Item 8
Enclosure

Transbay Program
Downtown Rail Extension
Phasing Study

August 20, 2021

Revision Record

Revision	Description	Status	Date
0	For ESC concurrence	Draft	August 20, 2021

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EXECUTIVE SUMMARY

The Transbay Program Phase 2 – Downtown Rail Extension (DTX) will connect Caltrain's regional rail system and the California High-Speed Rail Authority's statewide system to the Salesforce Transit Center in downtown San Francisco. The environmentally cleared DTX alignment will extend the existing Caltrain two-track alignment that currently terminates at the Fourth and King station. At a point near the Caltrain railyard, the alignment will descend into a tunnel, continue northward through a new station at Fourth and Townsend streets, and expand to three tracks as it continues to the new rail station in the transit center. The DTX and its related infrastructure will provide a critical link for Peninsula commuters, travelers on the state's future high-speed rail system, and other rail projects planned for the region in the coming years.

The DTX is being developed by the Transbay Joint Powers Authority in partnership with the Metropolitan Transportation Commission, San Francisco County Transportation Authority, Peninsula Corridor Joint Powers Board (Caltrain), California High-Speed Rail Authority, and City and County of San Francisco. An Integrated Program Management Team and an Executive Steering Committee, both composed of representatives from each of the partnering agencies, meet regularly to advise the TJPA on technical and policy matters.

Phasing Study

An early task in development of the DTX is to shape an initial operating project to deliver rail service to the Salesforce Transit Center as soon as possible, among other goals.

This Phasing Study, begun in mid-2020, is a collaborative effort by the Integrated Program Management Team to investigate whether some infrastructure elements could be deferred, reduced, or otherwise changed to optimize the initial operating project. Over the course of three workshops, the IPMT reviewed the history of the DTX, previous technical studies, and operational assumptions for blended Caltrain/high-speed train service on the Peninsula. The IPMT developed the phasing concepts and evaluation criteria for assessing them, and during the final workshop, reached either a unanimous judgement or consensus on each phasing concept.

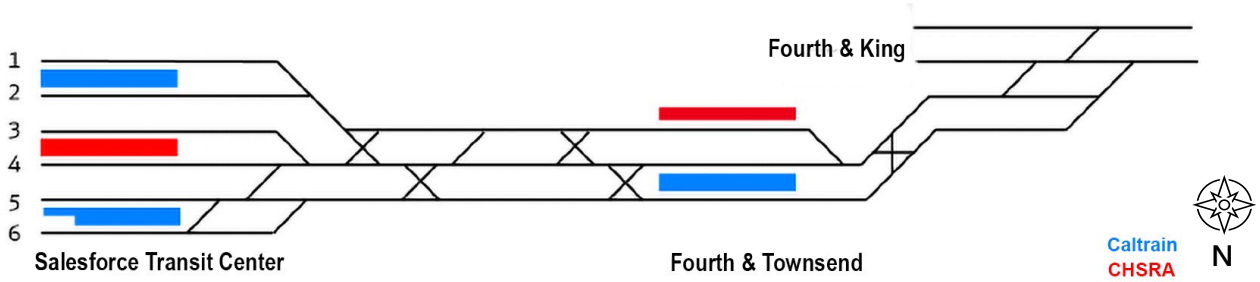
This report presents the phasing concepts, the results of the IPMT's work over the past year, and their recommendations to the Executive Steering Committee, which will make a final recommendation on the phasing concepts for action by the TJPA Board of Directors.

Operations Analysis

In 2020-21, the operators, Caltrain and California High-Speed Rail Authority, undertook an analysis as part of the Phasing Study to understand the minimum infrastructure needed to support various levels of Caltrain and high-speed service.

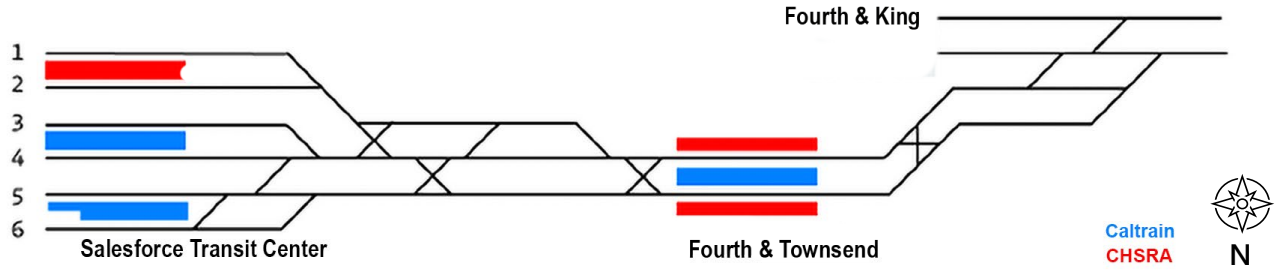
The operators' respective business plans and Caltrain's 2040 Long Range Service Vision establish an integrated peak service level in 2040 of eight Caltrain trains per hour per direction and four high-speed trains per hour per direction on the DTX (8+4 service plan). Two infrastructure options were developed that meet all operational requirements for the planned service levels in 2040—less than 10 years after the commencement of service in the DTX tunnel.

Concept A includes three tracks and three platform faces at the Fourth and Townsend station, with Caltrain occupying the northern and southernmost platforms and CHSRA occupying the center platform at the transit center.



Concept A

Concept B includes two tracks and four platform faces at the Fourth and Townsend station, with Caltrain occupying the two northern platforms and CHSRA occupying the southernmost platform at the transit center.



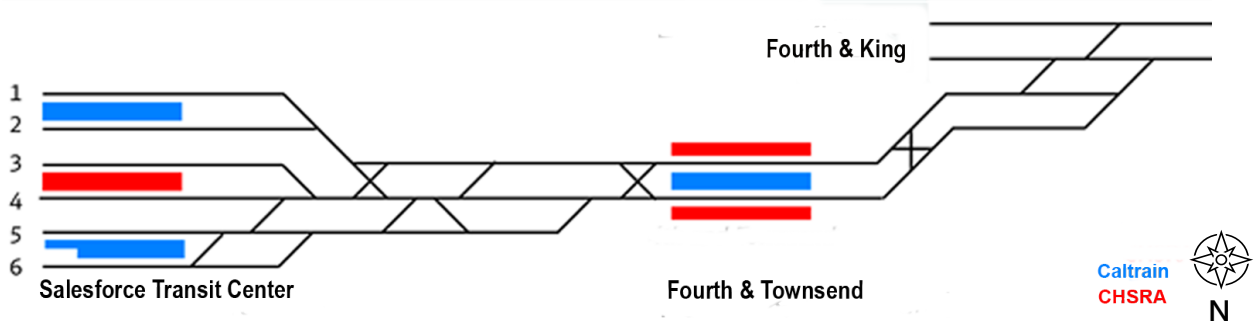
Concept B

Simulations run on the two infrastructure concepts showed that three tracks in the DTX tunnel between Fourth and Townsend Street Station and Salesforce Transit Center will support stable, compliant operations of the twelve trains per hour per direction. Additional findings are:

- Both concepts performed suitably during minor day-to-day variations, meeting the on-time performance requirements set out by the operators, although the operators noted that the Concept B layout would provide slightly more flexibility for operations.

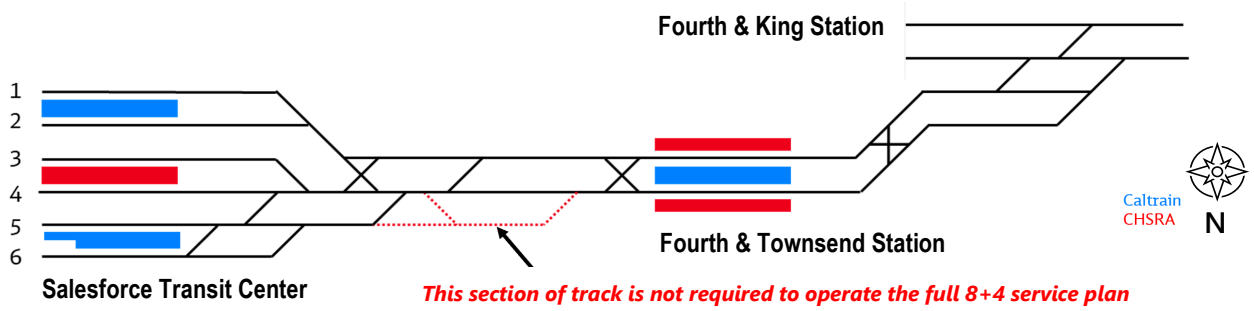
- To address major disruptions, acceptable contingency plans could be developed to allow continued but reduced service to the San Francisco stations on a temporary basis.
- Adding an extra crossover at or near the point at which the DTX diverges from the Caltrain mainline would allow for better operations.
- During normal operations, shared platforms provided little or no benefit because all platforms were occupied nearly 90% of the time.

Subsequent to the operational analysis, the DTX design team conducted a high-level engineering evaluation using the preferred Concept B layout, which determined that it would be advantageous to shift the southernmost track along Townsend Street from the south side of the alignment to the north. This modified Concept B alignment, Concept B Prime, was then subjected to the same operational analysis as Concepts A and B.



Concept B Prime

The operational analysis of Concept B Prime revealed that a substantial portion of the northerly third track, approximately one-half mile, could be reduced without compromising the ability of the DTX to meet the operators' 8 + 4 service plan. This arrangement, Concept B Prime Reduced, permits service reliability as required by the operators at a reduced infrastructure cost as compared to the other concepts.



Concept B Prime Reduced

Refer to Section 4 for a discussion of the operations analysis.

Evaluation Criteria

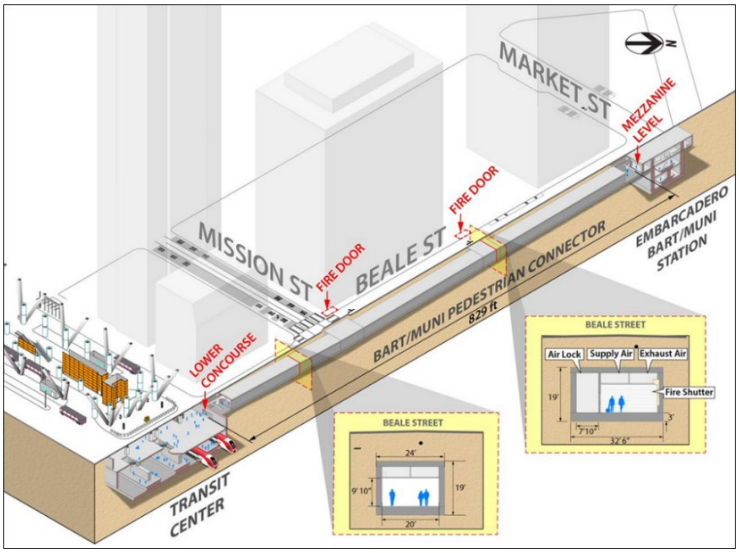
IPMT members developed criteria to evaluate each phasing concept. The criteria fall into six main topics that reflect multiple perspectives and consider the larger objectives of reducing capital costs and repositioning the project in the regional context. See Section 5 for evaluation criteria details.

COST AND SCHEDULE	▪ Capital cost deviation ▪ Right-of-way ▪ Cost of future implementation ▪ Baseline Master Schedule	
FTA NEW STARTS PROJECT JUSTIFICATION EVALUATION	▪ Land use ▪ Economic development ▪ Mobility improvements	▪ Cost-effectiveness ▪ Environmental benefits ▪ Congestion relief
REGIONAL CONTEXT	▪ Benefits ▪ Effect on regional projects ▪ Effect on regional significance	▪ Support for PBA 2050 ▪ Effect on passengers' cost of using the service
ENVIRONMENTAL EFFECTS	▪ Consistency with Phase 2 environmental documents ▪ Community Impact ▪ Dependency on non-environmentally cleared projects	
OPERATIONS	▪ Changes to operations costs ▪ Effect on service flexibility ▪ Effect on operational reliability, security, safety	▪ Effect on future service growth ▪ Effect on service during future retrofit
MAINTENANCE	▪ Changes to maintenance costs ▪ Effect on O&M responsibilities	▪ Effect on response time for repairs ▪ Effect on resilience

The evaluation was a collaborative undertaking by the IPMT and the TJPA and its consultants. Reviewers included staff from the operators—Caltrain and CHSRA—and subject matter experts in environmental clearance, regional planning, cost engineering, federal New Starts funding, and program delivery. With the exception of the cost evaluations, all evaluations were qualitative and reflect a consensus opinion on the effects of a phasing concept relative to each evaluation criterion. Results are expressed as either positive, negative, or not significant, as compared with the current project. Estimated cost savings are based on order-of-magnitude construction cost estimates developed from historic cost estimates and other resources.

The following sections summarize each phasing concept, the evaluation results, and a recommendation that reflects the majority opinion among IPMT members.

Defer the BART/Muni Pedestrian Connector



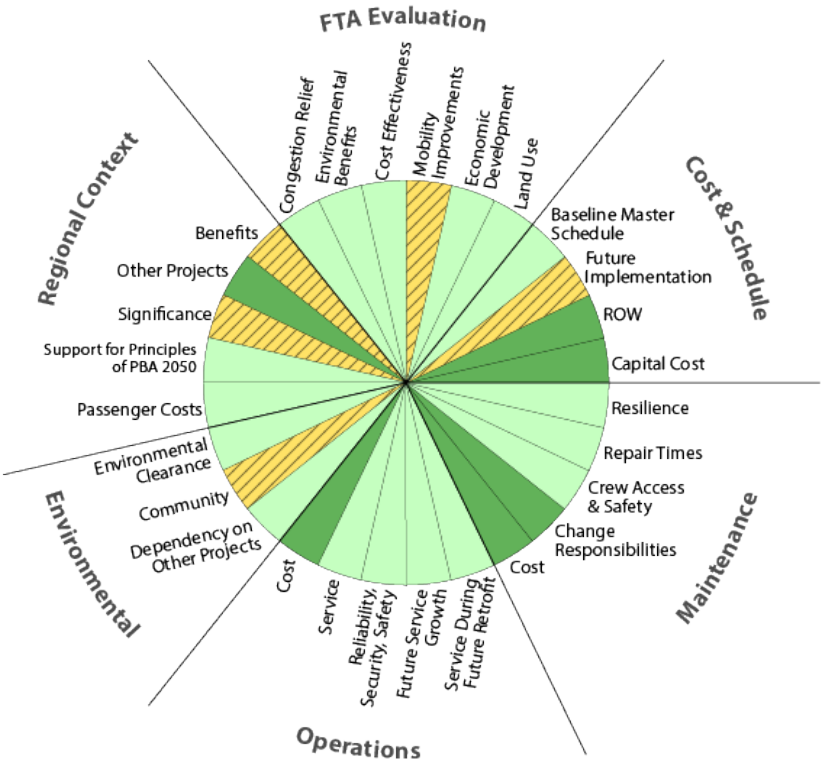
The BART/Muni pedestrian connector is a tunnel linking the mezzanine level of the BART/Muni Embarcadero Station with the lower concourse of the Salesforce Transit Center. The purpose of the connector is to alleviate peak-hour pedestrian traffic congestion on sidewalks between Mission and Market streets caused by passengers transferring between the two stations. The pedestrian connector, currently at the conceptual design level, is independent of other DTX infrastructure and could be constructed before, concurrently with, or after the other infrastructure. This phasing concept would defer completing design and construction of the BART/Muni pedestrian connector but would not change the connector's environmentally cleared status or its status as a project within the TJPA's purview.

Evaluation Summary

Deferring the connector would save $221 million ($2027 year-of-expenditure YOE) plus the value of the right-of-way.

Positive effects of deferring the connector are associated with savings to maintenance and operations costs. Deferral also would allow BART time to design planned station modifications at the BART/Muni Embarcadero Station. Negative effects are associated with reduced mobility, regional connectivity, and pedestrian safety.

See Section 6.1 for details.



Charts show majority opinions among IPMT members.

Evaluation Key

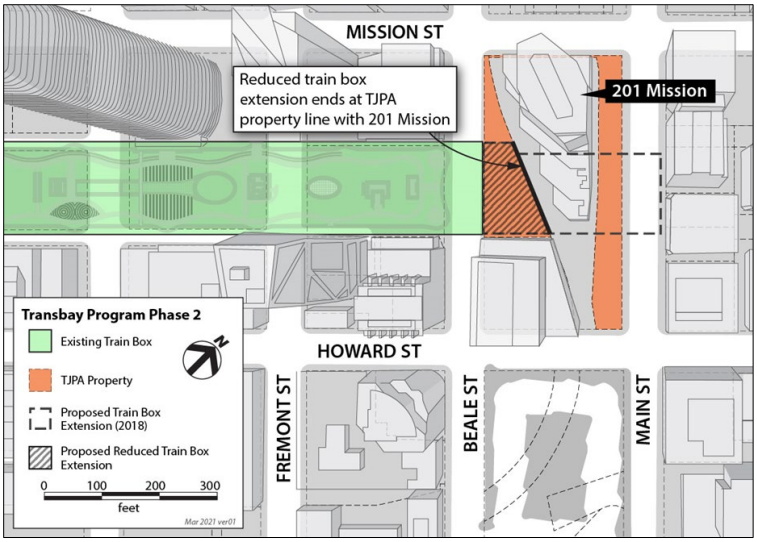
- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project

Recommendation

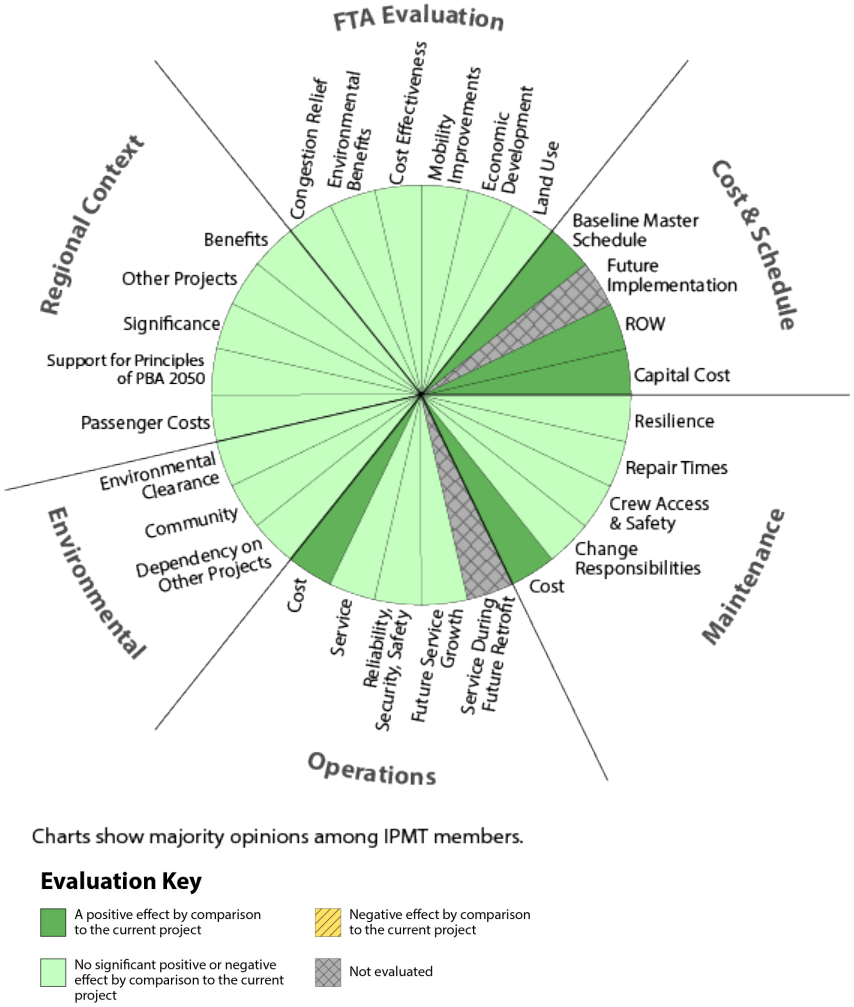
Accept deferral, provided that any impact to Caltrain ridership is identified and an environmental review of street-level mitigations is undertaken.

Reduce Train Box Extension

The existing train box (the shell of the train station at Salesforce Transit Center) extends to the east side of Beale Street. The environmentally cleared train box extension would expand the train box to the east side of Main Street to allow tangent platforms on five of the six tracks to accommodate CHSRA double-consist trainsets. The current design would require purchasing additional right-of-way and demolishing part of the building at 201 Mission Street.



While the train box extension cannot be eliminated altogether, as the space is required for ventilation and emergency egress, CHSRA will allow several cars of its double-consist trains to extend beyond the platform face if the double-consists do not affect adjacent track movements, which is possible and would allow for a reduction in the length of the planned extension. This phasing concept would reduce the length of the planned extension permanently.



Charts show majority opinions among IPMT members.

Evaluation Key

- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project
- Not evaluated

Evaluation Summary

Reducing the train box extension would save $86.8 million ($2027 YOE) plus the value of the right-of-way.

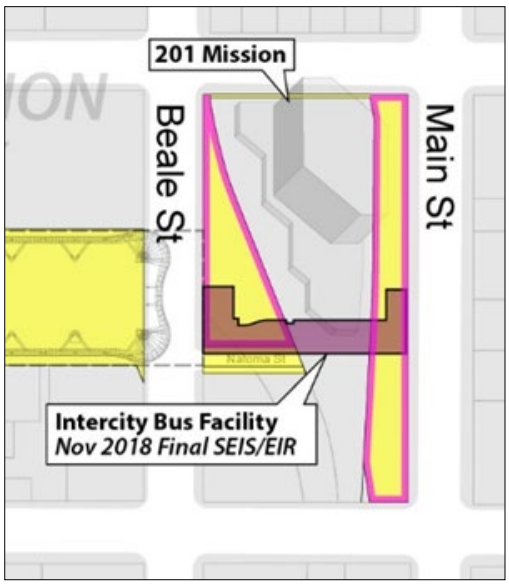
Other positive effects are associated with reduced operations and maintenance costs. Overall, reducing the extension would not have a significant effect on the DTX. See Section 6.2 for details.

Recommendation

Accept reduction of the train box extension.

Defer Intercity Bus Facility

The intercity bus facility (IBF) would include ten bus bays dedicated to regional bus services, two floors of office or residential space, and a direct connection to the lower concourse of the transit center. The facility would be constructed across the street from the east end of the Salesforce Transit Center above the train box extension between Beale and Main streets; it, therefore, depends on construction of the train box extension, as environmentally cleared, and acquisition of the associated the right-of-way. This phasing concept would defer the construction of the IBF as currently designed.



Regional bus services currently operate from the Salesforce Transit Center's bus deck under a lease agreements with AC Transit, the master lease holder. AC Transit anticipates expanding service between 2035 and 2050 and occupying all bus bays on the bus deck. If the transit center bus deck reaches capacity before the facility is built, then deferral would affect the availability of regional bus services that are interconnected with other services at the transit center. The result could be reduced accessibility and transit ridership.

Evaluation Summary

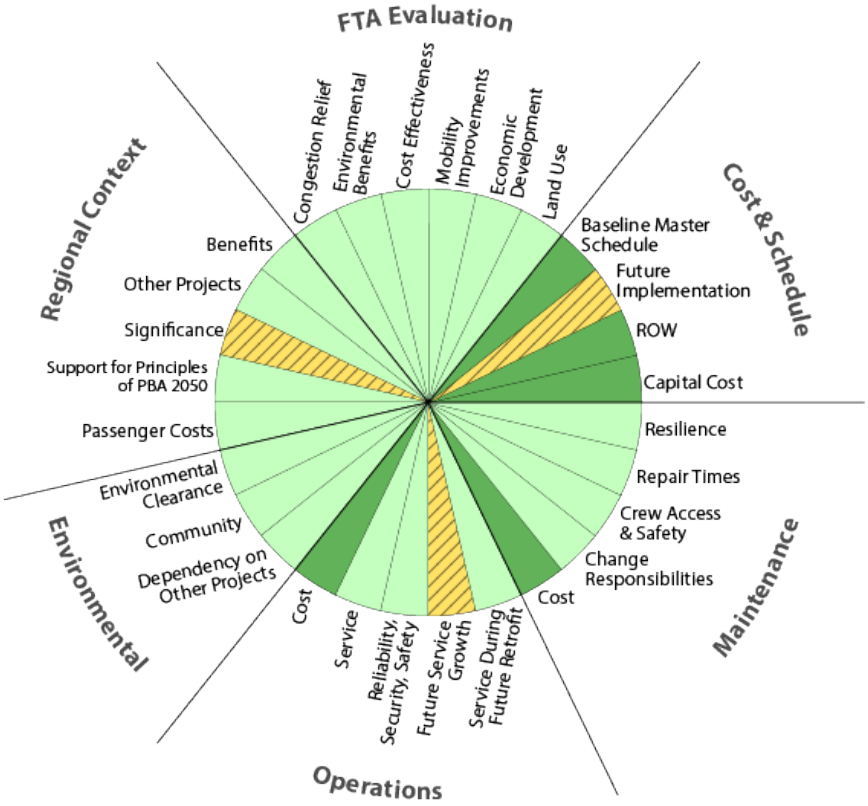
Deferring the IBF would save $40.3 million ($2027 YOE).

Other positive effects of deferring the facility are associated with reduced operations and maintenance costs. Negative effects are associated with constraints on service flexibility and fewer regional benefits.

See Section 6.3 for details.

Recommendation

Accept deferral of the environmentally cleared IBF.



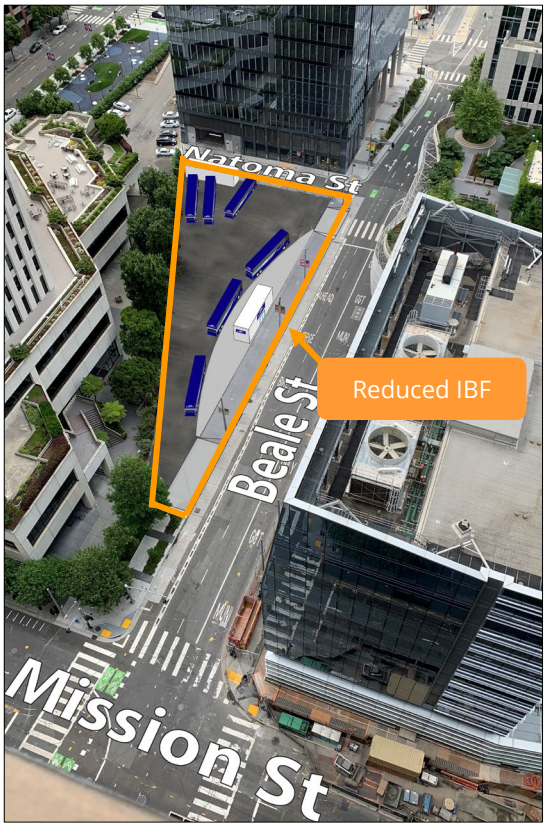
Charts show majority opinions among IPMT members.

Evaluation Key

- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project

Reduce Intercity Bus Facility

This phasing concept would reduce the intercity bus facility permanently and defer construction of the reduced intercity bus facility until it is operationally required. The reduced IBF concept, with six bus berths and two small buildings for passenger waiting and package storage, represents the maximum footprint for a bus facility on TJPA-owned property. Although reduced, the IBF would provide more bus capacity for regional bus services than is currently provided on the bus deck of the Salesforce Transit Center. Limited vehicle access to the facility and limited back-of-house space could constrain service and affect operational reliability, security, or safety.



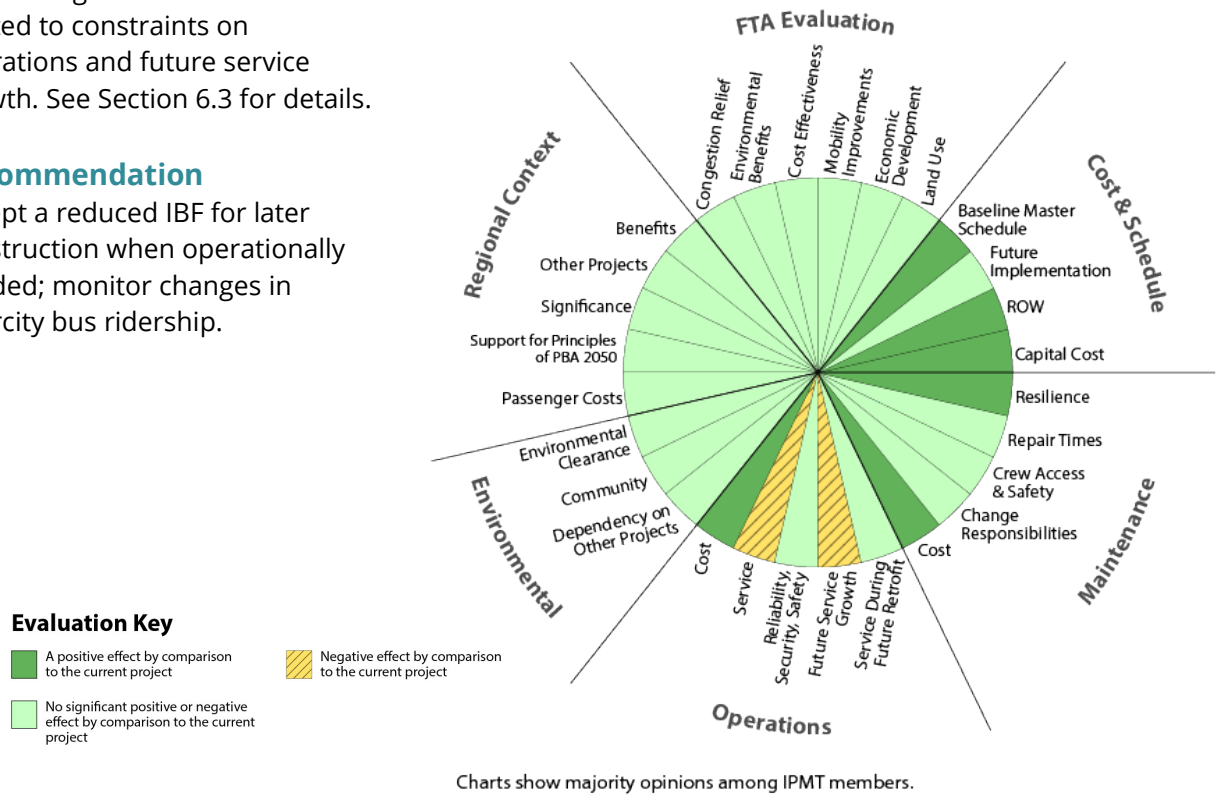
Evaluation Summary

Constructing the reduced IBF would save $31.4 million ($2027 YOE).

Other positive effects of reducing the IBF are associated with reduced operations and maintenance costs. Resilience of the facility would improve as a result because the reduced footprint would remove the facility from flood and sea-level rise inundation zones. Negative effects are related to constraints on operations and future service growth. See Section 6.3 for details.

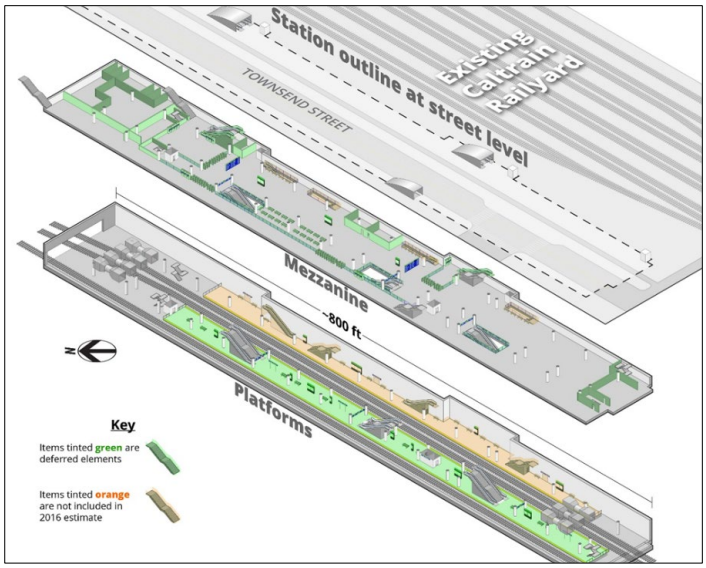
Recommendation

Accept a reduced IBF for later construction when operationally needed; monitor changes in intercity bus ridership.



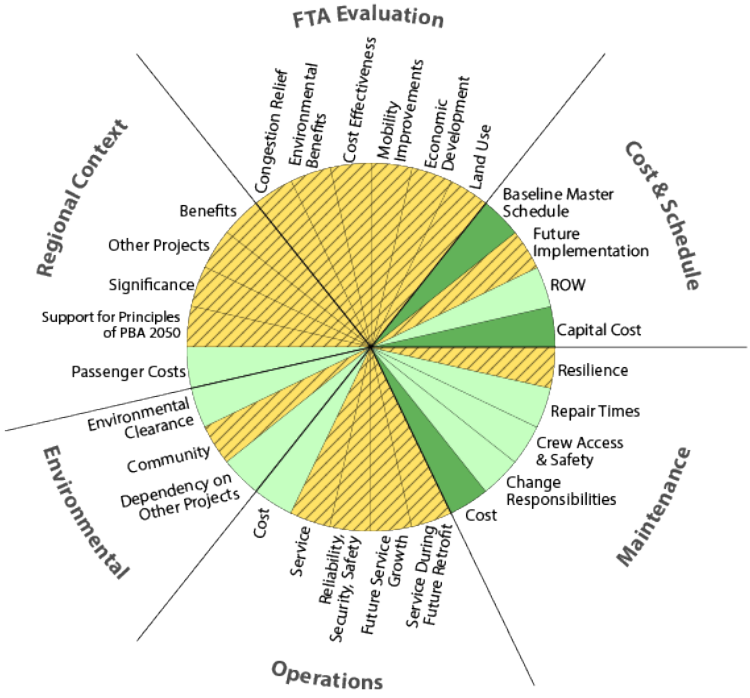
Charts show majority opinions among IPMT members.

Defer Fit-out of Fourth and Townsend Street Station



The underground Fourth and Townsend Street Station will serve passengers on trains bound for or returning from the Salesforce Transit Center. The environmentally cleared station includes a concourse mezzanine and a train platform level with three tracks and a center platform. This phasing concept would defer the fit-out of the Fourth and Townsend Street Station. "Fit-out" refers to the center train platform, architectural finishes, and amenities necessary to open the station for passenger revenue operations.

Deferring the fit-out of the station would delay putting the station into revenue service operations as a rail station and make high-speed train service unavailable in the area around Fourth and Townsend. Caltrain would likely need to terminate most of its service at the existing Fourth and King station, providing only limited service to the transit center.



Charts show majority opinions among IPMT members.

Evaluation Key

- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project

Evaluation Summary

Deferring fit-out of the station would save $28.9 million ($2027 YOE).

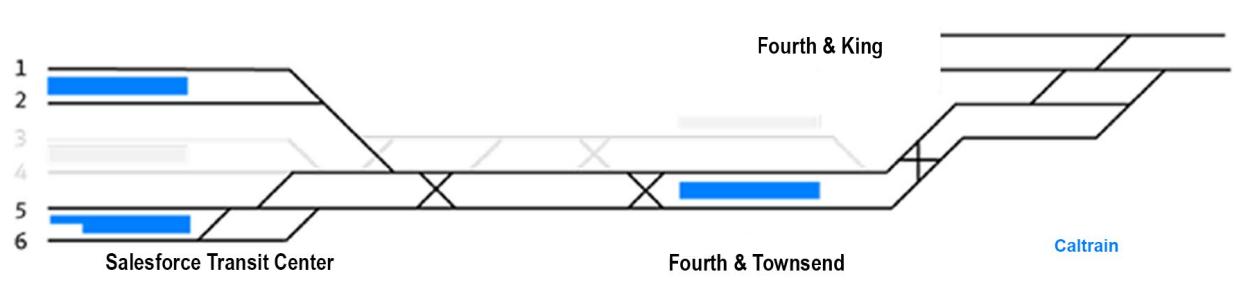
Significant constraints on train operations for both operators diminish nearly all of the regional benefits associated with the DTX—interconnectivity with other transit systems and projects, investments in transportation improvements in a priority development area, and overall regional significance. Additionally, deferring operations at the station would have a negative effect on the FTA's project justification rating. As with other deferral concepts, positive effects are associated with lower capital and maintenance costs and schedule benefits. See Section 6.4 for details.

Recommendation

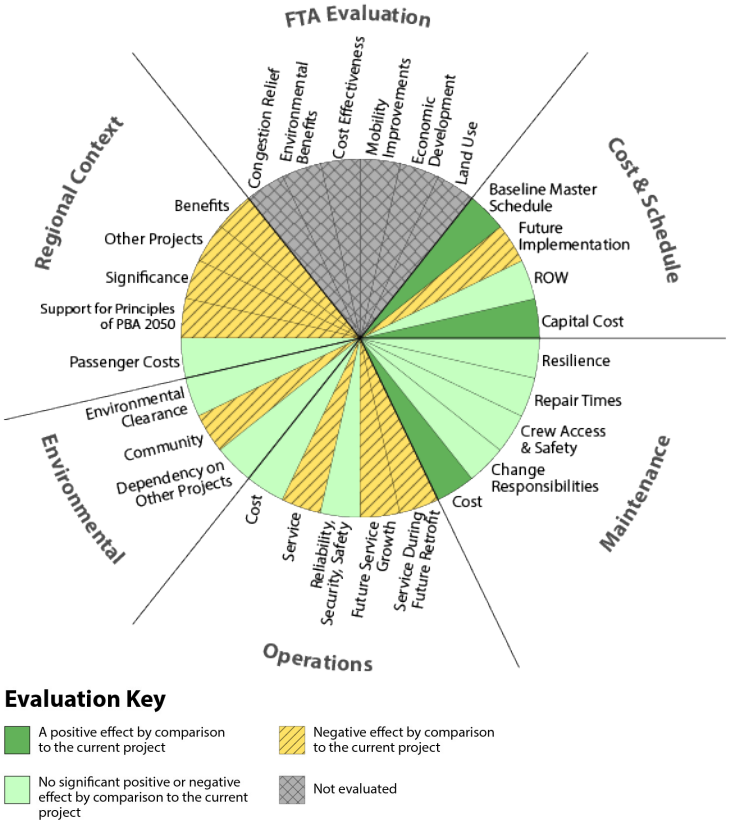
Reject deferral of the fit-out.

Defer Infrastructure Fit-out for CHSRA-related Elements

CHSRA anticipates arrival of its high-speed train service to the Salesforce Transit Center in 2031. This phasing concept assesses a scenario in which CHSRA's operations begin after 2031 and construction or "fit-out" of the infrastructure needed to support revenue service could be deferred until one year prior to the planned start date to allow for testing and commissioning. Deferred infrastructure fit-out includes systems, station platform elements, and some trackwork, including the third track in the DTX tunnel, although a tunnel capable of supporting the third track would still be constructed.



High-speed train service to San Francisco is a contributing factor to the regional significance of the DTX. Thus, deferring revenue operations would also defer the regional and environmental benefits associated with the DTX—providing better transit connections to the City's financial and employment center, connecting high-speed train service to bus and other rail services at the transit center, and increasing ridership on transit.



Evaluation Summary

Deferring the fit-out of CHSRA elements at Salesforce Transit Center would save $38.0 million ($2027 YOE).

Significant negative effects are associated with operations, especially service and future service growth both during the interim condition without the high-speed infrastructure and during construction of the infrastructure, which would affect Caltrain operations. The regional significance and benefits associated with the DTX would, likewise, be diminished. See Section 6.5 for details.

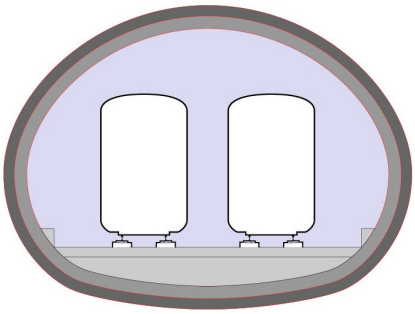
Recommendation

Reject deferral of the fit-out.

Two-Cell DTX Tunnel

As part of the Phasing Study, the IPMT examined several track configurations for a two-cell DTX tunnel. A two-cell tunnel would accommodate two tracks only as the permanent configuration.

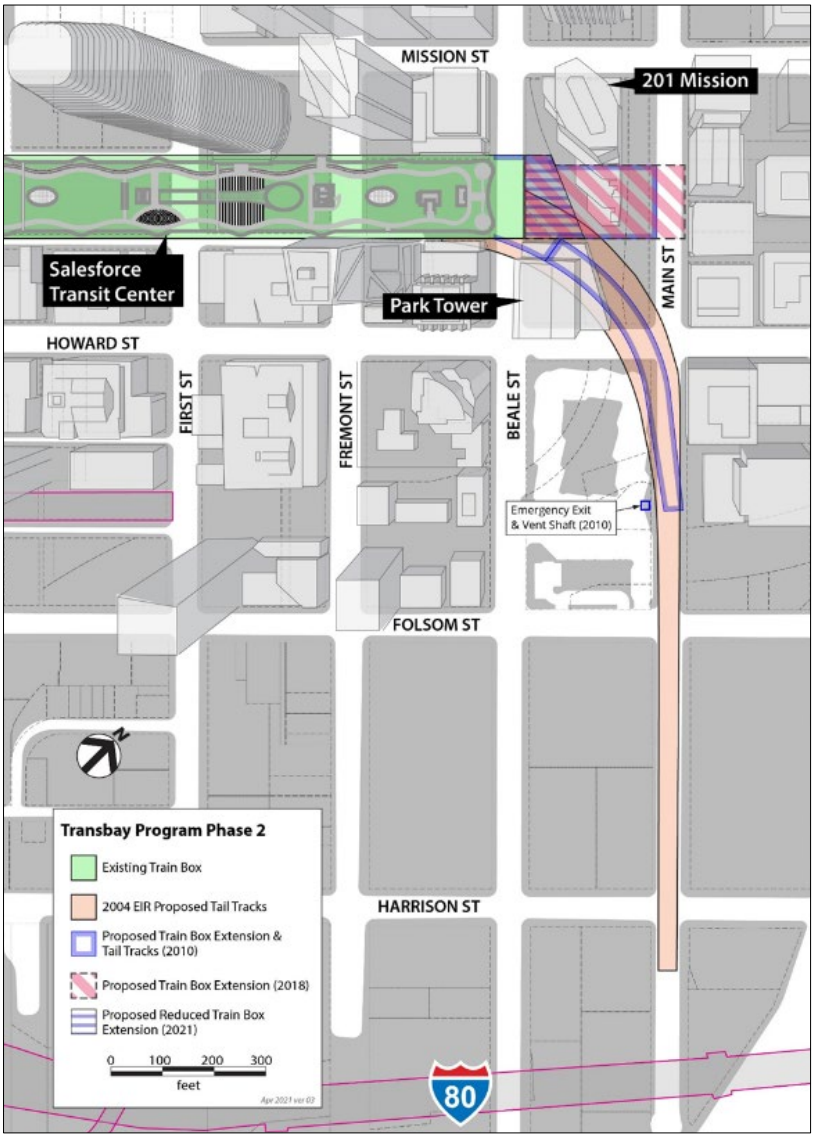
Two configurations were developed during conceptual and preliminary engineering for the DTX: a two-cell tunnel with the addition of tail tracks and a two-cell tunnel with a loop configuration.



Two Cell

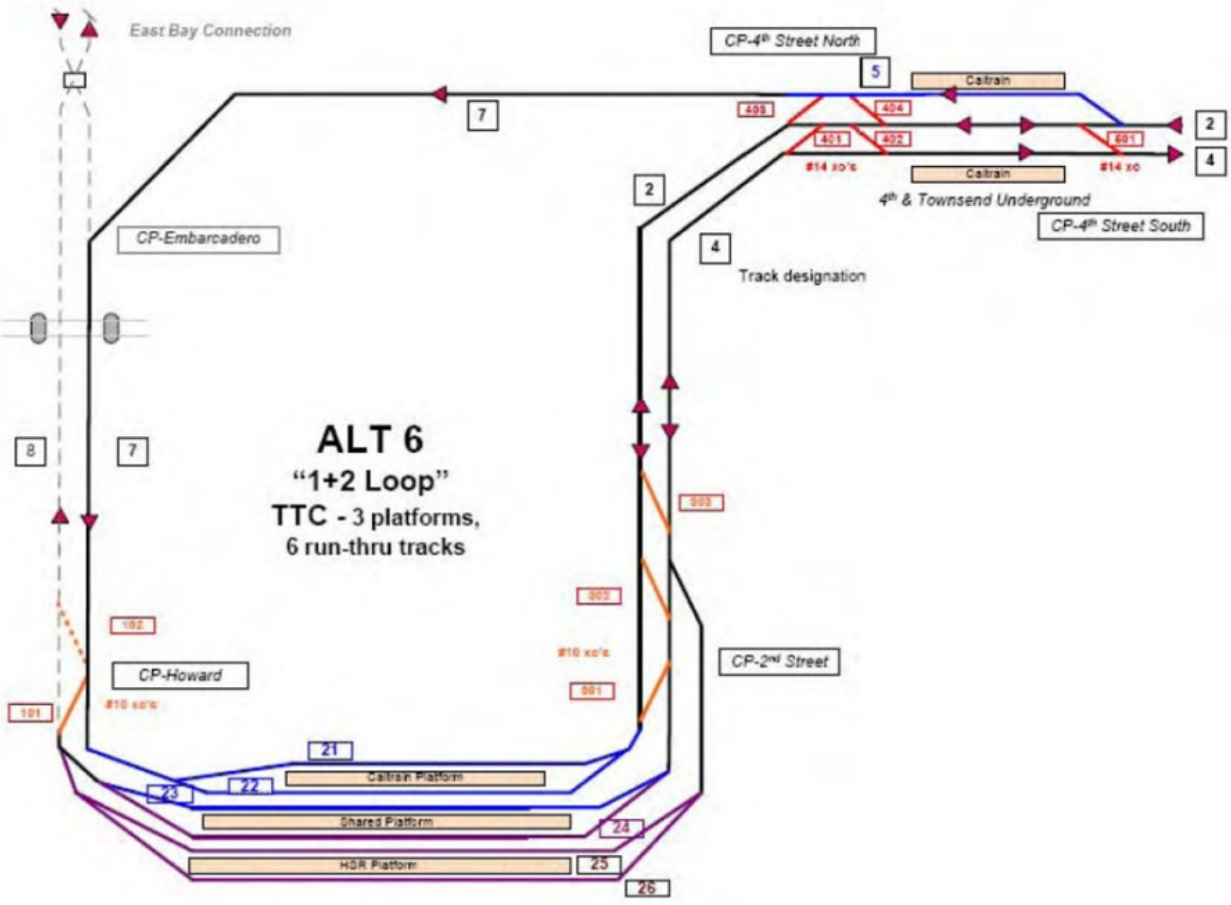
Two-Cell DTX Tunnel with Tail Tracks

The two-cell DTX tunnel with tail tracks encompasses five tracks extending from the east side of the Salesforce Transit Center and narrowing to two tail tracks in Main Street to just south of Harrison Street, as shown in the figure. The 2004 environmentally cleared DTX alignment included tail tracks.



Two-Cell DTX Tunnel with a Loop

The two-cell DTX with loop would transform the transit center from a stub-end station into a through-station with the goal of increasing capacity and facilitating a connection to a future transbay rail crossing. From 2006 to 2008, the TJPA studied the potential to reduce the number of tracks in the DTX tunnel and adding a loop, as shown in the figure.



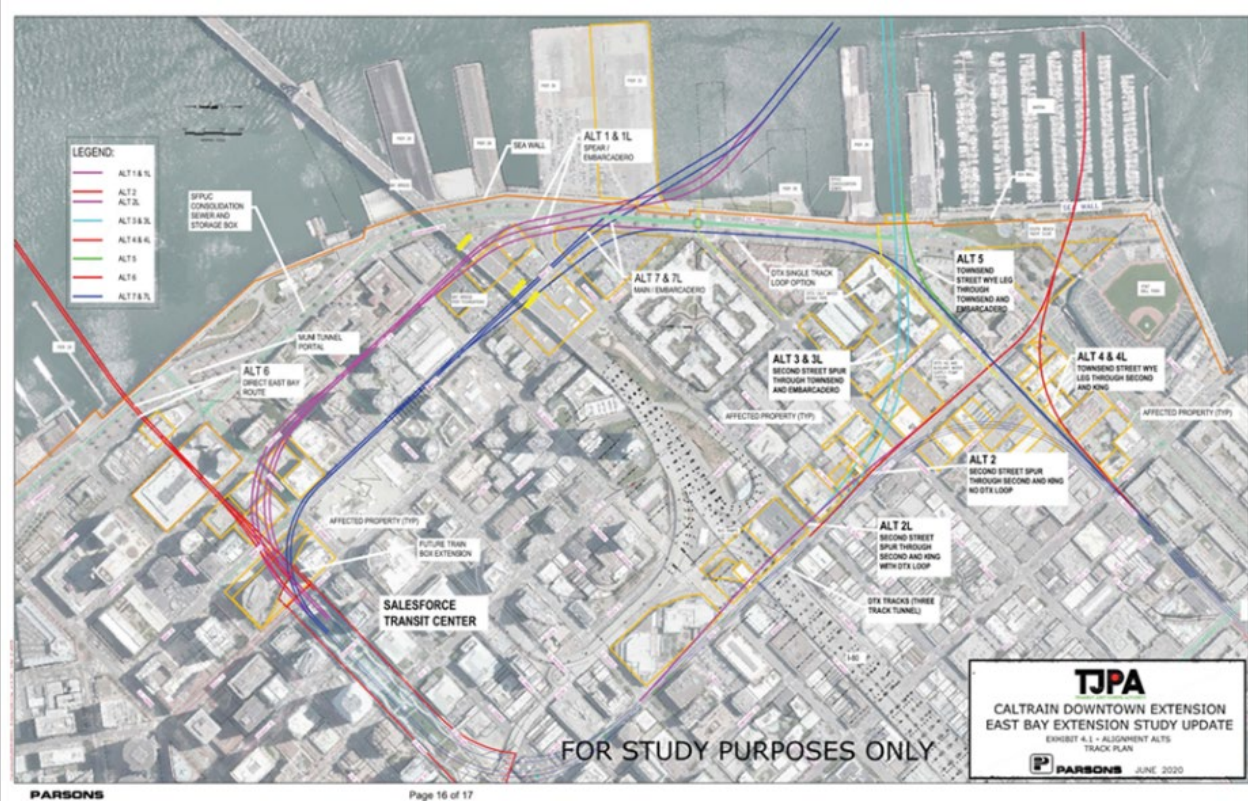
The IPMT undertook a limited evaluation of these two-cell tunnel options, looking mainly at the effects to cost.

Both the tail track and loop options would increase the cost of the DTX and would not provide significant improvements to operations. Because these phasing concepts for the tail tracks or a loop increase the costs, the IPMT concluded that they are fatally flawed and not acceptable.

See Section 6.6 for the full analysis.

Two-Cell DTX Tunnel with Through-Running Transit Center Station

The two-cell DTX tunnel with through-running Salesforce Transit Center station concept assumes that the DTX tunnel could take advantage of a potential future connection to the East Bay to manage future capacity needs.



BART and Capitol Corridor's Link21 program, which is studying a second rail crossing to the East Bay, participated in the phasing workshops and emphasized that flexibility in the DTX alignment is essential to the success of the Link21 Program.

See Section 6.6 for the full analysis.

1. INTRODUCTION

The Transbay Program (Program) is a multi-phase project to replace the former Transbay Terminal at First and Mission streets in San Francisco with a modern regional transit station that will connect eight Bay Area counties and the State of California through eleven bus and rail transit systems. The Program is being constructed in two phases. Phase 1, now operational, completed the above-grade portion of the Salesforce Transit Center, which includes an elevated bus deck and bus ramp and a ground-level bus plaza for local and regional bus transit services as well as the core and shell of the future below-grade rail station. See Figure 1.1.

Figure 1.1. Salesforce Transit Center Cross Section

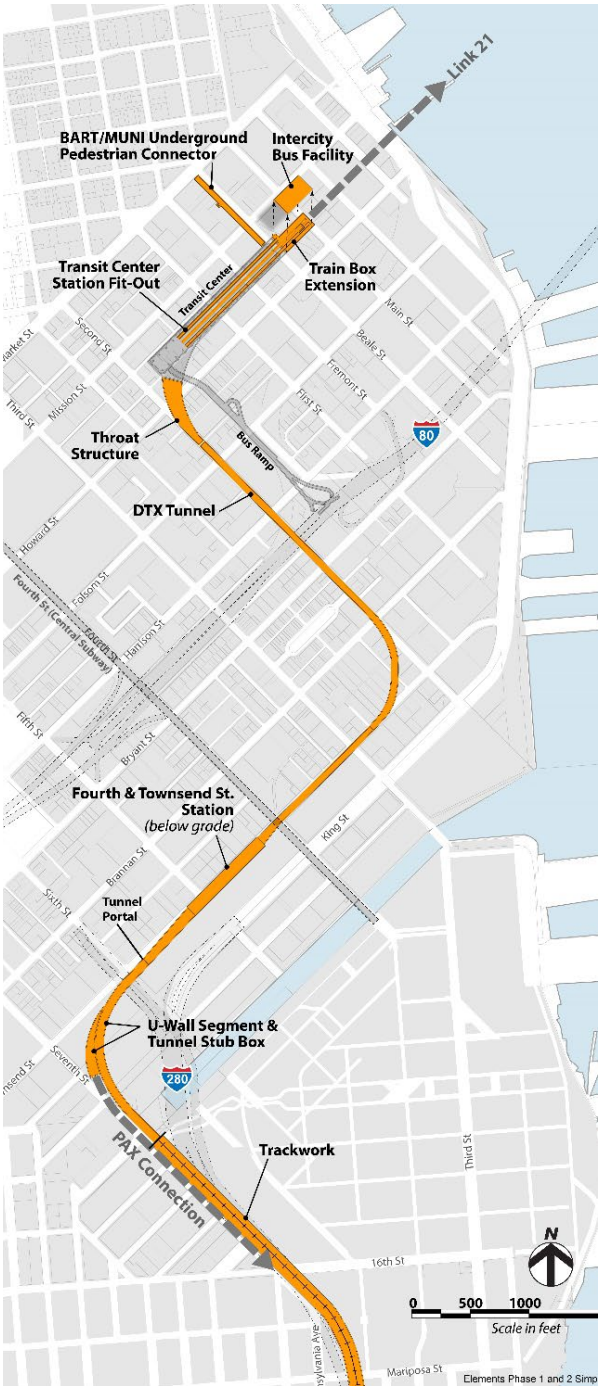


Figure 1.2. Environmentally Cleared DTX Alignment

Phase 2 – Downtown Rail Extension (DTX) will complete the rail alignment and transit center rail station to bring Caltrain's regional rail system and the California High-Speed Rail Authority's (CHSRA) future statewide system into downtown San Francisco. The DTX is an essential part of a long-term strategy to create seamless connections among local, regional, and statewide transportation systems and connect rail to important locations throughout the Northern California Megaregion. Figure 1.2 shows the major elements associated with the DTX:

- DTX tunnel
- Train box extension
- Salesforce Transit Center station fit-out
- Fourth and Townsend Street Station
- Intercity bus facility
- BART/Muni pedestrian connector

The DTX is being developed by the Transbay Joint Powers Authority (TJPA) in collaboration with the Metropolitan Transportation Commission, San Francisco County Transportation Authority, Peninsula Corridor Joint Powers Board (Caltrain), CHSRA, and City and County of San Francisco. In June 2020, these agencies executed the San Francisco Peninsula Rail Program Memorandum of Understanding (MOU), creating a formal partnership to support the TJPA in development and repositioning of the project. An Integrated Program Management Team and an Executive Steering Committee, both composed of representatives from each of the partnering agencies, meet regularly to advise the TJPA on technical and policy matters.

A Comprehensive Work Plan and Master Schedule for DTX development were approved by the TJPA Board of Directors in December 2020 and amended and approved in April 2021. The work plan describes the tasks, activities, and deliverables to implement the goals set forth in the MOU, consistent with Federal Transit Administration guidance for eligibility to participate in the federal Capital Investment Grants Program.

2. PHASING STUDY

The Comprehensive Work Plan calls for preparation of a Phasing Study and plan prior to advancing design work for the DTX (MOU Task 12). The objective of the study is to identify the preferred phasing option or options for an initial operating project for the DTX that conforms with technical studies and policy direction, is consistent with realistic amounts and timing of funding and stakeholder delivery date expectations, and aligns with an explicit goal to deliver rail service to the Salesforce Transit Center as soon as possible.

The Phasing Study is a collaborative effort by members of the Integrated Program Management Team (IPMT) and other subject matter experts from the partnering agencies and their consultants. The study was structured around three workshops whose purpose was to (a) set a baseline of project knowledge among the partnering agency participants, (b) confirm assumptions and constraints and develop evaluation criteria and specific phasing concepts, and (c) present findings and receive stakeholder feedback. The workshop schedule along with other milestones are shown in Table 2.1. The sections that follow summarize workshop discussion topics and findings.

Table 2.1. Phasing Study Schedule

Phasing Study Task	Start Date	Finish Date
Prepare for and hold Workshop #0 (Program History)	06/01/2020	06/15/2020
Update East Bay Crossing Technical Memorandum	06/01/2020	06/30/2020
Prepare for and hold Workshop #1 (IPMT brainstorming phasing concepts)	06/04/2020	06/22/2020
Draft Phasing Study report following Workshop #1	06/23/2020	07/27/2020
IPMT review and approve draft report	07/28/2020	08/04/2020
Prepare costs for phasing concepts and present to IPMT	08/11/2020	10/13/2020
Analyze options against evaluation criteria	10/07/2020	03/01/2021
Salesforce Transit Center-Downtown Rail Extension operations analysis	10/01/2020	04/13/2021
Prepare for and hold Workshop #2 (present Phasing Study findings)	03/03/2021	04/27/2021
Prepare updated draft of the Phasing Study report	04/28/2021	05/27/2021
IPMT review and approve draft Phasing Study report	05/28/2021	06/16/2021
Draft Final Phasing Study report	06/17/2021	07/9/2021
Present findings to ESC	08/20/2021	08/20/2021
Prepare final Phasing Study report	08/20/2021	08/29/2021
Present phasing recommendation to TJPA Board for approval	09/09/2021	09/09/2021

2.1 Workshop 0: Project History

The first Phasing Study workshop (Workshop 0) was held on June 15, 2020. The workshop was moderated by the TJPA Interim Project Director and attended by the IPMT and other representatives from the partnering agencies as well as BART, Capitol Corridor (Amtrak), the TJPA's Program Management/Program Controls (PMPC) team, and the DTX general engineering consultant Parsons Transportation Group (Parsons) and its subconsultants.

The workshop started with a presentation by the rail service operators—Caltrain and CHSRA—on operational assumptions, including the planning parameters for blended service and 2040 growth scenarios. The presentation highlighted those changes to the DTX configuration could affect the entire Caltrain Peninsula Corridor. Both operators expressed a strong preference for the DTX design to support the moderate growth scenario of twelve trains per hour at the transit center referenced in the 2020 Caltrain Business Plan: eight Caltrain trains and four high-speed trains.

Following the operators' presentation, the IPMT was asked to develop conceptual evaluation criteria. The IPMT identified their primary concerns and the need to quantify how deferrals would affect constructability, cost, and schedule for the DTX. Workshop 0 participants discussed the need to resolve operating assumptions, including equipment types for each operator, tunnel ventilation zone locations, platform dwell times for each operator, and platform lengths and heights. The operators noted that the development of their service levels had progressed to the degree that an updated operational analysis would be required to reliably assess phasing concepts.

Parsons presented the history of the DTX project (1990s to 2020) and an overview of the current state of the project configuration, budget, tunnel options study, and upcoming work. Parsons summarized design tasks completed over the previous two years (2018–2020) and identified design elements to be addressed when design resumes. Workshop 0 provided participants the opportunity to ask questions of the Parsons design team prior to the expiration of their contract and departure from the project on June 30, 2020.

The Workshop 0 agenda, meeting minutes, attendance sheet, and presentation materials are in Appendix A.

2.2 Workshop 1: Evaluation Criteria and Phasing Concept Development

Workshop 1 was held on June 22, 2020. The workshop was moderated by the TJPA Interim Project Director and attended by the IPMT and other representatives from the partnering agencies as well as BART, Capitol Corridor, and the Parsons team. During Workshop 1, IPMT members identified potential phasing concepts, more clearly defined agency-specific priorities, and developed preliminary evaluation criteria for assessing them.

As the discussion progressed, it became evident that additional coordination and analysis would be required to accurately evaluate each phasing concept, including an operational analysis by the operators. The group identified seven potential phasing concepts to be analyzed in depth by the IPMT with support from the PMPC team.

The Workshop 1 agenda, meeting minutes, attendance sheet, and presentation materials are in Appendix B. Appendix D contains the conceptual and preliminary criteria developed during Workshop 1.

2.3 Workshop 2: Results and Recommendations

Workshop 2 was held on April 27, 2021. The workshop was moderated by the TJPA Interim Project Director and attended by the IPMT and other representatives from the partnering agencies as well as BART, Capitol Corridor, and the Parsons team.

During Workshop 2, IPMT members discussed and clarified their comments on the second draft of this Phasing Study Report and reviewed and reconciled independent responses on each phasing concept in the evaluation matrixes, which were used by each member to characterize each phasing concept against the evaluation criteria. IPMT members discussed opposing responses and reached either a unanimous judgement or consensus on each evaluation criterion. The results from this exercise are discussed in Section 7, Results and Recommendations.

The Workshop 2 agenda, meeting minutes, attendance sheet, and presentation materials are in Appendix C.

3. PROJECT HISTORY

This section summarizes the important project development milestones for the DTX that were presented in Workshop 0.

Environmental Clearance and Alignment Studies. The planning stage of the DTX project involved environmental studies covering multiple alignment alternatives. The first, completed in 1997, explored an Essex Street alignment with options for two or three tracks. In 2002, another eleven alignment alternatives were studied. The Locally Preferred Alternative (LPA) for the DTX —a refined Second St.-to-Main St., three-track alignment and mined tunnel below Rincon Hill—was environmentally cleared in 2005 (USDOT 2005).

Conceptual engineering design of the refined LPA began in 2005 and involved train operations analyses, alternative alignment designs, a tunnel alternatives evaluation, and a preliminary construction cost estimate. The conceptual engineering design, completed in 2007, focused primarily on a three-track alignment in the Townsend Street and Second Street corridors, a six-track station at the Salesforce Transit Center with curved, dedicated platforms, and a new underground station at Fourth and Townsend streets. As part of the conceptual engineering design, value management exercises were performed for both a proposed loop configuration extending down Main Street to The Embarcadero, Townsend Street, and ultimately to a future East Bay connection. The loop concept also investigated other alternatives including tail tracks on Main Street and a modified transit center station configuration.

Preliminary engineering design began in 2008 and was guided by increased coordination with the rail operators Caltrain and CHSRA. An extended train box design was developed to maximize tangent platform lengths to 1,300 feet to accommodate double-consist trains for CHSRA. Multiple transit center concepts were explored, such as bi-level and side-by-side station configurations. During preliminary engineering, CHSRA approved a design variance for the throat structure (where the DTX tunnel enters the Salesforce Transit Center) to allow a minimum curve radius of 650 feet, which reinforced the Second Street corridor approach. A preliminary engineering design package, based on the refined LPA, was completed in 2010 and included dedicated operator platforms and tail tracks, although the latter would be deferred until operationally necessary. Required emergency egress and ventilation structures were added, train storage at the Fourth and King Railyard was moved to the surface from the previous underground concept, and the profile of the train box at the Fourth and Townsend Street Station was lowered.

Between 2010 and 2018, the scope and configuration of the DTX were refined to conform to changes to the Program and the design criteria and operations requirements of Caltrain and CHSRA. New elements were added, including a tunnel stub to accommodate a future grade separation tunnel and an at-grade turn-back track and maintenance-of-way track to facilitate operations. A supplemental environmental analysis for the modified design began in 2013 to evaluate both refinements to previously cleared elements and new elements. In 2014, the transit center track geometry was approved by Caltrain, CHSRA, and the Federal Railroad Administration. From 2016 to 2018, partial updates were made to the preliminary engineering design to support cost estimating

and the environmental documentation. The final supplemental environmental document was completed and certified by the TJPA Board of Directors in December 2018; the FTA issued an Amended Record of Decision on July 22, 2019.

DTX Alignment Adopted by San Francisco. Concurrent with the supplemental environmental process, in 2014, the San Francisco Planning Department began a multi-agency study of transportation and land use alternatives in southeast San Francisco—the Rail Alignment and Benefits (RAB) Study. The RAB Study focused on realizing the goal of bringing high-speed train and Caltrain service to the transit center and included an evaluation of three alternative rail alignments into the transit center. The City completed the RAB Study in 2018 and selected a preliminary recommended alignment, the Pennsylvania Avenue alignment, which comprises the environmentally cleared DTX and an extended tunnel under Pennsylvania Avenue—the Pennsylvania Avenue Extension (PAX). The PAX project would be pursued separately from the DTX by the City.

DTX Cost Estimate Updated. In November 2015, the Metropolitan Transportation Commission (MTC) completed a review of the Phase 2 – DTX cost estimate, focusing on the preliminary engineering plans and cost estimate prepared by the DTX design team in 2010 and taking into consideration subsequent design, scope, and estimate changes. In 2016, the TJPA updated the cost estimate, incorporating MTC's recommendations, including a 5% annual escalation rate. Figure 3.1 shows the estimated construction costs of the major scope elements (TJPA 2016). The costs do not include soft costs such as design, management, right-of-way, escalation, and contingencies. The 2016 cost estimate is the most recent estimate for the DTX and related infrastructure.

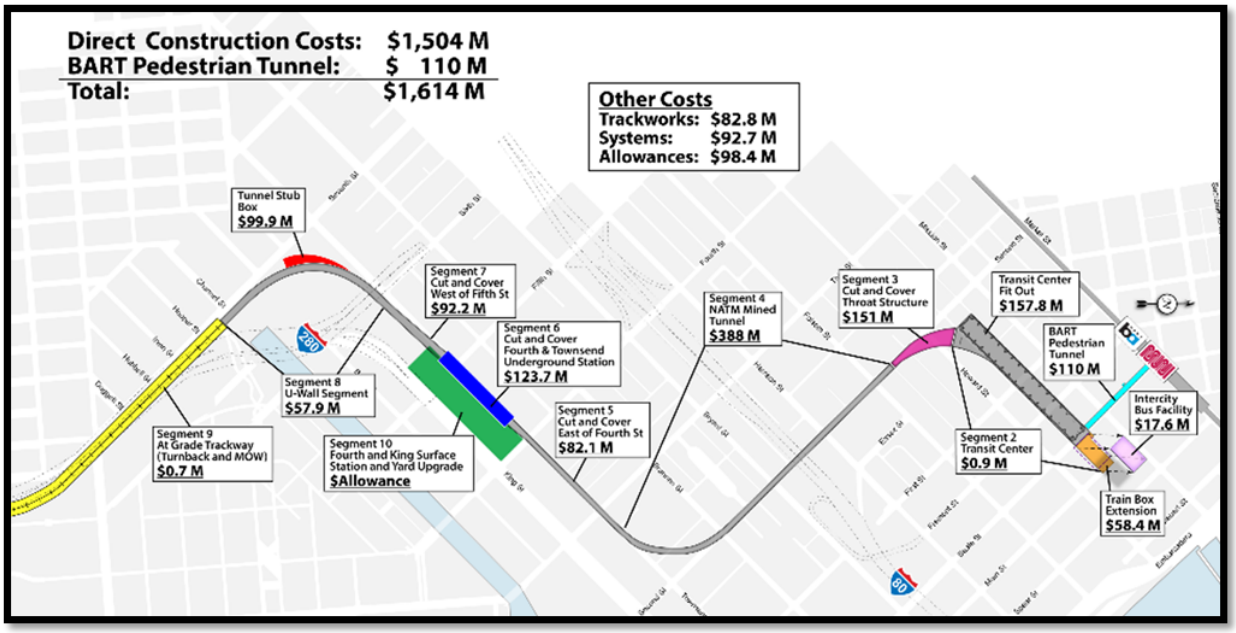


Figure 3.1. DTX scope elements and construction 2016 cost estimates

Tunnel Options Study. In 2017, at the request of the City and other stakeholders, Parsons on behalf of the TJPA investigated construction methodology options to reduce cut-and-cover construction to minimize surface disruption. Findings from the study indicated that there are feasible, though more costly, options for reducing cut-and-cover construction along the DTX alignment. The study was completed in spring 2018.

Regional Partnership Created for Development of the DTX. In June 2020, the TJPA, San Francisco County Transportation Authority, MTC, Peninsula Corridor Joint Powers Board (Caltrain), CHSRA, and the City and County of San Francisco executed the San Francisco Peninsula Rail Program Memorandum of Understanding for development of the DTX to ready-for-procurement status. The regional partnership created a new organizational structure that includes an Integrated Program Management Team and an Executive Steering Committee, both composed of representatives from each of the partnering agencies; these bodies meet regularly to advise the TJPA on technical and policy matters.

Rail Operations Analyses. Parsons performed rail operations analyses over the duration of the design effort through 2018. Each alternative alignment was conceptually developed, analyzed, and modeled to determine system capacity and reliability. The modeling results consistently showed that a two-track tunnel would not provide the resilience required to maintain the prototypical timetable for blended train service along the Peninsula Corridor.

As part of the Phasing Study, CHSRA and Caltrain developed operational criteria and undertook an operations analysis, consistent with their respective business plans as well as their project development and implementation schedules. The 2020-21 operations analysis is discussed in Section 4.

4. OPERATIONS ANALYSIS

In 2020-21, Caltrain and CHSRA undertook an operational planning analysis to determine the minimum infrastructure needed to support various levels of service, including Caltrain's 2040 Long Range Service Vision for integrated peak-service of twelve trains per hour per direction: eight Caltrain trains and four high-speed trains (8+4 service plan), as adopted by the agencies' respective boards of directors. The analysis, led by the operators' consultant Deutsche Bahn, was based on the environmentally approved DTX alignment on Second and Townsend streets, taking into account known rail geometry, tunnel ventilation zones, and the as-built configuration at the Salesforce Transit Center. A holistic planning approach was applied accounting for these constraints and the operational parameters of the two operators, including trainset characteristics, station dwell times, and minimum times to turn trains at the Salesforce Transit Center.

The analysis assessed options where all platforms at the Salesforce Transit Center and Fourth and Townsend Street Station are at a common height—specifically high platforms to accommodate high-speed trains. It found that, in normal operations, shared platforms provided little or no benefit because all platforms were occupied nearly 90% of the time, leaving little flexibility to shift trains around. The analysis also showed that in the occasional case of minor day-to-day delays, a late train could occupy a platform other than its assigned platform, but this simply transferred the delay to a later train because of the high platform occupancy rates. A more significant problem with shared platforms is that passengers needing assistance (including those with mobility devices, trolleys, or strollers) to board a Caltrain service would require the use of internal lifts inside Caltrain's vehicles. Operating these lifts results in extended dwell times (estimated at around 6 minutes), and this would severely affect the on-time performance levels to well below the operators' requirements.

The analysis looked at different train service levels as Caltrain and CHSRA increase their services from today's levels to those expected in their future plans; the infrastructure requirements, referred to as Concept A and Concept B, and various train service levels are shown in Figure 4.1. Caltrain plans to operate six trains per hour per direction beginning in 2024 with the completion of the Caltrain Electrification Program. High-speed rail anticipates operating four trains per hour per direction in 2031. Based on the timeline of the planned service levels by both operators, the DTX tunnel will be required to accommodate up to six Caltrain trains and four high-speed trains per peak hour per direction on opening day.

The operators considered four probable service levels prior to achieving the full 8+4 service plan:

- Integrated service of six Caltrain and four high-speed trains per hour per direction
- Integrated service of six Caltrain and two high-speed trains per hour per direction
- Caltrain service only with eight trains per hour per direction
- Caltrain service only with six trains per hour per direction

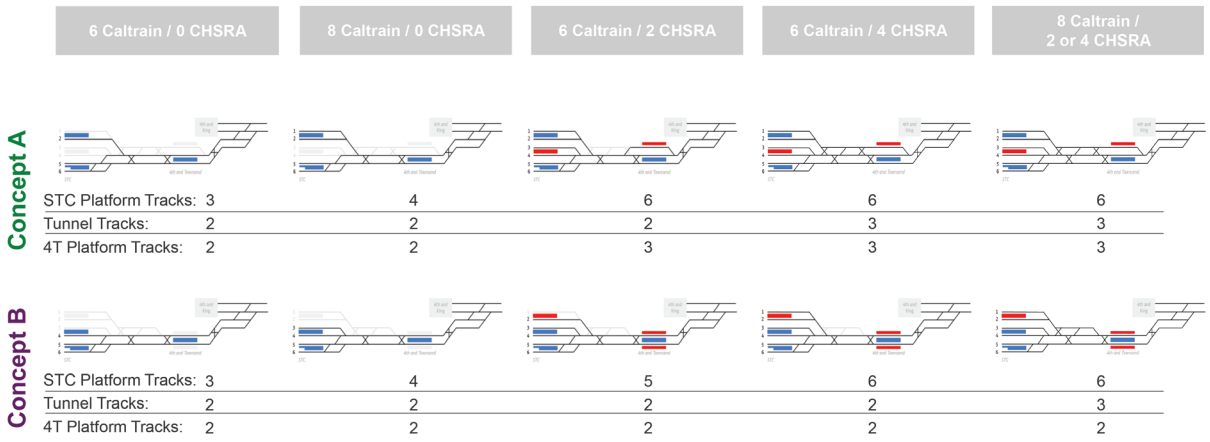


Figure 4.1. Concept A and Concept B: Two distinct paths for phased development

Concepts A and B, both with three tracks, meet all operational requirements for the planned service levels in 2040, less than 10 years after the planned commencement of operations in the DTX tunnel. Operators noted that the Concept B layout provides slightly more flexibility for operations.

The concepts are as follows:

- **Concept A**, Figure 4.2, includes three tracks and three platform faces at the Fourth and Townsend station, a three-track DTX tunnel, and Caltrain occupying the northern and southernmost platforms and CHSRA occupying the center platform at the transit center.
- **Concept B**, Figure 4.3, shows two tracks and four platform faces at the Fourth and Townsend station, a three-track DTX tunnel, and Caltrain occupying the two northern platforms and CHSRA occupying the southernmost platform at the transit center.

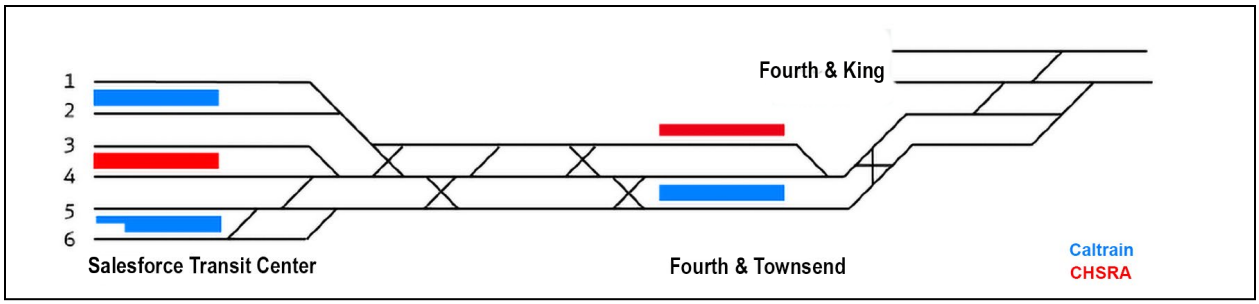


Figure 4.2. Operations Analysis Concept A

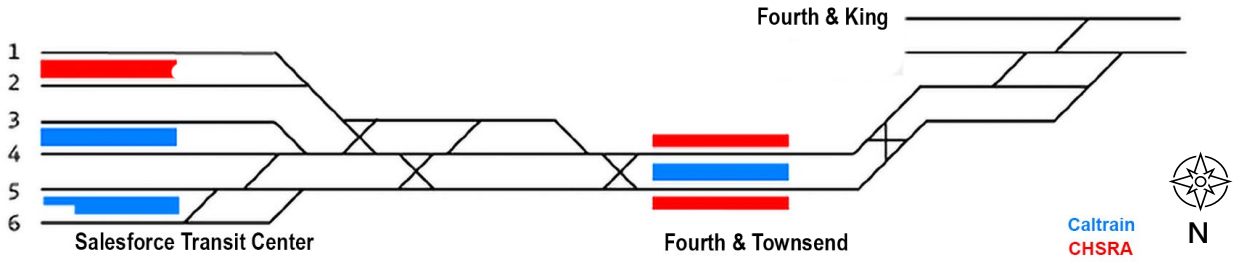


Figure 4.3. Operations Analysis Concept B

Subsequent to the operations analysis, the DTX design team conducted a high-level engineering evaluation on Concept B. The engineering evaluation determined that it would be advantageous to shift the southernmost track from the south side of the alignment to the north to shift the tunnel alignment further away from a planned building development at 655 Fourth Street. This modified Concept B alignment, Concept B Prime, was then subjected to the same operational analysis as Concepts A and B. Figure 4.4 shows Concept B Prime.

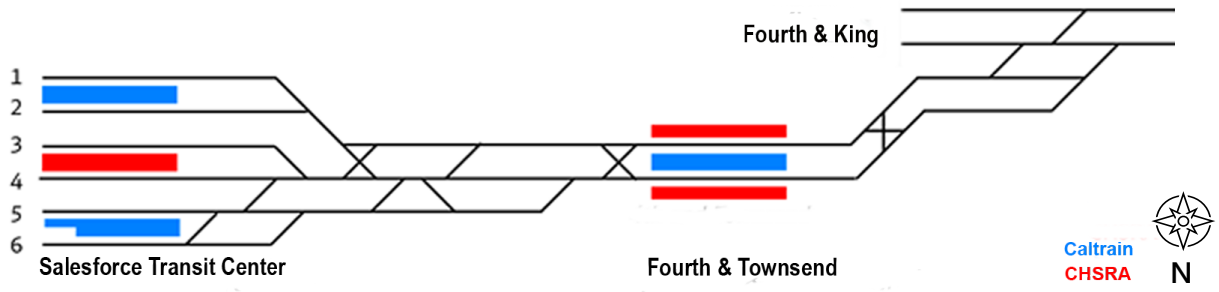


Figure 4.4. Operations Analysis Concept B Prime

Concepts A, B, and B Prime were assessed relative to the 8+4 service plan to determine how well they performed when minor day-to-day delays in train operations occurred and when more major disruptions affected the system. When minor day-to-day variations were applied to the system, all options performed suitably, meeting the on-time performance requirements set out by the operators. In the major disruption scenarios tested, acceptable contingency plans could be developed that, in general, allowed continued but reduced service to the San Francisco stations for the options on a temporary basis. One of the contingency planning scenarios identified that the addition of an extra crossover at or near the point at which the DTX diverges from the Caltrain mainline would allow for better operations. This is subject to further engineering and operations review to be undertaken by the TJPA with the operators.

The operational analysis of Concept B Prime revealed that a substantial portion of the northerly third track, approximately one-half mile, could be reduced without compromising the ability to meet the operators' 8+4 service plan. This arrangement, Concept B Prime Reduced, permits the service reliability required by the operators at a reduced infrastructure cost, as compared to the other concepts. Figure 4.5 shows Concept B Prime Reduced.

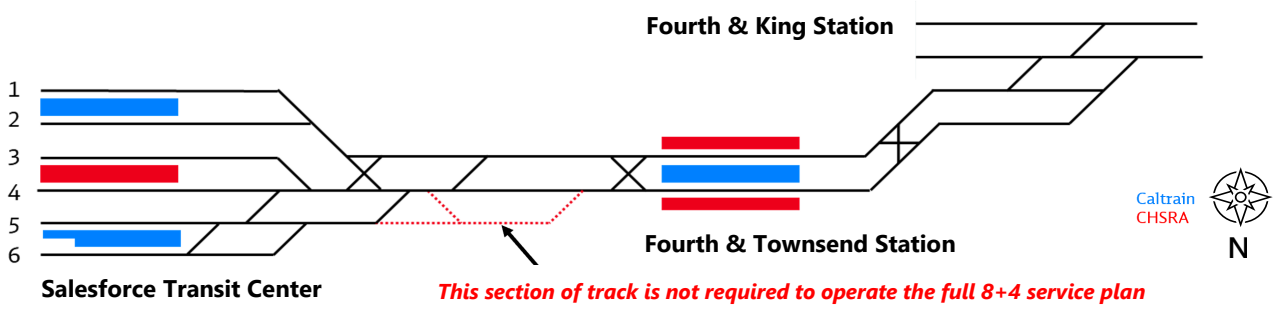


Figure 4.5. Concept B Prime Reduced

The operators are completing their report on the operations analysis, which will be provided separately.

5. EVALUATION CRITERIA

During Workshop 0, a discussion of conceptual evaluation criteria provided insight and clarified individual stakeholder priorities and constraints. Among these, phasing concepts could not produce new or unmanageable risks to the operating environment during initial operations or in the future after construction of the phased element. IPMT members concurred that each phasing concept must be analyzed from multiple perspectives and timelines, and trade-offs should be understood within the larger objectives—capital cost savings and project repositioning. Evaluation criteria were developed in Workshop 1 and assigned to the following high-level categories:

COST AND SCHEDULE

- Capital cost deviation
- Right-of-way
- Cost of future implementation
- Baseline Master Schedule

FTA NEW STARTS PROJECT JUSTIFICATION EVALUATION

- Land use
- Economic development
- Mobility improvements
- Cost-effectiveness
- Environmental benefits
- Congestion relief

REGIONAL CONTEXT

- Benefits
- Effect on other regional projects
- Effect on regional significance
- Support for principles of Plan Bay Area 2050
- Effect on passengers' cost of using the service

ENVIRONMENTAL EFFECTS

- Consistency with environmental documents
- Community impact
- Dependency on non-environmentally cleared projects

OPERATIONS

- Changes to operations costs
- Effect on service flexibility
- Effect on operational reliability, security and safety
- Effect on future service growth
- Effect on service during future retrofit

MAINTENANCE

- Changes to maintenance costs
- Effect on O&M responsibilities
- Effect on maintenance access and crew safety
- Effect on response time for repairs
- Effect on resilience

All evaluation criteria were intended to be qualitative apart from cost evaluations, which were performed quantitatively. Each IPMT agency decided for itself the relative importance of each evaluation criterion for each concept.

The final evaluation criteria were presented to the Executive Steering Committee by the Interim Project Director on October 23, 2020 (Polechronis 2020).

5.1 Cost and Schedule

Effects to the following areas of cost and schedule were analyzed by the Program Management/Program Controls (PMPC) team and reviewed by the IPMT. All evaluations are qualitative apart from cost.

- **Capital Cost Deviation.** An order-of-magnitude construction cost estimate was developed for each phasing concept. The process involved:
  - Determining the measured work using historic cost estimates developed during the previous phase of design as the basis.
  - Organizing the construction subtotals by FTA standard cost category (SCC) and in 2016 dollars, consistent with the 2016 Phase 2 – DTX cost estimate.
  - Applying escalation. The escalation rates applied to the construction subtotal for fiscal years between 2010 and 2021 are based on the Annual Infrastructure Construction Cost Inflation Estimate. Escalation rates for fiscal years between 2006 and 2010 are based on the Department of General Services California Construction Cost Index. The escalation rate of 5% annually between 2021 and 2027 is based on MTC's recommendation following its peer review of the Phase 2 – DTX cost estimate in 2015.
  - Applying contingency. Because the design is at a conceptual level, the cost estimate for each phasing concept includes the elevated, aggregate contingency as a percentage of the estimate; the resulting contingency value is in 2016 dollars.
  - Applying a Programwide professional services total of 22.5% and a construction contingency of 10% to the construction subtotal.
  - Applying a program reserve of 15% to phasing concept subtotal.

  Appendix F contains the calculations for each cost estimate along with annotated source documents.

- **Right-of-way**. Affected parcels are identified as either full or partial takes.
- **Cost of Future Implementation of Deferred Items**. An order-of-magnitude project cost is estimated for future years at five-year increments between 2040 and 2055, assuming an average year-over-year inflation rate of 5%.
- **Baseline Master Schedule.** The effect of the phasing concept on the Master Schedule is evaluated, along with potential mitigation measures if applicable; however, any cost savings associated with schedule improvements are not considered.

5.2 FTA New Starts Project Justification Evaluation

The TJPA will pursue funding for the DTX as a New Starts project through the FTA's Capital Investment Grant (CIG) program, the primary federal program to fund major transit capital improvements in the United States. The FTA evaluates and rates projects as they proceed through the New Starts process and prior to execution of a Full Funding Grant Agreement. Therefore, analyzing the effect a phasing concept would have on the FTA's rating for the DTX is considered in this evaluation.

FTA's rating is based on two equally weighted primary criteria—local financial commitment and project justification; projects must receive a Medium or higher for both criteria. This Phasing Study evaluation addresses the project justification rating only. Local financial commitment is based largely on the financial condition of the relevant local project funding partners at the time of the rating and the level of funding commitment to the project; because the Funding Plan is in development, this criterion is not addressed in this study.

FTA's ratings for four of the six project justification evaluation criteria are based on an average of the current year forecast and 20-year horizon year forecasts. Travel demand forecasting is underway to update 2008 DTX ridership forecasts. Because updated forecasts are not yet available, the assessment of each phasing concept relative to project justification is based on a qualitative analysis by the PMPC team's subject matter expert. The effect each phasing concept would likely have on the project justification criteria is expressed as either "none," "minimal" (neither positive nor negative), or "negative." The opinions expressed are based on relevant experience developing funding strategies and securing FTA grant agreements for other comparable projects.

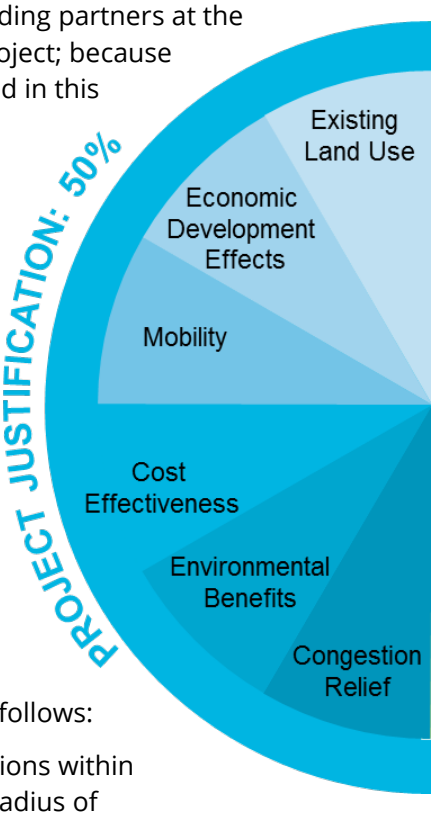


Figure 5.1. Project Justification Criteria

As shown in Figure 5.1, the six project justification criteria are as follows:

- **Land Use**. The land use rating is based on the existing conditions within proposed station areas, defined as the area within a ½-mile radius of the station. The land use measure includes an examination of the following: employment served, population density (population per square mile), proportional share of existing legally binding affordability restricted housing within station areas, existing station area pedestrian facilities (including access for persons with disabilities), and existing corridor, and station area parking supply.
- **Economic Development**. The economic development rating is based on transit supportive plans and policies (supportive zoning near transit, tools to implement transit-supportive plans and policies), demonstrated performance of those plans and policies, potential impact of transit project on regional development, and policies and tools in place to preserve or increase the amount of affordable housing in the project corridor.

- **Mobility Improvements.** The mobility improvements rating is based on the number of passengers using the new stations, transit dependent passengers are counted twice.
- **Cost-Effectiveness**. The cost-effectiveness rating is a blend of costs (annual operating and maintenance costs plus annualized capital costs) and annual ridership.
- **Environmental Benefits.** Environmental benefits are computed based on the change in vehicle miles traveled by automobiles and transit vehicles and the annualized capital costs of the alternative. The FTA methodology relates vehicle miles traveled to regional air quality pollutants, energy use, greenhouse gas emissions, and safety with conversion factors taking into account the differences between vehicle types, e.g. automobile, diesel bus, hybrid bus, buses with compressed natural gas, light rail vehicle, commuter rail (diesel), and commuter rail (electric).
- **Congestion Relief**. The congestion relief rating is based on the number of new weekday transit trips.

5.3 Regional Context

The DTX is part of a program of projects in the region that support regional transportation planning goals. The IPMT's qualitative evaluation contemplates how each phasing concept would affect the DTX within the regional context:

- **Benefits**. Regional benefits include connectivity, travel time reduction, safety, and rail service standards. A phasing concept may add to or forfeit regional benefits associated with the DTX.
- **Effect on Other Regional Projects.** A phasing concept may influence the feasibility or effectiveness of a related regional project, or the concept may of no effect on other regional projects.
- **Effect on Regional Significance**. Regional significance includes the project's regional status and ability to generate economic benefits in the region.
- **Support for Principles of PBA 2050**. MTC's Plan Bay Area (PBA) 2050, the nine-county Bay Area region's long-range plan, will guide growth for the next generation. Highlights from the PBA 2050 Final Blueprint include the following goals:
  - A more affordable Bay Area
  - A more accessible and reliable transportation network
  - Continued progress toward a more inclusive Bay Area
  - A healthier and safer Bay Area
  - A thriving economy and a more balanced growth pattern for the Bay Area

  PBA 2050 strategies include connectedness, pedestrian safety, micro-mobility, seamless mobility experience, and walkability, bike-ability. A phasing concept could improve or weaken the DTX's support for the PBA 2050 transportation-related strategies.
- **Effect on Passengers' Cost of Using a Service**. A phasing concept could result in an increase or decrease to the end user's cost of using a transportation service.

5.4 Environmental Effects

Environmental effects were analyzed by the Program Management/Program Controls (PMPC) team and reviewed by the IPMT.

- **Consistency with environmental documents or the need for additional review**. Substantiative deviations from the approved environmental documents could require re-opening the environmental process, or additional state or federal reviews could result in unmitigated delays to the project.

  FTA regulations (23 CFR 771.129 and 23 CFR 771.130) and standard operating procedures (particularly FTA SOP #17) identify conditions under which additional environmental review would be needed. In general, the following conditions would warrant some form of documentation: a change to the project description (e.g., a physical change to the project or to the timing of implementation); a new major approval (e.g., a request for funding or entry into one of the phases of the FTA CIG program, such as Project Development or Engineering); a lapse in time of three years or more since the approval of the environmental document or the last major action to advance the project; and new information or circumstances that could have a bearing on the project's impacts or mitigation measures and the validity of the previously approved environmental document.

  At the simplest level, an administrative memorandum to the file may be sufficient to satisfy FTA's NEPA obligations. Re-evaluations are often used if the project changes and impacts are anticipated to be relatively minor, can focus on the specific issues that might be affected, and can vary from memoranda to full evaluations. For more extensive deviations from the approved environmental documents and the 2019 Amended Record of Decision, the FTA may recommend a supplemental environmental assessment or, in the extreme, a supplemental EIS.

  Similarly, CEQA Guidelines Section 15162 identifies specific conditions when further environmental review would be necessary. Generally, these conditions include changes to the project, substantial changes to the circumstances under which the project would be undertaken, or new information of substantial importance that results in a new significant environmental effect or a substantial increase in severity of previously identified significant effects. For minor revisions to a project (i.e., none of the conditions in Section 15162 have occurred), CEQA compliance could be achieved with an addendum (pursuant to the CEQA Guidelines Section 15164). If an addendum would not be appropriate, then a subsequent or supplemental EIR would be necessary.

  Should a supplemental environmental document under NEPA or CEQA be required, it would be realistic to expect that the environmental review could require a year to potentially years, depending on the nature of the change, the time lapsed, and new conditions/ circumstances. The presentation and initial NEPA/CEQA determinations described for the phasing concepts reflect our professional opinion and should not be regarded as the required level of NEPA/CEQA review by the FTA and local lead agency, TJPA.

- **Community Impact**. Aspects of a phasing concept could affect the local community in terms of displacement, surface or street-level disruption, air quality, or land-use revitalization.
- **Dependency on Non-environmentally Cleared Projects**. A phasing concept could affect interfaces between the DTX and other transportation efforts in the Bay Area.

5.5 Operations

Effects to operations costs were estimated by the PMPC team; the remaining areas of operations were analyzed by the operators, Caltrain and CHSRA, and reviewed by the IPMT.

- **Changes to Operations Costs**. Estimated changes to operations costs are based on operations estimates for the Transbay Program (ISES 2016 and Parsons 2008). Annual savings for operations costs are presented in year-of-expenditure (2027$).
- **Effect on Service Flexibility**. A phasing concept could affect Caltrain's and CHSRA's planned levels of service and service flexibility, as identified in their respective 2020 business plans.
- **Effect on Operational Reliability, Security or Safety**. A phasing concept could affect operational reliability, security, or safety.
- **Effect on Future Service Growth**. A phasing concept could compromise or improve the ability of Caltrain or CHSRA to develop future service growth, as outlined in their respective 2020 business plans.
- **Effect on Service During Future Retrofit**. A phasing concept, if it can be implemented in the future, could affect active revenue service operations.

5.6 Maintenance

Effects to maintenance costs were estimated by the PMPC team; the remaining areas of operations were analyzed by the operators, Caltrain and CHSRA, and reviewed by the IPMT.

- **Changes to Maintenance Costs**. Estimated changes to maintenance costs are based on the most recently published maintenance estimates. Annual savings for maintenance costs are presented in year-of-expenditure (2027$).
- **Effect on O&M Responsibilities**. Depending on the project element, maintenance may fall to the operators or to the TJPA or other transit service provider.
- **Effect on Maintenance Access and Crew Safety**
- **Effect on Response Time for Repairs**
- **Effect on Resilience**. "Resilience" is defined as follows (FTA 2013):

  Projects (or elements thereof) designed and built to address current and future vulnerabilities to a public transportation facility or system due to future occurrence or recurrence of emergencies or major disasters that are likely to occur in the geographic area in which the public transportation system is located or projected changes in development patterns, demographics, or climate change and extreme weather pattern.

6. PHASING CONCEPTS & ANALYSES

The phasing concepts analyzed in this study were proposed by the IPMT at Workshop 1 and fall into three categories:

- Deferment. Deferred items are project elements that could be deferred without affecting the operators' ability to meet their initial service requirements. Deferred items would be removed from the DTX scope and budget but accounted for in design, which will allow for their future integration.
- Reduction. Reduced elements are project elements that could be reduced in scope to save project costs.
- Configuration change. Configuration changes are concepts that consider future regional projects that could affect the operation of the DTX and the Salesforce Transit Center.

The analysis was a collaborative undertaking by subject matter experts from the IPMT and TJPA and its consultants. These include experts in rail operations, environmental clearance, funding, regional planning, cost engineering, federal New Starts funding, and program delivery.

The phasing concepts are:

- Defer the BART/Muni pedestrian connector – Section 6.1
- Reduce the train box extension – Section 6.2
- Defer or reduce the intercity bus facility – Section 6.3
- Defer fit-out of the Fourth and Townsend Street Station – Section 6.4
- Defer fit-out of CHSRA-related project elements – Section 6.5

A configuration change from the three-cell DTX tunnel to a two-cell DTX tunnel was also considered in this study. See Section 6.6 for a discussion of the following configurations:

  - Two-cell tunnel
  - Two-cell tunnel with tail tracks from the east end of the transit center
  - Two-cell tunnel with a loop track from the east end of the transit center
  - A through-station configuration for the transit center

6.1 Defer BART/Muni Pedestrian Connector

The BART/Muni pedestrian connector is an approximately 860-foot-long pedestrian tunnel under Beale Street linking the mezzanine level of the BART/Muni Embarcadero Station with the lower concourse level of the Salesforce Transit Center. The purpose of the connector is to alleviate peak-hour pedestrian traffic congestion on sidewalks between Mission and Market streets caused by passengers transferring between the two stations. During the update to the preliminary engineering design in 2016, the pedestrian connector was identified as a standalone project, as it could be constructed before, concurrently with, or after the DTX. In 2017, several design elements of the connector were advanced to a conceptual engineering level, and the connector was included as a modified component of the Program in the 2018 Supplemental EIS/EIR. Figure 6.1 shows the conceptual design of the connector.

This phasing concept would defer completing design and construction of the BART/Muni pedestrian connector. Deferral would not affect the connector's environmentally cleared status, and completion of the connector would be led by the TJPA, as envisioned in the environmental document.

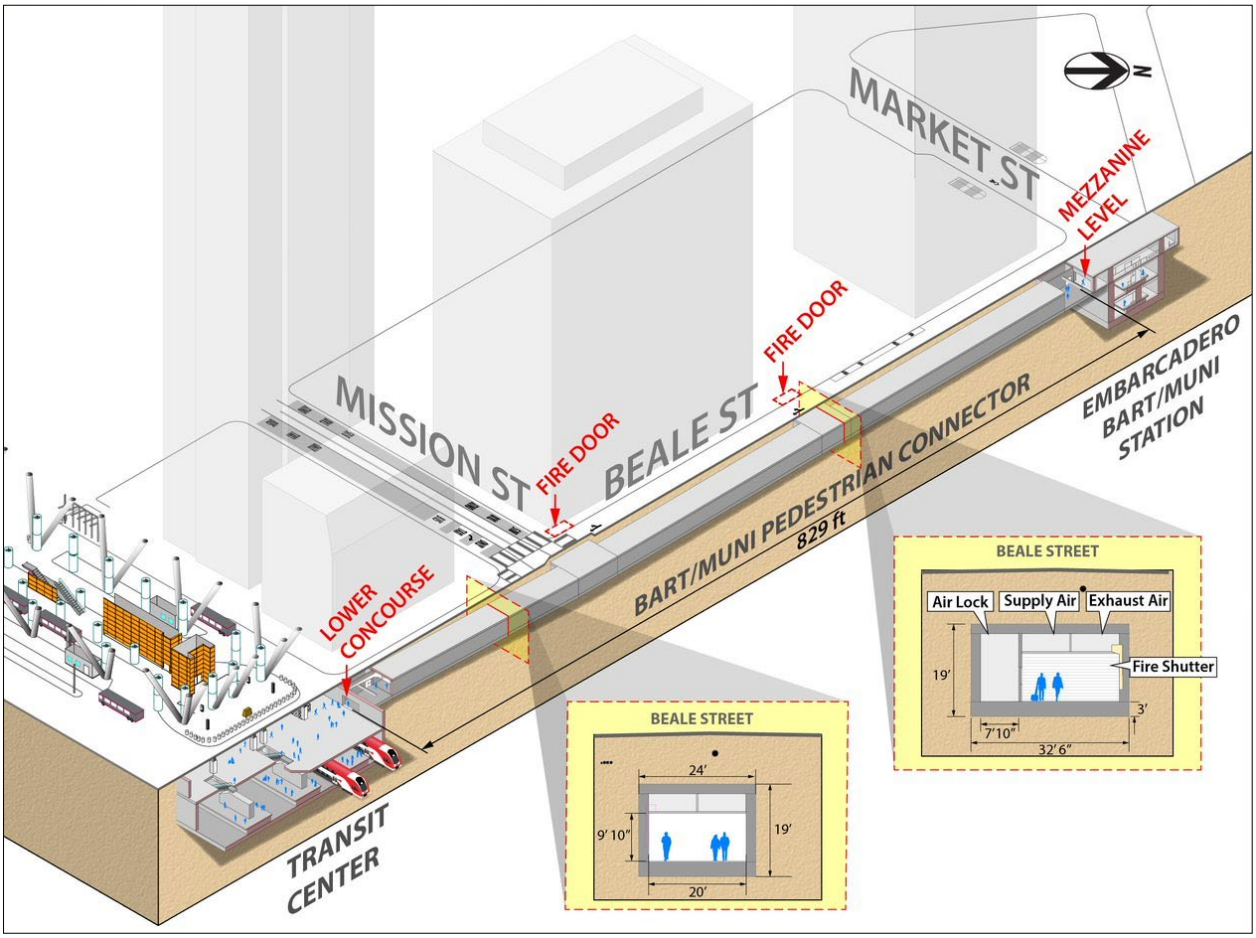


Figure 6.1. BART/Muni Pedestrian Connector

6.1.1 Cost and Schedule

Capital Cost Deviation

Deferring the BART/Muni pedestrian connector would reduce the Phase 2 – DTX project costs inclusive of right-of-way savings, by 4.8%. The estimated reduction in the is approximately $221 million in 2027 year-of-expenditure dollars plus the value of the right-of-way.

Two source estimates for this scope were reviewed: a 2016 estimate by TBD Consultants (TBD 2016) and an estimate by Parsons with 2016 dollar values for unit costs (Parsons 2018c). The Parsons estimate includes scope consistent with design updates, and therefore was used for this study. Estimates were escalated to 2027 dollars in accordance with the annual rates in Section 5.1.

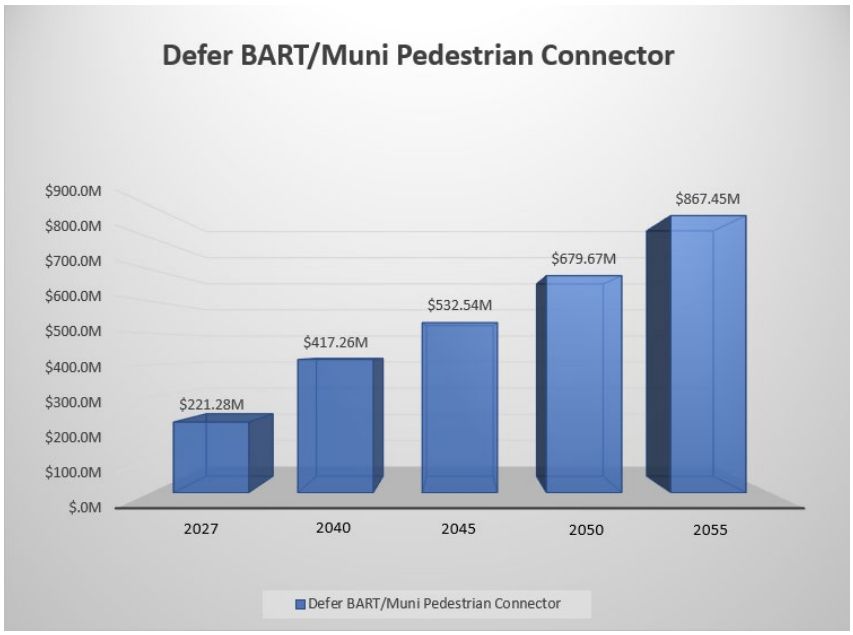
See Appendix F.1 for a detailed breakdown in FTA SCC format.

Right-of-Way

The right-of-way savings associated with the BART/Muni pedestrian connector are for a parcel needed for an emergency egress structure at 30 Beale Street. If this element is deferred, the project would no longer require a partial take of this parcel.

Cost of Future Implementation

The costs of future implementation of the BART/Muni pedestrian connector from 2040 through 2055, assuming an annual average (year-over-year or YoY) escalation rate of 5%, range from $417 million to $867 million, as shown in Figure 6.2. These estimates illustrate the escalated cost to construct the phasing concept, exclusive of right-of-way, and do not include allowance for the cost to operators due to operational disruption. If deferred, the connector would not be eligible for future funding through FTA CIG program as an independent project, under the current eligibility criteria.



Baseline Master Schedule

Deferring the BART/Muni pedestrian connector should not affect the current project schedule, as the DTX and transit center do not rely on the connector to function.

Figure 6.2. Cost of future implementation of the BART/Muni Pedestrian Connector

6.1.2 FTA New Starts Project Justification Evaluation

Deferring the BART/Muni pedestrian connector would have minimal effect on the DTX project justification rating. Table 6.1 summarizes the evaluation of each criterion.

Table 6.1. Effect of BART/Muni Pedestrian Connector Deferral on FTA Project Justification Rating

Criteria	Effect	Explanation
Land Use	Minimal	Existing station area pedestrian facilities, population density, employment served, share of legally binding affordable housing, and the well-connected network of sidewalks within the station area would remain unchanged.
Economic Development	None	Local plans and policies and their ability to shape development in a transit supportive manner would not be affected.
Mobility Improvements	Minimal	Travelers from the Peninsula would likely save about 5 minutes of travel time relative to the overall trip time (Cambridge 2008). Passenger mode choice would be only marginally affected.
Cost-Effectiveness	Minimal	Capital costs would decrease by 4.8%.
Environmental Benefits	Minimal	Because ridership would not be substantially affected, effects to the project's environmental benefits would be minimal.
Congestion Relief	Minimal	Because ridership would not be substantially affected, effects to congestion relief would be minimal.

6.1.3 Regional Context

Benefits

The BART/Muni pedestrian connector would enhance connectivity between BART, Muni Metro, and the transit services at the transit center because it would reduce the time transferring passengers would need to exit one station, travel to the street surface, cross the signalized intersection of Beale and Mission streets, and then descend to the other station. While the transfer time between the stations would be increased and less convenient for passengers with a deferral of the connector, it is unlikely to substantially affect projected transit ridership.

Effect on Other Regional Projects

Deferral of the BART/Muni pedestrian connector would not affect the planning of other major transit improvements in the Bay Area. BART has expressed no objections to the deferral of the connector: in a letter dated October 1, 2020, BART noted that the connector could present conflicts regarding the agency's future efforts to construct side platforms to improve capacity at the Embarcadero Station (Menotti 2020).

Effect on Regional Significance

The BART/Muni pedestrian connector supports the project's regional significance because it would speed transfers between the transit center and the BART/Muni Metro lines along Market Street. These transit connections would no longer be as seamless and convenient without the connector, as noted in the benefits discussion; therefore, deferring the connector would be expected have a modest impact on the project's regional significance. However, transit connections would still occur in a high-quality urban environment with accessible pedestrian infrastructure. By contrast, deferral could support BART's investments in new platforms to increase capacity at Embarcadero Station, another regionally significant transportation investment.

Support for Principles of PBA 2050

The BART/Muni pedestrian connector was not factored into the project evaluation for the PBA 2050 Project Performance Assessment. Therefore, deferring the connector would not alter the performance assessment findings for the project. The connector was not highlighted as a way to improve project performance or mitigate equity concerns in the project's commitment letter.

In relation to the plan's themes and strategies, the connector aligns with the plan's "connected" principle and strategy to "enable a seamless mobility experience." This strategy resonated with many groups, including members of the public and through targeted engagement on ways to improve the PBA 2050 Draft Blueprint. If the connector is deferred, attention should be placed on seamless mobility and connectivity, as well as any potential impacts having an effect on equity.

Effect on Passengers' Cost of Using the Service

Deferring the BART/Muni pedestrian connector will not affect passengers' cost of using the service.

6.1.4 Environmental Clearance

Consistency with Environmental Documents or Need for Additional Review

Deferring the BART/Muni pedestrian connector would not affect implementation of the DTX infrastructure. Because the project would differ from that previously approved by the TJPA Board in 2018, a CEQA addendum should be prepared to describe the revised project and explain why conditions specified in CEQA Guidelines Section 15162 would not apply. The addendum would not involve substantive analysis; rather, it would discuss why the revised project impacts would be less than those reported in the 2018 Final SEIS/EIR. For example, the second addendum to the 2004 FEIS/EIR, which deferred construction of the tail tracks, was two pages. For NEPA, FTA should be advised and the documentation (a re-evaluation) may be limited to an email exchange or a memo-to-file, as the revised project would result in lesser impacts than those for the project described in the 2019 Amended Record of Decision.

Depending on how long the connector is deferred, supplemental environmental analysis may be needed should a decision be made to construct it in the future. CEQA Guidelines Section 15162 identifies conditions that warrant further environmental review. The NEPA counterpart conditions are found in 23 CFR 771.130. In general, these sections of the environmental regulations recognize that new information or changed circumstances under which a project would be implemented may require updating the environmental documents. Under FTA guidelines, a re-evaluation of NEPA documentation is triggered when the project sponsor requests further approvals if major steps to

advance the project (for example, authority to acquire a significant portion of right-of-way or to undertake final design) have not occurred within three years after the approval of the final EIS, final EIS supplement, or the last major agency approval or grant (23 CFR 771.129(b)). In an area that is transforming rapidly, like the neighborhood surrounding the transit center, the circumstances under which the project would be implemented could result in substantially different impacts than those identified in the previously approved CEQA/NEPA environmental documents. It is anticipated that deferring the pedestrian connector would not require supplemental analysis, because its operational effects would be beneficial (relieving pedestrian volumes along Beale Street), and the construction mitigations associated with cut-and-cover construction have already been documented in prior environmental analyses.

Community Impact

Deferring the BART/Muni pedestrian connector would result in less overall subsurface excavation work, truck traffic, and construction-related impacts within the right-of-way (e.g., circulation, access to properties, noise, dust). However, these impacts would occur later when the connector is implemented.

As stated in the SEIS/EIR, the connector could be used by 45,000 pedestrians a day and 7,720 pedestrians during the weekday morning peak hour and 9,500 pedestrians during the weekday afternoon peak hour. Without the connector, these pedestrians would use the surface sidewalks and street-crossings. Deferring this facility would result in increased volumes of pedestrian foot-traffic on Beale Street that would cause additional delays for motorists, pedestrians, bicyclists, and Muni buses; decreases in crosswalk and street corner level of service; and increased potential for accidents involving pedestrians. Collision data indicates that 9 of 17 total accidents on Beale Street between Market and Howard streets in the years 2015 to 2020 were pedestrian/driver accidents and all resulted in injury.[1]

Deferring the connector would partially delay attainment of the project objective in the environmental document's "purpose and need" statement that seeks to enhance connectivity between Caltrain and other major transit systems.

Dependency on Non-environmentally Cleared Projects

Deferring the BART/Muni pedestrian connector is not dependent on and would not affect the planning of other major transit improvements in the Bay Area, such as the Link21[2] or PAX projects. The planning and design of these other major transit capital projects are not expected to be constructed or operated along the segment of Beale Street that would be used for the connector.

[1] TransBASE. TransBASE.sfgov.org
[2] Link21 Program: https://link21program.org/en

6.1.5 Operations

Changes to Operations Costs

Deferring the BART/Muni pedestrian connector would result in an annual net savings of $196,700 (2027$) in operations costs.

ISES Corporation's January 2016 O&M report (ISES 2016) was used to source annual operations costs for the following categories: insurance, security services, purchased utilities, and information technology (IT) services.

The ISES report did not specially allocate annual costs associated with the connector. However, the report did contain information regarding annual costs on a gross-square-footage basis. Annual costs per gross-square foot were applied to the estimated costs for each category. No deferred costs were assumed for security services or IT services. Security patrols are part of the larger project scope and would still be needed at the transit center whether the connector is constructed or not.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on Service Flexibility

Deferring the BART/Muni pedestrian connector would not affect service flexibility, as it will not affect rail operations.

Effect on Operational Reliability, Security, and Safety

Deferring the BART/Muni pedestrian connector would affect operational reliability, security, and safety. The increase in pedestrians on surface sidewalks and street crossings could cause delays for motorists, pedestrians, bicyclists, and Muni buses; decreases in crosswalk and street corner levels of service; and increased potential for accidents involving pedestrians.

Conversely, security and safety could be improved with pedestrians at street level, as safety and security in underground pedestrian connections throughout the BART system, and particularly in downtown San Francisco, are issues of concern.

Effect on Future Service Growth

Deferring the BART/Muni pedestrian connector will not affect future service growth, as the connector does not directly affect rail or bus operations.

Effect on Service During Future Retrofit

Future construction of the BART/Muni pedestrian connector would cause minor impacts to revenue service operations. As the tunnel would connect to the lower concourse level of the transit center, construction would require cordoning off a portion of the lower concourse, which could minimally affect pedestrian flow. Construction would also generate noise and dust in the lower concourse.

6.1.6 Maintenance

Changes to Maintenance Costs

Deferring the BART/Muni pedestrian connector would result in annual net savings of $468,700 (2027$).

ISES Corporation's 2016 O&M report (ISES 2016) was used to source annual costs for maintenance. The following categories are included in the estimate: building maintenance, grounds services, janitorial services, and service contracts.

The ISES report did not specifically allocate annual costs associated with the BART/Muni pedestrian connector. However, the report did contain information regarding annual costs on a gross-square foot basis. Annual costs per gross-square foot were applied to the estimated costs for each category. No deferred costs were assumed for service contracts, as the connector as currently envisioned does not include elevators or escalators.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on O&M Responsibilities

The division of O&M responsibilities between BART and TJPA have not been determined for the BART/Muni pedestrian connector. Deferring the connector, therefore, would defer the need for O&M agreements for this element.

Effect on Maintenance Access and Crew Safety

Maintenance access or crew safety would not change with deferral of the BART/Muni pedestrian connector.

Effect on Response Time for Repairs

Response time for repairs would not change with deferral of the BART/Muni pedestrian connector.

Effect on Resilience

The resilience of the DTX would not change with deferral of the BART/Muni pedestrian connector, as any vulnerabilities identified in the SEIS/EIR would be delayed and realized upon the future implementation of the connector. The connector is outside of the flooding and sea level rise hazard zones identified in the SEIS/EIR. The connector would be located in a zone susceptible to seismically induced subsidence, liquefaction, and lateral spreading, which would need to be addressed during design.

6.2 Reduce Train Box Extension

The existing train box—the shell of the train station at Salesforce Transit Center—extends to the east side of Beale Street. The current design of the train box extension expands the train box from the east side of Beale Street to the east side of Main Street, as shown in Figure 6.3. The extended train box would allow tangent platforms on five of the six tracks to accommodate CHSRA double-consist trainsets. The current design would require purchasing additional right-of-way and demolishing the four-story podium structure of 201 Mission Street. This phasing concept would permanently reduce the footprint of the train box extension to stay within TJPA-owned property.

Recent direction from the CHSRA (Armistead 2017) allows for reduced platform lengths with several cars of the double-consist trains extending beyond the platform face if the double-consists do not affect adjacent track movements. A feasibility level analysis performed by the TJPA's architect indicated that the train box extension cannot be eliminated altogether, as additional space is required for ventilation and emergency egress that cannot be accommodated in the existing train box. Therefore, the reduced train box extension would permanently reduce the project footprint while allowing the train box to meet the minimum space requirements to accommodate CHSRA double-consist length trainsets, fire-life safety systems, and emergency egress.

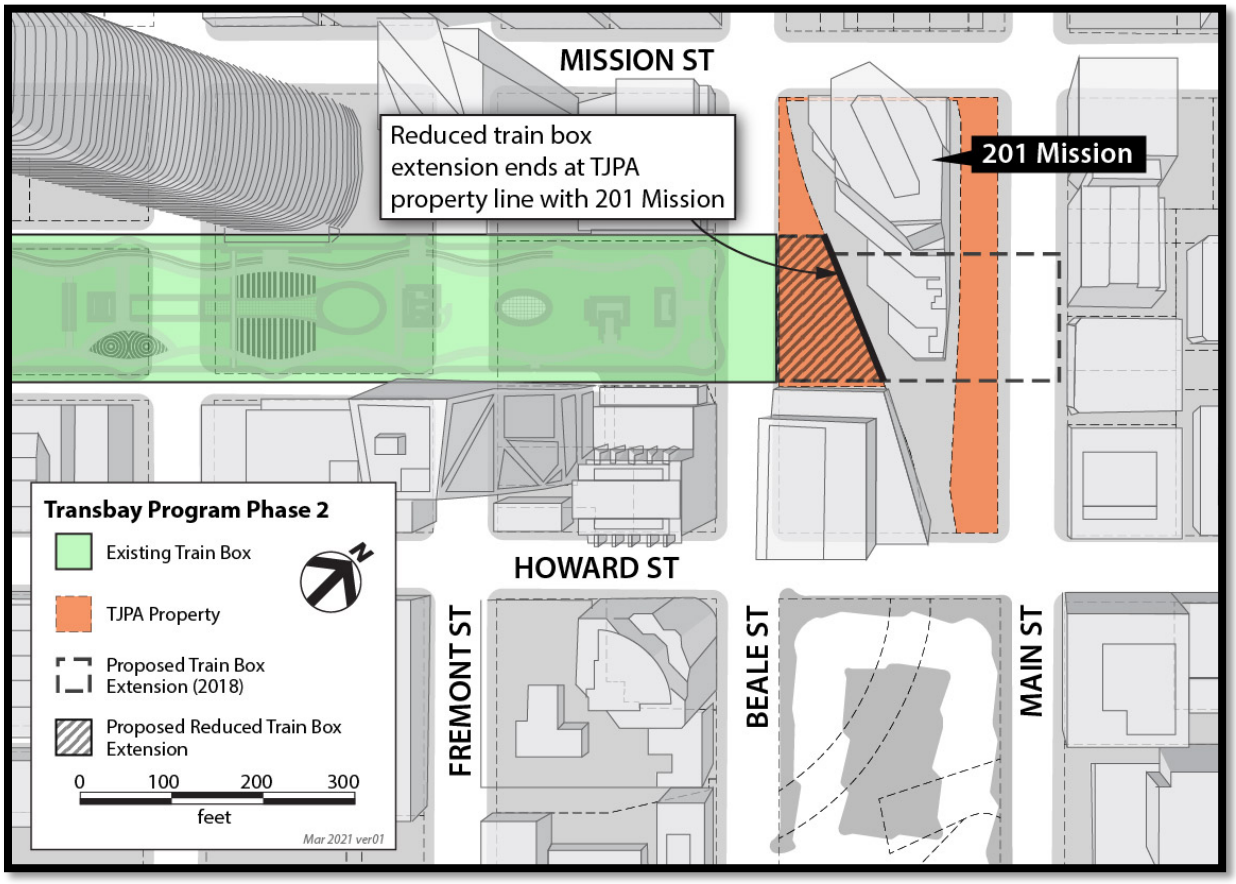


Figure 6.3. Current train box extension (2018) and reduced train box extension phasing concept

As a detailed design for the reduced train box extension is not available, the analysis of this phasing concept is based on a reduced footprint to the current TJPA-owned property line. The design of the reduced train box extension will be refined once preliminary engineering resumes.

6.2.1 Cost and Schedule Effects

Capital Cost Deviation

Reducing the train box extension would reduce the project costs, inclusive of right-of-way savings, by approximately 3.0%. The estimated reduction in the is approximately $86.8 million in 2027 year-of-expenditure dollars.

Because the reduced train box extension has not been designed, historic and newly developed cost estimates were used to develop the cost reduction estimates. The transit center architect, Pelli Clarke Pelli Architects (PCPA), prepared a standalone estimate for the structural shell of the train box extension in 2011 as part of the Phase 1 50% Construction Documents. The estimate did not include fire-life safety systems and finishes. AECOM prepared a rough-order-of-magnitude construction cost estimate of $46.9 million (2020$) in February 2021 to quantify construction costs for the reduced (trapezoidal) train box extension.

See Appendix F.2 for a detailed breakdown in FTA SCC format.

Right-of-Way

The reduced train box extension would not require the acquisition of right-of-way.

The current design for the extended train box would affect three parcels. One parcel, at 110 Main Street, is owned by the TJPA, and is within the footprint of the reduced train box extension. The other two parcels are the “podium” structure of 201 Mission Street and a portion of the vacant parcel east of the podium. The extended train box would require demolishing the podium.

Cost of Future Implementation

The reduced train box extension must be constructed prior to revenue train service operations, and therefore no costs are associated with the future implementation of this phasing concept.

Baseline Master Schedule

The design effort required for the reduced train box extension would be comparable to that for the current design; however, excavation and fit-out would be less extensive and therefor the current project schedule would be slightly shortened. The reduced extension could be built concurrently with the DTX tunnel.

6.2.2 FTA New Starts Project Justification Evaluation

Reducing the train box extension would have minimal effect on the DTX project justification rating. Table 6.2 summarizes the evaluation of each criterion.

Table 6.2. Effect of Reducing the Train Box on FTA Project Justification Rating Criteria

Criteria	Effect	Explanation
Land Use	None	The effects on land use measures would remain unchanged.
Economic Development	None	Local plans and policies and their ability to shape development in a transit supportive manner would not be affected.
Mobility Improvements	Minimal	Ridership would not be affected
Cost-Effectiveness	Minimal	Capital costs would be reduced by approximately 3%.
Environmental Benefits	Minimal	Because ridership would not be affected, effects to the project's environmental benefits would be minimal.
Congestion Relief	Minimal	Because ridership would not be affected, effects to the project's congestion relief would be minimal.

6.2.3 Regional Context

Benefits

Reducing the train box extension would not affect rail service, and therefore the regional benefits associated with the benefits of the DTX are not expected to change.

Effect on Other Regional Projects

Reducing the train box extension would provide the Link21 program with greater flexibility with alignment alternatives, as the reduced footprint would reintroduce the Main Street corridor as a potential option for a future tail track or East Bay rail connection. Section 6.6 considers scenarios involving a two-cell tunnel with tail tracks, a loop track, or a through-running transit center station. The implications of these configuration changes on Link21 that were identified as part of the Phasing Study are discussed in subsections 6.6.1, 6.6.2, and 6.6.3.

Effect on Regional Significance

Reducing the train box extension will not affect the regional significance of the DTX, as it would not affect rail service.

Support for Principles of PBA 2050

Reducing the train box extension will not affect the DTX's support of the regional strategies included in PBA 2050, as it would not affect rail service.

Effect on Passengers' Cost of Using the Service

The reduced train box extension concept is a reduction in space, not in service, and therefore it would not affect passengers' cost of using the service.

6.2.4 Environmental Effects

Consistency with DTX Environmental Documents or Need for Additional Review

The SEIS/EIR evaluated a train box extension to the east side of Main Street, and the reduced train-box extension would be located within the footprint of the extended train-box evaluated in the SEIS/EIR. The reduced train box extension would avoid some of the impacts described in the SEIS/EIR, most notably impacts associated with the acquisition and demolition of the podium on the southwest side of the 201 Mission Street office building. The reduced train box extension would also lessen associated construction noise, air emissions, and traffic impacts. There also would be less potential to encounter archeological resources, soil and groundwater contamination, and hazardous building materials. Because a reduced train box extension would reduce impacts of the previously approved project, the revised project could proceed with minimal new environmental documentation.

A CEQA addendum should be prepared to describe the revised project and explain why conditions specified in CEQA Guidelines Section 15162 would not apply. The addendum would not involve substantive analysis; rather, it would discuss why the revised project impacts would be less than those reported in the 2018 Final SEIS/EIR. For NEPA, FTA should be advised and the documentation (a re-evaluation) may be limited to an email exchange or a memo-to-file, as the revised project would be within the previous footprint and involve lesser impacts than those for the project described in the 2019 Amended Record of Decision.

Community Impact

Community impacts would be lessened with the reduced train box extension because acquisition and demolition of the 201 Mission Street podium would be avoided. The reduced train box extension would eliminate the significant impact of displacing an estimated 41 employees (and 48 parking spaces) from the southwest portion of the building. The community would benefit from reduced truck trips and excavation, which would shorten the timeline for construction of this component and therefore reduce disturbance to the neighborhood surrounding the train box extension. However, the community would still realize air quality benefits and greenhouse gas reductions by enabling Caltrain commuter and high-speed rail service to the Salesforce Transit Center. Greenhouse gas reductions associated with Caltrain and high-speed train ridership as a result of the DTX would total 8,587,188 metric tons of carbon dioxide equivalents. Emissions from criteria pollutants would decrease by 238,672 lbs. for reactive organic gases; 1,317,892 lbs. for nitrogen oxides; 1,141,872 for particulate matter of 2.5 microns in diameter or less; and 1,899 lbs. for diesel particulate matter.

The DTX, with the reduced train box extension, would continue to contribute to the benefits of the Transbay Program, including those associated with the redevelopment plans around the transit center. Those benefits are improving the transit center area as a place for passengers and the public to use and enjoy, revitalizing the station area with a more vibrant mix of land uses promoting

market-rate and below market-rate housing, and enhancing accessibility to employment, retail, and entertainment opportunities.

Dependency on Non-environmentally Cleared Projects

The reduced train box extension does not depend on another non-environmentally cleared project.

6.2.5 Operational Effects

Changes to Operations Costs

Reducing the train box extension would result in an estimated annual net savings of $853,900 (2027$) in facility operations costs. Caltrain and CHSRA have concluded that no significant impacts to day-to-day rail operations costs are forecasted as a result of this phasing concept.

ISES Corporation's 2016 O&M report (ISES 2016) was used to source annual operations costs for the following categories: insurance, security services, purchased utilities, and information technology services.

The O&M report included annual operations costs for the entire transit center fit-out, including the transit center structural shell, ticketing level, and current train box extension (53,245 sq ft). The overall transit center fit-out costs, per gross square foot, were applied to the category costs and adjusted to the area of the reduced train box extension (17,978 sq ft).

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on Service Flexibility

Caltrain and CHSRA have concluded that reducing the train box extension will not affect the flexibility of operations at the transit center, as the platform tracks in the reduced train box extension will be able to accommodate double-consist trains.

Effect on Operational Reliability, Security, and Safety

Caltrain and CHSRA have concluded that reducing the train box extension will not affect the security or safety of train operations. When double-consist trains begin using the reduced-length platforms, some additional time may be required to unload and load passengers from and onto the trains to allow passengers time to move through the train from cars that are not at the platform face. The operators anticipate that this additional dwell time will be accommodated in the turn times in the combined service train schedules.

Effect on Future Service Growth

Caltrain and CHSRA have concluded that the reduced train box will not place constraints on future service growth, provided that the platform tracks continue to accommodate double-consist trains. The TJPA's general engineering consultant Parsons has reviewed the trackwork and concluded that the reduced train box extension can accommodate double-consist trains without fouling train access to platforms at the transit center.

Effect on Service During Future Retrofit

No future retrofit would occur, as this phasing concept would result in a permanent train box footprint.

6.2.6 Maintenance

Changes to Maintenance Costs

Reducing the train box extension would result in annual net savings of $880,900 (2027$) in maintenance costs. Caltrain and CHSRA note that this phasing concept would result in lower maintenance costs because it involves slightly less trackwork and rail systems infrastructure.

The 2016 ISES Corporation O&M report was used to source annual maintenance costs for the following categories: Building Maintenance, Grounds Services, Janitorial Services, and Service Contracts.

The O&M report included annual maintenance costs for the entire transit center fit-out, including the transit center structural shell, ticketing level, and currently designed train box extension (53,245 sq ft). Maintenance category costs were estimated on a per-gross square foot basis and applied to the area of the reduced train box extension (17,978 sq ft). There were no deferred costs assumed for grounds services or service contracts.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on O&M Responsibilities

The changes associated with a reduced train box extension would result in minor reductions in O&M responsibilities because of the decreased footprint and associated back-of-house space in the transit center. O&M responsibilities have not yet been determined for the rail infrastructure. O&M responsibilities would be included in future negotiations.

Effect on Maintenance Access and Crew Safety

Caltrain and CHSRA have concluded that no changes to maintenance access and crew safety would result from the reduced train box extension.

Effect on Response Time for Repairs

Caltrain and CHSRA have concluded that no changes to the response time for repairs would result from the reduced train box extension.

Effect on Resilience

The resilience of the DTX would improve with the reduced train box extension because the reduced footprint would remove the train box extension from the 500-year flood zone, the 12-foot flooding scenario, and the 2100 sea-level rise inundation zone, as identified in the SEIS/EIR. The impacts of seismically induced ground movements would not change with the reduction.

6.3 Defer or Reduce Intercity Bus Facility

Two concepts for the intercity bus facility (IBF) were evaluated: deferral of construction of the IBF and reduction of the footprint and scale of the IBF.

The IBF shown in Figure 6.4 would be constructed across the street from the east end of the transit center above the train box extension between Beale and Main streets with a direct connection to the lower concourse of the transit center. Vehicle access to the IBF would be from both Main and Beale streets. The facility would be dedicated to regional bus services, some of which currently operate from the Salesforce Transit Center's bus deck under lease agreements with AC Transit, the master lease holder of the bus deck.

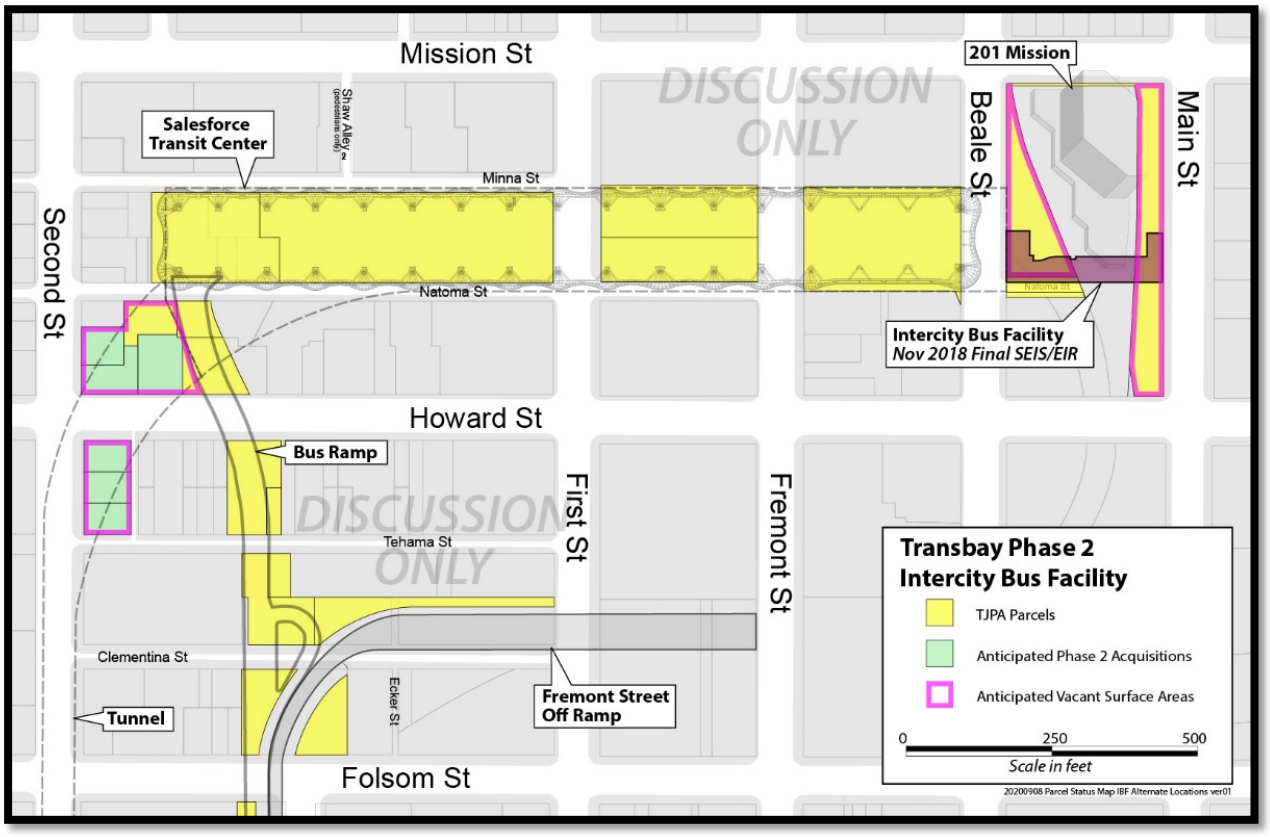


Figure 6.4. Current IBF as environmentally cleared in the SEIS/EIR

AC Transit anticipates that it will need to expand its use of the bus deck between 2035 and 2050. Currently, AC Transit leases two bus bays with shared use of a third bay to Greyhound and one bus bay to WestCAT. Greyhound has a separate lease agreement with the TJPA for approximately 4,500 square feet of the transit center for their office/ticketing area, package express operations, and passenger waiting area. Both of Greyhound's lease agreements will expire on August 31, 2029. It is unknown whether WestCAT would use the IBF or remain on the bus deck.

The environmentally cleared IBF would span between Beale and Main streets above the train box. The facility includes ten bus bays and two floors of office or residential space. Should the train box extension be reduced, the current IBF design would not be feasible because the right-of-way needed to build the IBF will be available only if the train box is extended as environmentally cleared.

Figure 6.5 shows the reduced IBF concept. The reduced IBF concept, with six bus berths and two small buildings for passenger waiting and package storage, represents the maximum footprint for a bus facility on TJPA-owned property. Although reduced, the IBF would still provide more bus capacity for regional bus services than is currently provided on the bus deck of the transit center. The reduced IBF concept is supported by the SFCTA, but has not yet been vetted by the regional bus operators.

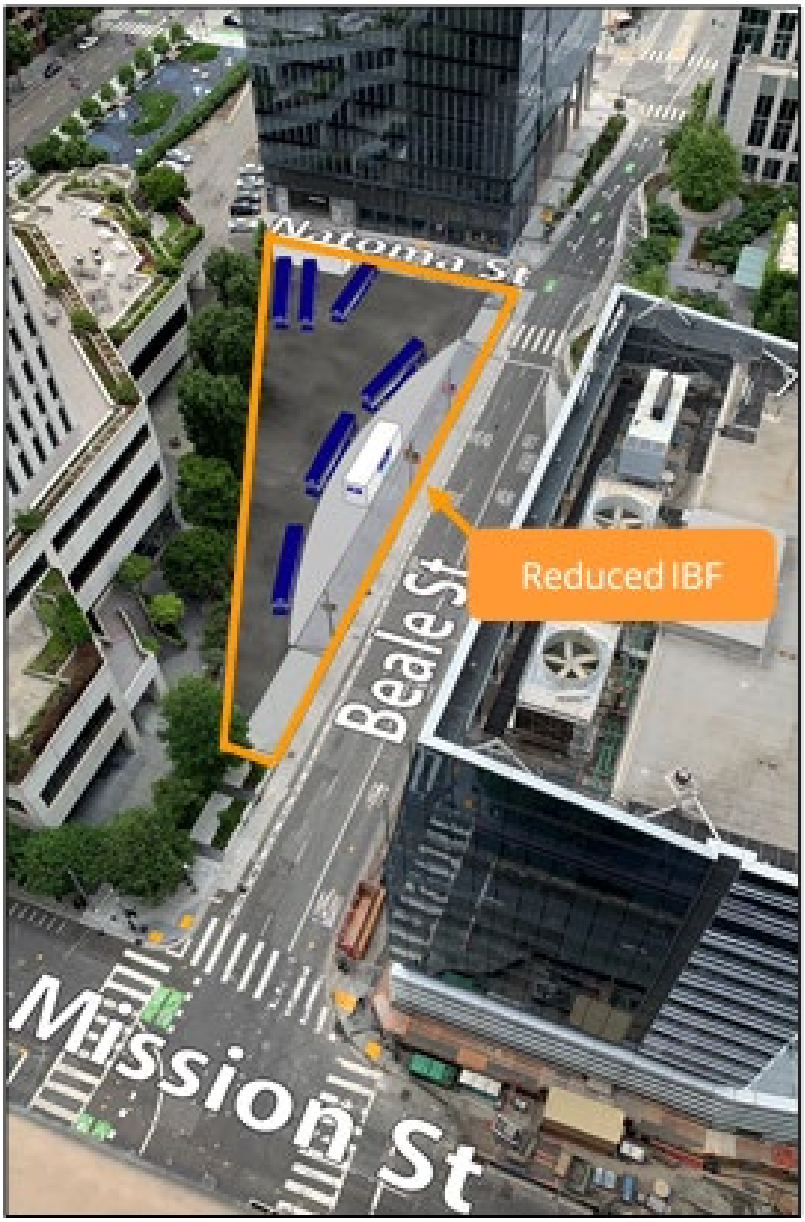


Figure 6.5. Reduced Intercity Bus Facility

6.3.1 Cost and Schedule Effects

Capital Cost Deviation

Deferring the IBF would reduce project costs by approximately 0.8%. This estimated reduction is approximately $40.3 million in 2027 year-of-expenditure dollars. Constructing the reduced IBF would reduce project costs by approximately 0.6%. The estimated savings are approximately $31.4 million in 2027 year-of-expenditure dollars.

Parsons developed a rough-order-of-magnitude construction cost estimate for the reduced IBF concept (Parsons 2021), based on T.Y. Lin International's concept drawing (see Figure 6.5).

See Appendix F.3 for a detailed breakdown in FTA SCC format.

Right-of-Way

The right-of-way associated with the IBF comprises the same parcels needed for the train box extension. See Section 6.2.

Cost of Future Implementation

The costs of future implementation of the deferred IBF from 2040 through 2055, assuming an annual average (year-over-year) escalation rate of 5%, range from $76 million to $158 million, as shown in Figure 6.6. Should the reduced IBF concept be accepted and also deferred, the costs of future implementation from 2040 through 2055 would range from $23 million to approximately $48 million, as shown in Figure 6.7. These estimates illustrate the escalated cost to construct the phasing concept and do not include allowance for the cost to operators due to operational disruption. If deferred, the IBF would not be eligible for future funding as an independent project through the FTA CIG program, under the current eligibility criteria.

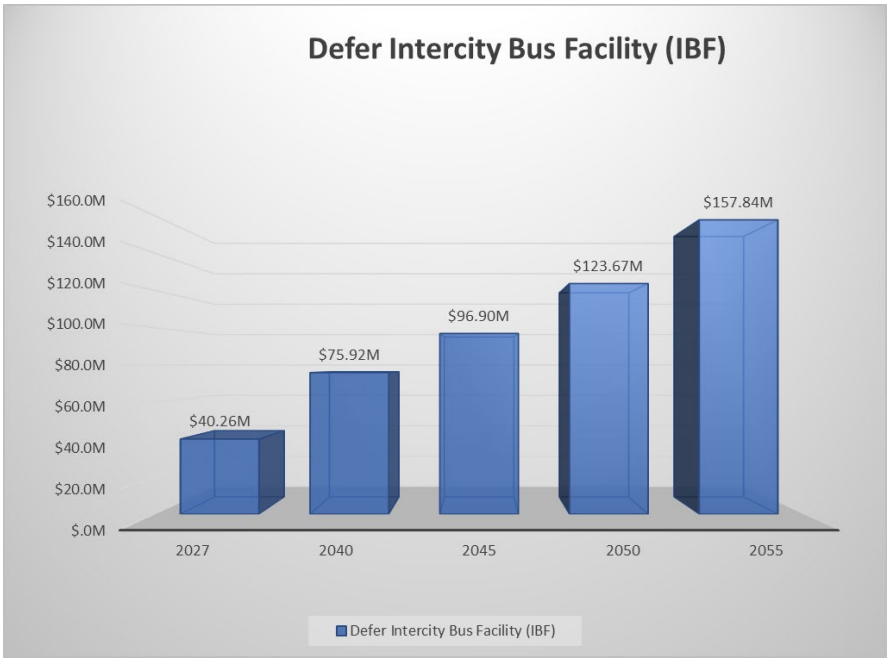


Figure 6.6. Cost of future implementation of the deferred currently designed intercity bus facility

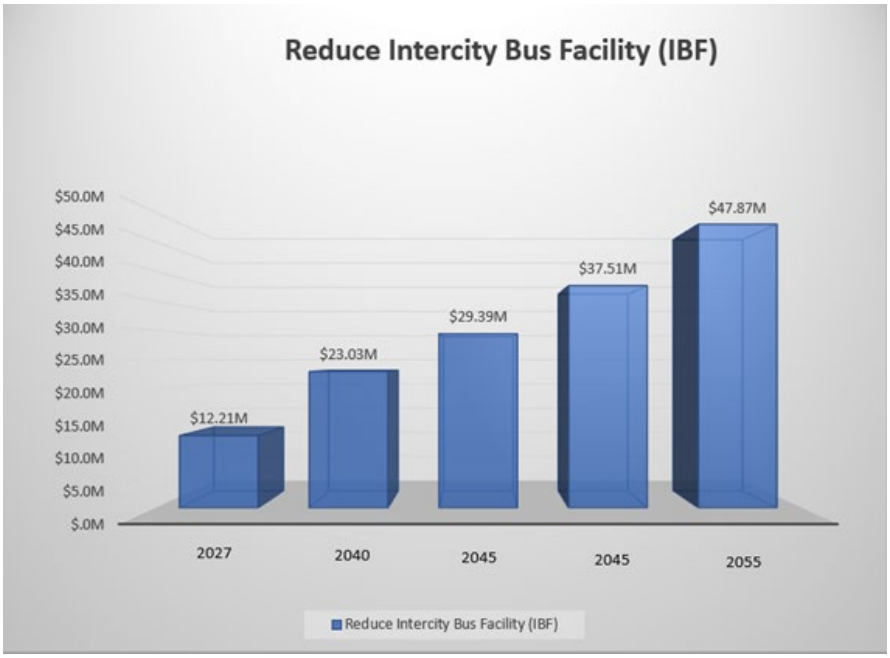


Figure 6.7. Cost of future implementation of the reduced intercity bus facility

Baseline Master Schedule

The current project schedule could be slightly improved by the deferral or reduction of the IBF. The construction of the train box extension would be completed sooner without surface construction should the IBF be deferred. Construction of the reduced IBF would also save time on the construction schedule because of the smaller scale of the facility.

6.3.2 FTA New Starts Project Justification Evaluation

Deferring or reducing the IBF would have minimal effect on the DTX project justification rating. summarizes the evaluation of each criterion. Table 6.3 summarizes the evaluation of each criterion.

Table 6.3. Effect of Reducing or Deferring the IBF on FTA Project Justification Rating

Criteria	Effect	Explanation
Land Use	None	The effects on land use would remain unchanged.
Economic Development	None	Local plans and policies and their ability to shape development in a transit supportive manner would not be affected.
Mobility Improvements	Minimal	No transit services would be added or removed transit services; thus, effects to ridership would be minimal.
Cost-Effectiveness	Minimal	Capital costs would decrease by less than 1%.
Environmental Benefits	Minimal	Because ridership would not be substantially affected, effects to the project's environmental benefits would be minimal.
Congestion Relief	Minimal	Because ridership would not be substantially affected, effects to congestion relief would be minimal.

6.3.3 Regional Context

Benefits

If the IBF is deferred but constructed prior to the transit center bus deck's reaching capacity, then the full benefits of the facility as described in the 2018 Final SEIS/EIR would be realized. However, if the bus deck capacity is reached, and space for regional bus operators is not available, regional bus services in and out of the transit center may have to be reduced (to reduce the number of buses present) or, more likely, alternate locations would need to be identified for shuttle and bus loading, unloading, and layovers. If regional bus services were decreased, regional mobility and accessibility to major employment centers, activity centers, social and recreational venues, airports—essentially, all of the services and destinations served by the buses—would be diminished and as a consequence, travelers would need to use alternative means of travel to access the transit connections available at the transit center. To the extent that travelers no longer used other transit options and instead used automobiles, the benefits of regional transit interconnectivity, which include reduced passenger vehicle trips, facilitation of non-vehicular trips, enhanced accessibility and transit ridership, and reduced passenger vehicle miles traveled, would be lessened.

A reduced IBF could be constructed above the train box on the TJPA-owned parcel before the transit center's bus deck capacity is reached. However, because the parcel shape is irregular and smaller than the parcel envisioned for the environmentally cleared IBF, access would be restricted to Beale Street, circulation and maneuverability for buses would be reduced compared to the full IBF, the number of possible bus berths would be limited, and space for ticketing, passenger waiting areas, and baggage would likewise be greatly reduced.

While the IBF might be accommodated at this site, the reduced facility would restrict the full benefits of regional transit interconnectivity, because regional bus demand, schedules, and layover needs would not be fully satisfied. The lack of space onsite for administrative and passenger activities means that joint development of the site for office or housing would likely not occur. Thus, the benefits associated with the current plans for jobs or housing—convenient access to intermodal transit, the associated reductions in the use of cars and air and greenhouse gas emissions, and contributions of the Program to enlivening this area of the City—would not be realized.

Effect on Other Regional Projects

Deferring or reducing the IBF would not affect other regional projects, as it is not anticipated that any other projects would use the parcel proposed for the IBF.

Effect on Regional Significance

Deferring the IBF would reduce the seamlessness and convenience of regional and interregional transit connections, and therefore deferring it would diminish the regional significance of the DTX.

Reducing the IBF would not affect regional significance if the facility provided adequate service for regional bus services.

Support for Principles of PBA 2050

The IBF was not factored into the project evaluation for the PBA 2050 Project Performance Assessment. Therefore, deferring or reducing the IBF would not alter the performance assessment findings. The IBF was not highlighted as a way to improve project performance or mitigate equity concerns in the project's commitment letter in response to project performance.
In relation to the plan's themes and strategies, the IBF aligns with the plan's "connected principle and strategy to "enable a seamless mobility experience." This strategy resonated with many groups, including members of the public and through targeted engagement on ways to improve the PBA 2050 Draft Blueprint. If the IBF is deferred, attention should be placed on seamless mobility and connectivity, as well as any potential impacts having an effect on equity.

Effect on Passengers' Cost of Using the Service

Deferring the IBF could cause an increase to the cost of using the affected bus services if the operators of those services were required to find a facility away from the transit center. This scenario could increase the cost to passengers if increased facility rental fees were passed on by the operators or if passengers needed to use other services such as BART or Muni to reach the transit center from the offsite facility.

It is not anticipated that passenger costs would be affected by the reduced IBF.

6.3.4 Environmental Effect

Consistency with DTX Environmental Documents or Need for Additional Review

Deferring the IBF would not affect implementation of the remaining elements associated with the DTX. Because the project would differ from that previously approved by the TJPA Board in 2018, a CEQA addendum should be prepared to describe the revised project and explain why conditions specified in CEQA Guidelines Section 15162 would not apply. The addendum would not involve substantive analysis; rather, it would discuss why the revised project impacts would be less than those reported in the 2018 Final SEIS/EIR. For NEPA, FTA should be advised and the documentation (a re-evaluation) may be limited to an email exchange or a memo-to-file, as the revised project would result in lesser impacts than those for the project described in the 2019 Amended Record of Decision.

Constructing the IBF in the future may require a supplemental environmental analysis, depending on how much time lapses before the IBF is built and how conditions in the project area change. CEQA Guidelines Section 15162 identifies specific conditions when further environmental review would be necessary. The NEPA counterpart conditions are found in 23 CFR 771.130. In general, these sections of the environmental regulations recognize that new information or changed circumstances under which a project would be implemented may require updating the environmental documents. Under FTA guidelines, a re-evaluation of NEPA documentation is triggered when the project sponsor requests further approvals but major steps to advance the project (for example, authority to acquire a significant portion of right-of-way or to undertake final design) have not occurred within three years after the approval of the final EIS, final EIS supplement, or the last major agency approval or grant (23 CFR 771.129(b)). In an area that is transforming rapidly, like the neighborhood surrounding the transit center, background conditions are changing and the circumstances

under which the project would be implemented could result in substantially different impacts than those identified in the previously approved CEQA/NEPA environmental documents. The environmentally cleared IFB was evaluated in the 2018 Final SEIS/EIR.

A reduced IBF would require some additional environmental review. Impacts of a reduced facility may be less (both adverse and beneficial) than reported in the 2018 Final SEIS/EIR if office or residential development were decreased. For minor revisions to a project, CEQA compliance would be achieved with an addendum (pursuant to the CEQA Guidelines Section 15164) and a NEPA re-evaluation (pursuant to 23 CFR 771.129), both of which acknowledge that revisions to an adopted project have been proposed but would not substantially alter the previously approved CEQA/NEPA environmental document. Six such addenda were prepared to the original 2004 Final EIS/EIR between 2006 and 2011, as the configuration of the project evolved.

Unlike the prior phasing concept to defer the IBF, a reduced IBF could have different impacts than reported in the 2018 Final SEIS/EIR with respect to local circulation, including pedestrian and bicyclist movements, because the layout and ingress/egress differ from those of the IBF evaluated in the 2018 environmental document. It is expected that a NEPA re-evaluation would still be appropriate, but may require more than a simple memo to the file, depending on FTA's discretion. The type of CEQA environmental document (i.e., an addendum or a supplemental initial study/mitigated negative declaration) would depend on whether the revised project with the reduced IBF might result in new significant impacts or significant impacts substantially more severe than identified previously. A transportation analysis would be critical to making this determination. If the reduced IBF did not result in new or more severe significant impacts, then an addendum could provide the necessary CEQA review. Inclusion of a reduced IBF as part of a revised project would delay advancing the remaining elements of the DTX project until the additional CEQA/NEPA analyses of this phasing concept could be completed.

Community Impact

Deferral of the IBF would also defer the associated beneficial community impacts. The IBF and associated future development could improve community cohesion by attracting residential development and contribute to a sense of community in the emerging neighborhood envisioned by the Transit Center District Plan. The development associated with the IBF would increase the accessibility to mass transit for populations that are transit-dependent and increase the density of development, pedestrian traffic, and use in the area, especially during non-business hours. In addition, benefits to the community from interregional and transregional transit could also be lessened if deferment of the IBF resulted in decreased regional transit ridership, which could occur because transferring among transit operators would be less convenient. Deferring the IBF could also result in two construction periods if the train box extension were completed and then sometime later the IBF and development above the facility were completed. This would result in additional disruption to the community and in construction-related impacts such as additional noise, traffic delays, local circulation of pedestrians and traffic, and air emissions.

Some of the community impacts associated with deferral of the IBF would be lessened with a reduced IBF, including fewer vehicles and pedestrians, less demand for parking because of less residential or office development, and reduced sources of new light. However, removing the development associated with the IBF would decrease accessibility to mass transit for populations

that are transit-dependent. A smaller IBF may also result in reduced truck trips and construction activities, which would shorten the timeline for construction of this facility and therefore reduce disturbance to the surrounding neighborhood.

Dependency on Non-environmentally Cleared Projects

The deferral or reduction of the IBF is not dependent on other non-environmentally cleared projects.

6.3.5 Operational Effect

Changes to Operations Cost

Deferral of the IBF would result in an estimated annual net savings of $245,100 (2027$) in operations costs. Reducing the IBF would result in an estimated annual net savings of $229,300 (2027$).

The 2016 ISES O&M report (ISES 2016) was used to source annual operations costs for the following categories: insurance, security services, purchased utilities, and IT services.

Estimated annual operations costs for the IBF are $144,400 (2015$). Therefore, deferral of the entirety of IBF scope would result in a savings of $245,100 (2027$).

Operations cost savings associated with the reduced IBF were derived by calculating the overall cost-per-gross-square-foot and applying it to the enclosed square footage of the reduced IBF.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on Service Flexibility

Deferral of the IBF would constrain service flexibility for regional bus operators should the transit center bus deck reach capacity before the IBF is constructed. This would require the regional bus operators to find an alternative service location.

The reduced IBF's six bus bays double the existing arrangement for regional bus services on the transit center bus deck, and therefore the availability of bus bays should not affect service flexibility or capacity. Limited bus access, however, would constrain service flexibility, as the reduced IBF would be accessible from Beale Street only.

If AC Transit reaches capacity on the bus deck before construction of the IBF, regional bus operators currently operating on the bus deck would need to locate to an alternative site for the facility.

Effect on Operational Reliability, Security, and Safety

Operational reliability, security, and safety would not be affected by deferral of the IBF provided that the regional bus operators could continue operating on the bus deck or if the regional bus operators could find a comparable offsite facility.

The reduced IBF could affect operational reliability, security, or safety. The April 2007 design criteria for the temporary terminal, based on Greyhound operations in Arizona (Greyhound 2005), called for approximately 8,500 square feet of programmatic space for passenger waiting, package storage, and other back-of-house spaces. The temporary terminal provided four dedicated bus bays for Greyhound with an additional two shared bus bays. It provided approximately 2,300 square feet of exclusive use and 4,700 square feet of shared interior area. The reduced IBF concept provides approximately 800 square feet for these purposes, which is less than was offered at the temporary terminal. The reduced passenger waiting area and operator back-of-house spaces could affect operational reliability, security or safety.

Effect on Future Service Growth

Future service growth for regional bus operators would be constrained with either the deferral or reduction of the IBF. AC Transit, as the primary tenant of the bus deck, forecasts that it will require all 37 bus bays on the bus deck for revenue operations beginning between 2035 and 2050. Should IBF construction be delayed beyond this timeframe, regional bus operators currently operating on the bus deck alongside AC Transit would need to locate an alternative facility.

The number of bus bays at the reduced IBF concept would be limited to six bus bays, which would constrain future service growth for the regional operators.

Effect on Service During Future Retrofit

The impact on revenue service operations during future construction of the IBF would be minor, as the IBF sits at-grade over the lower concourse level of the transit center, which is one level above the platform level. Construction may require cordoning off one exit from the lower concourse, which could minimally affect pedestrian flow and cause minor construction noise and dust.

6.3.6 Maintenance Effect

Changes to Maintenance Costs

Deferring the IBF would result in annual net savings of $323,500 (2027$) in maintenance costs. Reducing the IBF would result in annual net savings of $299,600 (2027$).

The 2016 ISES O&M report (ISES 2016) was used to source annual maintenance costs for the following categories: building maintenance, grounds services, janitorial services, and service contracts.

Estimated annual maintenance costs for the IBF are $190,600 (2015$). Therefore, deferral of the entirety of IBF scope would result in maintenance savings of $323,500.

Annual net savings in maintenance costs associated with the reduced IBF were calculated on a cost-per-gross-square-foot basis, adjusted as a percentage basis equal to the reduced scope of enclosed area. Elevators and escalators are not associated with this scope; therefore, no deferred costs were recognized for service contracts.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on O&M responsibilities

O&M responsibilities for Greyhound are included in the terms of Greyhound's leases with the TJPA. As the IBF is at a conceptual design level only, Greyhound has not documented its position on O&M responsibilities. O&M responsibilities for the IBF, whether the current design or the reduced IFB is built, would likely fall under the purview of the TJPA's asset manager and incorporated into Greyhound's leasing terms. Deferral of the IBF would result in no O&M responsibilities for this project element.

Effect on Maintenance Access and Crew Safety

Deferring the IBF would not change maintenance access or crew safety, as any light bus maintenance that is currently proceeding on the bus deck could continue. Light maintenance could also be accommodated at a reduced IBF.

Effect on Response Time for Repairs

Deferral of the IBF would not change the response time for repairs to buses, as any repairs currently proceeding on the bus deck could continue. Bus repairs could also occur at a reduced IBF.

Effect on Resilience

Deferral of the IBF would not change the resilience of the DTX, as any vulnerabilities identified in the SEIS/EIR would be delayed and realized upon construction of the IBF.

Reducing the IBF would improve the resilience of the project. The reduced footprint would remove the IBF from the 500-year flood zone, the 12-foot flooding scenario, and the 2100 sea-level rise inundation zone as identified in the SEIS/EIR. Seismically induced ground movements would not change based on the reduction.

6.4 Defer Fit-out of Fourth and Townsend Street Station

The Fourth and Townsend Street Station, under Townsend Street between Fourth and Fifth streets, will serve passengers on trains bound for or returning from the Salesforce Transit Center. The street level station entrances and exits along Townsend Street will lead to two levels below grade: a concourse mezzanine and a train platform level. The concourse mezzanine level will accommodate passenger amenities and house mechanical and electrical rooms and staff areas. The 800-foot underground station will be constructed using cut-and-cover techniques.

This phasing concept would defer the fit-out of the Fourth and Townsend Street Station. "Fit-out" refers to the architectural finishes and amenities necessary to open the station for passenger revenue operations. See Figure 6.8.

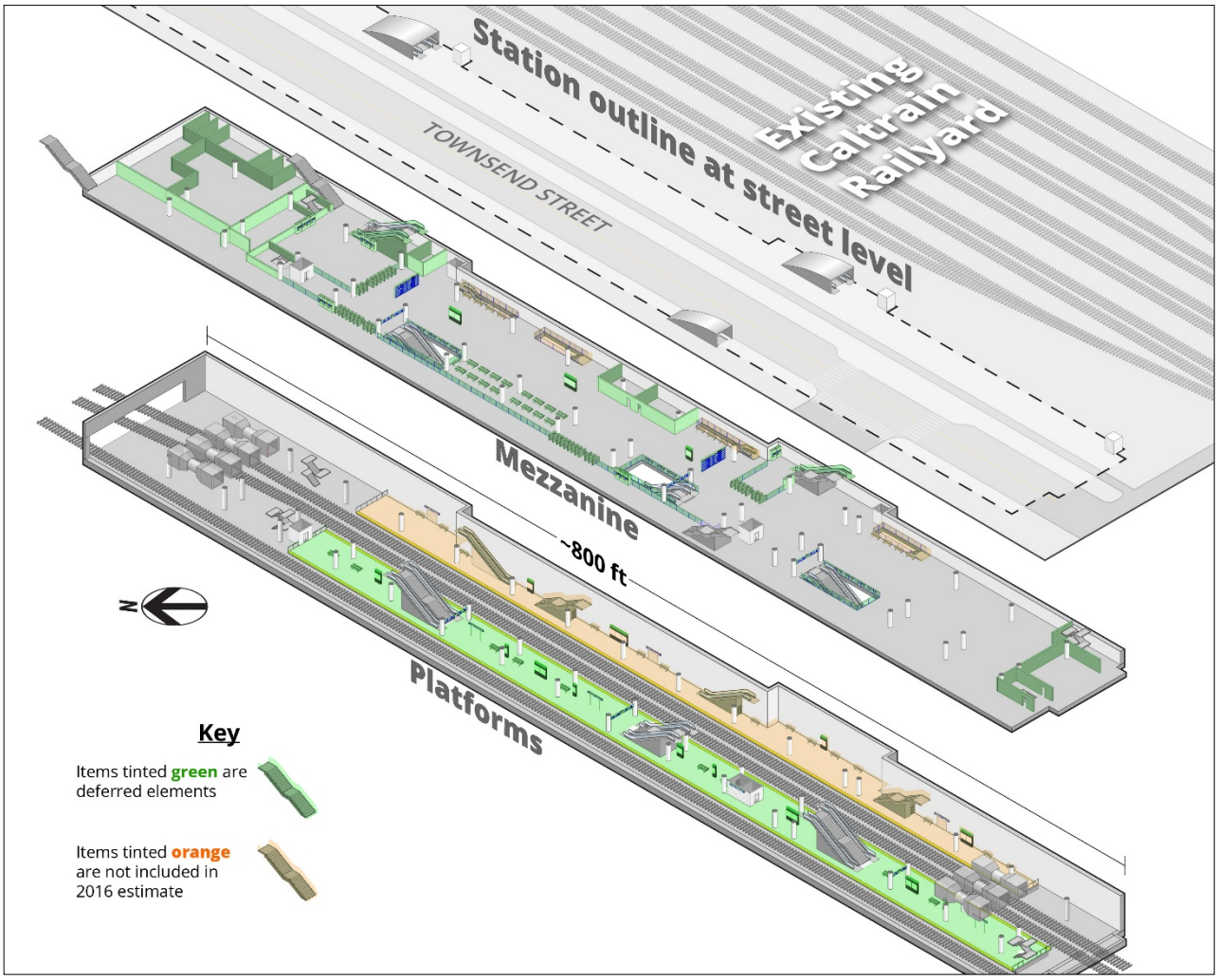


Figure 6.8. Fourth and Townsend Street Station Cross Section

The current design of the platform level and associated cost estimate for the station has three tracks and a center platform. An additional platform face for CHSRA was proposed by an SFCTA peer review panel in its review of a two-versus-three-track DTX in 2018 (SFCTA 2019). The three-track, two platform configuration is referred to as Concept A. Concept A is not included in the most recent 2016 cost estimate but is shown in Figure 6.8 for completeness. Concept B, another layout developed during the Phasing Study that is under consideration, has two tracks and three platforms—one low-level central platform and two outer high-level platforms. Refer to Section 4 for more on these concepts.

Under this phasing concept, the structural shell of the Fourth and Townsend Street Station, including necessary HVAC, electrical, plumbing, fire-life safety and track elements would be constructed; however, the station would not be put into immediate revenue service operations as a rail station. Items identified for potential deferment are the center platform, architectural finishes, and half of the vertical circulation elements, the balance of which are required for emergency egress, which will be maintained at the station regardless of revenue service operation.

Deferring the fit-out of the Fourth and Townsend Street Station was recommended by the IPMT to acknowledge a preliminary study by Caltrain with the owner of the Fourth and King Railyard site, Prologis, to examine the potential to develop a portion of the yard while maintaining rail service and trainset storage at the site. This phasing concept would allow time for the requirements for the development of the Fourth and King Railyard to be better quantified to facilitate coordination. Figure 6.8 highlights elements of the station fit-out proposed for deferral along with the items that are not included in the current cost estimate.

6.4.1 Cost and Schedule Effects

Capital Cost Deviation

Deferring the fit-out of the Fourth and Townsend Street Station would reduce project costs by approximately 0.6%. The estimated reduction is approximately $28.9 million in 2027 year-of-expenditure dollars.

See Appendix F.4 for a detailed breakdown in FTA SCC format and Appendix G for annotated source material.

Right-of-Way

There are no right-of-way cost savings associated with this phasing concept, as the structural shell of the Fourth and Townsend Street Station would be constructed as part of the initial operating project and have no effect on the current footprint.

Cost of Future Implementation

The costs of future implementation of the fit-out of the Fourth and Townsend Street Station in projected five-year increments from 2040 through 2055, assuming an annual average (year-over-year) escalation rate of 5%, range from $55 million to $113 million, as shown in Figure 6.9. The cost of future implementation is based on the current preliminary level design and associated cost estimate for the Fourth and Townsend Street Station. These estimates illustrate the escalated cost to

construct the phasing concept and do not include allowance for the cost to operators due to operational disruption. If deferred, fit-out of the station would not be eligible for future funding as an independent project through the FTA CIG program, under current eligibility criteria.

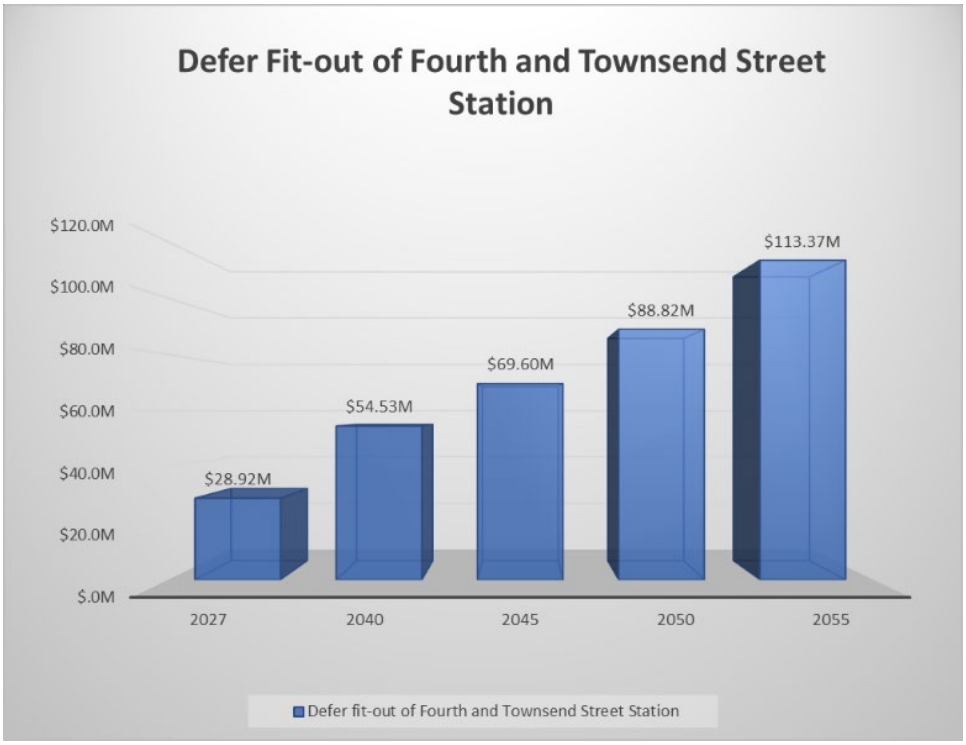


Figure 6.9. Cost of future implementation of deferred fit-out of Fourth and Townsend Street Station Cross Section

Baseline Master Schedule

It is not anticipated that the deferral of the fit-out of the Fourth and Townsend Street Station will have material impacts on the current project schedule. The deferred items do not account for the bulk of the anticipated construction timeline for the station.

6.4.2 FTA New Starts Project Justification Evaluation

Deferring fit-out of the Fourth and Townsend Street Station would have a negative effect on the DTX project justification rating. Table 6.4. summarizes the evaluation of each criterion..

Table 6.4. Effect of Deferring Fit-out of the Fourth and Townsend Street Station on FTA Project Justification Rating

Criteria	Effect	Explanation
Land Use	None	The effects on land use measures would remain unchanged.
Economic Development	None	Local plans and policies and their ability to shape development in a transit supportive manner would not be affected.
Mobility Improvements	Negative	Caltrain would not provide revenue service to the Fourth and Townsend Street Station and continue service to Fourth and King. Riders expected to use Fourth and Townsend would shift to another stop or mode or some trips would not occur, which would have a negative effect on ridership.
Cost-Effectiveness	Negative	It is unlikely that capital and O& M cost decreases would be significant enough to counterbalance the loss in ridership.
Environmental Benefits	Negative	Because ridership would be negatively affected, effects to the project's environmental benefits would also be negative.
Congestion Relief	Negative	Because ridership would be negatively affected, effects to the project's congestion relief would also be negative.

6.4.3 Regional Context

Benefits

Deferral of the fit-out and, thus, the functionality of the Fourth and Townsend Street Station would delay convenient transfers and increase travel time for Caltrain passengers with destinations along or near the Muni Metro T-Line and Central Subway corridors, and vice versa. With a functional Fourth and Townsend Street Station, Caltrain riders could transfer directly to Muni's Central Subway and conveniently access neighborhoods and regional destinations north and south of Townsend Street, including South of Market (SoMa), Bayview, Potrero Hill, UCSF Mission Bay Campus, Market Street, Union Square, and Chinatown. However, without a functional Fourth and Townsend Street Station, Caltrain riders from the south would have to select a train destined for the Fourth and King Station to reach these destinations or reach them from the Salesforce Transit Center, from the Caltrain 22nd Street Station, or through a transfer to BART at the Millbrae Station, adding travel time and transfers to their ride.

Effect on Other Regional Projects

Deferral of fit-out of the Fourth and Townsend Street Station would affect other regional projects, including the Central Subway and future projects, such as the PAX. The deferral of the fit-out would likely affect the planning of the PAX, which would provide an underground rail connection from DTX to the Caltrain 22nd Street Station. The Fourth and Townsend Street Station would be the primary transfer station for PAX passengers traveling to destinations north and south of Townsend Street. Nevertheless, the fit-out of the Fourth and Townsend Street Station could occur in advance of revenue service on the PAX.

The scale and nature of the impact will depend on the extent to which Caltrain could terminate a portion of San Francisco-bound service at the Fourth and King Street Station. "Split" service would provide direct connections from the Townsend Street area (e.g., to Central Subway/T-Third and N-Judah Muni Metro lines).

Effect on Regional Significance

The operators have concluded that the deferral of the Fourth and Townsend Street Station will have significant impacts on the regional significance of the DTX project. The area around the Fourth and Townsend Street Station is a key primary market for Caltrain, and its existing and future demand will require continued service. In order to maintain services, Caltrain would need to divide train service between the termini at Fourth and King streets and the transit center with most trains likely terminating at Fourth and King Street Station, and fewer terminating at the transit center. Minimal service to the transit center will lessen the significance of DTX for regional travel.

Support for Principles of PBA 2050

Deferring the fit-out of the Fourth and Townsend Street Station would delay realization of PBA 2050 strategies related to connectedness and would not support transportation enhancements in Communities of Concern, which aim to provide direct funding to historically marginalized communities for locally identified transportation needs. The area surrounding the Fourth and Townsend Street Station is a Priority Development Area in the PBA 2050 Growth Geographies. Given the prevalence of minority and low income people, referred to as "environmental justice populations," surrounding the Fourth and Townsend Street Station, deferring the station fit-out at this location would delay investment in these communities in terms of vital transit connections to jobs, social services, and education.

Effect on Passengers' Cost of Using the Service

Deferring the fit-out of the Fourth and Townsend Street Station is not anticipated to affect the cost of rail service to passengers. It will affect passenger experience, however, as passengers will be required to select the appropriate Caltrain train destined for either the Fourth and King surface station or the transit center when traveling from the south. Should a Fourth and King station-bound passenger select a train traveling to the transit center in error, the passenger could incur additional costs and time associated with transferring to Muni, a taxi, or a rideshare service to reach their desired destination.

6.4.4 Environmental Effects

Consistency with DTX Environmental Documents or Need for Additional Review

Deferring the Fourth and Townsend Street Station as part of a revised project could delay advancing other elements of the DTX project. In an area that is transforming, especially with the City's adoption of the Central SoMa Plan in December 2018, background conditions are changing and the circumstances under which a revised project would be implemented could result in substantially different impacts than those identified in the previously approved CEQA/NEPA environmental documents. As a result, supplemental environmental analysis could be required to assess construction and operational impacts from deferring a functional station at Fourth and Townsend streets. Impacts that would need to be analyzed relate to ridership on Caltrain and the Muni Metro

T-Third Street/Central Subway line, and pedestrian and traffic volumes and circulation at the Caltrain 22nd Street Station, the transit center, and the Millbrae BART Station, each of which would presumably absorb riders who would have stopped at the Fourth and Townsend Street Station. It is expected that a NEPA re-evaluation would still be appropriate, but would require more analysis than a simple memo to the file, depending on the FTA's discretion. The type of CEQA environmental document (i.e., an addendum or a supplemental initial study/mitigated negative declaration) would depend on whether the revised project with the deferred use of the station might result in new or substantially more severe impacts than identified previously. If the local impacts and ridership effects at the affected Caltrain stations do not result in either new or substantially more severe impacts, then a CEQA addendum could provide the necessary CEQA review. Inclusion of a deferred functional Fourth and Townsend Street Station as part of a revised project would delay advancing the remaining elements of the DTX project until the additional CEQA/NEPA analyses of this phasing concept could be completed.

The need for supplemental environmental analysis will depend on how long the fit-out of the station is deferred. CEQA Guidelines Section 15162 identifies conditions that warrant further environmental review. The NEPA counterpart conditions are found in 23 CFR 771.130. In general, these sections of the environmental regulations recognize that new information or changed circumstances under which a project would be implemented may require updating the environmental documents. Under FTA guidelines, a re-evaluation of NEPA documentation is triggered when the project sponsor requests further approvals if major steps to advance the project (for example, authority to acquire a significant portion of right-of-way or to undertake final design) have not occurred within three years after the approval of the final EIS, final EIS supplement, or the last major agency approval or grant (23 CFR 771.129(b)).

The 2004 Final EIS/EIR included a station at Fourth and Townsend streets as part of the proposed action and assessed construction of the DTX without the Fourth and Townsend Street Station as the no-action alternative. The 2018 Final SEIS/EIR modified this project component to its current siting, depth, and design with three tracks and a center platform.

Community Impact

Deferral of the fit-out of the Fourth and Townsend Street Station, and thus the delay in having a functional station at this location, would result in delayed connectivity benefits for minority and low income people (environmental justice (EJ) populations) surrounding the station and would continue to limit accessibility and mobility of these populations. The Fourth and Townsend Street Station is surrounded by two EJ census tract block groups, both of which include minority populations over 50% and one of which includes 26% of the population with a low income. The Fourth and Townsend Street Station would be within convenient walking distance of these EJ populations. This convenient access to major intermodal hubs provides access to other transit services, jobs, open space and recreation, social services, and education locally and within the region, because of the direct connection to transit providers that serve San Francisco, the Peninsula (San Mateo County), the South Bay (Santa Clara County), the North Bay (Marin and Sonoma counties), and the East Bay (Alameda and Contra Costa counties). Over the long term, EJ populations surrounding the station would enjoy improved access to employment and recreation facilities in the City and throughout the larger Bay Area.

Therefore, delayed functionality of the Fourth and Townsend Street Station would defer attainment of the project objective to enhance accessibility to employment, retail, and entertainment opportunities. In addition, without a functional Fourth and Townsend Street Station, connectivity to Muni would be reduced, and thus the project objective in the 2018 Final SEIS/EIR purpose and need statement, which seeks to enhance connectivity between Caltrain and other major transit systems, would not be fulfilled.

Dependency on Non-environmentally Cleared Projects

The deferral of the Fourth and Townsend Street Station is not dependent on another non-environmentally cleared project, though it could affect the PAX project, currently in the pre-environmental stage, by reducing service for Central SoMa.

6.4.5 Operational Effects

Changes to Operations Costs

Deferring fit-out of the Fourth and Townsend Street Station would result in an annual net savings of $326,400 (2027$) in operations costs. While the IPMT acknowledges that deferral of the station would result in a loss of potential revenue, those costs were not estimated as part of the study.

ISES Corporation's 2016 O&M report (ISIS 2016) was used to source annual operations costs for the following categories: insurance, security services, purchased utilities, and information technology services. The report's itemized categories that would be directly affected by the deferred fit-out were identified and estimated by gross square foot. The analysis found that two elevators and two escalators serving the lower platforms would be affected. Additionally, it was determined that negligible savings would be realized for electric (under purchased utilities) as the industrial equipment (i.e., ventilation fans) would be installed during the initial construction period. Stationary security posts would also be affected. No deferred costs were assumed for IT services, as the main portion of the IT infrastructure would still need to be installed if the phasing concept were implemented.

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on Service Flexibility

Caltrain and CHSRA have concluded that delaying the fit-out of the Fourth and Townsend Street Station would remove the ability for CHSRA to serve the area around Fourth and Townsend streets in San Francisco, although services to the transit center would not be affected. Delaying the Fourth and Townsend Street Station fit-out will substantially affect Caltrain services to the transit center. The existing Fourth and King Street Station area (which would also be served by the Fourth and Townsend Street Station) is Caltrain's primary existing market. Therefore, it is likely that a delayed Fourth and Townsend Street Station would see the majority of Caltrain services terminating at Fourth and King Street Station to preserve service to this area. Intermittent services (possibly two trains per hour) could bypass the Fourth and King Street Station to terminate at the transit center.

Effect on Operational Reliability, Security, and Safety

The operators project a marginal improvement in operational reliability without a stop at the Fourth and Townsend Street Station, as the variability associated with passengers boarding and leaving trains at this location would be removed. Similarly, operational security and safety would be marginally improved because the station would not be put into revenue service operations. However, the simulation work undertaken as part of the operations analysis has demonstrated high on-time performance of this location even when it is fully functional, so no material benefit in reliability accrues from the fit-out deferment.

Effect on Future Service Growth

The operators have concluded that without the fit-out of the Fourth and Townsend Street Station, service growth at this location would be constrained to the level of service that Caltrain could provide to the Fourth and King Street Station. Subject to further discussions with Caltrain, it may be possible for high-speed trains to use the existing, surface-level Fourth and King Street Station as a temporary San Francisco terminus. If the Fourth and King Station is not available, then high-speed trains would be unable to serve the primary market of San Francisco prior to the completion of the transit center rail station.

Effect on Service During Future Retrofit

The future fit-out of the Fourth and Townsend Street Station would affect operations during the fit-out of the platform level, which would require the installation of platforms immediately next to the operating trains. This work would likely be performed during nights and weekends, which would cause service interruptions to the transit center. Construction of the fit-out of the mezzanine would have minimal impacts on rail service, though it would disrupt the road surface, traffic, pedestrians, and bus service to allow space for construction equipment and supply deliveries.

6.4.6 Maintenance Effects

Changes to Maintenance Costs

Deferring fit-out of the Fourth and Townsend Street Station would result in an estimated annual net savings of $688,000 (2027$) in maintenance costs.

The 2016 ISES Corporation O&M report was used to source annual maintenance costs for the following categories: building maintenance, ground services, janitorial services, and service contracts. See Appendix I for annotated source material for operations and maintenance annual savings.

The report's itemized categories that would be directly affected by this phasing concept were identified and estimated by gross square foot. The analysis found that two elevators and two escalators serving the lower platforms would be affected. There are no deferred costs assumed for grounds services, as the surface is unaffected by this phasing concept.
See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on O&M Responsibilities

The operators have concluded that should the fit-out of Fourth and Townsend Street Station be deferred, they would not have any maintenance responsibility. O&M of the unfinished box would be the responsibility of the tunnel owner, either directly or through a contract. During subsequent fit-out, responsibility would also remain with the tunnel owner. As part of completion, certification, and the opening of revenue operations at Fourth and Townsend Street Station, an agreement would be required to specify how O&M responsibility will transition from the tunnel owner to the operators.

Effect on Maintenance Access and Crew Safety

Deferring the Fourth and Townsend Street Station fit-out would not affect maintenance access, as back-of-house spaces and associated fire-life safety systems required for maintenance access would not be deferred. Crew safety would not be affected, as emergency egress would still be provided at the station regardless of whether revenue service is deferred.

Effect on Response Time for Repairs

Deferring the Fourth and Townsend Street Station fit-out would not affect response time for repairs, as the back-of-house spaces and associated fire-life safety systems required for maintenance access would not be deferred.

Effect on Resilience

Deferring the Fourth and Townsend Street fit-out would not affect project resilience, as the project envelope would remain the same as that for the current design to support rail operations.

6.5 Defer Infrastructure Fit-out for CHSRA-related Elements

CHSRA's 2020 Business Plan anticipates the arrival of its high-speed train service to the Salesforce Transit Center in 2031. This phasing concept assesses a scenario in which the start of CHSRA's operations is delayed beyond 2031 and construction or "fit-out" of some of the infrastructure needed to support high-speed revenue service could be deferred until one year prior to CHSRA's planned start of revenue service to allow for testing and commissioning. Deferred infrastructure elements to support CHSRA rail service include systems, the high-speed train platform at the transit center, platform elements, and trackwork, including the third track in the DTX tunnel, although a tunnel capable of supporting the third track would still be constructed.

The current design of the DTX alignment assumes six Caltrain trains and four high-speed trains per peak hour per direction. An operations analysis conducted in connection with the Phasing Study demonstrates that the current design can support eight Caltrain trains and four high-speed trains per peak hour per direction. The transit center and the DTX tunnel were evaluated for this phasing concept; items associated with Fourth and Townsend Street Station are excluded, as the deferral of the fit-out of that station is analyzed separately. Refer to Section 6.4.

The operators evaluated several track and platform configuration concepts to meet their desired levels of service. Concept A shown in Figure 6.10 is a configuration that will allow for eight Caltrain trains per peak hour per direction on the DTX until high-speed service arrives. Concept A was selected to evaluate this phasing concept because the alignment is closest to the current DTX design and cost estimate.

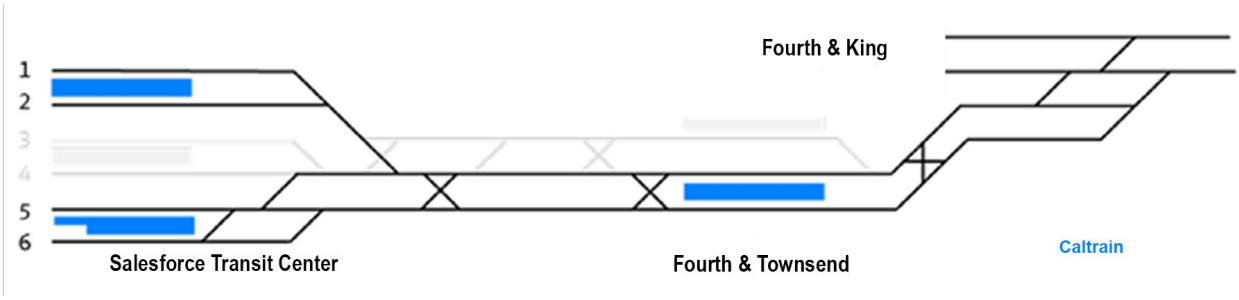


Figure 6.10. Defer CHSRA-related Infrastructure Fit-out - Concept A [Caltrain and CHSRA 2021]

6.5.1 Cost and Schedule Effects

Capital Cost Deviation

Deferring CHSRA-related infrastructure elements would reduce project costs by approximately 0.8%. The estimated reduction it is $38.0 million in 2027 year-of-expenditure dollars.

Caltrain and CHSRA were consulted to identify elements specific to high-speed rail in the 2016 Parsons construction cost estimate (Parsons 2016). These elements were assigned to the appropriate FTA cost categories. To determine quantities, the cost engineers cross-referenced the 2010 preliminary engineering track design plans with schematics developed for the operations analysis (see Figure 6.10).

See Appendix F.5 for a detailed breakdown in FTA SCC format and Appendix G for annotated source material.

Right-of-way

The deferral of CHSRA-related project elements will not affect project right-of-way costs, as the project envelope will remain as environmentally cleared to support Caltrain operations.

Cost of Future Implementation

The cost of future implementation of the fit-out of CHSRA-related infrastructure from 2040 through 2055, assuming an annual average (year-over-year) escalation rate of 5%, range from $72 million to $149 million, as shown in Figure 6.11. These estimates illustrate the escalated cost to construct the phasing concept and do not include allowance for the cost to operators due to operational disruption. If deferred, fit-out of CHSRA-related infrastructure would not be eligible for future funding as an independent project through the FTA CIG program, under current eligibility criteria; however, as a separate project, the fit-out could be included in a federal grant for CHSRA extension of service to the Salesforce Transit Center.

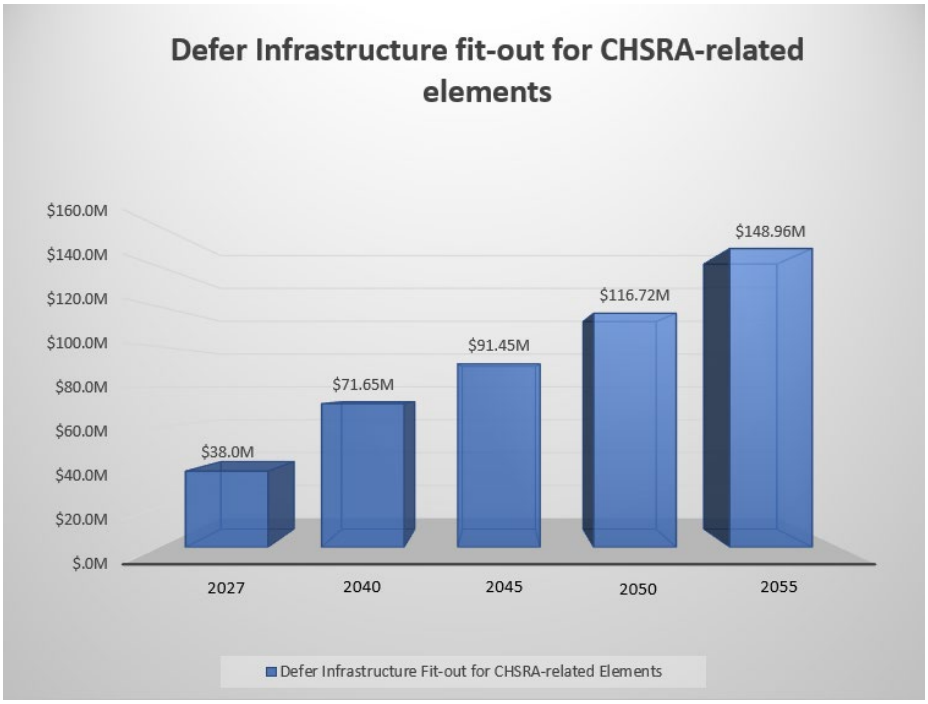


Figure 6.11. Future implementation cost of deferred CHSRA-related elements

Baseline Master Schedule

The current project construction schedule could be slightly improved with the deferral of CHSRA-related project elements, as the track and systems could be completed in less time with less infrastructure to install. This would allow testing and commissioning to begin sooner, leading to revenue operations for Caltrain at an earlier date. Depending on the selected contract packaging strategy, the initial track and systems construction schedule could be reduced as a result of this phasing concept. However, track and systems construction has not been identified as a critical path element at this time.

6.5.2 FTA New Starts Project Justification Evaluation

The infrastructure fit-out for CHSRA-related elements of the station would not have "independent utility," because fit-out of CHSRA-related elements is only needed for CHSRA operations. If CHSRA is not able to provide service to the Salesforce Transit Center by opening day, the infrastructure fit-out for CHSRA-related elements would need to be a separate project from the project funded by the New Starts grant..

6.5.3 Regional Context

Benefits

Deferring CHSRA-related infrastructure would delay some of the regional benefits anticipated with use of the DTX and transit center by high-speed trains. The overall benefits identified in the 2004 FEIS/EIR and 2005 Record of Decision included substantial ridership on high-speed trains (over 200,000 trips annually with 7.8 to 17 million annual high speed rail boardings and alightings at the transit center), due to the better connection to the City's financial and employment center and to the linkages and convenient transfers to and from bus and other rail services at the transit center or nearby (USDOT et al. 2004).

Additionally, the 2004 FEIS/EIR acknowledged the following benefits: greater use of public transit by a larger segment of residents, workers, and visitors; enhanced accessibility to employment, retail, and entertainment opportunities; support for the City's Transit-First Policy and state legislation requiring the new transit center to accommodate Caltrain and future high-speed rail passenger operations; economic development; reduced congestion (by saving 7,200 person hours in travel time and removing 8,000 daily auto trips from Peninsula roadways); improved air quality; and lower transit operating costs. The TJPA's 2020 application to the State's Transit and Intercity Rail Capital Program (TIRCP) shows that the induced ridership on Caltrain and high-speed rail from the DTX would result in an estimated lifetime[3] reduction of 8.5 million metric tons of carbon dioxide equivalent (MTCO2e), nearly 239 thousand pounds of reactive organic gases, 1.3 million pounds of nitrogen oxides, and 1.1 million pounds of small-diameter particulate matter, a reduction in passenger vehicle miles traveled of 27.8 billion, and reduced fossil fuel consumption of 752 million gallons.

These benefits would still occur with the deferral of CHSRA-related infrastructure, but they would take longer to realize. The arrival of high-speed rail service at the transit center, with forecasts of millions of annual boardings and alightings, and connections to statewide destinations, is responsible for a large share of the projected benefits. Of the air quality, greenhouse gas, and travel benefits reported in the TJPA's 2020 TIRCP application, roughly two-thirds of the estimated air emissions and travel reductions are related to high-speed train travel. Deferring construction of CHSRA-related infrastructure now would not diminish these benefits, but they would not be realized until CHSRA service commences. With deferral, construction of the DTX and use of the transit center by Caltrain could occur slightly sooner, thereby enabling the region to reap the still significant benefits associated with Caltrain service to downtown earlier.

[3] "Lifetime" for TIRCP calculation purposes is 50 years.

Effect on Other Regional Projects

The operators and SFCTA have concluded that deferring CHSRA-related infrastructure should not have any impact on other regional projects, provided that fit-out of the necessary infrastructure is completed prior to the start of high-speed rail operations to the Peninsula and San Francisco. If the fit-out were not completed by the negotiated date, then CHSRA would need to coordinate with Caltrain regarding alternative arrangements. These could include use of the Fourth and King Street Station or terminating high-speed rail services short of San Francisco, at either Millbrae or San Jose Diridon stations. Any of these alternatives could have significant impacts on projects and plans at these locations.

Effect on Regional Significance

The lack of CHSRA service would diminish the megaregional and statewide significance of the DTX. Additionally, according to the operators, should the fit-out of CHSRA infrastructure be deferred, the time to install, test, and commission the required infrastructure could create a period during which CHSRA may be ready to access the transit center, but the infrastructure may not be available. Until the CHSRA infrastructure fit-out, testing, and commissioning is completed, the DTX and transit center would be unable to accommodate high-speed rail service from Southern California and the Central Valley. Subject to further discussions with Caltrain, it may be possible for high-speed trains to use the existing, surface-level Fourth and King Street Station as a temporary San Francisco terminus. If the Fourth and King Station is not available, then high-speed trains would be unable to serve the primary market of San Francisco.

Support for Principles of PBA 2050

PBA 2050's equity strategies seek to reduce housing and transportation costs, enable transit riders to access their destinations more easily, reduce risk of displacement, and provide more opportunities for recreation, especially for Communities of Concern. Deferral of CHSRA-related infrastructure would lessen attainment of these strategies, although Caltrain with its 16 stations along the Peninsula between Diridon Station and the Salesforce Transit Center would confer equity benefits for Santa Clara, San Mateo, and San Francisco counties. The arrival of high-speed trains would extend these equity benefits further, providing a better connection between fast-growing, more affordable housing areas in the Central Valley with employment opportunities in the Bay Area.

Effect on Passengers' Cost of Using the Service

The operators have concluded that deferring CHSRA-related infrastructure should not have any impact to passengers' costs of using service. Direct costs to passengers for accessing the infrastructure have not been fully addressed or agreed upon.

6.5.4 Environmental Effect

Consistency with DTX Environmental Documents and/or Need for Additional Review

The 2004 FEIS/EIR and the 2018 Final SEIS/EIR evaluated the DTX with the necessary infrastructure to accommodate CHSRA service. The project footprint, operations, and facilities anticipated use of the rail infrastructure and the transit center by CHSRA. The deferral of CHSRA-related infrastructure would not alter the project footprint or construction envelope; thus, the impacts related to land coverage such as land use and displacement, aesthetics, cultural resources and Section 4(f), geology,

hazardous materials, and hydrology would remain unchanged from those reported in the previous environmental documentation. For those impacts related to ridership and operations, deferral of CHSRA-related infrastructure alone would also not change previously described impacts on air quality, noise, transportation, and safety and security. These impacts are a function of high-speed train service and passenger use of the facilities, not the infrastructure. The approved environmental documents rely on the most current CHSRA business plans to describe when high-speed train service would commence, but its impacts are addressed, and the 2005 Record of Decision and the 2019 Amended Record of Decision identify the project as including CHSRA facilities and service.

According to 23 CFR 771.129, prior to granting any new approval (e.g., authority to undertake final design or approval of plans, specifications, and estimates) related to an action, FTA must determine whether the prior environmental documentation remains valid. This determination is made based on a written evaluation of the final environmental document and is typically required if major steps to advance the project have not occurred within three years of the final environmental document. The extent of the documentation depends on the nature and magnitude of the change to the project, the length of time elapsed since the final environmental document was approved, and changes in conditions and circumstances that may have a bearing on the impacts and mitigation commitments. If a decision to defer the CHSRA-related infrastructure is made, FTA should be advised and provided with any information on the timing of the fit-out for CHSRA use. Pending further discussions with the FTA, it could be determined that minimal environmental analysis would be required, as the 2018 Final SEIS/EIR did not anticipate high-speed train service to the transit center until nearly 2030. Deferral of service to a later date would delay the associated adverse and beneficial impacts of high-speed rail. The FTA would be interested in understanding how deferred use of the transit center by CHSRA may result in new or more severe impacts on nearby circulation by motorized and non-motorized travel, land uses, air quality, socioeconomics. Similarly, the required CEQA review could be completed with an addendum or supplemental initial study/mitigated negative declaration, depending on the potential for new or substantially more significant impacts. Inclusion of the DTX infrastructure without CHSRA-related facilities as part of a revised project would delay advancing the remaining elements of the DTX project until the additional CEQA/NEPA analyses of this phasing concept could be completed.

Community Impact

Because the construction of CHSRA-related infrastructure would occur underground and within the project footprint and envelope, deferral of this infrastructure would not be expected to change the type of impacts that would affect the community, namely, disruption of access and circulation, noise, air emissions, and traffic congestion during construction. However, without the installation of CHSRA-related infrastructure, the duration of construction for Caltrain's infrastructure alone could be minimally reduced, and thus impacts to the community would occur for a slightly shorter duration. Impacts associated with construction of the CHSRA-related infrastructure, when it occurs, would be temporary, construction-related impacts as materials, equipment, and construction crews fit out the tunnel and stations. The duration and intensity of this deferred construction is unknown, but the community impacts would be substantially less because tunneling and cut-and-cover construction methods would not be necessary, and the majority of the work would be performed underground. Community impacts would be likely concentrated in locations where materials, equipment, and construction crews would enter and exit the tunnel and stations.

Dependency on Non-environmentally Cleared Projects

Deferring fit-out of CHSRA-related infrastructure does not have a dependency on another non-environmentally cleared project, as it will not reduce the project footprint.

6.5.5 Operational Effect

Changes to Operations Cost

Deferring fit-out of CHSRA-related infrastructure would not affect estimated operations costs.

The scope defined under this phasing concept will not affect Caltrain's revenue service operations, as the Fourth and Townsend Street Station would function as originally intended.

Effect on Service Flexibility

Without the infrastructure required to accommodate high-speed trains, CHSRA will not be able to serve the Fourth and Townsend Street Station or the transit center. High-speed trains would be restricted to operating to the existing Fourth and King Street Station to provide San Francisco service, subject to suitable, agreeable train and service plans with Caltrain.

Effect on Operational Reliability, Security, and Safety

No differences in security or safety issues are anticipated as a result of this phasing concept. Depending upon any alternate plans agreed between Caltrain and CHSRA, any reliability improvements on the DTX may be offset by disbenefits elsewhere on the Peninsula.

Effect on Future Service Growth

The operators have concluded that future service growth can only be accommodated with increases in the infrastructure provided. This phasing concept provides the minimum necessary infrastructure required to operate the Caltrain service levels identified.

Effect on Service During Future Retrofit

The operators have concluded that the impact on operations during the retrofit for this phasing concept would be significant. Major construction would include:

- Construction of the third track identified, as shown to be necessary in the operations analysis
- Construction of the special trackwork to connect the third track
- Signal system redesign, testing, and commissioning
- Construction or alterations to platforms at the Fourth and Townsend Street Station and the transit center

Each of these activities would require shutdowns of the DTX, which would prevent Caltrain from serving the Fourth and Townsend Street Station and the transit center during those times. Shutdowns could be continuous over a period of months or occur as a series of weekends. An assessment of the tradeoff between construction costs and loss of operator revenue should be made to determine the best approach.

6.5.6 Maintenance Effects

Changes to Maintenance Costs

Deferring the fit-out of CHSRA-related infrastructure elements would result in an annual net savings of $1,576,700 (2027$) in maintenance costs.

A 2008 technical memorandum by Parsons (Parsons 2008) summarizes annual maintenance costs for the following categories: escalators, elevators, mezzanine maintenance, platform maintenance, HVAC, electrical/plumbing, building interior, and utilities. No savings were recognized for grounds services and service contracts categories. See Appendix I for annotated source material for operations and maintenance annual savings. The 2016 ISES Corporation O&M report was used to source annual maintenance costs for janitorial services and were applied on a cost-per-gross-square-foot-basis to the deferred area of the CHSRA-dedicated platform in the transit center.

Each maintenance-related element was calculated on a cost-per-gross-square-foot-basis, and applied to the deferred scope. The Parsons findings were escalated from 2008$ to 2027$, which resulted in estimated annual maintenance savings of $1.6 million (2027$).

See Appendix H for annual savings calculations and Appendix I for annotated source material.

Effect on O&M Responsibilities

O&M responsibilities for the tunnel and rail infrastructure have not yet been determined. If Caltrain-only infrastructure were constructed, these responsibilities would be negotiated with Caltrain only, not both rail operators. As part of completion, certification, and opening of high-speed train revenue operations, an agreement would be required to determine how O&M responsibilities would shift, if necessary.

Effect on Maintenance Access and Crew Safety

Caltrain and CHSRA have concluded that no change to maintenance access or crew safety would result from implementation of this phasing concept.

Effect on Response Time for Repairs

Caltrain and CHSRA have concluded that no changes to the response time for repairs would result from the implementation of this phasing concept.

Effect on Resilience

The deferral of CHSRA-related infrastructure would not have an impact on project resilience, as the project envelope will remain the same to support Caltrain operations.

6.6 Two-Cell DTX Tunnel Configurations

In Workshop 0, Caltrain and CHSRA presented updates on their operational assumptions, which supported the need for a resilient three-track alignment. Subsequently, the IPMT confirmed that further operations analysis was needed to verify prior studies that supported three tracks in the DTX tunnel (i.e., a "three-cell" tunnel) between Fourth and Townsend Street Station and the throat structure entering the Salesforce Transit Center. The Phasing Study Operations Analysis results are presented in Appendix F.6.

The IPMT concluded that should a three-cell tunnel be required operationally, three other configurations to potentially eliminate the need for the three-cell tunnel should be reexamined or investigated in the context of the Phasing Study. These configurations include (1) the addition of tail tracks at the east end of the Salesforce Transit Center, (2) a loop track, and (3) through-running tracks to the East Bay.

6.6.1 Two-Cell DTX Tunnel

This concept would construct a two-cell tunnel instead of the currently designed three-cell tunnel. As illustrated in Figure 6.12, the configuration change to a two-cell tunnel would be permanent: adding a third track to the constructed two-cell tunnel would be infeasible because of constructability concerns and insufficient available public right-of-way.

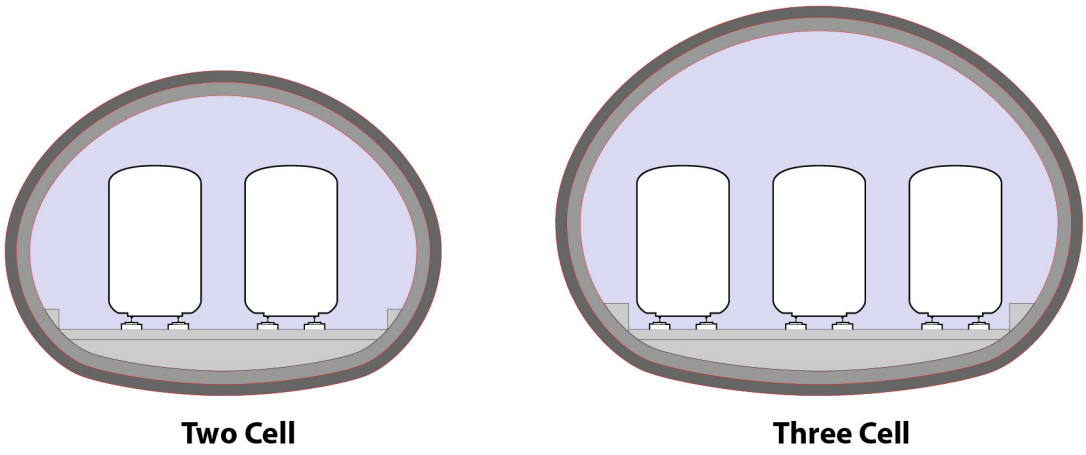


Figure 6.12. Two-cell and three-cell tunnel cross sections

The length of the two-cell tunnel portion of the DTX alignment would be approximately 2,000 feet and does not include trackwork with crossovers, a three-track Fourth and Townsend Street Station, or the throat trackwork that expands to six tracks in the Salesforce Transit Center beginning at approximately Folsom Street.

Cost and Schedule Effects

The incremental cost savings of building a two-cell tunnel as compared to a three-cell tunnel are estimated at $203 million in 2027 year-of-expenditure dollars.

To estimate this phasing concept, PMPC engineers used conceptual cost estimates prepared in 2008 as part of a value management exercise to identify areas where project cost and schedule efficiencies could be achieved, including cost savings for a two-track tunnel. The estimates prepared in 2008 included costs savings for the Fourth and Townsend Street Station, as it was assumed that the station would be different if a two-track tunnel were built (URS 2008). However, the cost savings for the station were not considered in the estimate for this phasing concept, as the current plans would include the same station design for either two or three tracks in the tunnel. The cost estimate includes escalation, professional services, construction contingency, and program reserve. It is not anticipated that any additional savings from right-of-way would be realized, as the geometry of the throat structure requires the expansion of the tracks to six at approximately Folsom Street. See Appendix F.6 for a detailed breakdown in FTA SCC format.

Depending on construction approach, a two-cell tunnel could offer some schedule savings. The DTX tunnel will use mined tunneling methods along portions of Townsend Street and Second Street between the Fourth and Townsend Street Station and the throat structure. If the mined portion of the DTX tunnel includes a length of two-cell tunnel and a combination of tunnel boring machine and sequential excavation methods (TBM+SEM concept) is chosen, the 2,000-foot two-cell portion would be mined using TBMs. A sequentially excavated third bore would then be mined between the TBM tunnels to create a third trackway for the balance of the tunnel, as shown in Figure 6.13.

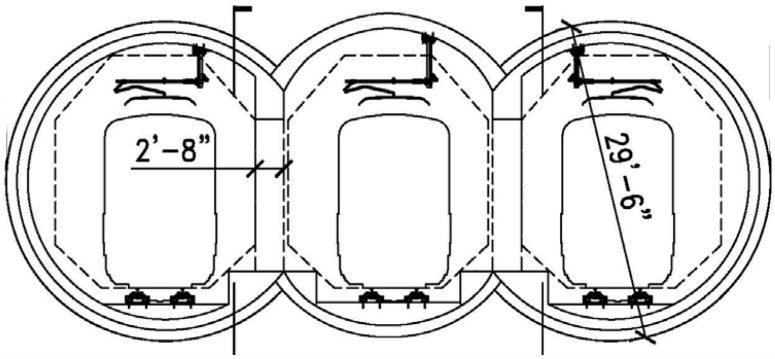


Figure 6.13. Typical Three-Cell Running Tunnel (Parsons 2018a)

In 2018, the DTX design team prepared an addendum to the Tunnel Options Study (see Section 3), which included a construction schedule for the TBM+SEM concept for the three-cell tunnel. As construction of caverns for crossovers and the third cell would be simultaneous, no time savings would be recognized by removing the construction of the SEM for the third cell for the approximately 2,000 feet. The TBM+SEM concept was determined to be a schedule improvement of approximately three months when compared with the baseline SEM approach (Parsons 2018b). Should a two-cell tunnel be constructed using the SEM concept, there would be some schedule savings, though it would likely not be significantly more than the schedule savings realized by using the TBM+SEM approach.

Additional savings may be realized by reducing construction risks, both in hard costs and schedule delays. Though the additional savings may be offset by the risk to future operational reliability, which could have economic impacts for the region. These risks were neither qualitatively nor quantitatively assessed in this study.

Regional Context – Effect on Other Regional Projects

The Link21 team has advised the IPMT that it views constraints on capacity of the DTX tunnel as a Link21 program risk because it may unfavorably limit the number and reliability of trains traversing the tunnel, including trains that would use a future transbay crossing. To address this concern, the operators will conduct a planning-level analysis of the transit center as a through-running station to examine the impacts on the operational capacity of Concept B Prime and Concept B Prime Reduced.

Operational Effect –Service Flexibility

The latest CHSRA business plan indicates that high-speed service will commence with four trains per hour per direction in late 2031. Caltrain plans to operate six trains per hour per direction once its electrification program is complete in 2024, and this will increase to eight trains per hour per direction no later than 2040, based on its adopted 2040 Long Range Service Vision. The Phasing Study operations analysis determined that Concept B Prime Reduced layout would accommodate these planned service levels.

The operations analysis and the track layout options developed by the operators are discussed in Section 4.

6.6.2 Two-Cell DTX Tunnel with Tail Tracks

The two-cell DTX tunnel with tail tracks concept encompasses five tracks extending from the east side of the Salesforce Transit Center and narrowing to two tail tracks in Main Street to just south of Harrison Street, as shown in Figure 6.13.The IPMT identified the addition of tail tracks as a potential means to mitigate the need for the three-cell DTX tunnel. The addition of tail tracks to the project was evaluated in 2004 (USDOT et al. 2004) and, as a result, significant information regarding the layout of those tracks, along with associated costs and effects are available. The 2004 environmentally cleared DTX alignment included tail tracks.

In 2007, the TJPA Board of Directors adopted an addendum to the 2004 FEIS/EIR (TJPA 2007) that delayed construction of the tail tracks on Main Street pending the outcome of future rail planning studies to optimize Caltrain operations and accommodate high-speed rail. Nevertheless, the tail track concept was carried through the 2010 preliminary engineering design (also shown on Figure 6.13), which included the southern two tracks extending from the transit center for Caltrain's exclusive use, which, due to their limited radii, precluded use by high-speed trains. Construction of the tail tracks would use the cut-and-cover method, extending down Main Street for approximately 680 feet. In 2010, the design of the as-yet unconstructed transit center train box included a curved southern wall to allow for the curved extension from the two southernmost tracks.

Conditions have changed and now preclude the 2010 alignment of the tail tracks from the southernmost tracks in the transit center:

- The existing transit center train box was constructed without a curved southern wall, as the intent at the time of construction was to extend the train box to the east side of Main Street. This fully extended configuration would preclude tail tracks on Main Street. However, as part of the Phasing Study, a reduced train box extension is being considered (see Section 5.2) which may allow tail tracks to be extended down Main Street from different transit center tracks than were envisioned in 2010.
- Park Tower, a high-rise building with multiple levels of underground parking, has been constructed on Transbay Redevelopment Project Area Block 5, just south of the train box at Howard and Beale streets. The geometry of the building and underground parking precludes the 2010 alignment from the two southern tracks of the transit center.

The geometry of the reduced train box along with the other constraints described will allow only two tail tracks for Caltrain's use; these would extend from the tracks serving the center platform at the transit center. The depth and ground conditions would require cut-and-cover construction for the tail tracks. This configuration with a two-track DTX tunnel is analyzed in this phasing concept.

Cost Effects

The two-cell tunnel with tail tracks, exclusive of right-of-way, is $280 million more expensive in 2027 year-of-expenditure dollars than the environmentally cleared three-cell tunnel. Adding the cost of the right-of-way required to construct tail tracks will raise the cost of this concept further above the cost of the three-cell tunnel. The IPMT concluded that this solution does not meet the basic intent of the Phasing Study, and therefore, did not subject it to a full analysis. This section further discusses the cost analysis.

To estimate this phasing concept, PMPC engineers used the conceptual cost estimates for both two- and three-cell tunnels prepared in 2008 as part of the value management exercise. These estimates included the cost of tail tracks, which was removed from the three-cell estimate to compare the estimated cost of a two-cell tunnel with tail tracks with the cost estimate for the three-cell tunnel. This cost estimate is exclusive of right-of-way and includes escalation, professional services, construction contingency, and program reserve. See Appendix F.6 for a detailed breakdown in FTA SCC format.

Additional savings may be realized by reducing construction risks, both in hard costs and schedule delays. These risks will be the subject of qualitative and quantitative analysis and mitigation as design development progresses.

Regional Context – Effect on Other Regional Projects

With the exception of BART and Capitol Corridor's Link21 program, SFCTA has concluded that the addition of tail tracks on Main Street would not directly affect other regional projects.

Relative to Link21, the tail track alignment is consistent with one of the alignment options under consideration for a future rail extension from the transit center to the East Bay. The tail tracks would allow the DTX to connect to a future transbay rail crossing, though the feasible curve radius would not meet CHSRA's design criteria minimum of 650 feet. Conversely, the tail track alignment could be inconsistent with another Link21 alternative that envisions a direct easterly route from the transit center toward the San Francisco Bay.

The Link21 team has advised the IPMT that it views constraints on capacity of the DTX tunnel as a Link21 program risk because it may unfavorably limit the number and reliability of trains traversing the tunnel, including trains that would use a future transbay crossing. To address this concern, the operators will conduct a planning-level analysis of the transit center as a through-running station to examine the impacts on the operational capacity of Concept B Prime and Concept B Prime Reduced.

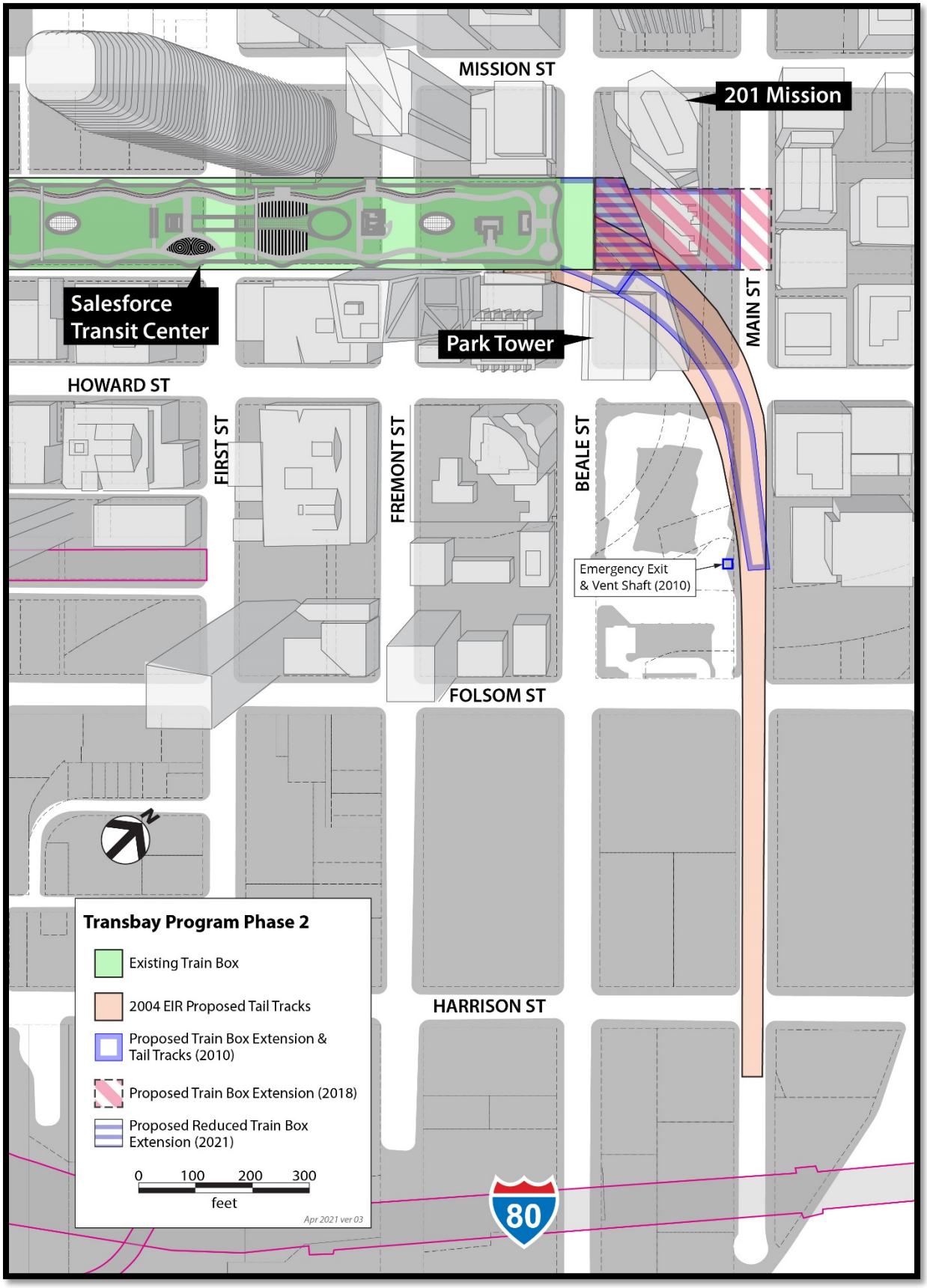


Figure 6.14. DTX Tail Track Configuration Previously Studied Alternatives

6.6.3 Two-Cell DTX Tunnel with a Loop

The two-cell DTX tunnel with a loop concept would reduce the DTX tunnel to two tracks and add a single-track loop from the east end of the Salesforce Transit Center, as shown in Figure 6.14.

The concept of a loop has been studied throughout the history of the DTX project. In 2006, a value management exercise resulted in a recommendation to study a loop configuration. A loop would transform the transit center from a stub-end station into a through-station with the goal of increasing capacity and facilitating a connection to a future transbay rail crossing. From 2006 to 2008, the TJPA studied the potential to reduce the number of tracks in the DTX tunnel and add a loop.

In 2008, Parsons summarized the six studied alternatives and identified a preferred loop alternative with two tracks in the DTX tunnel and one loop track (Parsons 2008a). In the preferred loop alternative, all tracks at the transit center would access the loop through the east end of the transit center through a second throat structure. The loop would then progress south on Main Street, along The Embarcadero to Townsend Street, and connect with the DTX at approximately Third and Townsend streets (see Figure 6.14). Because of the Park Tower development and CHSRA's increase of minimum track radii requirements since 2008, the Main Street loop and associated throat structure are no longer viable; however, they provide a benchmark for cost comparison purposes.

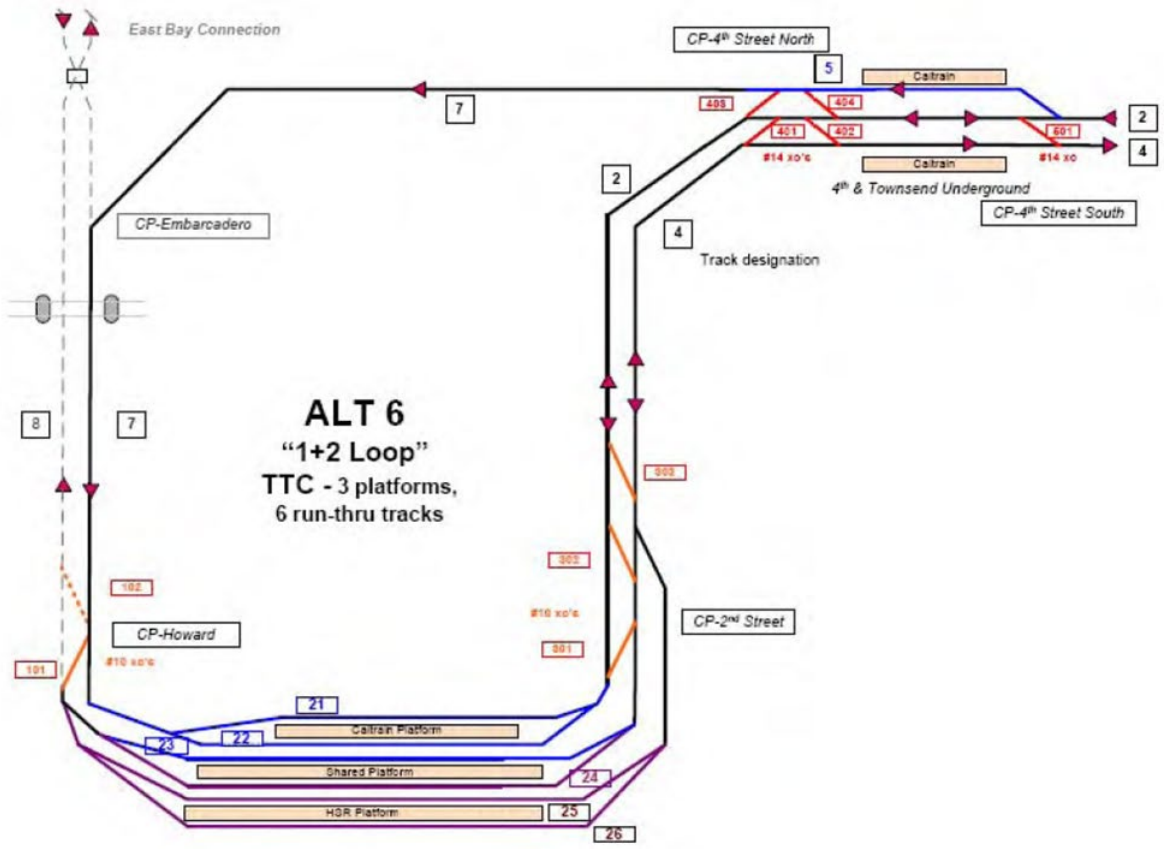


Figure 6.15. Loop concept with two tracks in the DTX tunnel and one loop track (Parsons 2008)

The loop concept was examined again as part of the Railyard Alignment and Benefits (RAB) Study between 2014 and 2018 (SF Planning 2018). The RAB Study reviewed four loop alignments including Main Street, Spear Street, and Stuart Street and an option that extended under San Francisco Bay.

The preferred Main Street loop alignment from the 2008 study was used for the cost evaluations in this section; the other evaluations are based on a Spear Street loop alignment.

Cost and Schedule Effects

The two-cell DTX tunnel with a loop concept would increase the cost of the DTX project because the cost to construct the two-cell DTX tunnel with loop track would exceed the cost of the three-cell DTX tunnel by approximately $1.2 billion (2027$). The IPMT concluded that this solution does not meet the basic intent of the Phasing Study, and therefore, did not subject it to a full analysis. This section further discusses the cost analysis.

To estimate this phasing concept, PMPC cost engineers developed a construction cost estimate using Parsons' DTX Loop Track Cost Report (Parson 2008b) as a basis, as follows:

- The construction costs of the preferred loop alternative, one loop track on Main Street, with a two-cell DTX tunnel, was $1.47 billion (2007$). The cost to construct a single-track loop (assumed tunnel boring machine approach) alone was estimated at approximately $0.42 billion (2007$).
- This estimate was compared to the three-cell DTX tunnel construction cost of $1.11 billion in the 2007 refined LPA (2007$) (Parsons 2007).
- The construction subtotal costs of a two-cell DTX tunnel with a single-track loop is $358 million (2007$) more than that of a three-cell DTX tunnel – the refined locally preferred alternative (RLPA). The total cost to of a two-cell DTX tunnel with a single-track loop is $1.2 billion (2027$) more than that of the RLPA configuration.

This construction cost excludes construction costs of ventilation structures for the loop and additional right-of-way costs.

Refer to Appendix F.6 for a detailed breakdown in FTA SCC format.

Regional Context – Effect on Other Regional Projects

With the exception of BART and Capitol Corridor's Link21 program, SFCTA has concluded that the addition of the loop track would not directly affect other regional projects.

Relative to Link21, the loop track alignment could be consistent with one of the alignment options under consideration for a future rail extension from the transit center to the East Bay. However, the Link21 program envisions a two-track connection, which is not considered in this concept. Conversely, the loop track alignment could be inconsistent with the Link21 alternative that envisions a direct easterly route from the transit center toward San Francisco Bay.

The Link21 team has advised the IPMT that it views constraints on capacity of the DTX tunnel as a Link21 program risk because it may unfavorably limit the number and reliability of trains traversing the tunnel, including trains that would use a future transbay crossing. To address this concern, the

operators will conduct a planning-level analysis of the transit center as a through-running station to examine the impacts on the operational capacity of Concept B Prime and Concept B Prime Reduced.

Operational Effects –Service Flexibility

The operations analysis showed that the track and platform configuration at the transit center necessitates a third track in the DTX tunnel to provide sufficient capacity that meets the operational parameters to deliver the peak-hour service plan of eight Caltrain and four CHSRA trains (8+4 service plan). Because this phasing concept trades that third track for the loop track, the operators have concluded that it is fatally flawed and not acceptable.

6.6.4 Two-Cell DTX Tunnel with Through-Running Transit Center Station

In June 2020, the TJPA examined potential connections to a future transbay rail crossing (Parsons 2020) and identified potential alignments on Main Street (for Caltrain-only due to CHSRA radii requirements), Spear Street, and a direct route straight from the east end of the transit center, as shown in Figure 6.15.

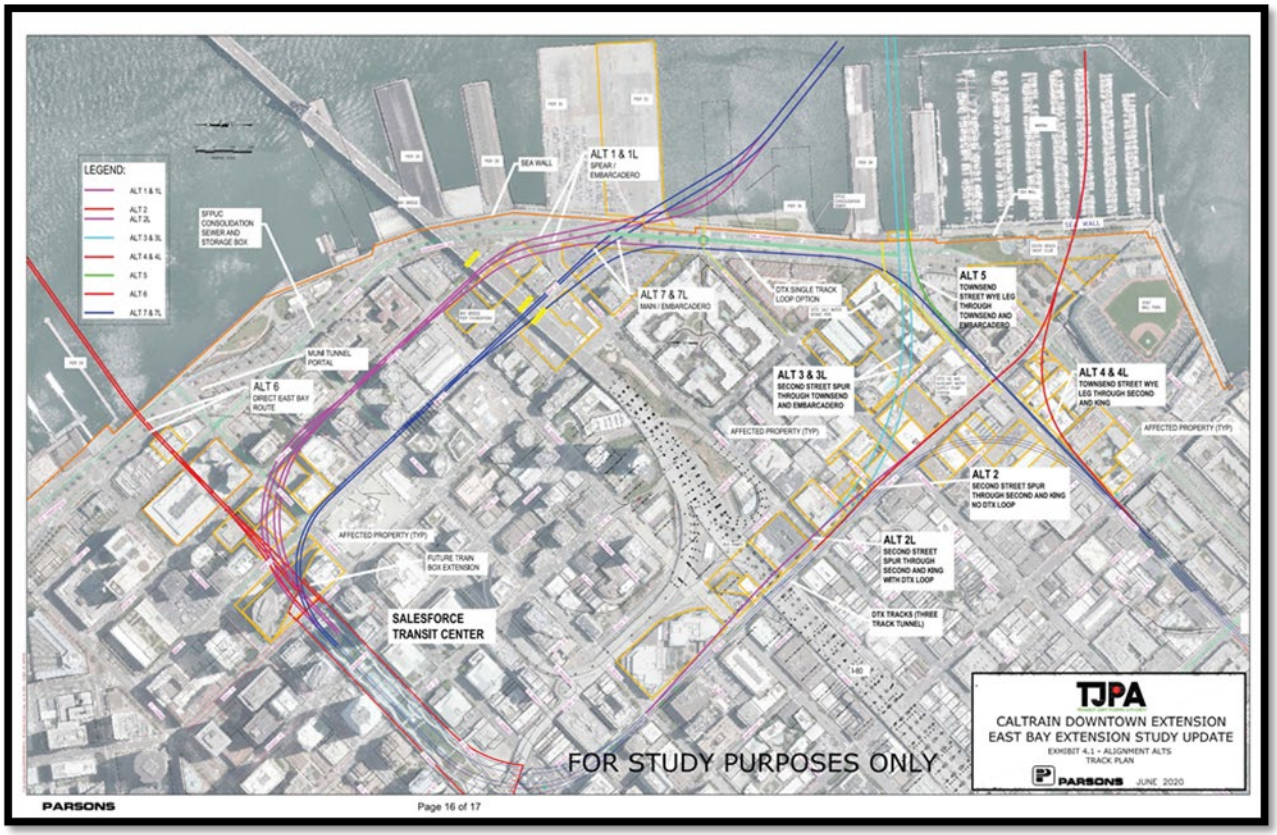


Figure 6.16. DTX Through-Running Alternatives (Blue - Main Street, Purple - Spear Street, Red – Direct) (Parsons 2020)

The two-cell DTX tunnel with through-running transit center station concept assumes that the DTX tunnel could take advantage of a potential future connection to the East Bay to manage future capacity needs.

The comments in this section assume that a second crossing to the East Bay will be compatible with Caltrain and high-speed trains and that the alignment chosen creates a through-running opportunity at the Salesforce Transit Center. Any such run-through would provide opportunities to provide train services between the Peninsula, East Bay destinations, and Stockton and Sacramento as part of a megaregional transit plan. These opportunities would potentially be available to operators other than Caltrain and CHSRA, including the San Joaquin Regional Rail Commission (ACE) and Capitol Corridor Joint Powers Board (Capitol Corridor).

The latest CHSRA business plan indicates that high-speed service will commence with four trains per hour per direction from late 2031. Caltrain currently plans to operate six trains per hour per direction once its electrification program is complete in 2022, and this will increase to eight trains per hour per direction no later than 2040, based on its adopted 2040 Service Vision.

Link21 Considerations

BART and Capitol Corridor's Link21 program is currently in the early stages of development and has not yet determined a preferred alignment, technology, or rail gauge options to meet their goals and objectives for a future transbay rail crossing. As expected at this stage of development, all options remain available for consideration. For example, Link21 may determine that a second transbay crossing best meets stakeholder needs if it provides additional capacity for the BART network only and does not provide a standard gauge rail crossing of the Bay. BART's infrastructure and trainset design, however, are incompatible with Caltrain and CHSRA standards. Most significantly, BART operates on a wider track gauge with vehicles that may not meet collision requirements, and therefore a BART-only connection would not relieve congestion and conflicts on the DTX.

Link21's current program timeline envisions opening a transbay crossing for service in 2040. The Link21 program is currently in the very early planning stage, and a connection to the transit center is not certain. The Link21 program team participated in phasing workshops to provide perspective on the various phasing concepts' potential impact on DTX–Link21 compatibility. During Workshop 2, the Link21 project team advised the IPMT that reducing the DTX tunnel from three to two tracks was viewed as a Link21 project risk, possibly affecting the capacity of the DTX by limiting the number and reliability of trains traversing the tunnel, including those trains that would use a future Link21 crossing. The Link21 project team stated:

> We have received briefings on the operational modeling for DTX and it would seem that even a three-bay DTX tunnel poses operational constraints. A robust service level through the transbay crossing is required to justify investment into Link21. Link21 is envisioning scenarios where not all trains that cross the Bay would continue to San Jose. At this point, there is no other location to turn trains around in the northern peninsula which makes flexibility in DTX important to the Link21 Program.

The 2040 Service Vision provides a service plan with all trains terminating at the transit center regardless of a future connection to the East Bay. While CHSRA is interested in exploring the opportunities that a second transbay crossing would provide, decisions will not be made until the

Link21 program is more developed. Therefore, it must be assumed that CHSRA trains will turn at the transit center. Furthermore, it should be noted that any increase beyond the 12 trains per hour per direction on the DTX will trigger the need for additional major infrastructure further down the Peninsula. Link21 has not defined their frequencies of service yet; however, the level of train services required to justify the construction of a transbay tunnel is likely to be high. Accordingly, Link21 may propose increases to the number of trains using the DTX for through movements and for turnbacks, which would require the maximum number of tracks possible.

To address this concern, the operators will conduct a planning-level analysis of the transit center as a through-running station to examine the impacts on the operational capacity of Concept B Prime and Concept B Prime Reduced.

7. RESULTS AND RECOMMENDATIONS

IPMT members evaluated each phasing concept prior to Workshop 2. The results summarized in the following sections include charts that show the consensus achieved on each evaluation criterion during Workshop No. 2.

The results of cost estimating for each phasing concept are summarized in Table 7.1. Table 7.2 presents the IPMT's recommendation for each phasing concept.

Table 7.1. Cost Savings ($ millions in 2027$) by Phasing Concept

Phasing Concept	Capital Cost Savings	Annual O&M Cost Savings
Defer BART/Muni Pedestrian Connector	$221.3	$0.47
Reduce Train Box Extension	$86.8	$1.73
Defer Intercity Bus Facility	$40.3	$0.57
Reduce Intercity Bus Facility	$28.1	$0.53
Defer Fit out of Fourth & Townsend	$28.9	$1.01
Defer Infrastructure Fit-out for CHSRA-related Elements	$38.0	$1.58

Table 7.2. IPMT Recommendations on Phasing Concepts

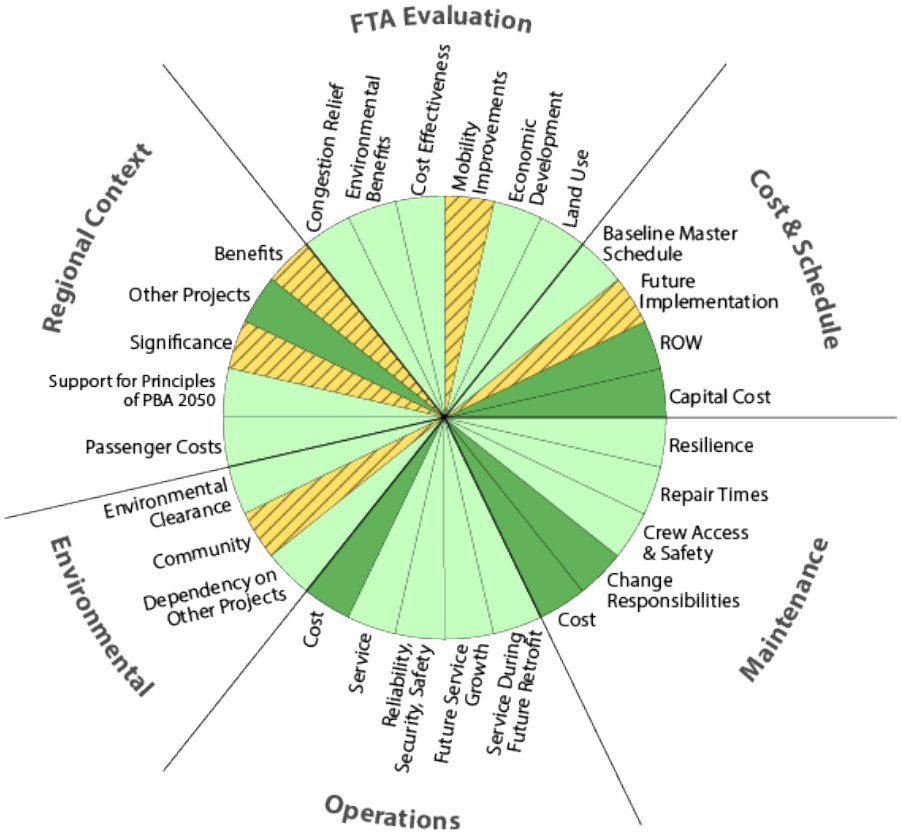
Phasing Concept	Recommendation
Defer BART/Muni Pedestrian Connector	Accept*
Reduce Train Box Extension	Accept
Defer Intercity Bus Facility	Accept
Reduce Intercity Bus Facility & Defer Until Operationally Required	Accept
Defer Fit-out of Fourth and Townsend Street Station	Reject
Defer Fit-out for CHSRA-related elements	Reject

* Provided that an environmental review of street-level mitigations is undertaken

7.1 Defer BART/Muni Pedestrian Connector

The IPMT concluded that deferring the BART/Muni pedestrian connector would generally have a positive effect on the Phase 2 project cost and schedule, with the exception of the cost of future implementation, as constructing the connector in the future would be more expensive. Deferral would not have a significant effect on the FTA's New Starts evaluation, though the FTA could view the connector as providing mobility improvements, and therefore not building the connector could be viewed as a negative. The IPMT had mixed opinions on regional effects: deferring the connector to allow BART time to design planned station modifications at the BART/Muni Embarcadero Station was considered favorable, and it was agreed that deferral would not change support for the Plan Bay Area 2050 principles or affect passenger costs. However, deferral could affect the perceived connectivity to BART and thus the regional significance and benefits of a convenient underground connection. Generally, no significant changes would be anticipated relative to the environmental criteria, with the exception of community impacts, which would be greater should the connector be constructed separately from the rest of the Phase 2 project, as it would cause construction disruption to the area twice. Operations and maintenance would not be significantly different except, with deferral, operations and maintenance costs would be lower.

After Workshop No. 2, the IPMT recommended accepting the deferral of the BART/Muni pedestrian connector provided that an environmental review of the street-level mitigations is undertaken. Preliminary comments from the Executive Steering Committee noted that impacts to Caltrain ridership, if any, should be identified. Two IPMT members noted that to avoid affecting ridership, the need for pedestrians to make seamless transfers to Market Street needs to be evaluated in the design and incorporated into the cost estimate.



Charts show majority opinions among IPMT members.

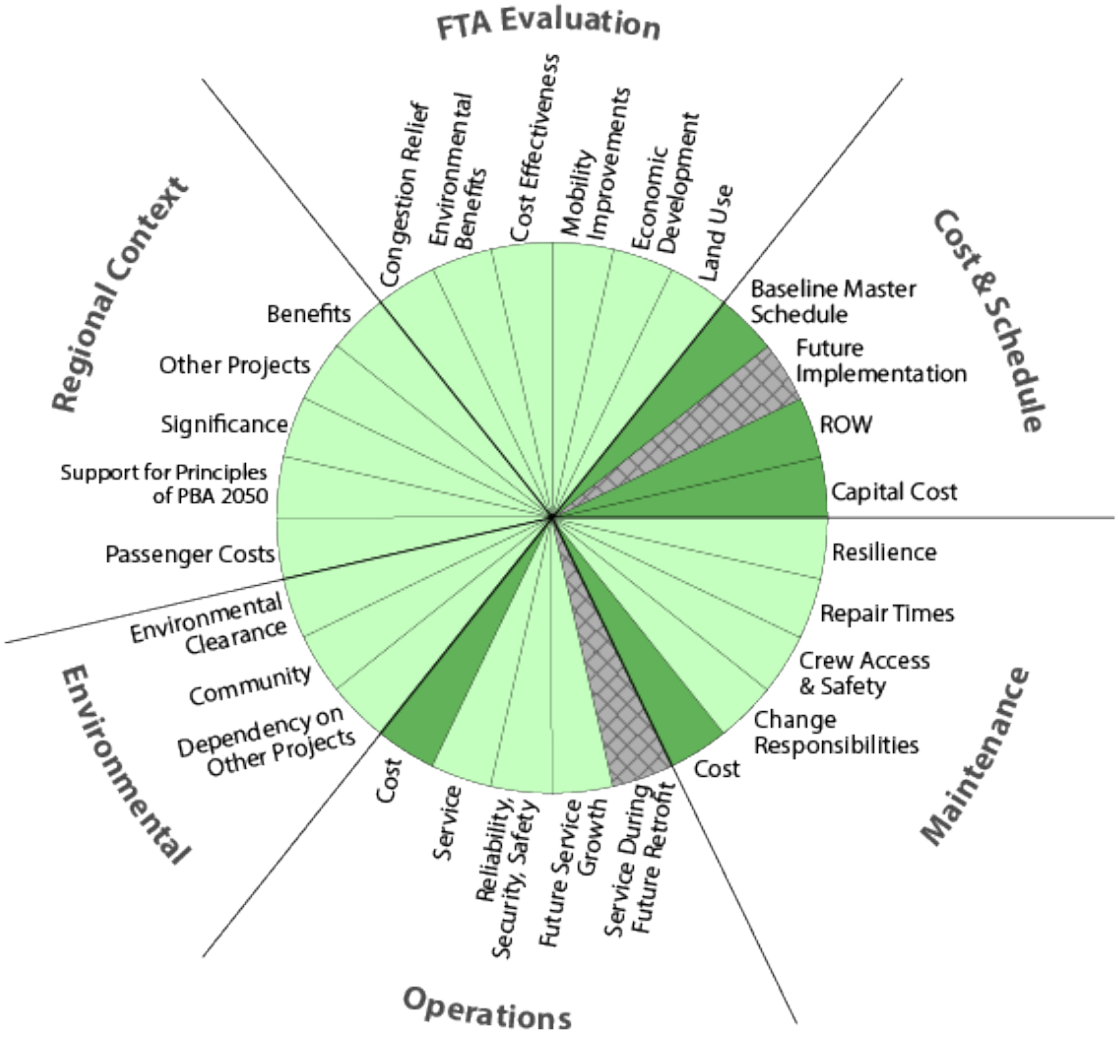
Evaluation Key

- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project

7.2 Reduce Train Box Extension

The IPMT concluded that reducing the train box extension would have a positive effect on the Phase 2 project costs and schedule; the cost of future implementation was not evaluated, as this phasing concept would result in the permanent footprint for the train box. The FTA's New Starts evaluation and regional and environmental effects of the Phase 2 project would not be significantly different. Likewise, operations and maintenance would not be significantly different, except that operations and maintenance costs would be lower.

After Workshop No. 2, the IPMT recommended accepting the reduction of the train box extension.



Charts show majority opinions among IPMT members.

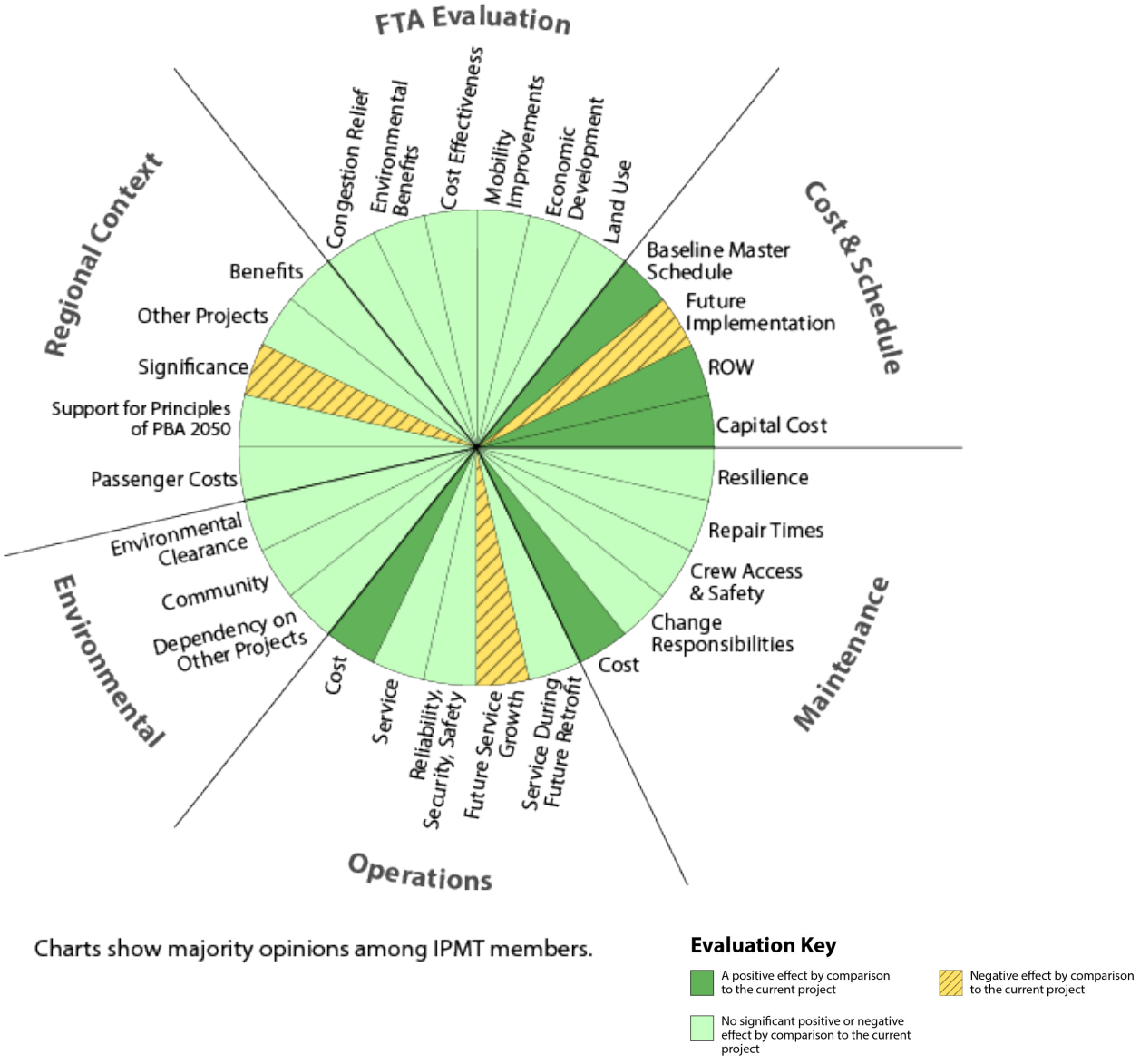
Evaluation Key

- A positive effect by comparison to the current project
- Negative effect by comparison to the current project
- No significant positive or negative effect by comparison to the current project

7.3 Defer Intercity Bus Facility

The IPMT concluded that deferring the intercity bus facility would have a positive effect on the Phase 2 project cost and schedule, with the exception of the cost of future implementation, which was considered a negative, as deferring construction of the IBF would result in higher costs. Deferral of the IBF would not significantly affect the FTA's New Starts evaluation or the environmental effects associated with the Phase 2 project. Similarly, deferral would not affect the regional effects, with the exception of regional significance, which could be diminished should regional bus operators require the facility before the IBF is constructed. Operations and maintenance would not be significantly different, except that the costs associated with these categories would be lower. The one exception was for future service growth, which would be limited for regional bus operators should they required additional capacity prior to construction of the IBF.

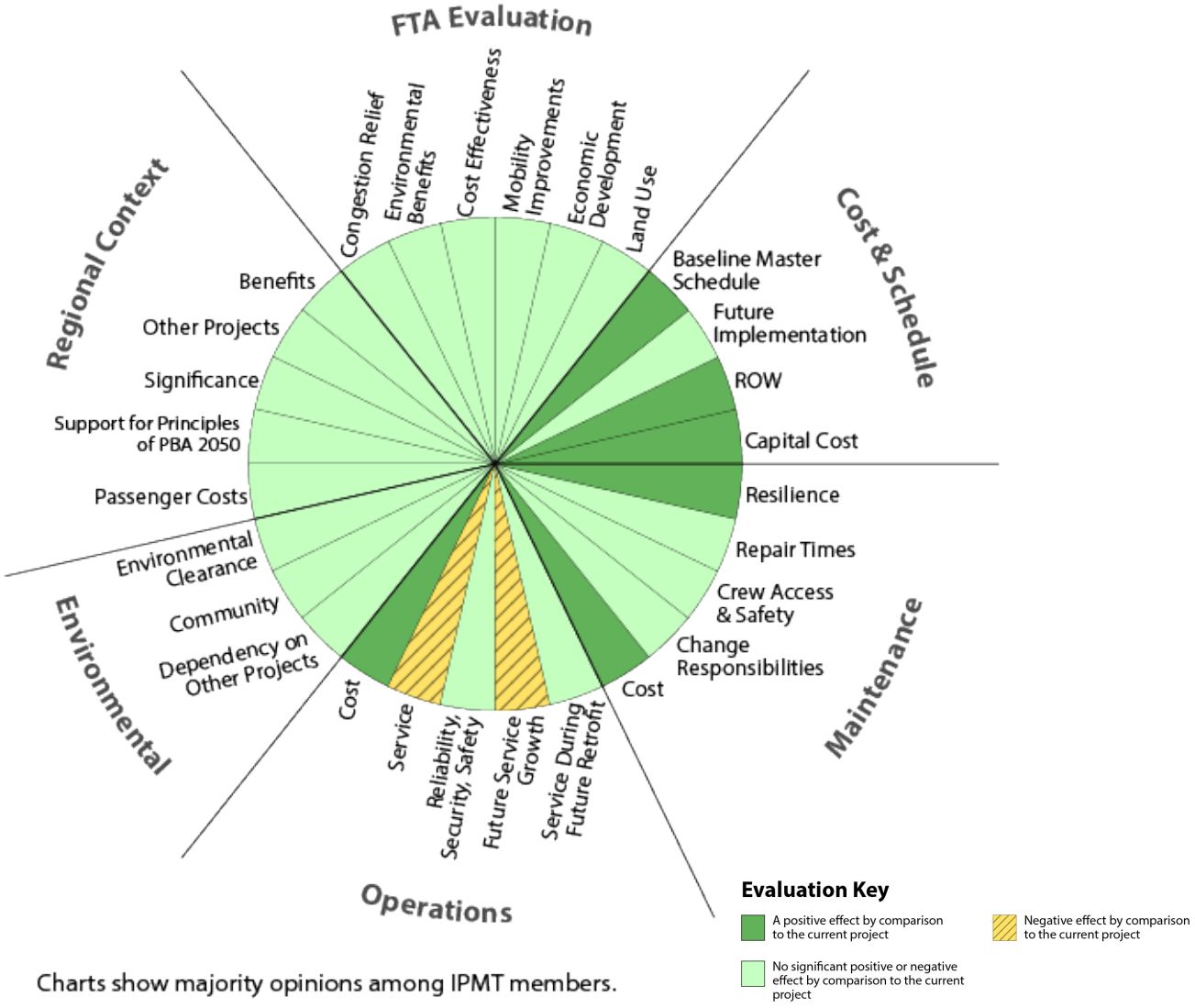
After Workshop No. 2, the IPMT recommended accepting deferral of the IBF.



7.4 Reduce Intercity Bus Facility

The IPMT concluded that reducing the intercity bus facility would generally have a positive effect on the Phase 2 project cost and schedule. The FTA's New Starts evaluation and regional and environmental effects would not be significantly different from the Phase 2 project. Likewise, maintenance of the reduced facility would not differ significantly from the IBF as currently planned, except that maintenance costs would be lower and resilience would improve with reduction of the facility. The effects to operations, however, are mixed: operations costs would improve but service and future service growth would be negatively affected, due to the smaller footprint of the facility, which would provide less room for passengers and buses.

After Workshop No. 2, the IPMT recommended accepting the reduced IBF and building it if and when it becomes operationally needed by the regional bus operators. Preliminary discussion with the Executive Steering Committee confirmed that changes in intercity bus ridership should be monitored.

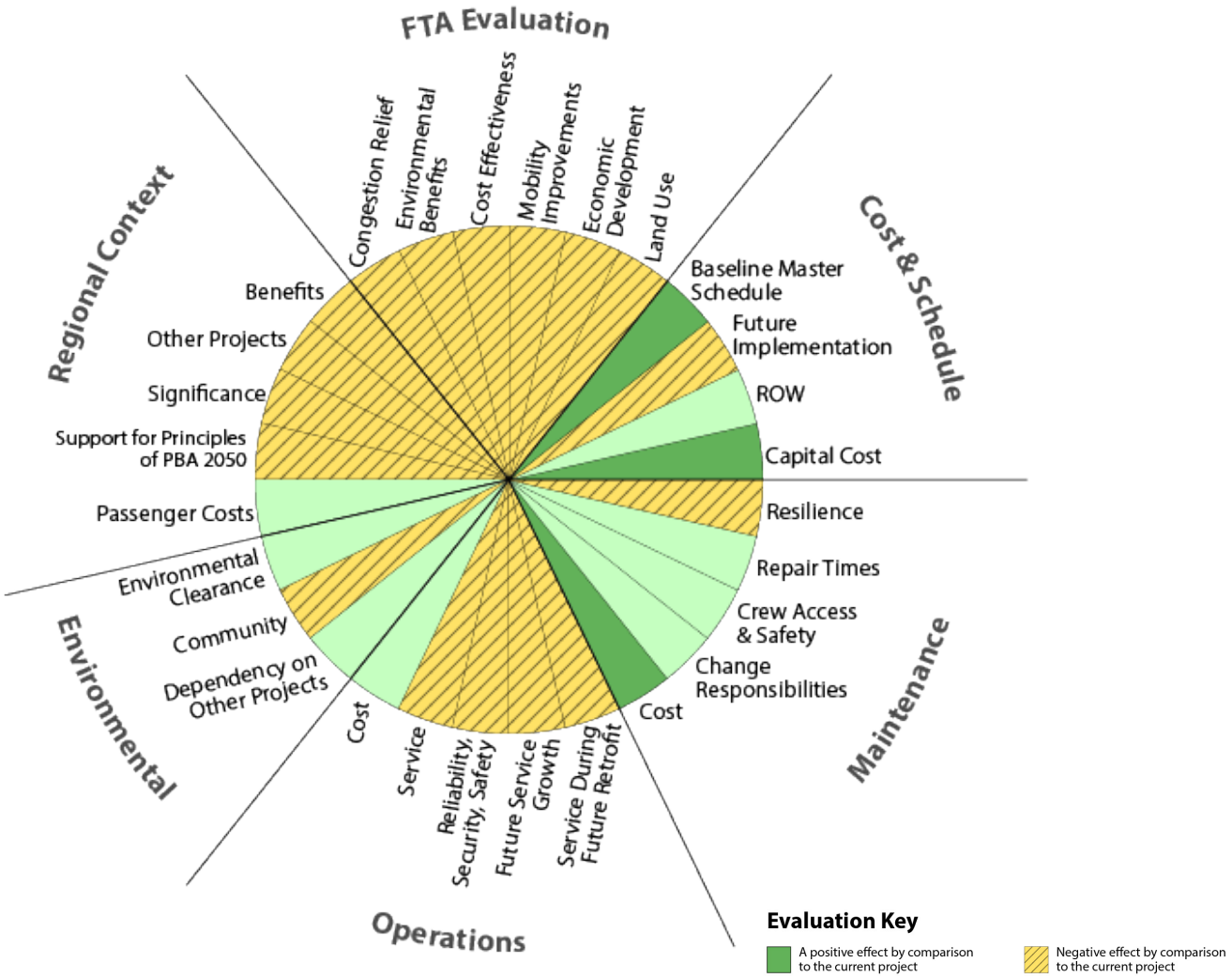


Charts show majority opinions among IPMT members.

7.5 Defer Fit-out of the Fourth and Townsend Street Station

The IPMT concluded that the effects of deferring the fit-out of Fourth and Townsend Street Station on the Phase 2 project cost and schedule were mixed: while effects to capital costs and schedule were positive, the cost of future implementation was viewed as a negative, as the fitout would be more costly if constructed at a later time. The FTA's New Starts evaluation, regional impacts, and operations would be negatively affected, compared with the current project. The environmental impacts would remain mostly the same with the exception of community impacts, which would be greater, as constructing the fitout separately from the rest of the project would cause construction disruption to the area twice. Maintenance would generally not be affected, with the exception of maintenance costs, which would improve, and resilience, which would be negatively affected.

After Workshop No. 2, the IPMT recommended rejecting deferral of the fitout of the Fourth and Townsend Street Station and constructing the fit-out with the rest of the project.

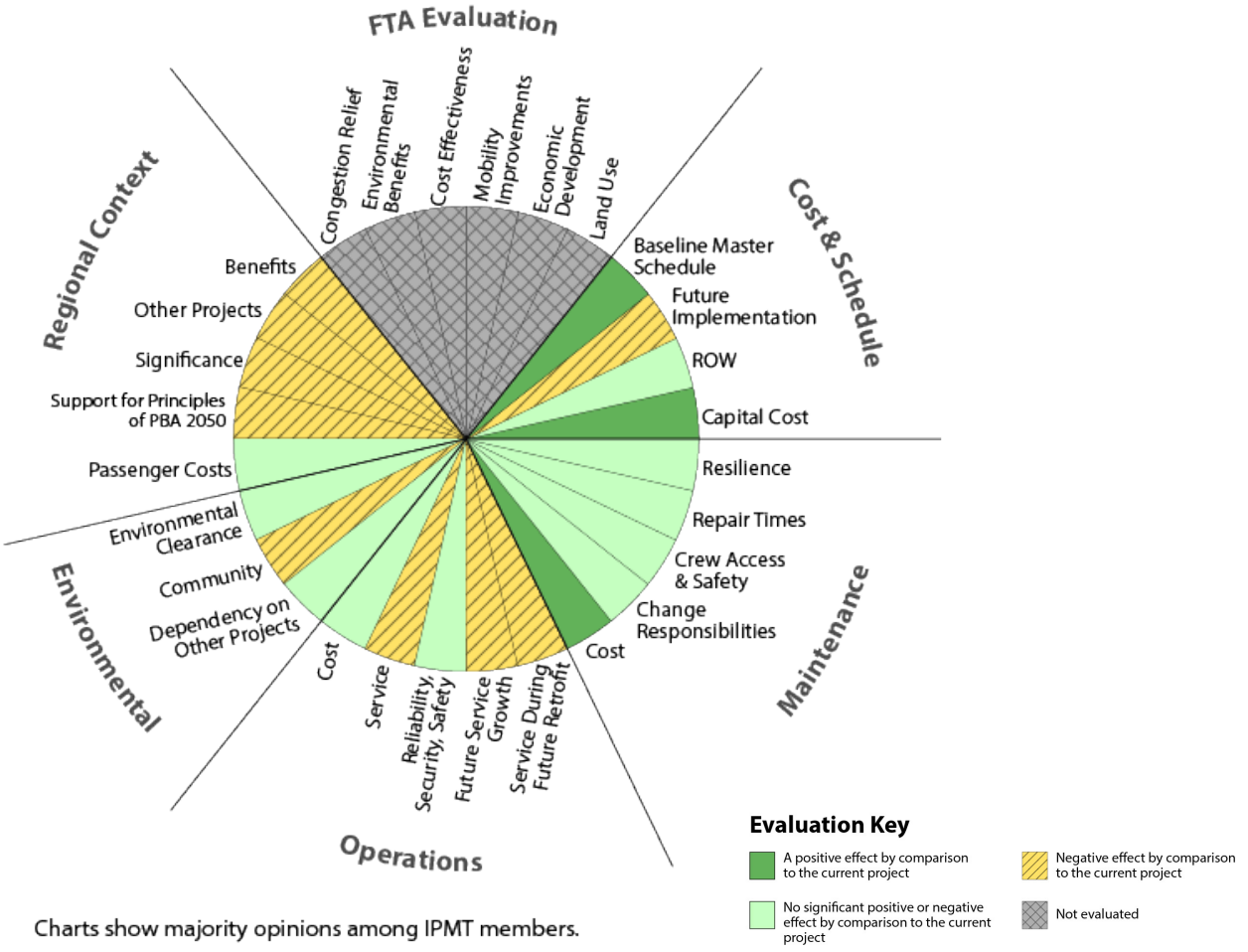


Charts show majority opinions among IPMT members.

7.6 Defer Infrastructure Fit-out for CHSRA-related Elements

The IPMT concluded that deferring the CHSRA infrastructure fit-out would have a positive effect on the Phase 2 project cost and schedule, with the exception of the cost of future implementation because of the higher costs of future construction. The effect of deferral on the FTA's New Starts evaluation was not evaluated; however, the infrastructure could potentially be part of a CHSRA-requested FTA grant in the future. Effects to regional considerations were generally found to be negative when evaluated against the current project, as high-speed train service in San Francisco is important for regional transit connectivity. Environmental impacts would mostly remain the same, with the exception of community impacts, which would be greater because constructing the fit-out separately from the rest of the project would cause construction disruption to the area twice. Maintenance would mostly remain the same, with the exception of maintenance costs, which would improve. By contrast, operations would be negatively affected, especially service and future service growth both during the interim condition without the high-speed infrastructure and during construction of the infrastructure, which would negatively affect Caltrain operations.

After Workshop No. 2, the IPMT recommended rejecting the deferral the fit-out of the CHSRA infrastructure and constructing the fit-out with the rest of the project.



Charts show majority opinions among IPMT members.

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