LINK21

CONNECT NORTHERN CALIFORNIA

STRATEGIC CASE FRAMEWORK

DRAFT FINAL

April 2022

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Prepared By:
Link21 Program Management Consultants (PMC)

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BART

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ISSUE AND REVISION RECORD

REVISION	DATE	PREPARER(S)	PMC REVIEWER(S) / BART/CCJPA REVIEWER(S)	APPROVER / BART/CCJPA APPROVER	DESCRIPTION/NOTES
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	12/10/2021	---	Andrew Tang, Sadie Graham, Nicole Franklin, Donald Dean, Duncan Watry, Emily Alter, BART Camille Tsao, CCJPA	Andrew Tang, BART	Working DRAFT submittal review
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	04/01/2022	---	Andrew Tang, BART	Andrew Tang, BART	DRAFT submittal review

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ACRONYMS AND ABBREVIATIONS

ACRONYM/ABBREVIATION	DEFINITION
BART	San Francisco Bay Area Rapid Transit
CCJPA	Capitol Corridor Joint Powers Authority
AMBAG	Association of Monterey Bay Area Governments
BRT	bus rapid transit
MCAG	Merced County Association of Governments
MPO	metropolitan planning organization
MTC	Metropolitan Transportation Commission
PBA	Plan Bay Area
PMC	Program Management Consultants
SACOG	Sacramento Area Council of Governments
SJCOG	San Joaquin Council of Governments
StanCOG	Stanislaus Council of Governments
VMT	vehicle miles traveled

LINK21 PROGRAM TEAM NAMES

TEAM NAME	TEAM MEMBERS
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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1 INTRODUCTION

Link21 is using a business case process to establish a multidimensional and data-driven framework to inform decisions that will meet the vision of a megaregional rail network, including a new transbay passenger rail crossing between Oakland and San Francisco.

The overall business case framework will guide Link21's concept development and evaluation through four separate cases: Strategic, Economic, Financial, and Deliverability and Operations. This Strategic Case Framework addresses the first of these four cases.

The document has been structured as follows:

- Introduction to the Strategic Case Framework and how it fits into the overall business case document
- Problems the Megaregion is facing and adverse outcomes if they are not addressed
- Need for a new transbay passenger rail crossing
- Link21's vision, goals, and objectives
- Link21's scope
- High-level metrics for evaluating concepts

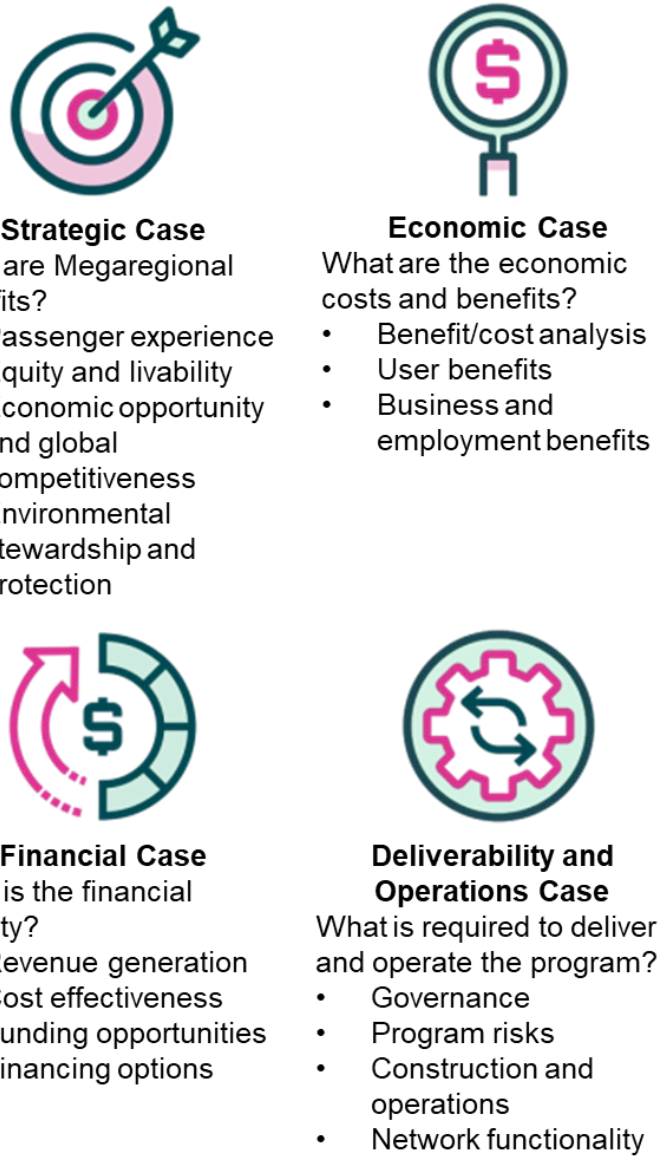
1.1. Business Case Approach

The business case approach defines the rationale and requirements for delivering Link21. The business case framework defines the methodology to evaluate proposed alternatives, to inform the decision-making process, and to make a persuasive case for investment to stakeholders and the public.

The business case approach will guide the program's concept development and evaluation through four cases, as described below and illustrated in **Figure 1-1**:

- **Strategic Case:** Identifies the problem to address, the vision for the program, and how alternatives satisfy the goals and objectives.
- **Economic Case:** Evaluates benefits to the users and other economic benefits and analyzes cost effectiveness of the alternatives.
- **Financial Case:** Summarizes the financial cost of the program and how to fund it and considers financing options and revenue generation.
- **Deliverability and Operations Case:** Addresses governance, construction, operations, and project risks, such as displacement.

Figure 1-1. Business Case Approach



1.2. Why a Business Case?

A business case is a comprehensive, organized collection of evidence and analyses that guides the development of a program to meet its defined goals and objectives. Link21 presents challenges unlike other projects in its scale, reach, and multimodal aspects. A business case approach provides a way to make sure that decision-making is balanced and takes into account the full range of issues that need to be considered throughout the Megaregion. Throughout the four cases, benefits, risks, and costs to priority populations will be assessed.

The rationale for adopting a business case for Link21 includes:

- Transparent, consistent, and evidence-based decision making, based on a defined set of goals and objectives for the program.
- Clear identification of benefits, costs, and risks throughout the program's lifecycle.
- Staged, iterative approach to screen out low-performing concepts based on high-level evaluation, with more detail placed on high-performing concepts.

1.3. The Link21 Strategic Case

As mentioned in the prior section, the business case is designed to optimize the use of resources, with more detailed analysis and evidence dedicated to more promising concepts.

During the early stages of the program, the focus of the business case will be on the Strategic Case, particularly the alignment of various concepts with the program's goals and objectives. As the number of concepts reduces and each concept becomes more specific, the business case evolves with more detailed and mature evaluation tools and analyses.

The Strategic Case Framework addresses the first of the four cases. It establishes the need and rationale for Link21 by describing the problems it will address, adverse outcomes if these problems are not addressed, need and opportunity for a new transbay passenger rail crossing, Link21's vision, goals, and objectives, Link21's scope, and high-level metrics associated with its successful implementation.

1.4. Terminology

1.4.1. Geographic Definitions

The 21-county Northern California Megaregion (Megaregion) 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.

These counties fall within the jurisdictions of seven metropolitan planning organizations (MPO) and are referred to as the following regions in the report:

- **San Francisco Bay Area:** Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties. The Bay Area is further divided into smaller subregions:
  - **West Bay:** San Francisco and San Mateo counties
  - **South Bay:** Santa Clara County
  - **East Bay:** Alameda and Contra Costa counties
  - **North Bay:** Sonoma, Marin, Napa, and Solano counties
- **Monterey Bay Area:** Monterey, San Benito, and Santa Cruz counties
- **Sacramento Area:** El Dorado, Sacramento, Placer, Sutter, Yolo, and Yuba counties
- **Northern San Joaquin Valley:** San Joaquin, Stanislaus, and Merced counties

1.4.2. Transbay and Other Travel Corridors

Transbay refers to the crossings between San Francisco and Oakland, including the San Francisco-Oakland Bay Bridge (Bay Bridge), as well as the San Francisco Bay Area Rapid Transit (BART) Transbay Tube (Transbay Tube) crossing between the Embarcadero and West Oakland stations. While bus and ferry services also connect San Francisco and Oakland, they have been excluded from transbay corridor analysis in this document as they account for a small proportion of travel demand in the corridor.

Bay crossings include the transbay crossings as well as the crossings between Alameda County and San Mateo County via the San Mateo–Hayward and Dumbarton bridges.

Other crossings refers to all other San Francisco Bay bridge crossings, such as, but not limited to, the Golden Gate and Richmond–San Rafael bridges.

1.4.3. Priority Populations

Advancing equity is a core goal of Link21, and the Link21 Program (Link21) is committed to creating needed benefits and minimizing harms to those communities who need resources most.

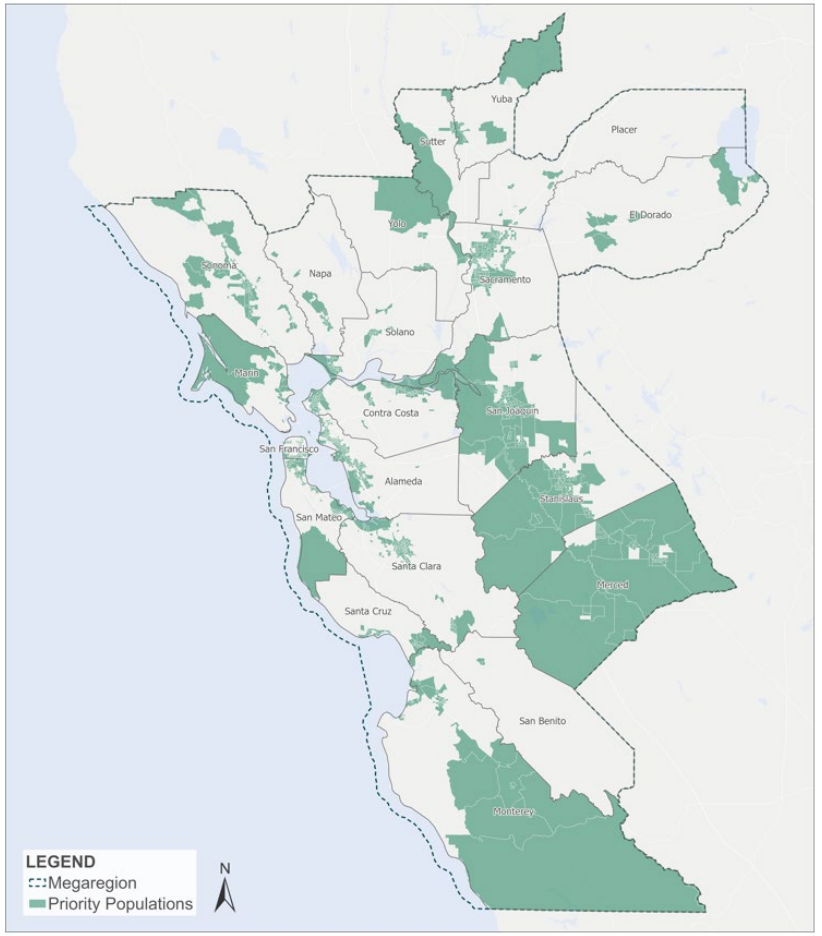
To facilitate the evaluation of equity impacts related to Link21, a program-specific geographic designation of equity has been defined (**Figure 1-2**). To support Link21's efforts to address inequities across the Megaregion, priority populations have been defined as areas where communities currently experience the highest levels of disproportionate burdens. Areas of the Megaregion **not** designated as priority populations are referred to as general populations.

Priority populations will be used in the business case evaluation to review the distribution of program benefits or negative impacts. In the problem statement, it is used to explore disparities and disadvantages experienced by priority populations in livability, affordability, and accessibility compared to general populations.

The priority populations definition in this document is an early working version developed for the initial phase of Link21. It encompasses:

- State Priority Populations (disadvantaged and low-income communities)
- Metropolitan Transportation Commission (MTC): Equity Priority Communities
- Additional locally created definitions

Figure 1-2. Priority Populations Geographic Definition



The priority populations definition has since been updated to better align with Link21's goals and objectives, to better reflect the unique megaregional program area, and to incorporate input from community co-creation and a Megaregion-wide equity poll. This revised definition will be incorporated into subsequent work.

The update to the priority populations definition focuses on identifying areas in the Megaregion that experience the greatest burden. The process for creating the updated definition is comprised of three steps:

1. Qualify: Census tracts with higher levels of transportation-cost burdened, low-income, or non-white populations are identified.
2. Evaluate: The census tracts are then evaluated against several metrics that are organized into categories representing economic, mobility, community, and health and safety burdens.
3. Validate: The output of this second step is an updated priority populations designation, which is then validated by examining the level of correlation between those census tracts and demographic characteristics known to be associated with burdens.

Most demographic factors are not built into the Qualify and Evaluate steps, because demographic traits themselves are not burdens. The exceptions are:

- Black, Indigenous, and People of Color (POC) population (included in the Qualify step): This aligns with national, state, and regional best practices.
- Age and family size (included in the Evaluate step): When co-creating the updated priority populations definition with communities, many participants noted that these demographic traits have more inherent burdens associated (e.g., larger families require higher incomes to meet essential needs) with them.

Other demographic characteristics were examined in the Validate step to confirm that the priority populations census tracts aligned with the Link21 Team's understanding of what demographic traits tend to be associated to experiencing burdens.

1.4.4. Note on COVID-19

The forecasts in this document are based on MPO forecasts that were developed well before the COVID-19 pandemic, though future documents may be based on forecasts developed after the start of the pandemic. Public health measures, such as lockdowns discouraging inessential trips, contributed to an unprecedented decrease in travel demand across the Megaregion.

How the COVID-19 pandemic will impact population and employment growth that underpin travel demand forecasts for Link21 is uncertain, but it will be examined as part of the program. An uncertainty analysis will be part of Link21's evaluation to make sure the proposed alternatives are robust under different uncertain futures.

Further discussion on initial uncertainty analysis and robustness testing, performed under the market analysis, can be found in the Link21 *Market Analysis Report* (Chapter 10 and Appendix I).

2 PROBLEM STATEMENT

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 connecting 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.

This chapter discusses three key transportation problems facing the Megaregion: insufficient capacity, insufficient rail access and service, and accessibility challenges faced by priority populations.

2.1. The 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**.[1,2] These numbers have increased significantly over the last 30 years and population is expected to reach **16 million by 2050**.[3]

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[4] 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.

[1] *The Northern California Megaregion: Innovative, Connected, and Growing*, Bay Area Council Economic Institute, June 2016
[2] *Continuing Growth and Unparalleled Innovation: Bay Area Economic Profile*, Bay Area Council Economic Institute, July 2018
[3] *P-3: State and County [Population] Projections Dataset*, California Department of Finance, 2019
[4] For the purposes of this document, rail is defined as BART and Regional Rail (including commuter, intercity, and high-speed rail). It excludes light rail.

2.1.1. Three Key Problems

Managing growth in the Megaregion has been challenging, particularly with respect to rail and other transportation systems. Three key problems now 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. Roadway and railroad capacity is insufficient in key travel corridors.
2. 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.
3. Priority populations face particularly difficult challenges related to transportation (including fare affordability), housing, job accessibility, and other factors.

The remainder of this chapter explores each key problem in detail.

2.2. Problem 1: Insufficient Capacity

Roadway and rail capacity is insufficient in key travel corridors.

Growing travel demand in the Megaregion has exceeded available capacity in key travel corridors, resulting in overcrowded trains and congested highways. Travel demand in the Transbay Corridor between Oakland and San Francisco exceeded available capacity by 2015[5] and is projected to do so through 2050,[6] even with planned short-term (within the next 5-10 years) capacity increases to both the Transbay Tube and the Bay Bridge.

The following aspects of this problem are explored in this section:

- The existing megaregional transportation network is struggling to meet demand growth.
- The Transbay Corridor infrastructure is already insufficient to meet 2015 travel needs.
- Future transbay capacity expansion projects will be insufficient to accommodate future demand.

[5] Year 2015 is used as the Base Year since it is the year used by MPOs in their plans and is consistent with data sources.

[6] COVID-19 has strongly affected travel behavior and its long-term impacts are unknown. MTC's recently adopted long range strategic plan, Plan Bay Area (PBA) 2050, anticipates that the Transbay Tube will exceed its capacity in the medium-long term. However, uncertainty tests will be carried out to test alternatives with the uncertain future.

Existing Megaregional Transportation Network is Struggling to Meet Demand Growth

Travel demand across the Megaregion has been growing, fueled by strong, sustained population and employment growth.

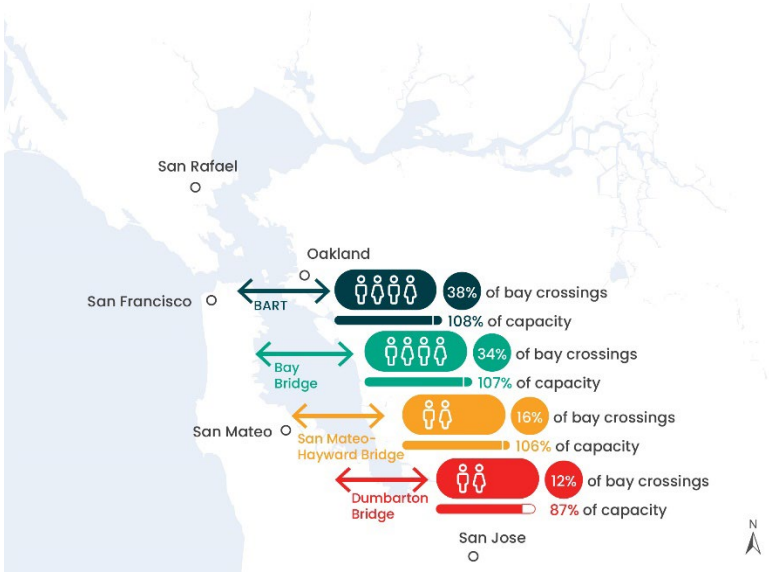
In 2015, 62% of travel demand was concentrated in the Bay Area, with a large share concentrated in counties adjacent to or near San Francisco Bay: Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara.

In 2015, over 337,000 daily trips in each direction crossed the bay. These trips are currently geographically constrained to four crossings, broken down in **Figure 2-1**:

- Transbay Corridor, comprising the Transbay Tube and the Bay Bridge
- San Mateo – Hayward Bridge
- Dumbarton Bridge

The Transbay Corridor accounts for approximately 70% of total trips crossing the bay. Many of these trips are commuting journeys concentrated in peak hours. They put pressure on existing infrastructure, and the crossings are currently a bottleneck for commuters with overcrowded trains and congested highways.

Figure 2-1. Average Weekday Travel Demand by Bay Crossing (2018)



Source: Program Management Consultants (PMC) analysis of MTC Travel Model 1.5 and Caltrans traffic census data

Note: Demand relative to capacity values shown are during peak hours, and the value for BART is based on the operator-provided planning capacity.

Transbay Corridor Infrastructure is Insufficient to Meet Current Travel Needs

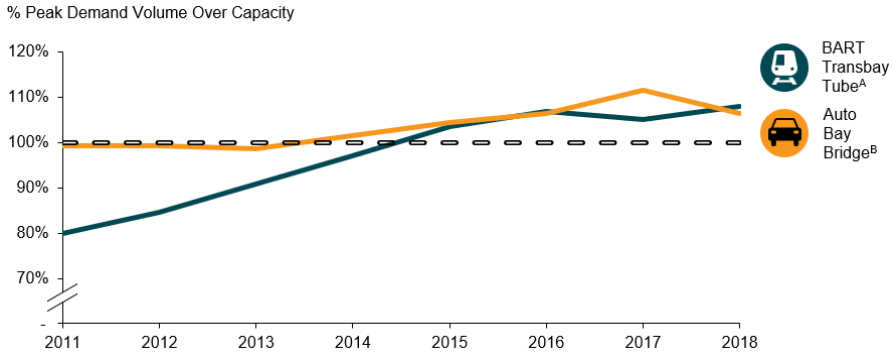
By 2015, the Transbay Corridor was already operating over its planned capacity during peak periods, as shown in **Figure 2-2**.

The **Bay Bridge**, with almost 9,500 vehicles per peak hour and direction, was the single most congested highway in the Megaregion, creating secondary impacts to feeder highways (especially I-80, as illustrated in **Figure 2-3**).

BART Transbay Tube demand increased significantly between 2011 and 2015 as the Bay Bridge grew more congested, and by 2015 it was the single most congested rail segment in the Megaregion. With almost 27,000 passengers per peak hour in each direction, the Transbay Tube exceeded its planned capacity by 2015. Capacity constraints in the Transbay Tube also have reliability impacts on BART services beyond the Tube, particularly in the East Bay between MacArthur and Bay Fair stations, and in crowded downtown San Francisco stations.

Figure 2-2. Percent Peak Demand Volume Over Capacity

Both Transbay Corridor crossings have been operating above their planned capacities since 2015.



Source: PMC analysis of BART peak loading and Caltrans traffic census data

Figure 2-3. Top Ten Congested Highway Segments in the Bay Area

Congestion on the Bay Bridge creates secondary impacts on feeder highways in San Francisco and the East Bay.

Source: PMC analysis of MTC Vital Signs data

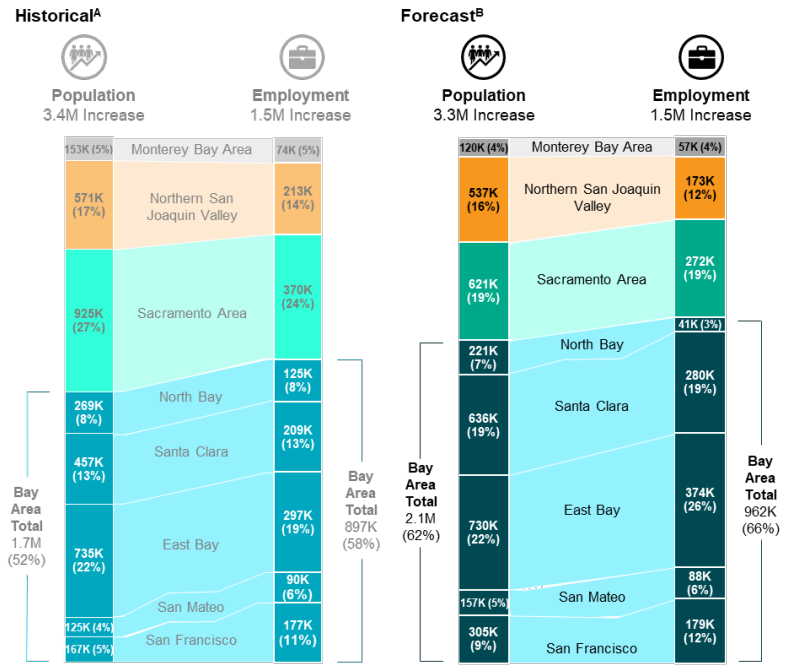
Strong Future Growth Will Exacerbate the Capacity Shortfall

The Megaregion has experienced substantial growth over the last three decades, with population increasing by 3.4 million, employment by 1.5 million, and gross regional product by 3.6% per annum. This strong growth is expected to continue over the next several decades with projections[7] adding 3.3 million residents and 1.5 million jobs between 2015 and 2040. However, this growth has been imbalanced with significant income inequality and displacement and increasing housing and transportation cost burdens disproportionately impacting disadvantaged populations.

As **Figure 2-4** shows, most of the historical and future growth is expected to concentrate in the Bay Area, which accommodates a larger share of megaregional employment than population growth. This population and employment imbalance is expected to generate substantial additional travel in the Megaregion and specifically in the Transbay Corridor.

As a result of this growth,[8] it is estimated[9] that transbay travel demand will increase from 237,000 trips per day in each direction in 2015 to 319,000 trips by 2040, further straining the overcrowded and congested crossings.

Figure 2-4. Comparison of Historical Growth and Baseline Forecast Growth



Source: PMC analysis of data from the California Department of Finance, California Employment Development Department, and MPOs (MTC, Association of Monterey Bay Area Governments [AMBAG], SACOG, San Joaquin Council of Governments [SJCOG], Stanislaus Council of Governments [StanCOG], and Merced County Association of Governments [MCAG])

Note: Historical growth rates are from 1990 to 2019, and future forecast growth rates are from 2015 to 2040.

[7] Adopted MPO plans: MTC PBA 2040, Sacramento Area Council of Governments (SACOG) 2040 Medium Term Plan/Sustainable Communities Strategy. MTC PBA 2050 was adopted while this analysis was being finalized; as such, the analysis is based on MTC PBA 2040 data.

[8] From adopted MPO plans listed above, including MTC PBA 2040

[9] Link21 assumptions based on StreetLight and MPO data. More details are in Chapters 4 and 6, and Appendix D of the *Market Analysis Report*.

Future Transbay Corridor Capacity Will Be Insufficient to Meet Future Travel Needs

MTC's PBA 2050 estimates that peak hourly transbay rail travel will reach 53,000 passengers by 2050 in the AM peak hour and direction. MTC has also estimated potential future demand under a range of potential PBA 2050 future scenarios in which peak transbay rail travel by 2050 will be at least 45,900 and could be up to 71,500 (**Figure 2-5**).

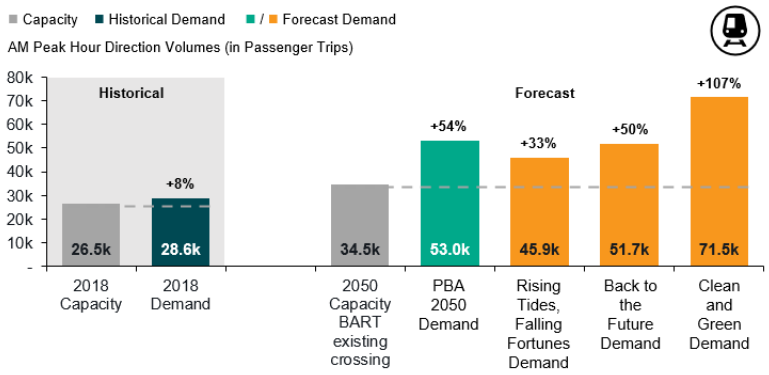
PBA 2040 and 2050 include short-term investments to alleviate capacity constraints in the Transbay Corridor:

- BART: Core Capacity improvements will increase hourly capacity per direction from 26,400 to 34,500 passengers.
- Bay Bridge: all-electronic tolling is expected to increase capacity to 10,000 vehicles per hour per direction.

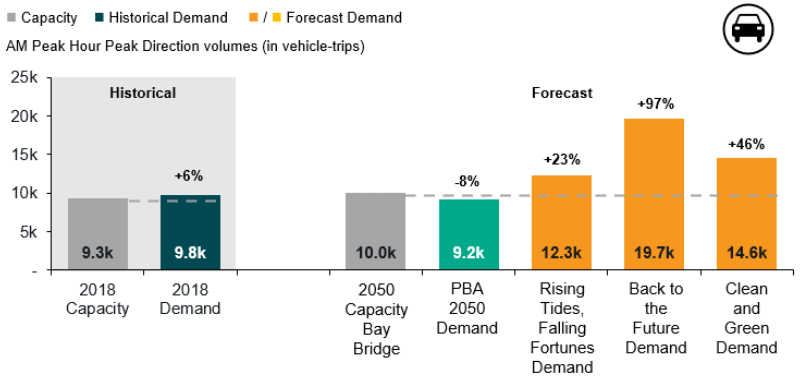
These improvements are expected to provide medium-term capacity relief; however, demand is projected to exceed planned capacity before 2040. Demand scenarios analyzed by MTC could result in the Transbay Tube requiring between 33% and 107% additional capacity by 2050.

Figure 2-5. AM Peak Hour and Direction Forecast Demand vs Capacity for the Transbay Tube (top) and the Bay Bridge (bottom)

While the Core Capacity project will increase capacity on the Transbay Tube, unconstrained demand is forecast to exceed available capacity, even in the most conservative Baseline Forecast.



With demand already exceeding capacity, transbay auto demand is expected to continue to grow, putting further strain on the Bay Bridge.



Source: PMC analysis of MTC travel model data

Note: PBA 2050 forecast values include the Link21 Program, whereas the three scenarios exclude all PBA 2050 projects.

2.3. Problem 2: Insufficient Access to Reliable and Affordable Rail Service

Insufficient rail access and service leaves some residents with inadequate transportation choices and with many struggling to access jobs and other key destinations and opportunities.

The megaregional rail network is not sufficiently dense or accessible to serve the needs of its residents, with only a quarter living within typical walking distance (1 mile) of the nearest rail station.

Additional factors, such as long travel times and infrequent or limited service hours, contribute to, in many cases, a poor rail passenger experience in the Megaregion compared to car travel. This results in many residents struggling to access jobs and other opportunities by rail. In addition, limited routes and accessibility to stations, as well as safety and affordability concerns, present significant barriers to rail use for priority populations.

The following aspects of this problem are explored in further detail in this section:

- Passenger rail service is generally insufficient when compared to auto, and for many trips it is not viable.
- In the future, the passenger rail market share is expected to remain low, even with planned network improvements not included in Link21.

Rail Service is Inaccessible or Uncompetitive Against Car Travel

Poor network coverage for some trips and other service quality factors contribute to an unsatisfactory or altogether inaccessible rail passenger experience in the Megaregion compared to car travel.

A behavioral survey of megaregional travelers, conducted in June and July 2020,[10] found that the key barriers to using rail in the Megaregion are different for BART and Regional Rail services:

- Although BART currently provides frequent service, there are barriers related to cleanliness, safety, parking availability, and reliability issues around incident recovery, (i.e., when incidents, especially those in the San Francisco and East Bay core of the system create a cascading series of systemwide delays).
- Regional Rail barriers are mostly related to frequency, hours of operation, trip planning, transfers, and reliability.
- For priority populations specifically, additional barriers to using both BART and Regional Rail include access to/from stations and distribution of and accessibility to stations. Megaregional Equity Poll respondents cited "Doesn't go where I need it to", "No rail station nearby", "Don't feel safe on public transportation", "I prefer to drive", and "Rail takes too long" as the major barriers to rail use.

For transbay trips in particular, the key incentive to use BART is its competitiveness with auto in terms of cost, travel time, and avoidance of traffic, with some indicating that it was the only option since they do not have access to a car. That said, some key barriers remain:

- Accessibility to rail stations (from home or destination)
- Crowded trains
- Total travel time and/or number of transfers

Subsequent pages explore some of these barriers in greater detail.

[10] This behavioral survey of megaregional travelers refines Link21's understanding of travel through the Transbay Corridor and the potential for increasing rail usage in the Megaregion. The survey was designed, developed, hosted, and analyzed by the PMC using primarily an online panel of megaregional respondents.

A pilot was conducted over three days between June 17 and June 19, 2020, collecting over 100 preliminary responses. The main survey was launched on June 26, 2020, and it remained online for one full month until July 27, 2020. A total of 2,063 completed surveys were collected. After removing unusable responses, 2,046 surveys were retained for analysis.

More details on the survey can be found in Appendix C of the *Market Analysis Report*.

The rail network does not serve places where the Megaregion's residents and workers travel.

- Only 25% of residents in the Megaregion live within typical walking distance (one mile or less) of a rail station.
- Only 30% of megaregional trips start or end within typical walking distance (one mile or less) of a rail station.
- 73% of megaregional trips start or end within 5 miles of a rail station (corresponding to a reasonable transit/driving access distance).

As seen in **Figure 2-6**, the inaccessibility of rail stations is particularly noticeable in certain areas of the Megaregion that are also associated with high trip volumes, such as western San Francisco, parts of the East Bay (San Pablo, Hercules, Vallejo, San Ramon, Napa), parts of Santa Clara County, the coastal section of the Monterey Bay Area, and most of the Sacramento Area.

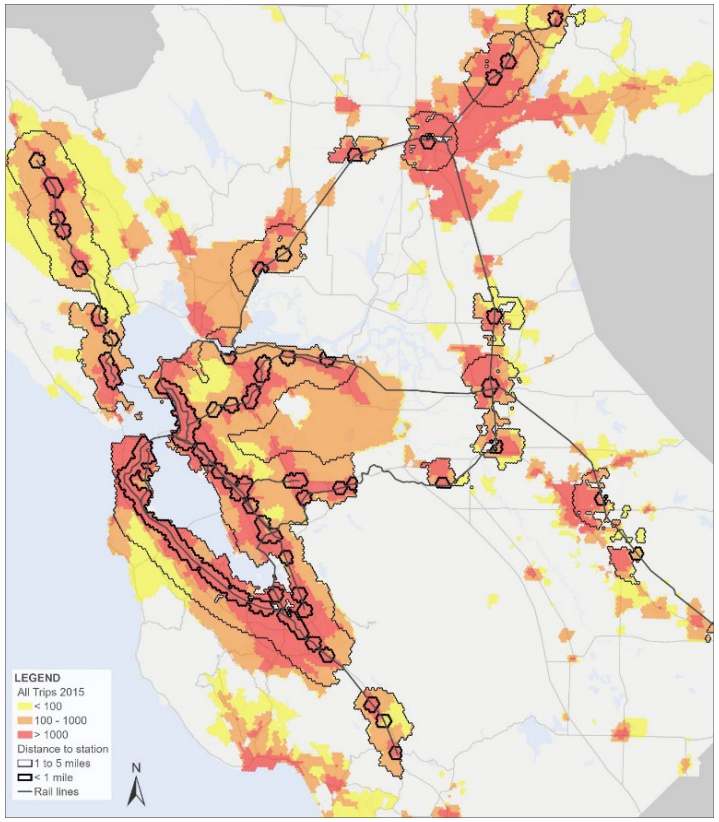
The long access distance to a rail station makes rail travel unattractive, impractical, or altogether infeasible:

- Of those with car access, most choose to drive the full trip or drive to the closest rail station, which in turn heavily constrains parking capacity at the stations. Those without car access (and a small group of travelers who choose not to drive) may rely on other, slower forms of public transit to make their trip. These slower forms of transit, such as local buses, may stop closer to where their passengers live and may be more affordable.

Due to the sparse rail network and limited accessibility to stations by transit, many residents struggle to access jobs and other key megaregional destinations by rail.

Figure 2-6. Average Weekday Trip Origins by Distance from Nearest Rail Station (2015)

30% of megaregional trips in 2015 started within 1 mile (typical walking distance) of a rail station.



Source: PMC analysis of StreetLight and other travel pattern data

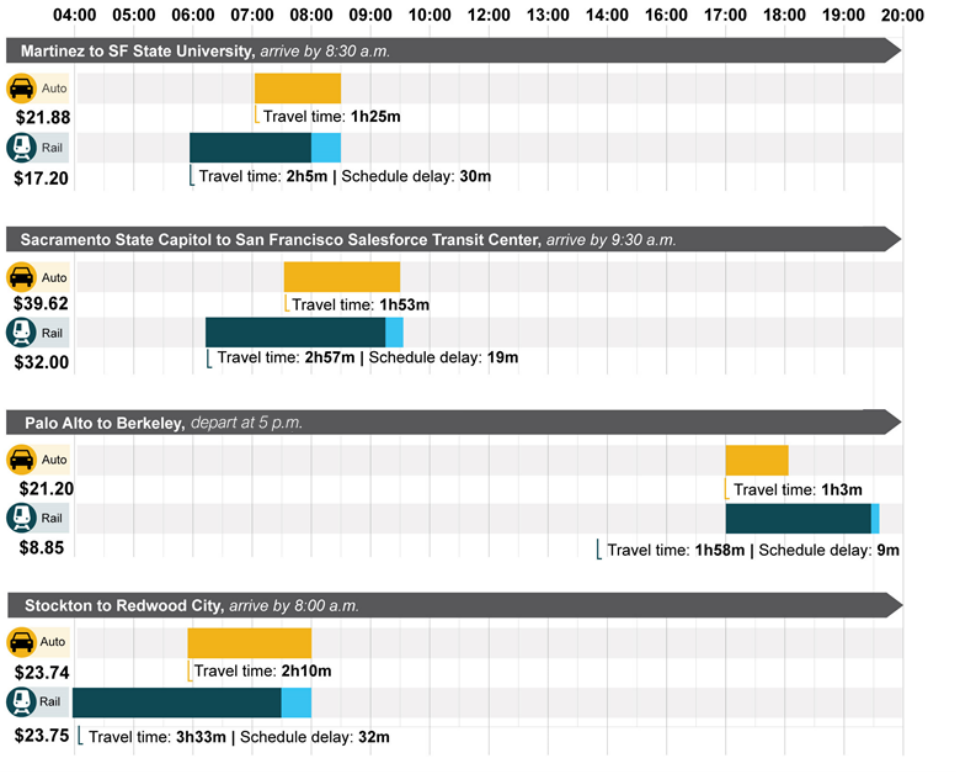
Note: the geographic unit of analysis in this figure is the hexcell, which is a standard hexagonal area 0.5 miles in diameter. Hexcells cover the entire Megaregion and are the main geographic unit of analysis for the market analysis.

Rail travel times and costs are typically worse than the corresponding car travel times and costs.

Particularly when involving multiple operators, rail trips can take significantly longer and be more costly, as illustrated in **Figure 2-7**. Key contributors include:

- Infrequent services with limited service hours
- Unreliable service and slow recovery when services are disrupted
- Multiple and long transfers between infrequent services, particularly between BART and Regional Rail
- High fares
- Multiple fare products and transfer penalties

Figure 2-7. Auto vs Rail Cost and Level of Service for Key Trips Across the Megaregion



Source: PMC analysis of Google Maps travel time and cost data

Note: Auto costs include tolls and average parking rates but exclude ownership costs. Schedule delay is the difference between a traveler's desired time of arrival or departure and the actual arrival or departure time of the earliest or latest feasible rail service.

The rail network is vulnerable to systemwide delays.

A variety of factors contribute to individual, isolated delays in rail service across the Megaregion, including:

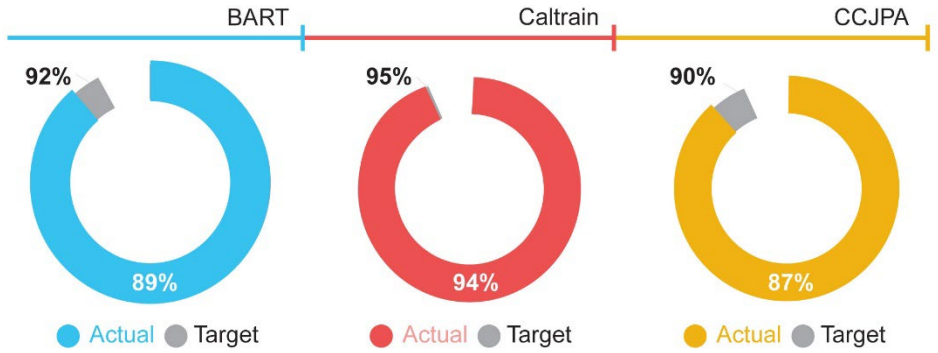
- Aging infrastructure, vehicles, and systems
- Crowding affecting station dwell times
- Passenger incidents and behavior
- Right-of-way intrusion (in the case of Regional Rail)

Furthermore, infrastructure constraints in the megaregional rail network mean that a single delay at one point in the network can quickly cascade across the network, causing systemwide delays that can impact trips well beyond the initial point of delay. For example, a BART delay anywhere between the 24th St./Mission and West Oakland stations causes delays on four lines as far out as Dublin/Pleasanton and Berryessa, as trains must either wait until the delay has been cleared or use single tracking to bypass a stopped train.

These delays contributed to three major rail operators in the Megaregion falling short of their respective 2019 on-time performance targets (**Figure 2-8**). Unreliable service (or at least perceived unreliable service) creates a further barrier to using rail, particularly for long interregional trips where a delay on the first leg of a rail journey may be especially costly when transferring to an infrequent service for the second leg.

Transit-reliant passengers are additionally burdened by service delays on other public transit, such as buses, ferries, or shuttles, that impacts their ability to rely on infrequent rail services. Notwithstanding, congestion and reliability issues on the highway network, as previously covered, continue to hinder mobility for megaregional residents.

Figure 2-8. On-Time Performance by Rail Operator Compared to Targets (2019)



Source: PMC analysis of rail operator on-time performance data

Inaccessible and Uncompetitive Rail Service Results in Low Rail Mode Shares

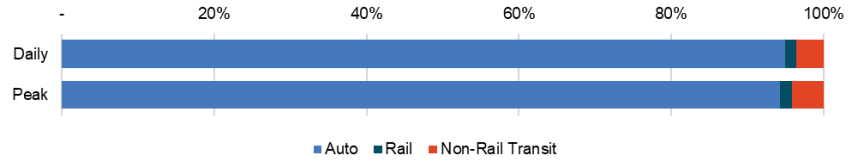
At a megaregional level, auto is the dominant mode of travel at all times of day. The share of trips made by rail is 1.5% throughout the day, rising slightly to 2% during peak periods. Non-rail transit, including light rail and local and regional buses, accounts for a slightly higher share of trips, at 4% throughout the day and during peak periods (**Figure 2-9**).

Rail has a higher mode share in select markets served with frequent rail service, such as BART's Transbay Corridor between San Francisco and the East Bay (49% on an average weekday and up to 56% during peak hours), served by BART (**Figure 2-10**), and San Francisco to Santa Clara County (27% on an average weekday), served by Caltrain. On the other hand, non-rail transit, consisting mostly of regional and express buses and ferries, accounts for a small share of transbay trips compared to rail and auto.

At the same time, growing highway congestion in key corridors and links, such as the Bay Bridge, has made rail a more competitive alternative to auto. However, capacity constraints in trains may limit the effectiveness of rail going forward.

While demand for rail travel in the Megaregion has grown over the past decade, rail service for many is still uncompetitive against car travel or not an option altogether (primarily due to poor coverage). If not addressed, this will result in more car trips, more emissions, and more congestion, even with planned rail network improvements.

Figure 2-9. Megaregional Average Weekday Mode Shares (2015)



Source: PMC analysis of StreetLight and other travel pattern data

Figure 2-10. BART Mode Share by Region Pairs (2015)

In 2015, BART's highest mode share was in the East Bay – San Francisco market, at almost 50% throughout the day and just over 55% during the peak period.

Average Weekdays

ORIGIN	DESTINATION: SAN FRANCISCO	DESTINATION: SAN MATEO COUNTY
EAST BAY	49.0%	4.3%
NORTHERN SAN JOAQUIN VALLEY	23.0%	0.9%
SACRAMENTO AREA	8.5%	1.7%
NORTH BAY	3.7%	N/A

Average Peak Hours

ORIGIN	DESTINATION: SAN FRANCISCO	DESTINATION: SAN MATEO COUNTY
EAST BAY	56.4%	4.7%
NORTHERN SAN JOAQUIN VALLEY	38.6%	2.9%
SACRAMENTO AREA	15.8%	3.6%
NORTH BAY	6.2%	N/A

Source: PMC analysis of StreetLight and other travel pattern data

Future Rail Mode Share is Expected to Remain Low, Even with Planned Network Improvements

As a result of expected population growth, travel needs will increase in the Megaregion and the number of trips crossing the bay is projected to grow from 337,500 to 474,500[11] on an average weekday in 2040 each direction, shown in **Figure 2-11**. The Transbay Corridor is forecast to carry the highest share and volume of all crossing trips.

Approximately 319,000 trips in each direction are forecast to use the Transbay Corridor on an average weekday in 2040, representing a 35% increase from 2015 volumes (237,000 trips).

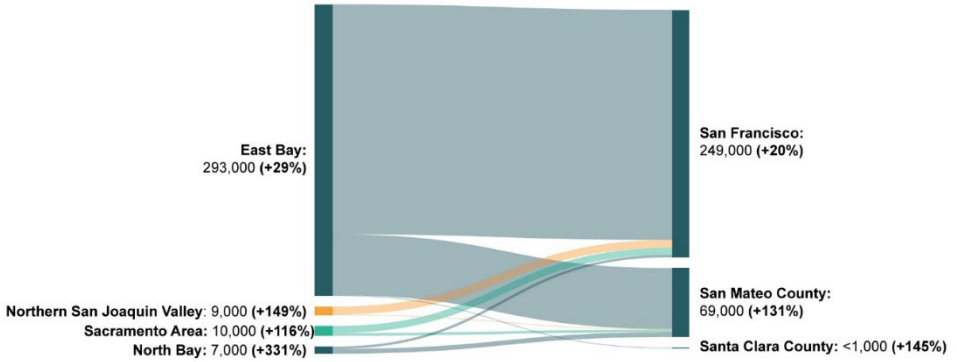
Transbay trip growth between 2015 and 2040 is projected to be fastest for trips between outer regions and the Bay Area, especially to/from the Sacramento Area and the Northern San Joaquin Valley.

On the other hand, trips within the Bay Area are forecast to grow by the largest absolute amounts. East Bay – San Mateo County is projected to grow at a very fast rate (122%) and add a large volume (34,000 average daily trips).

Planned projects in MPOs' adopted plans are expected to result in some level of improvement in future rail market share. However, a major shift to rail in the Transbay Corridor is not anticipated. Rail share is forecast to go from 1.4% to 1.7% for the Megaregion from 2015 to 2040 but is projected to reduce from 42.9% to 40.2% for the Transbay Corridor.[12]

More information on future travel conditions can be found in Chapter 6 of the *Market Analysis Report*.

Figure 2-11. Average Weekday Transbay Roundtrips (2040) and Percent Growth from 2015 (in Parentheses)



Source: PMC analysis of Streetlight, MPO (as listed in footnote), and other travel pattern data

[11] Future travel demand forecasts are based on PMC analysis of data from the California Department of Finance, California Employment Development Department, and MPOs (MTC, AMBAG, SACOG, SJCOG, StanCOG, and MCAG).

[12] Assuming no Link21 is included.

2.4. Problem 3: Priority Populations Challenges

Priority populations face particularly difficult challenges related to transportation, housing, and access to jobs and essential non-work destinations.

Not all Megaregion residents have benefited equally from recent population and economic growth, and many face extreme commuting realities due to lack of affordable housing and livability options. In fact, some residents have been negatively affected by this growth.

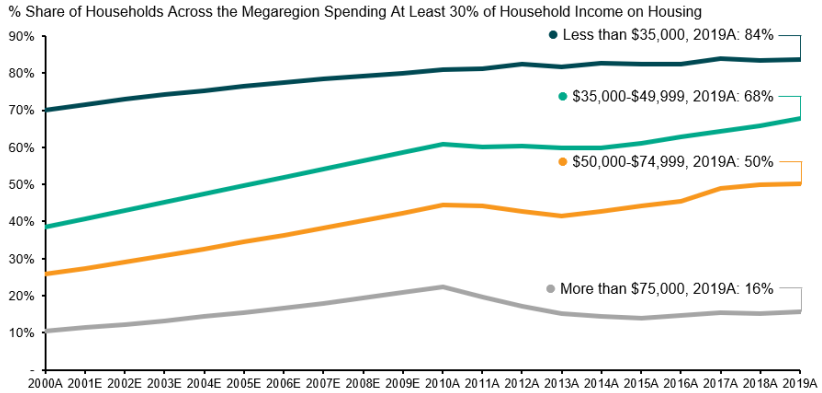
The following aspects of this problem are explored in further detail in this section:

- Economic growth over the past 30 years has been unequal, resulting in significant wealth and income inequality.
- Inaccessibility problems faced by residents in the Megaregion are typically intensified for priority populations.
- Priority populations present specific travel needs that are not always accounted for in transportation planning, limiting their access to rail or preventing it from serving their needs.

Unequal Economic Growth Over the Past 30 Years, Resulting in Significant Wealth and Income Inequality

Income inequality across the Megaregion worsened between 2010 and 2019. Market demand from high-income residents drove up housing costs, resulting in more cost-burdened households in lower income groups spending over 30% of their income on housing costs (**Figure 2-12** and **Figure 2-13**).

Figure 2-12. Share of Megaregion Households Spending At Least 30% of Household Income on Housing



Source: PMC analysis of data from the U.S. Census Decennial Census (2000) and American Community Survey (Table B25106, 1-year Table, 2011-2019)

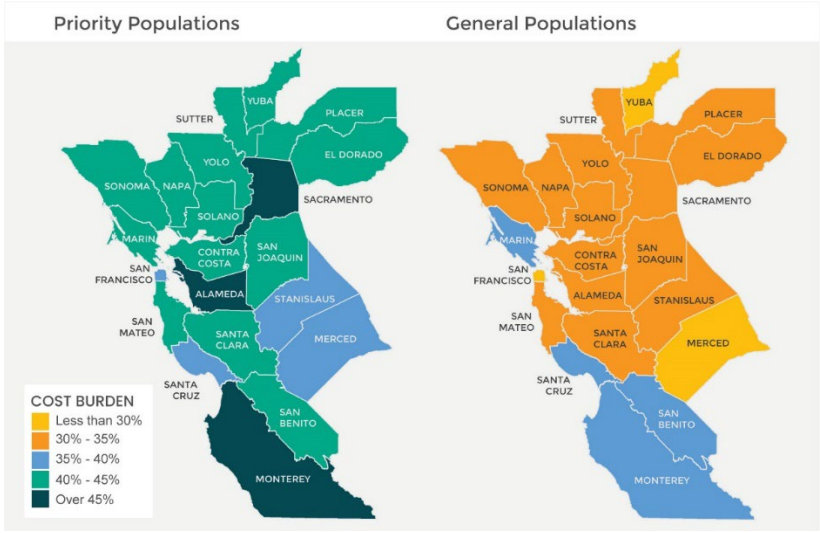
Note: The "A" designation on the horizontal axis stands for actual data from the U.S. Census Decennial Census for 2000 and 2010. After 2010, data comes from the U.S. Census American Community Survey. For data between 2001 and 2009, the "E" designation represents extrapolated estimates between 2000 and 2010.

Low-income residents and historically marginalized groups, such as Black and Latinx residents, experience growing challenges associated with:

- Moving or being displaced to outer, more affordable areas, which increases the imbalance between job and home locations, leading to longer commutes and transportation costs; and/or
- Increasing housing cost burden.

Figure 2-13. Priority and General Population Cost Burdened Households (2015-2019)

Thirty-seven percent of Megaregion households are cost burdened, meaning they spend over 30% of their income on housing. Thirty-two percent of general population households are cost burdened, compared to 43% of priority populations households.



Source: PMC analysis of data from the U.S. Census American Community Survey (Table B25106, 5-Year Table, 2019)

Inaccessibility Problems are Typically Intensified for Priority Populations

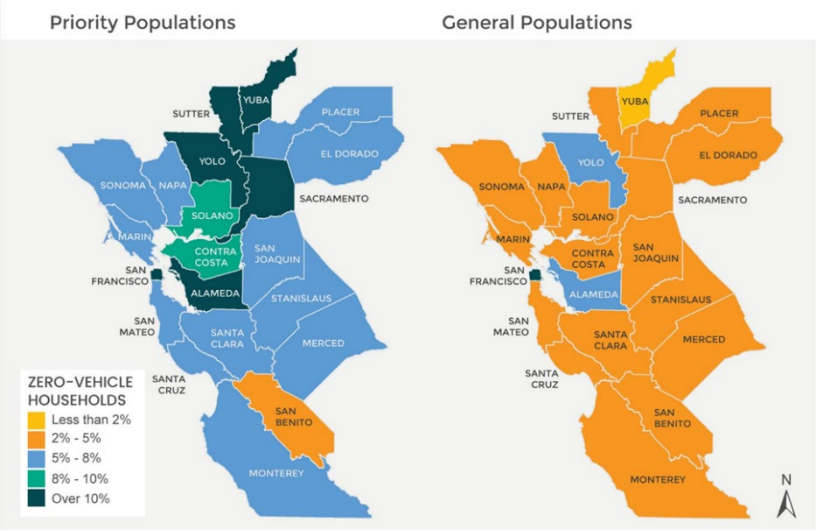
The inaccessibility and inefficiencies of the rail network means that many, particularly those without access to a car or who cannot afford high rail fares, are isolated, impacting their access to opportunities.

Across the Megaregion, an estimated 8% of households do not have access to a vehicle. This proportion is 12% for priority populations compared to general population at 5% (**Figure 2-14**). Many more priority populations households are transit reliant, which means there is access to a vehicle, but that access is insufficient to meet the needs of all household members.

The share of zero-car priority populations households is highest in the core urban parts of the Bay Area (San Francisco, Alameda, and Contra Costa counties), as well as rural counties in the Sacramento Region (Yolo, Sutter, and Yuba).

Figure 2-14. Zero-Vehicle Households by Priority and General Populations (2015-2019)

In both urban and rural areas, the share of households without access to a personal vehicle is higher in priority populations households compared to general population households. San Francisco, Alameda, and Yuba counties have the greatest difference in auto ownership between priority and general populations.

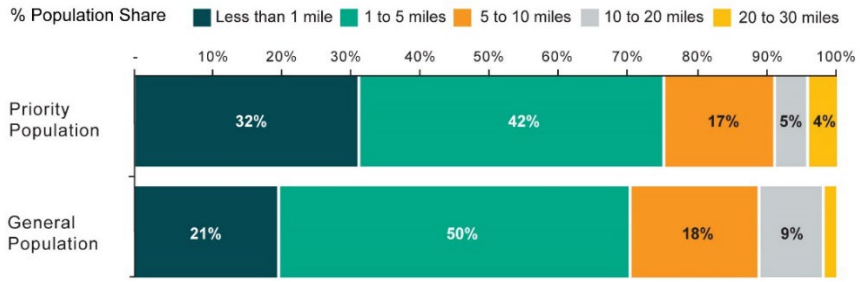


Source: PMC analysis of data from the U.S. Census American Community Survey (Table S2504, Five Year Table, 2019)

Figure 2-15 shows that 32% of Megaregion priority populations residents live within typical walking distance (less than one 1 mile) of the nearest rail station, and 74% live within 5 miles of the nearest rail station. Although this percentage is higher than for general population residents, the lack of access to a rail station has a higher impact on priority populations who are more likely to lack access to a car and thus rely on rail and other public modes of transportation more often.

First- and last-mile connections, such as walking, cycling, or local bus service, for the 68% of priority populations living beyond 1 mile from rail are critical to accessing key destinations and opportunities.

Figure 2-15. Priority and General Populations' Proximity to a Rail Station



Source: PMC analysis of California Department of Finance and American Community Survey data

Priority Populations Present Specific Travel Needs Not Always Accounted for in Transportation Planning, Limiting Their Access to Rail or Keeping it from Serving Their Needs

A combination of historical government programs, policies, and urban planning practices, such as redlining, racial covenants, and urban renewal, have shaped the form of cities, suburbs, and rural areas across the United States with profoundly negative, lasting impacts on low-income residents and communities of color, especially Black and Latinx communities. Current planning efforts have a unique responsibility to redress past harm given the outsized role that planners and policymakers have played in perpetuating racial inequities in the built environment.

In particular, transportation policies and projects have reinforced and accelerated inequitable outcomes by designing systems intended to meet the needs of some users over others. For example, highway investments in the urban renewal era encouraged the development of suburbs, which, at the time, were inaccessible to many communities of color due to redlining and racial covenants that explicitly restricted Black, Asian, and other racialized groups from homeownership. These projects simultaneously resulted in the degradation of predominantly Black neighborhoods when they demolished entire city blocks to build expensive aerial structures, permanently dividing communities and

divesting from urban public transportation systems. This history plays an important role in the lasting patterns of residential segregation and continues to limit access to opportunities through the transportation network and the wealth-building opportunities allowed by home ownership.

At its inception in 1957, BART participated in these discriminatory patterns as it planned the new rail system with a focus on connecting mostly white workers from the suburbs to the San Francisco Financial District. The original alignments and stations reflect the structural racism baked into historic planning decisions by disproportionally prioritizing service for white suburban communities, while negatively impacting low-income residents and communities of color, specifically Black, Latinx, and Asian neighborhoods. The impacted communities in cities experienced a higher presence of divisive above-ground alignments, which dislocated communities, created neighborhood barriers, and generated noise pollution, not to mention displacing historic businesses during initial construction.

Recognizing the lasting historical impacts of racism in planning decisions is the first step to incorporating an equity framework into future transportation projects, like Link21. Beyond the travel attributes discussed in prior sections, marginalized communities face additional travel challenges and needs because of the harm perpetuated by these past planning efforts. These projects have resulted in discriminatory outcomes in part because traditional community engagement has often not provided accessible, flexible, and approachable opportunities for disenfranchised and marginalized community members to engage, such as those who work multiple jobs, are dedicated caregivers, or have limited mobility or English proficiency. Future transportation planning efforts must start by creating authentic and meaningful spaces for communities to articulate their needs and to closely evaluate the benefits and burdens of projects on marginalized communities to ensure they have access to opportunities that will allow them to thrive.

Existing rail services lack several key trip attributes that priority populations express a need for, including travel time, service frequency, service hours, travel cost, and service reliability.

Beyond the travel attributes discussed in prior sections, priority populations face other travel challenges and needs.

The following is a non-exhaustive list of transportation challenges identified through co-creation workshops:

- Limited service hours (jobs that require evening, night, and/or weekend travel are not currently accommodated by rail schedules)
- High cost and unaffordability of rail fares
- Limited access to specific work destinations (not necessarily as oriented to jobs in traditional urban cores as general populations are)
- Limited access and/or service availability to non-work destinations (destinations not currently served by rail;

trips in the middle of the day or at irregular hours, including weekends)

- Safety concerns (on trains and platforms, getting to/from stations)
- Poor infrastructure for active transportation (walking, bicycling)
- Poor connections to other transit operators
- Station and system accessibility difficulties faced by older adults, individuals with disabilities, people traveling with children or luggage, and other factors

Past transportation projects have resulted in substantial harms to priority populations, particularly from projects that have derived very few benefits for the impacted communities, for example:

- Improved access to transit increased the value of the surrounding area, which resulted in increased rents and property prices, making the area less affordable for priority populations, and leading to gentrification
- Constrained affordable housing supply and high housing costs impacted housing location choices and transportation needs
- Displacement to transit poor areas and/or farther away from jobs, schools, and community
- Creation of physical infrastructure barriers for communities, dividing communities and limiting access
- Enactment of eminent domain, which led to community destruction
- Fare increases
- Replacement of existing transit preferred by residents
- Disruption due to construction

If rail remains unavailable or an inviable option for priority populations, these communities will continue to experience:

- Limited travel options, particularly for those who are heavily reliant on transit, to access job opportunities and other key destinations.
- Increased housing costs and ongoing displacement.
- Further reductions to their quality of life.

2.5. What Happens If The Problem Is Not Solved

The lack of mobility options and capacity to accommodate growing travel demand will hinder opportunities for residents, especially priority populations, and businesses. Absent investments in the rail network, roadway congestion and rail network crowding will continue to worsen, and residents will struggle even more to access jobs and other destinations. In turn, the Megaregion will struggle to maintain its economic competitiveness and attractiveness as a place to live and do business. Furthermore, as most trips will continue to be made by car, greenhouse gas emissions will increase, and public health and safety will be adversely impacted.

Outcome 1: The transportation network will not keep up with expected growth, resulting in poorer and more constrained mobility options.

Road travel times will become longer due to increased congestion and rail travel times will be less reliable due to crowding. People will have more constrained mobility options and will travel more by car. People without a car will have reduced access to travel.

Outcome 2: The livability of the region will worsen, continuing to escalate the burdens of a poorly functioning transportation network, particularly for priority populations.

People will spend more unproductive time traveling, thus reducing their quality of life. People without access to a car risk being isolated and left with reduced access to opportunities, which will result in increased inequalities across the Megaregion. More congested roads cause more pollution and more accidents, impacting the health and safety of residents.

Outcome 3: The transportation network becomes a barrier to economic growth.

Increased travel times make it harder for people and businesses to access economic activities. Businesses may find it harder and more costly to attract talent, and people will find it harder and more costly to access a wide variety of jobs. Goods movement also becomes more challenging. This may eventually deter or divert investment away from the Megaregion.

Outcome 4: Reliance on car travel will result in more greenhouse gas emissions, worse pollution, and a more resource-intensive transportation network.

Climate change is already negatively impacting the Megaregion in the form of wildfires, drought, and sea level rise. These impacts will continue to worsen without major changes to reduce the emission of greenhouse gases, especially from the transportation sector, which is the leading emitter of greenhouse gases in California. Accordingly, initiatives to combat climate change emphasize “greening” transportation, including expanding transit and rail to reduce the reliance of travelers on cars. Failure to implement these changes will hinder the fight against climate change and expose the Megaregion’s residents to deteriorating conditions.

3 THE NEED

Link21 is an anchor project to address long-term travel needs and related problems, and to act as an enabler in transforming the megaregional passenger rail network.

This chapter:

- Reviews various studies that have recommended a new transbay passenger rail crossing as an opportunity to address the Megaregion's travel needs and problems.
- Identifies Link21 in recent regional state and regional plans as a key enabler in transforming the passenger rail network.
- Showcases findings from the Link21 market analysis, confirming that improving transbay passenger rail service will unlock unmet demand and benefit the entire Megaregion.

3.1. Previous Studies

The problems identified in the previous chapter have been a growing concern in the Megaregion for several decades. MTC studies have evaluated potential crossing solutions, analyzing different crossing locations, transportation technologies (metro, Regional Rail, auto, bus/bus rapid transit [BRT]) and types of infrastructure (tunnel, bridge, etc.), as shown in **Table 3-1**.

The MTC 2020 Horizon report formed the basis for the Bay Area's long-range regional plan, PBA 2050. It identified the need for major investments in transit infrastructure and services, including the improvement of existing bus and transit systems. Planning and development for those investments will be done by many of the region's transit operators.

Across all studies, a new transbay passenger rail crossing solution, using BART and/or Regional Rail technology, was identified as a key investment to address long-term travel needs. Implementing this element of PBA 2050, and consistent with voter initiatives in 2016 (BART Measure RR) and 2018 (Regional Measure 3 [RM3]), BART and the Capitol Corridor Joint Powers Authority (CCJPA) are advancing the planning and development of a new transbay passenger rail crossing as the central element of Link21.

MTC's 2020 Horizon report states:

> *A new Transbay Rail Crossing emerged as the most cost-effective transit expansion megaproject. To relieve crowding, support focused growth, and enhance mobility across the Bay Area, Plan Bay Area 2050 should consider a new rail and/or BART crossing between San Francisco and the East Bay as a critical new investment.*

Table 3-1. MTC Studies and Recommended Long-term Solutions for a New Transbay Passenger Rail Crossing

MTC STUDY	YEAR	BART	OTHER RAIL	BUS/ BRT	AUTO
San Francisco Bay Area Regional Rail Plan	2007	X	X		
San Francisco Bay Crossings Study	2012	X*		X	X
Bay Area Core Capacity Transit Study	2017	X	X		
Crossings: Transformative Investments for an Uncertain Future	2019	X	X		X (auto + BRT)
The Megaregional Case for a New Transbay Rail Crossing	2021	X	X		

** Note: includes BART capacity improvements but not a new transbay passenger rail crossing.*

3.2. Regional and State Plans

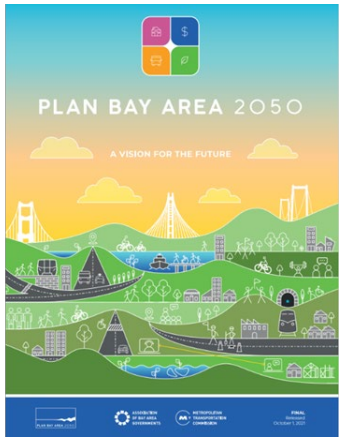
A new transbay passenger rail crossing has been included in the final PBA 2050 and the 2018 California State Rail Plan.

Link21 is considered an enabler and anchor for an expanded and modernized rail network in the Megaregion.

- The California State Rail Plan (2018) notes that implementing the rail plan vision will "depend on a second Transbay crossing."
- PBA 2050 references Link21 and a new transbay passenger rail crossing as the "anchor of a plan for rail in the Bay Area."
- Regional voters have twice approved funding to implement the regional recommendations, including BART Measure RR in 2016 and RM3 in 2018. Specifically, RM3 included funding for studies, engineering, and design associated with a second crossing of the Transbay Corridor.

MTC's PBA 2050 states:

> *The anchor of a plan for rail in the Bay Area, looking out over the next three decades, is Link21, a new program to transform Northern California's passenger rail network with a new transbay crossing between Oakland and San Francisco at its core. This new crossing will provide much-needed capacity in the heart of the Bay Area and beyond.*



3.3. Link21 Market Analysis

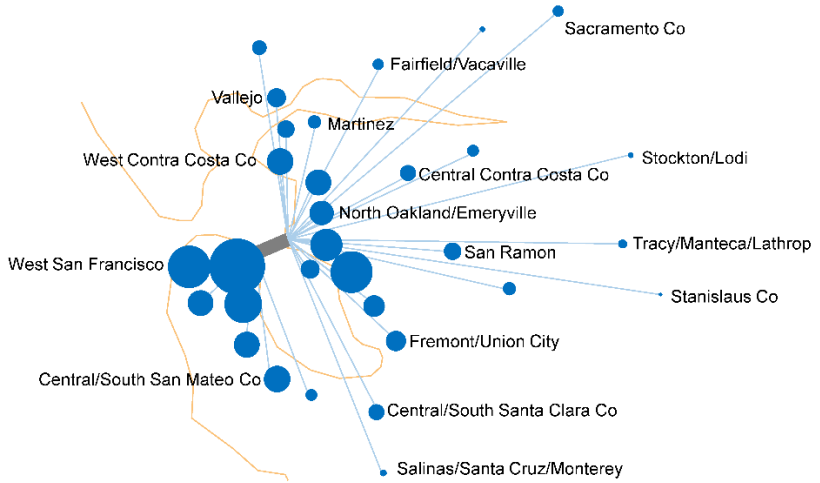
The Link21 Market Analysis confirms that improving transbay rail service will unlock unmet rail demand and in doing so benefit the whole Megaregion. It identifies potential demand for rail in the Megaregion under a theoretical "good rail service"[13] scenario, where all places in the Megaregion are connected by fast, direct, and frequent rail service. Key findings include:

- There is substantial unmet potential[14] for rail ridership in the Megaregion, 45% of which is for transbay trips, illustrated in **Figure 3-1**.
- Transbay Corridor service improvements can unlock unmet potential across the Megaregion. The highest transbay unmet potential exists in areas closest to the Corridor, particularly markets poorly or not currently served by rail.
- 63% of transbay unmet potential is to or from areas with high concentrations of priority populations.[15]
- Transbay unmet potential is more modest in medium- and long-distance markets. However, medium- and long-distance transbay trips show potential to reduce vehicle miles traveled (VMT) across the Megaregion.

Additional information on the market analysis approach and findings can be found in the *Market Analysis Report*, particularly the Executive Summary and Chapters 7-10.

Figure 3-1. Transbay Equity-Weighted Unmet Rail Potential (2040)

The largest transbay unmet potential is found in San Francisco and in the East Bay between Richmond and San Leandro.



Source: PMC Market Analysis

[13] Good rail service assumes vehicle speeds of 40 to 50 mph, peak and off-peak frequencies of 4 to 8 and 2 to 5 trains per hour, direct service (no transfers) to/from every possible station, a maximum fare equivalent to 150% of the corresponding auto costs, and no crowding onboard trains.

[14] Unmet potential is defined as the difference between the potential demand under the "good rail service" scenario and future baseline ridership. It represents the potential for attracting new riders. The unmet potential values have had potential trips made by priority populations double counted, in line with the Federal Transit Administration's (FTA) equity analysis guidelines. Potential trips are reported for trips longer than 3 miles.

[15] The Market Analysis was done using the preliminary definition of priority populations.

4 LINK21 VISION, GOALS, AND OBJECTIVES

As a result of the needs identified previously, the Link21 vision is to transform the BART and Regional Rail network in the Megaregion, including a new transbay passenger rail crossing between Oakland and San Francisco.

This chapter includes:

- Link21 vision statement
- Link21 goals and objectives
- Engagement with various stakeholders to agree on the above, particularly the goals and objectives

4.1. 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.

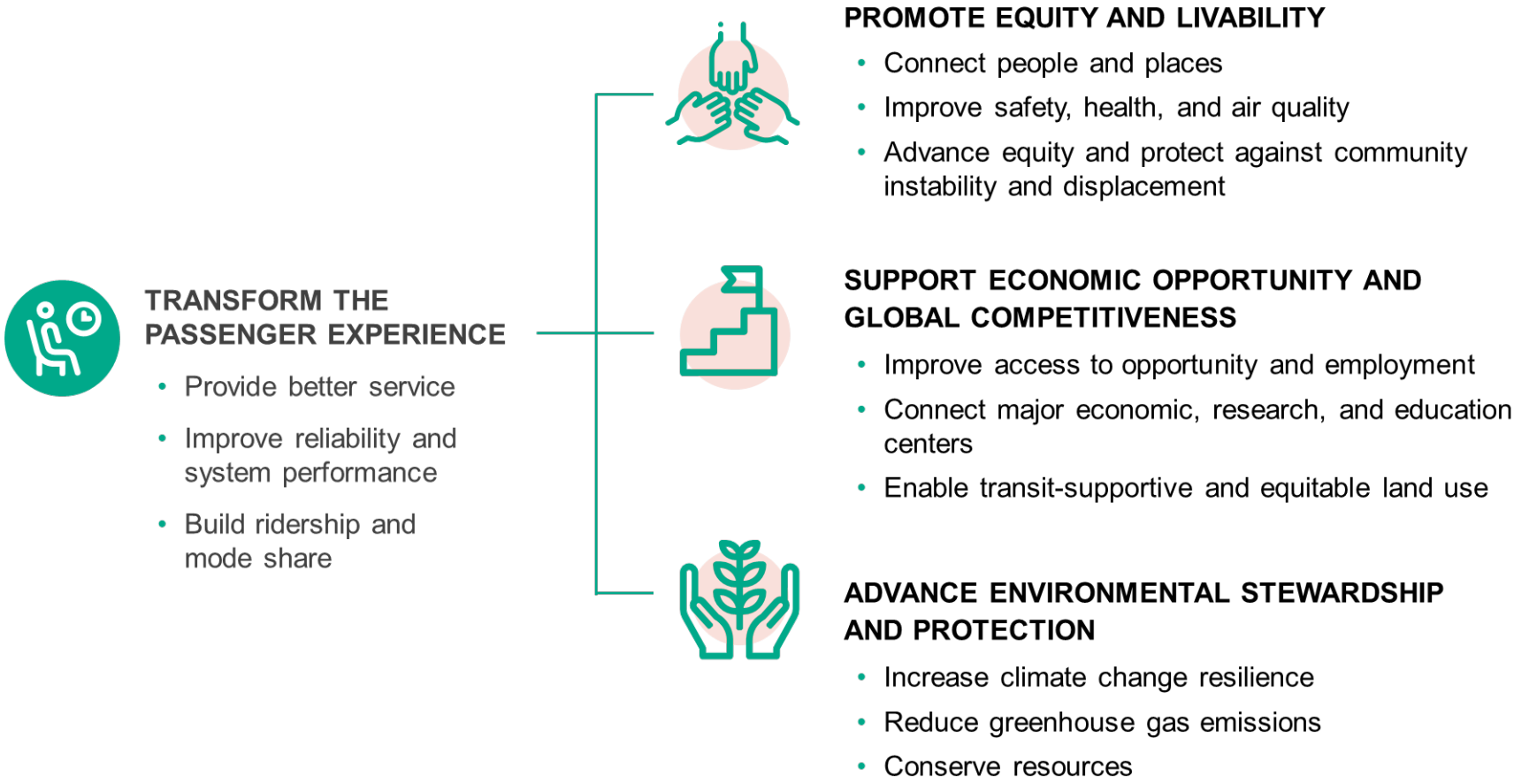
4.2. Link21 Goals and Objectives

The Link21 vision can be achieved through specific goals that deliver benefits to the Megaregion. Each goal is then broken down into more specific, lower-level outcomes known as objectives. These goals and objectives are presented in **Figure 4-1** and described in greater subsequent detail in **Table 4-1**.

The goals and objectives are presented at two levels: delivery of 1) transportation benefits as a foundational goal, which in turn will 2) enable the delivery of a broad range of societal benefits, such as promoting equity and livability, economic opportunity, and environmental stewardship.

Finally, 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 that priority populations will be provided with benefits throughout all four goals and their corresponding objectives.

Figure 4-1. Link21 Goals and Objectives



Note: Goals are in **BOLD CAPS,** objectives are in the bullets below.

Table 4-1. Description of Link21 Goals, Objectives, and their Associated Benefits

GOAL	BENEFITS
Transform the passenger experience	▫ Link21 will transform the **availability and quality of rail service** passengers receive by boosting connectivity between locations that are currently poorly connected, allowing for faster, more convenient trips. It will also increase capacity in the core of the rail network, allowing for more frequent service and reducing crowding in the most heavily traveled corridors, particularly the Transbay Corridor, as well as providing longer service hours. ▫ Link21 will transform the **reliability and resilience** of the megaregional rail network into one that passengers can depend on. The resulting integrated network will help optimize operational efficiency and reduce operational risk by adding resiliency and redundancy to key corridors. ▫ Through these transformational changes, Link21 will deliver significant increases in **rail ridership and mode share** in the Megaregion, especially among priority populations. These increases are the key enablers for the equity and livability, economic opportunity, and environmental benefits described in the next goal.
Promote equity and livability	▫ Link21 will create new and improved **rail connections** to key destinations—including cultural, recreational, educational, healthcare, and social service institutions, as well as residential, employment, and retail hubs—closing key gaps in existing rail service. These destinations will be accessible by faster, more frequent service over a longer daily service duration. ▫ By encouraging mode shift from auto to rail for some trips, Link21 will improve **health and safety**, by reducing the rate and number of auto crashes in the Megaregion and by improving the air quality in communities. It will also result in a greater uptake of active transportation (walking and bicycling) as a means to access the rail network. ▫ Link21 will advance **equity and community stability** by increasing the range of transportation options available to residents in low-income and historically underinvested areas (identified priority populations), and by reducing barriers to rail access and usage. It will improve service and the ability to access jobs at employment hubs and services and amenities at other destinations. Finally, it will advance community stability by enabling equitable land use around stations, reducing the likelihood of displacement and/or other negative impacts.

GOAL	BENEFITS
Support economic opportunity and global competitiveness	▫ Link21 will create transformational rail capacity and new connections between **people and jobs**. The newly integrated rail network will unlock improved rail access from residential areas across the Megaregion to employment opportunities in the core. Expanding the number and variety of jobs accessible to residents will contribute to the Megaregion's competitiveness and accommodate projected economic growth in future decades. ▫ By improving network connectivity and reducing travel times, Link21 will stimulate increased **productivity** and innovation — both in key business, education, and research centers in existing jobs-rich areas, and in places that are not historically large commercial centers, increasing competitiveness and spurring economic growth. ▫ Link21 will facilitate **transit-supportive and equitable land use** around stations by creating partnerships with municipalities to proactively plan and rezone, particularly in areas adjacent to rail stations, to support communities' stability and livability, economic, and environmental goals. ▫ Link21 will partner with jurisdictions to ensure the materialization of benefits and the mitigation of burdens (e.g., displacement) for **priority populations**.
Advance environmental stewardship and protection	▫ Link21 will provide additional **resiliency** to the megaregional rail network by providing alternatives to services threatened by sea level rise. ▫ Link21 will provide new rail alternatives that are competitive with auto, encouraging mode shift from auto to rail. In doing so, it will reduce the amount and rate of **greenhouse gas emissions** attributable to transportation, helping the Megaregion meet statewide targets. ▫ Link21 will encourage mode shift from auto onto a more energy-efficient rail network, and, in doing so, lower **energy consumption** rates on a total, per capita, and per trip basis.

4.3. Stakeholder Engagement

Early, frequent, and transparent stakeholder engagement is critical to the development of Link21. The goals and objectives are the foundation of the program, and they are critical in the development and evaluation of Link21 concepts. As such, engagement with stakeholders, the general public, and priority populations has been key in the process of defining and refining these goals. Engagement and outreach efforts to date have included:

- Review of local, regional, state, and federal plans and policies to ensure alignment with their goals
- Engagement with, and outreach to, key stakeholders, the general public, and priority populations
- Goals and Objectives Survey with more than 2,000 respondents
- Two rounds of public engagement that introduced Link21 and provided an update on technical work
- Two rounds of community co-creation with priority populations and other underserved communities
- A survey to understand what good service means to current and potential riders
- Grassroots outreach that consisted of attendance at community events and festivals, and outreach at BART and Capitol Corridor stations and onboard Capitol Corridor trains
- Webinars and live question and answer (Q&A) sessions with technical experts

4.3.1. Review of Existing Plans

State, regional, and local studies and plans were analyzed to align Link21's goals and objectives with key stakeholders in the Megaregion. **Table 4-2** provides further detail on how Link21 goals were aligned with the overall goals and objectives of the Megaregion.

In addition to the local, regional, and statewide plans and associated goals shown stated in Table 4-2, the current federal administration and Congress have instituted a focus on both equity and climate change and resiliency in their funding priorities. This federal focus mirrors Link21's priorities to benefit priority populations from an equitable project development standpoint and to incorporate climate change benefits.

Table 4-2. Alignment of Link21 Goals and Objectives with State, Regional, and Local Plans

ENTITY/ JURISDICTION	ALIGNMENT WITH GOALS AND OBJECTIVES
Bay Area Region	▫ **MTC's Plan Bay Area:** evaluates programs and projects based on climate protection, healthy and safe communities, equitable access, economic vitality, and specifically for transportation system effectiveness, such as increase in non-auto share and reduction of transit rider delay. ▫ **MTC's Core Capacity Transit Study:** included the following guiding principles: system operation rather than focused on agency or mode, full economic benefits, and alternatives to deliver safety, capacity, reliability accessibility, speed, and quality of service benefits. ▫ **The Bay Area Council Economic Institute's "The Megaregional Case for a New Transbay Rail Crossing":** key goals from implementation include regional competitiveness, economic development, and quality of life.
Other Regions	▫ **SACOG Metropolitan Transportation Plan (2016):** includes the following guiding principles that lead to critical indicators: smart land use around transport options, environmental quality and sustainability, financial stewardship, economic vitality, access and mobility, and equity and choice. ▫ **AMBAG 2040 Metropolitan Transportation Plan/Sustainable Communities Strategy (2018):** focuses on the following strategies to grow the region: more focused growth in high quality transit corridors, provide more travel choices as well as a safe and efficient transportation system with improved access to jobs and education for residents, support job creation through economic development, ensure the region's economic competitiveness through strategic investments in freight, and improve environmental outcomes for the region's residents by 2035. ▫ **The "Northern California Megaregion" (2016):** policy paper from the Bay Area Council Economic Institute that demonstrates the existence and relevance of the Megaregion, and it provides policy recommendations to maintain economic growth with a focus on environmental objectives.

ENTITY/ JURISDICTION	ALIGNMENT WITH GOALS AND OBJECTIVES
Local	▫ **San Francisco County Transportation Authority (SFCTA) San Francisco Transportation Plan 2040 (2017):** outlines a diverse investment strategy to make progress toward four important goals through the year 2040: safe and livable neighborhoods, economic competitiveness, world class infrastructure, and environmental health. ▫ **Alameda County Transportation Commission (Alameda CTC) Countywide Transportation Plan (2020):** contains four goals for the county: accessibility, affordability, and equity; safety, health, and sustainability; high-quality and modern infrastructure; and economic vitality. ▫ **Contra Costa Transportation Authority (CCTA) Countywide Comprehensive Transportation Plan (2017):** identifies five goals: efficient, safe, and reliable movement of people and goods; managed growth to sustain the county's economy, preserve its environment, and support its communities; expanded safe, convenient, and affordable alternatives to auto travel; maintenance of the current transportation system; and maximization of benefits from available funding.
Statewide	▫ **California State Rail 2040 Vision Plan (2018):** focuses on several key elements for a statewide system that correspond to the Link21 goals, including a truly statewide system, integrated services, coordinated schedules, frequent service, and a customer focus.
Transit and Rail Operators	▫ **BART System Expansion Policy (2002):** focuses on several goals that match Link21's, including: enhance regional mobility, especially access to jobs; generate new ridership on a cost-effective basis; enhance multimodal access to the BART system; and develop projects with a community input and lens. ▫ **Capital Corridor Joint Powers Authority Vision Plan (2016):** focuses on seven vision elements for the system, including: speed, frequency, reliability, connectivity, electrification, level boarding, and clockface headways. ▫ **Caltrain Business Plan (2020):** is based on the understanding that in order to support a changing region and meet future demand the system will need to grow. Caltrain has adopted specific goals and metrics related to equity, connectivity, and recovery and growth as it looks to implement the long-range service vision.

4.3.2. Engagement and Outreach Methods

STAKEHOLDER ENGAGEMENT

Link21 shared, collected feedback, and refined the goals and objectives through engagement with local, regional, and state agencies and operators in the Megaregion. Specific stakeholder groups include:

- **Program Development Team (PDT):** consists of senior staff and executives from Regional Rail operators and transportation planning and funding agency partners. They are helping to shape Link21 by offering feedback on key aspects of the program. Their inputs were instrumental for the definition of the goals and objectives.
- **Jurisdictional Working Group (JWG):** consists of city and jurisdictional partners who provide input to Link21 with a particular focus on local issues, such as stations and land use.

Link21 also conducted regular briefings with elected and public officials.

PUBLIC OUTREACH AND SURVEY

Link21 undertook public outreach through different vehicles to create dialogue and opportunities to educate and receive input and feedback, specifically on the goals and objectives. These vehicles included:

- Link21 website
- Public workshops
- Goals and Objectives Survey

EQUITY OUTREACH (CO-CREATION)

Link21 engaged in targeted outreach through a community co-creation process to overcome barriers to public participation inherent in traditional engagement strategies. In the first round of co-creation, Link21 worked with 20 community-based organizations to reach 350 participants from priority populations and other underserved communities. Round one, conducted between February and April 2021, focused on soliciting priority populations feedback on the draft goals and objectives.

Participants confirmed that the goals and objectives, as well as key potential metrics, align with improvements they hope to see realized through Link21. Some goals were adapted to provide more clarity, and equity metrics were refined to represent specific equity needs.

In co-creation, community members frequently expressed a desire to see improvements around critical issues like safety, cleanliness, system access (e.g., first/last mile improvements) and accessibility (e.g., Americans with Disabilities Act [ADA]), and fares. These issues will be considered throughout program work, but they also require more immediate consideration through nearer-term work by BART, CCJPA, and other government partners. Link21 is developing strategies to make this input available to project teams so that they can influence change on a quicker timeline.

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5 THE SOLUTION

Link21 will include a new transbay passenger rail crossing between San Francisco and Oakland as well as other potential projects that support it to meet Link21's vision, goals, and objectives.

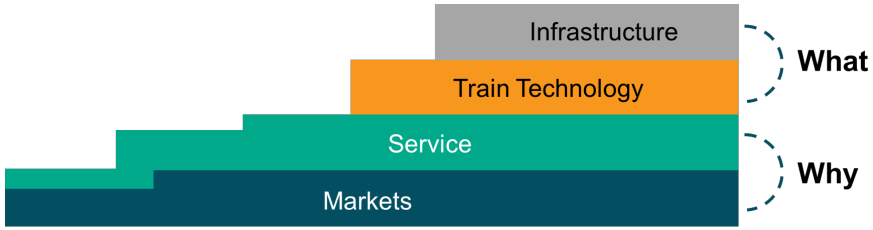
This chapter outlines the scope of the program in greater detail, and it provides a high-level overview of how program concepts will be developed to meet the vision, goals, and objectives.

5.1. Link21 Scope

Link21 will include a new transbay passenger rail crossing between San Francisco and Oakland as well as other potential projects that support the crossing to meet Link21's vision, goals, and objectives.

Link21 program concepts will be developed around four sequential building blocks: markets, service, rail technology, and infrastructure, as illustrated in **Figure 5-1**. The first two address the core goals of Link21 (why we are investing), and the last two address what can be done to address those goals.

Figure 5-1. Program Concept Building Blocks Over Time



- **Markets:** Link21 market analysis shows which geographic areas in the Megaregion have the highest unmet potential demand for rail that can be best served by investments in rail, with an emphasis on serving priority populations.
- **Service:** includes travel time, frequency, and service hours for key markets. Through a survey, the Engagement and Outreach Team will ask the public about their most desired service improvements — what they consider to be good service, including longer hours, higher frequency of trains, improved system resiliency, higher capacity, and others.
- **Rail technology:** once initial markets and service standards have been identified, the next step involves selecting a rail technology — BART or Regional Rail (standard gauge) or both — that is most suitable to deliver the necessary service standards to the appropriate markets.
- **Infrastructure:** in the Bay Area, this could include investments in existing, planned, and potentially new rail corridors; whereas those outside the Bay Area will be limited to infrastructure investments in existing and planned corridors, as identified in the *2018 California State Rail Plan* and individual rail operators' long-range plans and visions.

5.2. Link21 Program vs Project

The Link21 **program** will include megaregional solutions to meet the goals and objectives. The program may comprise multiple different projects, delivered with a phased approach and in alignment with the California State Rail Plan.

Each Link21 **project** will be a specific part of the program with independent utility. A new transbay passenger rail crossing is a key project in the program and will be supported by other projects to deliver the megaregional vision.

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6 STRATEGIC CASE EVALUATION

In assembling the Strategic Case, Link21 program concepts will be developed and evaluated based on their ability to successfully deliver Link21's goals and objectives and achieve the Link21 vision.

This section illustrates how delivering Link21 could generate the proposed benefits, and how these benefits will be quantified through a set of metrics aligned with the goals and objectives.

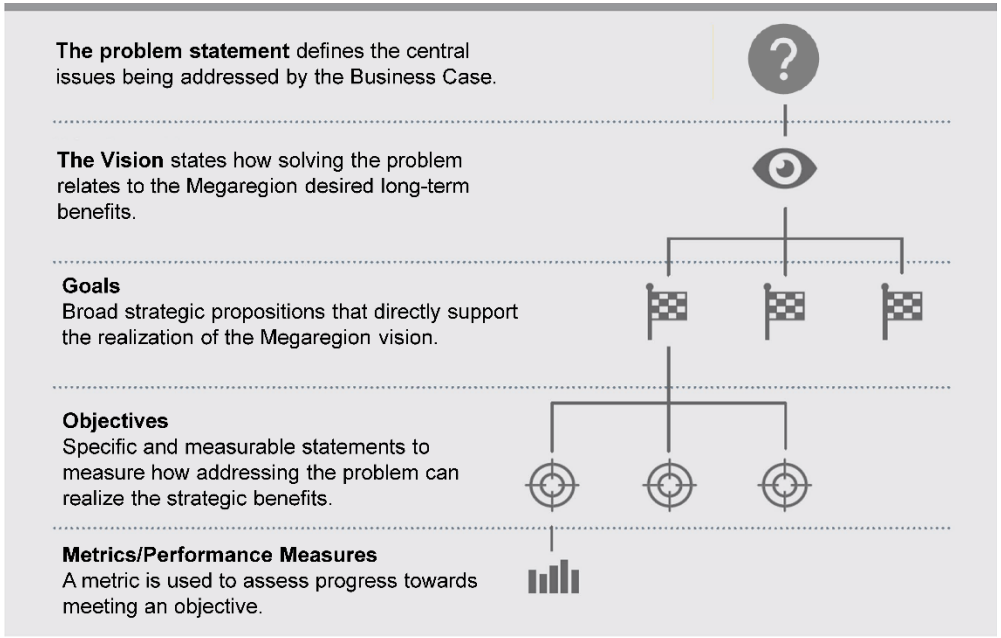
6.1. Strategic Case Evaluation Hierarchy

The Strategic Case evaluation follows a hierarchical structure. It starts with the identification of a broad problem and vision and progresses to more specificity with regard to strategic propositions and ultimately measurable performance outcomes to allow decision-makers to assess benefit trade-offs with strong evidence.

- The **Vision** states how solving the problem relates to the Megaregion's desired long-term benefits.
- **Goals** define the broad strategic propositions that directly support the realization of the megaregional vision.
- **Objectives** define specific and measurable statements that measure how addressing the problem can realize the strategic goals.
- Finally, a set of specific and quantifiable **metrics** are identified to measure and provide evidence of progress towards meeting an objective.

To evaluate Link21 program concepts, a bottom-up approach will be implemented, as illustrated in **Figure 6-1**. It will start by evaluating how each program concept performs on each specific metric. Aggregating information upward will then inform the alignment of each program concept with the Link21 objectives, goals, and ultimately the vision to solve the problem.

Figure 6-1. Link21 Strategic Case Evaluation Hierarchy



6.2. Strategic Case Metrics

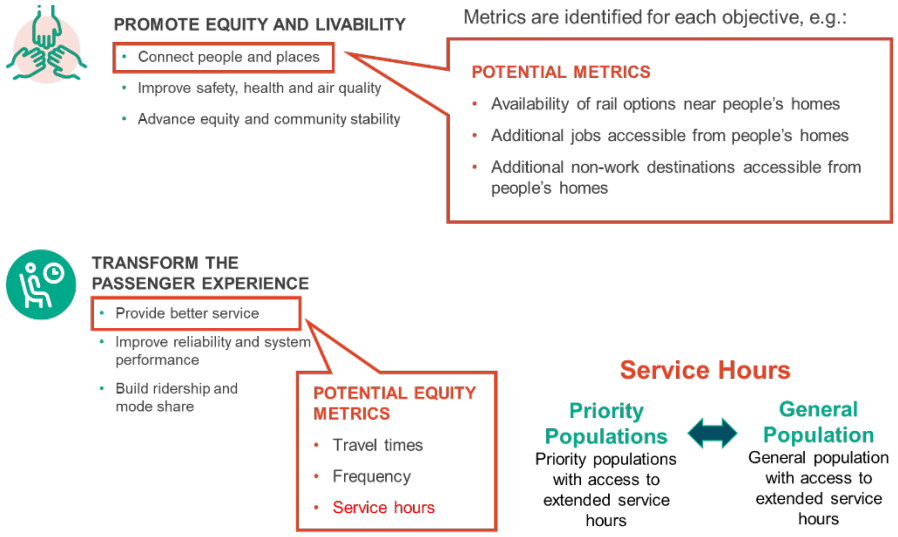
The following points are considered when selecting metrics:

- Metrics should be representative of the benefits associated with each objective.
- They should be clear and measurable:
  - Typically, as the differential between the Build scenario and the Baseline[16] (No-Build)
  - At a megaregional level to assess the benefits to the entire Megaregion rather than a specific geography
  - For a specific horizon year, where applicable
- They should contribute to a collective basis of evidence to support decision-making.
- Specific equity metrics are identified as the most relevant metrics for priority populations across all goals and objectives.[17] Some of these metrics will be assessed separately for priority populations and the general population to assess how Link21 advances equity (**Figure 6-2**).

Multiple rounds of evaluation will be conducted iteratively as the program advances: different decisions will be made on different timelines, and program concepts will be progressively developed and refined using outputs from prior rounds. As program concepts become more specific, metrics increase in number and level of detail. The name and definition of each metric may also evolve over time while staying true to its intent.

For example, the reduction in pollutants might be measured at a megaregional level during early stages of evaluation for broadly defined program concepts, whereas it might be measured at a local level to assess impacts to specific populations during later stages of evaluation, when there are more specific project definitions.

Figure 6-2. Indicative Examples of Metric Development



[16] Includes adopted plans of MPOs.

[17] Supported by co-creation inputs

Table 6-1 and **Table 6-2** list a preliminary set of metrics to be introduced progressively at different stages of evaluation.

Table 6-1. Metrics Associated with Foundational Goal

OBJECTIVE	METRICS	DESCRIPTION
Provide better service	▫ Travel times * ▫ Service frequency * ▫ Service hours * ▫ Crowding ▫ Network integration	Improving rail service makes it a more viable and attractive mode for travelers and trips of all types: ▫ Shorter travel times allow travelers to make their trips faster and spend their time doing more productive activities. ▫ More frequent service reduces first wait times at stations. ▫ Longer service hours make rail a viable option for more trips, particularly late night and over weekends. ▫ Less crowded trains are more comfortable. ▫ A more integrated network increases the number of connecting hubs between modes and has coordinated schedules to reduce time-consuming transfers.
Improve reliability and system performance	▫ Reliability ▫ Recovery times from incidents ▫ Ability to maintain existing and new infrastructure ▫ Flexibility to meet future growth (demand/capacity) ▫ Viability in emergency events	An operationally reliable, sound, and flexible rail system benefits both travelers and operators: ▫ More reliable service means fewer delays and an improved ability to recover from delays, thus less time wasted for passengers. ▫ Better ability to maintain existing infrastructure increases service redundancy and availability to meet passenger needs. ▫ Planning to meet future demand growth will provide the right level of capacity to operate reliably. ▫ Planning and adding redundancy to the network for emergency events, such as earthquakes, future proofs the system and ensures that operators will be better able to respond to these outcomes when they occur.
Build ridership and mode share	▫ Ridership * ▫ Mode shares * ▫ VMT reduction	Higher rail ridership and mode shares, and in turn greater VMT reductions, are associated with improved service and a more reliable, high-performance network. These outcomes in turn drive community livability, economic, and environmental benefits described in Table 6-2.

Note: Asterisks (*) in this and the following table denote metrics that will be assessed seperately for prioirity populations and the general population.

Table 6-2. Metrics Associated with Wider Goals

OBJECTIVE	METRICS	DESCRIPTION
Goal: Promote equity and livability		
Connect people and places	▫ Availability and accessibility of rail * ▫ Access to jobs and non-work destinations * ▫ Work and non-work trips*	A more comprehensive rail network and/or improved rail service can make rail a viable travel option for some residents, simply by providing service near their homes, workplaces, and/or other major destinations and expanding the number of places residents can travel to/from within a reasonable journey time. These places include cultural, recreational, educational, healthcare, and social service institutions, as well as residential, employment, and retail hubs.
Improve safety, health, and air quality	▫ Pollutant levels * ▫ Auto-involved crashes ▫ Active mode usage, particularly to access rail * ▫ Coverage of Areas of Health Concern	A shift from auto to rail for some trips will reduce the rate and number of auto crashes and improve air quality in the Megaregion. At the same time, a greater uptick in active transportation (walking and bicycling), particularly as a means to access the rail network, has health benefits for individual residents.
Advance equity and protect against community instability and displacement	▫ A wide range of metrics across other objectives will be assessed for priority and general populations to assess this objective of advancing equity and community stability. These metrics are denoted with an asterisk (*). ▫ Additional metrics might be assessed as a result of co-creation inputs	Priority populations, defined broadly as residents of Megaregion census tracts that experience the highest levels of burden, have the potential to derive a range of benefits spanning all objectives. Most importantly, they could benefit from more transportation options available to them and reduced barriers to rail access and usage, in turn improving their ability to access jobs as well as services and amenities at other destinations. Bringing jobs and other opportunities closer to residents' homes, through a combination of transportation and equitable land use improvements, can advance equity and improve the stability of populations and communities across the Megaregion.

OBJECTIVE	METRICS	DESCRIPTION
Goal: Support economic opportunity and global competitiveness		
Improve access to opportunity and employment	▫ Jobs accessible to new or improved service ▫ Access to jobs * and employees ▫ Work trips*	Similar to the potential for improving access to key destinations across the Megaregion, investments in rail can create new connections between people and jobs. An integrated rail network can unlock improved rail access from residential areas across the Megaregion to employment opportunities in the core. Expanding the number and variety of jobs accessible to residents will contribute to the Megaregion's competitiveness and accommodate projected economic growth in future decades.
Connect major economic, research, and education centers	▫ Travel times and trips between major centers, and between major centers and transportation hubs	An improved rail network and service can also stimulate increased productivity and innovation — both in key business, education, and research centers in existing jobs-rich areas, and in places that are not historically large commercial centers — increasing competitiveness and spurring economic growth and opportunity.
Enable transit-supportive and equitable land use	▫ Current and potential future land uses near rail stations* ▫ Land use policies consistent with Link21 land use and equity strategy	Transit-supportive and equitable land use in areas near rail stations enables or enhances certain benefits. For example, higher residential densities near stations means that more residents can access jobs and other destinations within a shorter travel time. And specific equitable land use policies (e.g., anti-displacement) would advance the overall stability of communities. Being able to accommodate higher densities around stations, specifically from priority populations, means that the Megaregion can accommodate its forecast population growth in a sustainable way ensuring community stability.

OBJECTIVE	METRICS	DESCRIPTION
Goal: Advance environmental stewardship and protection		
Increase climate change resilience	▫ Viability under sea level rise scenarios and other climate events	A rail network that is resilient against sea level rise and other climate events is more likely to remain usable during and following such events, providing residents with a means of travel when other services and infrastructure may be disrupted.
Reduce greenhouse gas emissions	▫ Greenhouse gas emissions	A shift from auto to rail for some trips will reduce the amount and rate of greenhouse gas emissions attributable to transportation, helping the Megaregion meet statewide targets.
Conserve resources	▫ Energy consumption for transportation	Reduced energy consumption associated with transportation can enable other environmental and public health benefits. In particular, the shift from auto to rail will reduce dependence on fossil fuels, the production of which carries significant costs and harms to the environment.

6.3. Strategic Case Evaluation Tools

Several tools will be developed to inform the Strategic Case evaluation:

- A spreadsheet-based tool will aggregate metrics for all program concepts from several different sources and summarize their values in a single location. It can then translate their values into a scoring system that is commensurate and easily comparable across metrics, many of which have different scales and dimensions. Finally, it enables the aggregation of outputs from the individual metric level to the objective and goal levels. The primary objective of this tool is to deliver evidence to a wide range of audiences (particularly non-technical ones) in an easily understandable manner, and, in doing so, aid decision-making.
- A dashboard will provide a dynamic visual representation of key metrics and other performance indicators with the primary objective of displaying detailed spatial data to aid the evaluation and the refinement of concepts. These visualizations may include benefit maps, crowding in network links, and origin-destination flows. Some example outputs are shown in **Figure 6-3**.

Initial versions of these tools are currently under development. Like the metrics, they will be refined as the Strategic Case evaluation progresses.

Figure 6-3. Illustrative Example of Visual Dashboard