6-9. Evaluation Results for Objective C3: Enable Transit-supportive and Equitable Land Use

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Local land use policies consistent with Link21 land use policies (score out of 5)	2.3	1.7
Potential for future land uses within station catchment areas (score out of 5)	2.3	2.0

6.4. Goal D: Advance Environmental Stewardship and Protection

6.4.1. Objective D1: Increase Climate Change Resilience

This objective is measured through metrics that assess how the concepts are resilient to sea level rise. Climate change poses challenges for the resilience of the megaregional rail network, specifically as a result of sea level rise in low-lying coastal areas.

Both concepts would make the rail network equally more resilient by providing an alternative transbay crossing, and by building infrastructure to a higher sea level rise

resilience standard than the existing infrastructure, either by modifying existing facilities or by constructing new ones.

The infrastructure included in any Crossing Project would be resilient to sea level rise as a design requirement, so there is no difference in sea level rise vulnerability between the infrastructure of either concept. However, the Regional Rail Representative Concept provides train services in more areas of sea level rise vulnerability where no other public agency is likely to take action (e.g., the existing route through the Suisun Marsh). Also, the Regional Rail network would likely incur more costs to address sea level rise vulnerability in existing right-of-way than the BART network.

6.4.2. Objective D2: Reduce Greenhouse Gas Emissions

This objective is measured through metrics that assess how concepts reduce greenhouse gas emissions through mode shift, and it considers the embodied carbon from constructing the new crossing.

Both concepts provide new rail alternatives that are competitive with auto, encouraging mode shift from auto to rail. This **reduces the amount and rate of greenhouse gas emissions attributable to transportation** and helps the Megaregion meet statewide targets. However, the projected reductions are relatively modest as a high proportion of autos in California are assumed to be zero-emission vehicles by 2050.[42]

The BART concept reduces vehicle greenhouse gas emissions by 1.7 million tons[43] (compared to 1 million tons for Regional Rail), reflecting how it generates greater ridership and mode shift from auto; therefore, it has a greater reduction in vehicle miles traveled.

Note that the Baseline assumes Regional Rail services in the Bay Area are already zero emission, so there is no benefit from reduced greenhouse gas emissions from the propulsion of Regional Rail services.

The Regional Rail concept generates more embodied carbon during construction due to its larger construction footprint for at-grade sections beyond the crossing itself.

Table 6-10 summarizes the evaluation results for this objective.

[42] Under state legislation, by 2035 100% of new cars and light trucks sold in California will be zero-emission vehicles, including plug-in hybrid electric vehicles. By 2050, a high proportion of vehicles is expected to be zero-emission.
[43] The evaluation period is assumed to cover the period up to 60 years from service commencing.

Table 6-10. Evaluation Results for Objective D2: Reduce GHG Emissions

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
GHG emissions from vehicles (million tons of carbon dioxide over the evaluation period)	-1.7	-1.0
Embodied carbon from construction (tons of carbon dioxide)	24,000	95,000

GHG = greenhouse gas

6.4.3. Objective D3: Conserve Resources

This objective is measured through metrics that assess the transportation network's energy consumption. Since both concepts encourage mode shift from auto onto a more energy-efficient rail network, they lower energy consumption rates on a total, per capita, and per trip basis.

The BART concept generates a greater reduction in energy consumption for transportation, which reflects a greater mode shift and how the additional rail services in the BART concept require less energy than those for Regional Rail.

Table 6-11 summarizes the evaluation results for this objective.

Table 6-11. Evaluation Results for Objective D3: Conserve Resources

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Energy consumption from transportation (billion kilowatt-hour over the evaluation period)	-37	-20

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7. Economic Case

The Economic Case evaluates the benefits of each Representative Concept for rail and non-rail travelers and society as a whole, and it identifies the economic value to the Megaregion. It assesses the cost-effectiveness of the BART and Regional Rail Representative Concepts by monetizing benefits and comparing them to their estimated costs.

The evaluation results reflect the specific assumptions for each Representative Concept and the current stage of development. The results and conclusions presented in the following sections will evolve as the concepts are developed and refined in the future.

7.1. Cost-benefit Analysis

7.1.1. Background

Cost-benefit analysis is based on assessing the costs of a project (including to build, maintain, and operate it) against its monetized benefits. Typically, it is used either to support discretionary funding applications, or to support comparison of projects alternatives and identify 'trade-offs'.

At this stage, the cost-benefit analysis has been primarily prepared as an information tool to identify opportunities for future project refinement. The focus to date has been an initial assessment of the benefits of the Representative Concepts to transportation system users (time savings and reductions in crowding) and wider society (reduced air pollution, auto-involved crashes, reduced greenhouse gas emissions, and improved health outcomes). It should be stressed that, reflecting the early stage of development of the Crossing Project, **not all benefits** have been quantified to date.

Representative Concepts and the Corridor ID Program

The cost-benefit analysis undertaken to date is based upon the Representative Concepts, while the eventual project(s) advanced by Link21 are likely to be very different, informed by continued stakeholder engagement, planning and project development.

Specifically, the recent acceptance of the Capitol Corridor into the federal Corridor ID Program may substantially change certain Baseline assumptions about the project context. Because of the way the Link21 planning process has processed in advance of the California State Transportation Agency-led *California State Rail Plan* and Corridor ID Program, the Baseline, as currently defined, assumes **only** metropolitan planning organizations' adopted projects and **not** other planned enhancements are being considered through the Corridor ID Program.

The Corridor ID process is expected to identify a phased sequence of Regional Rail projects that may fundamentally change the relative costs and benefits of the transbay

crossing concepts for Regional Rail and BART. Several key elements of the scope of a Regional Rail crossing project could be delivered as separate, independent projects, depending on how the Corridor ID Program advances. For example, this could include dedicated passenger tracks between Richmond, Oakland and Coliseum, a new downtown Oakland station, and/or electrification in the East Bay, which could be delivered prior to completing a transbay crossing. These elements could then be included within a future Baseline, reducing the costs attributable to a Regional Rail crossing project, and therefore potentially improving its cost-effectiveness.

Therefore, with refined assumptions about the infrastructure that will be in place at the time a decision is made to advance the transbay tunnel element, the cost-benefit analysis as it currently stands may understate the marginal benefits and overstate the marginal costs of a Regional Rail crossing.

At this stage, the cost-benefit analysis does not capture the **wider economic benefits** of the two concepts, such as impacts on productivity or employment in the Megaregion, which is in line with federal and regional evaluation guidance. For large-scale, transformational megaprograms, such as Link21, these benefits can be substantial. Not all benefits have been monetized, such as improved reliability, increased productivity from improved proximity between businesses and labor markets,[44] and potential for future land uses, which is an important limitation of the cost-benefit analysis.

7.1.2. Evaluation Results

Noting the limitations discussed in Section 7.1.1, the cost-benefit analysis indicates the BART and Regional Rail Representative Concepts generate large economic benefits that are driven by travel time savings benefits to new and existing transit riders and improve travel time to auto users. However, the concepts have higher costs than monetized benefits as currently defined.

The BART concept generates a higher initial benefit-cost ratio than the Regional Rail concept due to greater monetized benefits and lower capital cost. It could potentially generate a benefit-cost ratio of near 1.0 in a low-cost scenario (-20% capital cost reduction). The Regional Rail concept could generate a benefit-cost ratio of around 0.5 in a low-cost scenario (-20% capital cost reduction). In a high-cost scenario (+30% capital cost increase), the BART concept would generate a benefit-cost ratio of 0.6, while the Regional Rail concept would generate a benefit-cost ratio of 0.3.

The cost-effectiveness of the BART and Regional Rail concepts could be improved by providing service to new high-demand markets. The cost-effectiveness of Regional Rail also could be improved by adding more frequency in the crossing, providing service to new high-demand markets, and/or exploring cost savings.

[44] Increased productivity from improved proximity between businesses and labor markets is known as agglomeration benefits.

There also is potential to identify and monetize additional benefits to be included in the benefit-cost ratio. This will be undertaken post-Stage Gate 2 for the identified crossing technology.

Table 7-1 summarizes the cost-benefit analysis evaluation results.

Table 7-1. Evaluation Results for the Cost-benefit Analysis Metrics

METRIC	BART	REGIONAL RAIL
BENEFITS (BILLION DOLLARS, DISCOUNTED[1])		
Transit and auto user benefits	15.8	11.1
Transit and auto user benefits due to reducing transit crowding[2]	*3.9*	*2.8*
Air pollution	0.04	0.02
Auto-involved crashes	4.1	2.4
Greenhouse gas emissions	0.05	0.03
Health improvements due to increased walking and bicycling	1.8	1.4
Total Benefits	**21.8**	**15.0**
COSTS (BILLION DOLLARS, DISCOUNTED[1])		
Capital cost indicator[2]	19 – 31	28 – 46
Operating and maintenance costs	2.2	3.1
Renewal costs	2.8	2.8
Residual value[3]	1.8	1.4
Total Costs[3]	**22.2 – 34.2**	**32.5 – 50.5**
COST-BENEFIT ANALYSIS		
Benefit-cost Ratio Range[4]	**0.6 – 1.0**	**0.3 – 0.5**

[1] Benefits and costs in the Economic Case are measured in billion dollars over the evaluation period in 2023 prices and discounted at 3% per year in real terms to 2028.

[2] The transit crowding monetized benefit is included in the transit and auto user benefits value. It is separated out here for emphasis and is not double counted in the total.

[3] The residual value is deducted from the costs.

[4] The capital cost indicator and benefit-cost ratio range assume a 20% reduction in capital costs in a low-cost scenario and a 30% increase in capital costs in a high-cost scenario.

7.2. Wider Economic Benefits

Wider economic benefits refer to the increase in productivity, employment, and investment as a result of improved transport connectivity.

The greatest source of wider economic benefits arises from increased productivity from **economic agglomeration**. Extensive research demonstrates that firms and workers become more productive as a result of being better connected to one another, which increases wages and firms' profits. These significant productivity benefits from agglomeration help explain why many similar firms choose to cluster together despite the high cost of doing so, such as high-tech companies within Silicon Valley.

Consequently, productivity benefits from megaprograms, such as Link21, can be large, especially in highly productive megaregions, such as Northern California. However, it is unclear how long-term trends in travel behavior post-pandemic, such as increased teleworking, will affect how these benefits persist over time.

These impacts form an important part of the economic benefits of megaprograms, such as Link21, but in line with federal and regional evaluation guidance, they are not currently included in the cost-benefit analysis and have been scored qualitatively. Initial work has sought to quantify the productivity impacts from agglomeration of the Crossing Project and indicates that they equate to an additional 30 to 90% of the overall monetized benefits.

This reflects how both concepts improve connectivity within a densely populated Megaregion with a large share of employment in skilled, highly productive roles, both are expected to generate productivity benefits. Future work will consider these impacts in more detail and consider including them within the overall cost-benefit analysis.

Both BART and Regional Rail provide at least five minutes of travel time savings between major destinations and transportation hubs within the Bay Area, such as downtown San Francisco, Berkeley city center, and the San Francisco International Airport. Regional Rail, which directly connects San Francisco with Sacramento, Stockton, and other new markets, has the potential to deliver wider economic benefits across the Megaregion.

Table 7-2 summarizes the wider economic benefit evaluation results.

Table 7-2. Evaluation Results for the Wider Economic Benefit Metrics

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Wider economic impacts (score out of 5)	3	3
Travel times between major destinations and transportation hubs (minutes)	-4.0	-4.3

8. Financial Case

The Financial Case considers the financial implications of the BART and Regional Rail Representative Concepts. It assesses how much it could potentially cost to deliver and operate each concept, how much revenue each could potentially generate, and the balance between fare revenues versus ongoing operating costs (the farebox recovery ratio). It also considers the potential funding opportunities for BART and Regional Rail.

The evaluation results reflect specific assumptions for each Representative Concept, which reflect the current stage of development. The results and conclusions presented in the following sections will evolve as the concepts are developed and refined in the future.

8.1. Revenue

Both concepts generate increased farebox revenues from increased rail trips. The BART concept is estimated to generate an annual fare revenue of $140 million, while the Regional Rail concept is estimated to generate $90 million, both for the 2050 forecast year in (undiscounted) 2023 dollars.[45]

Table 8-1 summarizes the evaluation results for the revenue metric.

Table 8-1. Evaluation Results for the Revenue Metric

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Farebox revenues (billion dollars, discounted*)	+2.9	+1.8

** Revenues and costs in the Financial Case are measured at billion dollars over the evaluation period in 2023 prices and discounted at 3% per year in real terms to 2028.*

8.2. Cost

Reflecting the scale of the Crossing Project, both concepts incur significant capital, operating, and renewal costs.

The capital costs of the transbay crossing, largely a new tunnel under the San Francisco Bay, is similar for the BART and Regional Rail Representative Concepts, at between $18 and $30 billion in 2023 dollars. Overall capital costs differ for how a future crossing is connected to the BART and Regional Rail networks on either side of the San Francisco Bay.

Since the BART network is already well developed, the scale of additional infrastructure required to effectively connect it to the wider network is modest compared to the

[45] It should be noted that all evaluation scenarios assume a reformed future fare policy where Regional Rail fares are similar to BART fares on a per mile basis for Urban | Metro services.

crossing, at between $5 and $10 billion in 2023 dollars. Including the costs for elements beyond the crossing, the capital cost range for the BART Representative Concept is estimated to be $24 to $38 billion in 2023 dollars (or between $30 and $49 billion in year of expenditure dollars).

Since the Regional Rail network is less developed than for BART, a Regional Rail Crossing Project requires greater investment to alleviate constraints on the wider network (especially between Emeryville and Richmond), enable improved Urban | Metro service, and support ridership in the crossing. This means that a Regional Rail crossing would cost between $15 and $25 billion in 2023 dollars to effectively connect to the wider rail network and ensure the new capacity is used effectively. The capital cost range for the Regional Rail Representative Concept is estimated to be $33 to $54 billion in 2023 dollars (or between $42 and $68 billion in year of expenditure dollars).

However, some elements of a Regional Rail Crossing Project could be delivered and funded as separate, independent projects that are developed under the Corridor ID Program and in line with the proposals set out in the *California State Rail Plan*. This could include dedicated passenger tracks between Richmond, Oakland, and Coliseum; a new downtown Oakland station; and/or electrification in the East Bay. These enhancements each have distinct benefits and costs, and if delivered independently, potentially in advance of Link21, could reduce the capital costs attributable to a Regional Rail Crossing Project.

The annual operations and maintenance costs for the BART concept is estimated at $110 million, while the operations and maintenance costs for the Regional Rail concept is estimated at $150 million for the 2050 forecast year in (undiscounted) 2023 dollars. Note these values represent operational costs **in addition** to those required to operate the existing BART and Regional Rail networks in the Baseline.

Table 8-2 summarizes the evaluation results for the cost metrics.

Table 8-2. Evaluation Results for the Cost Metrics

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Capital cost indicator (billion dollars, in 2023 dollars)	24 – 38	33 – 54
Capital cost indicator (billion dollars, discounted*)	19 – 31	28 – 46
Operations and maintenance costs (billion dollars, discounted*)	2.2	3.1
Renewal costs (billion dollars, discounted*)	2.8	2.8

** Revenues and costs in the Financial Case are measured at billion dollars over the evaluation period in 2023 prices and discounted at 3% per year in real terms to 2028.*

8.3. Financial Sustainability

8.3.1. Financial Performance During Operations

The balance between revenues and operating costs, known as the farebox recovery ratio, is an indicator of whether a project could generate a revenue surplus or require ongoing subsidy. Note that this metric evaluates incremental revenue and operating costs to assess the recovery ratio for the additional rail services included in each Representative Concept only. It does not reflect the financial sustainability of the wider BART or Regional Rail networks.

The BART concept achieves a farebox recovery ratio greater than 1.0, which means incremental fare revenues are greater than ongoing operating costs. Since Regional Rail generates lower fare revenue and is more costly to operate, it achieves a lower farebox ratio of 0.6.

The discounted[46] net present value of revenue and costs assesses the total financial subsidy required for each concept across the evaluation period (from 2028 to 2100). This includes capital and operating and renewal costs alongside fare revenue. The net present value is estimated at -$26 billion for the BART concept and -$39 billion for the Regional Rail concept.

8.3.2. Project Funding

Regardless of the technology, the cost and scale of a new transbay passenger rail crossing could mean that funding its development and construction would be a major effort. However, BART and Regional Rail have the potential to be affordable through a combination of three sources:

1. **Regional:** via tax measure or other mechanisms
2. **Federal:** could be a combination of Federal Transit Administration and Federal Railroad Administration funding
3. **State:** primarily the Transit and Intercity Rail Capital Program and possibly other sources

The evaluation assumes current federal and state funding and financing structures continue to be available with federal jurisdiction and funding for a BART crossing likely coming under the Federal Transit Administration and a Regional Rail crossing likely coming under the Federal Railroad Administration.

[46] Revenues and costs in the Financial Case are measured at billion dollars over the evaluation period in 2023 prices and discounted at 5% per year (3% in the Economic Case) to 2028.

BART Crossing

A BART crossing, despite lower capital costs, has fewer opportunities for state and federal funding. It is likely federal capital funding for BART would come from the Federal Transit Administration Capital Investment Grant Program, which is more clearly established and predictable than the Federal Railroad Administration's funding sources. However, the Federal Transit Administration Capital Investment Grant Program is more competitive, and a BART crossing could face greater competition, including against other potential BART funding needs. It is likely state funding will be significantly more challenging for a BART than a Regional Rail crossing, as a BART crossing is less aligned with the *California State Rail Plan*.

Regional Rail Crossing

A Regional Rail crossing is eligible for a wider range of funding sources than a BART crossing — especially with the recent increase in federal funding for intercity passenger rail projects, from which the Bay Area has already benefited.

The selection of the Capital Corridor within the Corridor ID Program —which Link21 is included in — already positions Link21 for federal support and funding. The next step involves a planning process that will identify a phased program of projects to realize planned service levels in the corridor. The resulting projects —potentially including Link21 — are then eligible for federal design and construction grants under the Federal-State Partnership program. Federal financing also could be available through the Railroad Rehabilitation and Improvement Financing Program and/or state funding since a Regional Rail crossing would clearly advance the *California State Rail Plan*.

The Portal continues to advance with support from local, state, and federal partners, including federal funding through the Federal Transit Administration's Capital Investment Grants Program. The project, which would be leveraged by a Regional Rail crossing, demonstrates that Regional Rail improvements are being funded by Federal Transit Administration and Federal Railroad Administration programs, and a Regional Rail Crossing Project could be eligible for funding from both sources. The Portal's success also demonstrates how a longer-term vision can be delivered through a series of smaller projects over a longer period of time, scoped and developed through the Corridor ID Program, and better aligned to the long-term profile of federal funding.

This funding model could be directly applicable to Link21. Particularly in the East Bay, some elements of a Regional Rail crossing project could be delivered as separate, independent projects with their own benefits, costs, and funding sources, and could advance before a transbay crossing is constructed. This sequential implementation opens other opportunities for Federal Railroad Administration funding and financing programs, such as the Consolidated Rail Infrastructure and Safety Improvements program, Railroad Crossing Elimination program, and Railroad Rehabilitation and Improvement Financing program. This could maximize the opportunity for federal

funding by delivering Link21 through a series of smaller projects over a longer period of time, which is better aligned to the long-term profile of federal funding.

It should be noted, however, that the availability of future Federal Railroad Administration funding streams is not guaranteed and would compete with other CCJPA and intercity rail priorities outside the Megaregion (although not BART and other transit priorities).

Table 8-3 summarizes the evaluation results for the financial sustainability metrics.

Table 8-3. Evaluation Results for the Financial Sustainability Metrics

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Farebox recovery ratio	1.3	0.6
Present value of revenue and costs[1]	-26	-39
Affordability of the project, funding, and finance[2] (score out of 5)	-4	-2

[1] *The metric is measured at billion dollars over the evaluation period in 2023 dollars and discounted at 3% per year in real terms to 2028.*

[2] *Under this metric, a greater negative score represents a greater challenge to affordability, funding, and financing for the project.*

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9. Deliverability Case

The Deliverability Case considers how each of the Representative Concepts can be delivered, and what is required to design, construct, manage, and operate them. It also assesses potential project risks or considerations associated with each concept, such as environmental, right-of-way, and land use risks, including the potential risk of direct and indirect displacement.

It should be noted that the evaluation results reflect specific assumptions for the design and extent of each Representative Concept, which will change as the concepts are developed and refined in the future. The evaluation adopts a risk-based approach, highlighting potential project risks or considerations for both concepts. Project risks are scored qualitatively, reflecting both their severity and likelihood of occurrence. Ongoing development of the concepts will seek to eliminate or reduce potential risks as far as possible.

9.1. Construction and Transportation Network Risks

Major complex construction, system integration, rolling stock, and operational procurement exercises would be required for both concepts. The Representative Concepts carry significant design and construction requirements, reflecting the scale and complexity of a megaproject, such as the Crossing Project, and the potential risk of service disruption during construction.

The BART concept carries lower potential construction and transport network risks, which reflects a smaller construction extent, fewer and less complex interfaces with the existing transport network, and more limited at-grade construction. The Regional Rail concept is likely to require the potential widening on UPRR right-of-way in the East Bay for dedicated passenger service, unlike BART which has fewer right-of-way acquisition needs.[47]

Neither BART nor Regional Rail is expected to impact the ability to reliably operate the transport network following completion of the Crossing Project. The infrastructure and fleet for both concepts will be designed to meet operational performance requirements based on accepted industry standards.

Table 9-1 summarizes the evaluation results for the deliverability risk metrics.

[47] The Regional Rail concept assumes this widening is required and subject to future negotiations with UPRR; this requirement may be reduced. The risk that widening is required is reflected in the scoring.

Table 9-1. Evaluation Results for the Deliverability Risk Metrics

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Design/construction risk (score out of 5)	-3	-5
Transportation network risk during construction (score out of 5)	-1	-3
Transportation network risk after construction (score out of 5)	0	0

9.2. Displacement Risks

A preliminary assessment of displacement risks reflects the specific assumptions of the Representative Concepts, such as station location, alignment, service, and policies.

Both concepts create potential direct and indirect displacement risks, particularly for low-income households. The analysis indicates that rent increases occur across all stations for new units if they are built within approximately 0.5 miles of a station for either concept and households at all income levels that move into station areas served by either concept. These trends create the potential for indirect displacement under both concepts.

Although displacement risks are station specific, indirect displacement risks from higher rent, redevelopment, and demolition are broadly lower with the BART concept. This largely reflects how most BART concept stations are located in areas currently with anti-displacement policies, whereas a large proportion of current or potential Regional Rail stations are located in jurisdictions currently without basic anti-displacement policy protections.[48] These policies directly influence the level of displacement risk for both concepts. The following stations exhibit a higher potential for indirect displacement:

- **BART:** Alameda, Downtown Oakland, and Jack London Square
- **Regional Rail:** 12th St./Oakland City Center, Alameda, Berkeley, Coliseum, Emeryville, Millbrae, and Richmond

Similarly, the BART concept also performs stronger against an affordable housing provision, reflecting local jurisdictions' Regional Housing Need Allocation performance for low- and very low-income housing units and the amount of affordable housing planned near existing BART stations. It is important to note that the analysis assumes jurisdictions' current anti-displacement policies remain unchanged, and it does not account for the willingness of jurisdictions without these protections to adopt stronger anti-displacement ordinances prior to project delivery. Post-Stage Gate 2, the Link21

[48] For BART, only Alameda has no rent control protections, and all other jurisdictions served by the Representative Concept have basic anti-displacement policies. For Regional Rail, Alameda, Emeryville, Millbrae, and Richmond lack rent control protections, and Millbrae has no just cause eviction policy.

Team will coordinate with jurisdictions regarding anti-displacement policies to minimize potential displacement, including developing an Anti-displacement Toolkit to support local jurisdictions.

Potential direct displacement risks due to right-of-way acquisition are greater with the Regional Rail concept, reflecting the assumed widening of the existing at-grade UPRR right-of-way in the concept, which would likely result in some direct displacement of various land uses. Subject to further design work and negotiations with UPRR, there are potential options that involve Regional Rail services sharing tracks with UPRR that could deliver a better outcome overall.

Ongoing development of the concepts will seek to eliminate or reduce potential displacement risks as far as possible.

Table 9-2 summarizes the evaluation results for the displacement risk metrics.

Table 9-2. Evaluation of Results for the Deliverability Risk Metrics

METRIC (UNIT OF MEASURE)	BART	REGIONAL RAIL
Anti-displacement policy provision (score out of 5)	-1.0	-1.7
Indirect displacement risk (score out of 5)	-2.8	-3.0
Affordable housing provision (score out of 5)	-2.5	-3.2
Potential direct displacement: construction and right-of-way acquisition (score out of 5)	-1.0	-5.0

9.3. Environmental Risks

A preliminary assessment of environmental risk reflects the specific assumptions of the Representative Concepts, such as station location and alignment.

Both concepts carry potential environmental risks. The evaluation approach seeks to identify potential challenges during future environmental review and permitting that may result in design challenges and/or potentially require extensive mitigation to address. Such risks are typical for a project of the Crossing Project's scale, and they do not necessarily represent an issue that would prevent a project concept from being advanced through environmental review or approval.

Overall, the Regional Rail concept has greater potential environmental risks. This reflects its larger project extent with environmental risks present in downtown San Francisco, Alameda, Oakland, from Emeryville to San Pablo, and from South San Francisco along the Peninsula. The Regional Rail concept presents environmental risks that are associated with biological resources, historic building/structures, community

resources, sea level rise vulnerability, Section 4(f) resources,[49] a power plant, and construction disturbance in multiple priority populations and potential environmental justice communities. The extent to which environmental risk can be avoided, minimized, or mitigated would be determined in the next phases of project definition and planning.

The BART concept serves different station locations in San Francisco and Oakland to the Regional Rail concept, and, consequently, the environmental risks associated with this concept are unique and distinct. BART has similar environmental risks to Regional Rail that are associated with historic resources and a power plant. However, BART has fewer risks associated with community resources, sea level rise vulnerability, and Section 4(f) resources, and it has less construction within priority populations and potential environmental justice communities. It poses a unique transportation risk from overlap with one portion of California State Route 24.

Ongoing development of the concepts will seek to eliminate or reduce environmental risks as much as possible.

9.4. Delivery Approach

Key aspects of the delivery approach for a BART and Regional Rail crossing are discussed in this section. Note that these metrics are not scored. They provide context of key deliverability considerations for progressing with either crossing technology.

9.4.1. Project Planning and Risk Management

Advancement of a Crossing Project would be guided by several external requirements and processes, most notably compliance with the California Environmental Quality Act and National Environmental Policy Act and the requirements of the federal lead agency, either Federal Railroad Administration (likely for Regional Rail) or Federal Transit Administration (likely for BART). These external requirements are similar for both concepts.

Similarly, irrespective of the technology adopted, Link21 will continue to utilize the Stage Gate Process to manage the program, and there should be no significant differences between BART and Regional Rail concepts during this process.

The key considerations for project planning and risk management include the following:

- BART is a closed system and currently benefits from having limited interfaces with UPRR and other operating agencies, such as Caltrain and the Transbay Joint Powers Authority.

[49] Section 4(f) properties include publicly owned public park and recreation lands (including public trails, recreational areas of public schools open to the public, publicly owned golf courses, and sometimes civic plazas), publicly owned wildlife or waterfowl refuges, or any publicly or privately owned historic site listed or eligible for listing on the National Register of Historic Places.

- Regional Rail would require engagement and agreement with UPRR on right-of-way and coordination with other agencies and authorities due to the intercity nature of the system. Successful integration of a Regional Rail crossing with other standard-gauge rail services and planned projects would be critical to maximizing its benefits.

Planning processes for a BART or Regional Rail crossing would be different. The Federal Transit Administration has a long history of overseeing the planning and development of urban transit systems. The Federal Railroad Administration has an established program and recently expanded its partnerships with local sponsors to passenger rail programs. This includes the acceptance of the Capitol Corridor, which includes a future transbay crossing, into the Federal Railroad Administration Corridor ID Program.

9.4.2. Governance

BART has broad statutory authority to plan and construct facilities and deliver and operate rapid transit services in its geographic service area, which the BART concept lies within. BART is already an eligible recipient of Federal Transit Administration funding. Some governance changes may be needed to ensure coordination and realize the goal of greater network integration, which may require either statutory change or less formal coordination.

CCJPA (as the statutorily designated intercity rail operator) is already an eligible recipient of Federal Railroad Administration funding. BART, as the designated managing agency for CCJPA, has the statutory authority to construct Regional Rail facilities, including a transbay crossing.

The Regional Rail concept would require coordinating rail services by several agencies, especially Caltrain, which would likely involve new interagency agreements and/or state legislation.

9.4.3. Procurement

Neither BART nor Regional Rail present significantly different procurement challenges, and either technology will require a detailed procurement strategy to support design and delivery. Historically, BART has delivered (and procured) major projects and is assumed to have the capacity to deliver either a BART or Regional Rail crossing (the latter with oversight from the CCJPA Board of Directors).

For delivery of a BART crossing, the bespoke and segregated technical nature of the network, including the use of broad-gauge tracks, could limit the pool of available vendors/contractors and/or increase the cost of delivery of specific components, such as fleet and signaling systems. A Regional Rail crossing could enable joint procurement of rolling stock and other materials between rail agencies and benefit from access to a wider pool of potential vendors/contractors due to more standardized equipment and rail technology.

9.4.4. Engagement and Consultation

Link21 has made a commitment to community engagement that exceeds what would be typical of most transportation infrastructure projects. This focus on engagement will remain regardless of which Crossing Project is advanced and is reinforced by the program's pursuit of federal funding. While specific engagement and outreach activities would differ, the overall level of effort, including the commitment to engage with communities that have been marginalized, would be comparable for both concepts and not a basis for differentiation.

9.4.5. Alignment with Stakeholder Aspirations

Link21's goals, objectives, and problem and vision statement broadly align with key stakeholders' goals and initiatives. This is evidenced through Link21's recent funding applications (such as the successful application to the Transit and Intercity Rail Capital Program and the recent, albeit ultimately unsuccessful, application for the Federal State Partnership Program), which have received numerous letters of support from partner agencies, elected officials, and labor unions.

This support speaks to the broad goals and objectives of the program. The recent selection of the Capitol Corridor into the Federal Railroad Administration Corridor ID Program and the inclusion of the corridor in the *California State Rail Plan* indicates the strong levels of federal and state support for Link21.

A public survey was conducted in fall 2023 to understand the public sentiment towards Link21 and a potential BART or Regional Rail Crossing Project more specifically. A total of 1,255 respondents completed the survey.

The survey revealed a preference for features offered by a Regional Rail crossing over those offered by a BART crossing. For example, 71% of respondents considered it important to create a broader, more connected passenger rail network in Northern California by directly linking systems together, and 65% of respondents considered it important to create faster, direct connections from Northern California destinations, such as Sacramento and Stockton, to jobs and housing in San Francisco and the Peninsula. This compares with 45% of respondents who considered it important to increase the frequency of trains on all BART lines in the East Bay.

It should be noted that that the survey did not provide the public with a description of any specific concept, nor did it describe the benefits and costs, so this preference should be considered as indicative rather than definitive.

10. Limitations

10.1. Overview

This report is informed by a range of analyses that are designed to inform the **identification of a crossing technology** at Stage Gate 2. This analysis is based on several key limitations:

- The use of **two Representative Concepts**, as described in Chapter 4, at a conceptual level of development that is sufficient for preliminary planning to determine, approximately, the service potential and infrastructure needs, but **do not** represent the definition of a final Crossing Project.
- The reliance on **future assumptions**, including projected population growth, employment trends, travel behavior changes (e.g., teleworking or willingness to use transit), upcoming project implementation (e.g., The Portal), and policy evolution (e.g., fare integration or land use policies), all of which influence the evaluation results.
- The cost-benefit analysis **does not monetize all the economic benefits** of the two concepts, in particular their wider economic benefits, which is consistent with cost-benefit analysis guidance.

Further details on these limitations are set out in the following sections. When reviewing the evaluation findings, it is important to consider these limitations before identifying the crossing technology for further development.

10.1.1. Representative Concepts Limitations

The Link21 Team considered several ideas and concepts in prior rounds of evaluation. This identified specific high-performing features (such as stations and service patterns balanced against their infrastructure requirements) for BART and Regional Rail Crossing Projects. These findings were used to develop both Representative Concepts, as described in Chapter 4, alongside substantial stakeholder coordination with partner agencies and the public.

Each Representative Concept is a reasonable representation of a transbay crossing and a potential future program of associated infrastructure improvements and service upgrades. This approach is intended to inform the **identification of a crossing technology**, and it does not provide a definitive assessment of the performance or cost-effectiveness of a future Crossing Project. The concepts may differ substantially from an eventual project as they were developed to identify and assess key considerations that could potentially influence the development and implementation of a project.

The Representative Concepts **have not been optimized for cost-effectiveness** at this early conceptual stage. Potential station location, alignment, and service plan options

can influence evaluation results, both in terms of costs and benefits, and consequently change cost-effectiveness. The service plans assumed in the Representative Concepts have not been optimized for ridership, benefits, revenues, and incremental operations and maintenance costs.

Opportunities to improve the performance of the Crossing Project could include refined service frequencies, capacities, and service extents by time of day and/or year. There are further opportunities to enhance ridership on either concept by providing new and/or improved rail service to different markets, which may include projects that are being advanced by others, including through the Corridor ID Program. Both concepts have the potential to connect with new rail lines, such as to western San Francisco, that could enhance the value of the crossing.

As the concept definition and service plan development matures, these opportunities could enable the economic and financial performance of the Crossing Project to be improved in future phases. The definition of the Crossing Project will evolve over time as it is developed and refined in subsequent phases of work.

The capital cost indicator presented in this report reflects the infrastructure assumptions associated with the two Representative Concepts. The cost estimates are based solely on outline engineering or design work. As the Crossing Project is developed in future phases, its definition will likely be different from the Representative Concept of the corresponding crossing technology, and it will influence the capital cost estimates.

For example, the Regional Rail Representative Concept assumes additional investments would be made to the Regional Rail network from central Oakland north to Richmond and south to the Coliseum in the East Bay, and along the Peninsula in the West Bay, with associated benefits and costs. This includes the considerable costs associated with a dedicated right-of-way between Oakland and Richmond, rather than some form of shared operations with UPRR. Subject to further design work and negotiations with UPRR, there are potential options that involve Regional Rail services sharing tracks with UPRR that could deliver a better outcome. Additionally, if this infrastructure is delivered and funded independently of Link21 through the Corridor ID Program, this would significantly reduce the costs attributed to the Crossing Project and potentially increase its cost-effectiveness.

Outside the core crossing infrastructure, the BART Representative Concept largely utilizes existing BART infrastructure. This contrasts with the Regional Rail Representative Concept, which connects to an existing network that covers a much larger geography outside the core crossing infrastructure. Unlike BART, it presents multiple solutions to integrate potential new or enhanced interregional train services within the existing network and deliver service enhancements. Additionally, in terms of trains per hour, the

Regional Rail Representative Concept utilizes a lower proportion of the crossing's practical operational capacity,[50] which presents greater opportunity for change.

Overall, the **definition of the Regional Rail Representative Concept has a greater potential to change**, especially with additional targeted investments to the existing Regional Rail network (e.g., enabled by the *California State Rail Plan* enhancements) compared to the BART Representative Concept.

Aside from the improvements included in the Baseline and/or proposed in the two Representative Concepts, the rest of the rail and transit network for both concepts is assumed to be unchanged. First/last mile connectivity enhancements at stations, such as changes to local transit services and/or bike lane infrastructure, have not been considered or modeled. There may be potential to improve the rail and transit network across all modes and/or plan complementary investments in active travel surrounding stations to increase ridership and deliver better outcomes overall.

The evaluation identified potential risks for each concept. As the concept extents could change, it has not been possible to be definitive about the potential risks, such as environmental, construction, or direct displacement for right-of-way acquisition. These will be considered in more detail in subsequent phases of work as the Crossing Project becomes more clearly defined.

10.1.2. Ridership Modeling, Forecasting, and Baseline Assumptions Limitations

The ridership, revenue, and benefits underpinning the evaluation of the concepts is based on the Refined Travel Demand and Land Use Tool (Refined TDLU Tool). This is an activity-based model covering the nine-county Bay Area, and it is used to evaluate how travel times and demand change in response to new transportation infrastructure. Demand, time savings, and access metrics are derived from the Refined TDLU Tool outputs.

It should be noted that the Refined TDLU Tool does not directly model the entire Megaregion. Some metrics, notably ridership, use outputs from the Initial Travel Demand Forecasting Tool (Initial TDLU Tool)[51] that was used in earlier rounds of evaluation in combination with the Refined TDLU Tool to provide estimates of the megaregional benefits. It should be noted that the cost-benefit analysis, including travel time savings, is based solely on the Refined TDLU Tool and does not include monetized benefits attributable to trips to and from destinations outside the Bay Area. However, since interregional trips only account for 1% and 2% of new rail trips for the BART and Regional Rail Representative Concepts, respectively, the impact of this limitation on the evaluation results is not significant.

[50] Refer to Section 6.1.3 for operational capacities.
[51] Further details about the Initial TDLU Tool can be found in the *Initial TDLU Tool Documentation Report.*

The long-term evaluation of large projects, such as the Crossing Project, involves critical assumptions with high levels of future uncertainty. Forecasts and estimates are based on available data, modeling tools, preliminary engineering work, and assumptions about right-of-way requirements. These will change as the data, tools, and assumptions are refined over time.

Uncertainty analyses are undertaken to explore the impact of certain assumptions and further justify transportation investment decisions. For example, *Plan Bay Area 2050* assumptions are based on pre-pandemic data, and analyses indicate results are highly susceptible to potential shifts in travel preferences and demographic growth, which could reduce the importance of adding capacity for the purpose of relieving potential future crowding.

The Refined TDLU Tool is used to estimate many metrics, and it is calibrated to a 2015 base year as recent travel demand and patterns have changed after the COVID-19 pandemic. To understand the potential impacts of key forecasting assumptions, the following stress tests were undertaken:

- **Change in travel preferences**, which assumed current levels of post-pandemic transit usage persisted over the long term, reflecting sustained higher levels of remote and hybrid working and a reduced preference of travelers to use rail and transit. It showed that under these assumptions, the Baseline total weekday linked rail trips in the Bay Area would reduce by 58% with comparable reductions in new rail trips generated by the Representative Concepts.
- **Change in population and employment growth assumptions**, which assumed lower future growth based on Caltrans' *2022 California Economic Forecast*. It showed that under these assumptions, the Baseline total weekday linked rail trips in the Bay Area would fall by 24% with even greater reductions in new rail trips generated by the Representative Concepts.

There are many other factors that have the potential to influence the evaluation results. For example, the Baseline the Representative Concepts are evaluated against assumes that several transit projects, such as The Portal, and transportation policies, such as the harmonization of BART and Regional Rail fares in the Bay Area, or auto cordon pricing are implemented. The inclusion or exclusion of these projects and policies would likely impact the evaluation results. Further work will be undertaken to understand the potential impact of some of these assumptions in future phases.

10.1.3. Monetized Economic Benefits Limitations

Since the Representative Concepts are at an early stage of development, the detail and precision of the evaluation and the scope of the cost-benefit analysis has focused predominately on travel time savings alongside other social and environmental benefits, such as reduced vehicle miles traveled and greenhouse gas emissions. The scope of the benefits monetized in the cost-benefit analysis at this early stage is intended to support the comparison between the two Representative Concepts to inform a

technology recommendation rather than provide a definitive view of the absolute cost-effectiveness of a BART or Regional Rail crossing.

Wider economic impacts form an important part of the economic benefits of megaprojects, such as the Crossing Project, but in line with federal and regional evaluation guidance, they are not currently included in the cost-benefit analysis. Wider economic benefits from increased agglomeration will be monetized in future stages of work, and there is potential for further social and economic benefits to be identified and monetized.

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11. Conclusions and Next Steps

11.1. Business Case Summary

BART and Regional Rail crossings present distinct approaches to improving the Megaregion's rail system, each with unique benefits, challenges, and considerations.

Regardless of whether the new crossing uses BART or Regional Rail technology, the Crossing Project could:

- **Meet crossing travel demand** between San Francisco and Oakland by 2050.
- **Enable uninterrupted transbay rail service** if one crossing goes out of service, improving system resilience and reducing delays.
- **Facilitate increased transbay train frequency** that can grow ridership.
- **Reduce traffic** and shift highway journeys onto rail and transit, including from the Bay Bridge.
- **Create new and improved transfers** between the BART and Regional Rail networks for faster and more convenient journeys.
- **Provide greater benefits to priority populations** that are aligned with federal Justice40 goals.
- Potentially **serve new markets** with new stations near the crossing (e.g., Alameda).
- Potentially **support extended service hours** on the BART network.[52]

Table 11-1 summarizes the distinct benefits and considerations associated with each crossing. Further information on the evaluation that was carried out to support these findings and the limitations of the analysis is provided in Chapter 10.

[52] Although limited-service hours in the evening and overnight periods are policy and operator driven, an additional transbay crossing could provide an opportunity for some form of transbay rail service while implementing localized track outages to maintain the network.

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Table 11-1. Distinct Benefits and Considerations for a BART and Regional Rail Crossing Project

BART CROSSING CONCEPT	REGIONAL RAIL CROSSING CONCEPT
Overview: **Improves frequency and service in the five Bay Area counties it already serves. Generates increased ridership and reduces crowding in the existing Transbay Tube.**	**Overview:** **Enables the *California State Rail Plan* vision by connecting and integrating the rail network across the San Francisco Bay. Enables more one-seat rides across the wider Megaregion.**
Enhances existing BART services and creates improved transfers with Regional Rail.	Closes the gap in the Regional Rail network to provide an integrated rail system across the Megaregion. Complements the existing BART system and creates improved transfers with BART.
Enables incremental travel time benefits (through shorter wait times) to well-served markets across the East Bay BART network. Creates new, faster travel opportunities and substantial benefits for potential new markets (e.g., Mission Bay, Alameda).	Delivers transformational travel time savings to areas with poor service (e.g., Emeryville) and new one-seat rides (e.g., the Peninsula to the East Bay, Sacramento to San Francisco). Creates new, substantially faster travel opportunities for potential new markets (e.g., Alameda).
Increases rail ridership within established markets and from new stations and reduces auto vehicle miles traveled, mainly from trips within the five-county BART service area.	Increases rail ridership within new markets with poor rail service (e.g., Emeryville, West Berkeley) and less established interregional markets (e.g., Sacramento). Makes other planned Regional Rail investments more effective by providing direct transbay service.
Does not improve the poor reliability of the Regional Rail system. Improves the resilience and redundancy of the existing BART crossing.	Removes bottlenecks and improves Regional Rail reliability. Improves the resiliency and redundancy of the existing BART crossing.
Supports increased availability of affordable housing, primarily around existing BART stations, and improves access to jobs for priority populations within the five-county BART service area.	Supports increased availability of affordable housing, and improved access to jobs for priority populations. Potential to support development of affordable housing within a broader geography if appropriate land use policies are implemented.
Requires a lower level of overall investment as it capitalizes on existing BART infrastructure and does not require significant investment beyond the actual crossing infrastructure.	Requires a higher level of overall investment as the Regional Rail network is less developed and requires greater investment beyond the crossing to improve services, potentially delivered and funded outside of Link21. Level of investment for the transbay crossing is comparable to BART.

BART CROSSING CONCEPT	REGIONAL RAIL CROSSING CONCEPT
Faces greater funding challenges than Regional Rail due to fewer, more limited, and more competitive funding sources. Could potentially compete against other BART funding needs.	Is eligible for a wider range of funding opportunities than BART, with the potential ability to be separated into more easily funded phases, and it has greater alignment with state and federal priorities, plans, and funding sources.
Requires modest enhancements to improve cost-effectiveness that are potentially achieved through changes to stations, alignments, and/or service plans.	Requires enhancements to improve cost-effectiveness that are potentially achieved through complementary investments across a wider geography.
Has lower deliverability risks, reflecting a smaller construction extent, fewer project interfaces, and the self-contained nature of the existing BART system.	Has higher deliverability risks, reflecting complex interfaces with different operators, a potential need for new governance, and greater right-of-way requirements with associated construction, environmental, and displacement risks.

11.2. Opportunities for Crossing Project Enhancement

The Crossing Project is at an early stage of development. Future work will explore potential opportunities to enhance benefits and reduce costs, while considering how different project elements could be best phased for delivery.

This includes:

- **Serving new markets** by adding new stations on the existing rail network, such as Bayview and San Antonio, or expanding to new markets, such as a potential future rail line to western San Francisco.
- **Investigating complementary Regional Rail investments** that could help fully utilize the capacity of a new Regional Rail crossing by increasing rail demand and enhancing transportation benefits. Future Regional Rail investments are planned to be developed through the Corridor ID Program in line with the *California State Rail Plan*.
- **Examining cost-reduction strategies** that could help enhance the crossing's performance by increasing the proportion of benefits relative to costs. Potential cost-saving measures include changing service levels (to better match capacity to demand), refining right-of-way requirements, and exploring how Link21 could be delivered as a series of smaller, independent projects over time with better alignment to federal funding availability.

Further evaluation, that is informed by the findings of work performed to date, will seek to review and refine the concepts to improve the performance of the Crossing Project. Specifically for a Regional Rail crossing, further work — through the Corridor ID Program — would be required to define the extent and phasing of the Crossing Project alongside parallel investment in the Capitol Corridor, San Joaquins, and California High-Speed Rail Phase 1 corridors. The phasing of these parallel enhancements will be critical to determining the scope of investment required for the Crossing Project.

11.3. Next Steps

11.3.1. Identification of a Preliminary Project

The Preliminary Business Case, and the evaluation findings that underpin it, is intended to provide guidance that supports the identification of the **train technology** in the future crossing. Its purpose is **not** to define the exact details of the Crossing Project, like station locations or alignments, but to inform the strategic decision of which technology is best suited for creating an integrated system.

The identification of a technology forms the core element of the identification of a **Preliminary Project** that is centered on a new transbay passenger rail crossing

between San Francisco and Oakland. This technology identification forms a key output of Stage Gate 2, which advances the **Preliminary Project** for further development.

Key next steps at each stage gate are summarized in **Figure 2-2**.

11.3.2. Advancement to a Proposed Project

After Stage Gate 2, the concept options, including station and service improvements and infrastructure to support those improvements, will continue to be advanced into a Proposed Project by working closely with key agency partners, community stakeholders, and in partnership with state and federal funding partners through the Corridor ID Program.

An Intermediate Business Case will be developed in later stages to evaluate options (e.g., those included in Section 11.2) to support the advancement of a Proposed Project (and potential Alternatives). The Proposed Project will define in detail the project extents, alignments, and station locations to the level of detail necessary to advance into environmental review in accordance with the National Environmental Policy Act and California Environmental Quality Act.