San Francisco
County Transportation
Authority

1455 Market Street, 22ND Floor, San Francisco, California 94103 415-522-4800 info@sfcta.org www.sfcta.org

Agenda

SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY
Meeting Notice

DATE: Tuesday, July 12, 2022, 10:00 a.m.

LOCATION: Legislative Chamber, Room 250, City Hall (hybrid)

Watch SF Cable Channel 26 or 99 (depending on your provider)

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PUBLIC COMMENT CALL-IN: 1-415-655-0001; Access Code: 2492 879 3483 # #

To make public comment on an item, when the item is called, dial '*3' to be added to the queue to speak. Do not press *3 again or you will be removed from the queue. When the system says your line is unmuted, the live operator will advise that you will be allowed 2 minutes to speak. When your 2 minutes are up, we will move on to the next caller. Calls will be taken in the order in which they are received.

COMMISSIONERS: Mandelman (Chair), Peskin (Vice Chair), Chan, Dorsey, Mar, Melgar, Preston, Ronen, Safaí, Stefani, and Walton

CLERK: Angela Tsao

Remote Access to Information and Participation

This meeting will be held in person at the location listed above. As authorized by California Government Code Section 54953(e), it is possible that some members of the San Francisco County Transportation Authority Board may attend this meeting remotely. In that event, those members will participate by teleconferencing. Members of the public may attend the meeting to observe and provide public comment at the physical meeting location listed above or may watch SF Cable Channel 26 or 99 (depending on your provider) or may visit the SFGovTV website (www.sfgovtv.org) to stream the live meeting or may watch them on demand.

Members of the public may comment on the meeting during public comment periods in person or remotely. In-person public comment will be taken first; remote public comment will be taken after.

Written public comment may be submitted prior to the meeting by emailing the Clerk of the Transportation Authority at clerk@sfcta.org or sending written comments to Clerk of the Transportation Authority, 1455 Market Street, 22nd Floor, San Francisco, CA 94103. Written comments received by 5 p.m. on the day before the meeting will be distributed to Board members before the meeting begins.

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1.	Roll Call	
2.	**[Final Approval on First Appearance]** Approve the Resolution Making Findings to Allow Teleconferenced Meetings under California Government Code Section 54953(e) – **ACTION***	**5**
3.	Approve the Minutes of the June 28, 2022 Meeting **– ACTION***	**9**
4.	Community Advisory Committee Report **– INFORMATION***	**15**
5.	Appoint One Member to the Community Advisory Committee – **ACTION***	**23**
6.	State and Federal Legislation Update – **ACTION***	**31**
	Support: Assembly Bill 1938 (Friedman)	
7.	Allocate $17,739,152 in Prop K Funds, with Conditions, and Appropriate $307,000 for Seven Requests – **ACTION***	**53**
	Projects: BART: BART Tunnel Water Intrusion Mitigation ($1,269, 471). SFMTA: Paratransit ($13,300,000). SFPW: Street Repair and Cleaning Equipment ($983,021), Public Sidewalk and Curb Repair ($637,680), and Tree Planting and Establishment ($1,548,980). SFCTA: Duboce Triangle Neighborhood [NTIP Capital] ($7, 000) and District 1 Multimodal Transportation Study [NTIP Planning] ($300,000).	
8.	Accept the Pennsylvania Avenue Extension Project Initiation Report – **ACTION***	**63**

Other Items

9. Introduction of New Items **– INFORMATION***

During this segment of the meeting, Commissioners may make comments on items not specifically listed above or introduce or request items for future consideration.

10. Public Comment

11. Adjournment

*Additional Materials

Items considered for final approval by the Board shall be noticed as such with **[Final Approval]** preceding the item title.

The meeting proceedings can be viewed live or on demand after the meeting at www.sfgovtv.org. To know the exact cablecast times for weekend viewing, please call SFGovTV at (415) 554-4188 on Friday when the cablecast times have been determined.

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to ensure availability. Attendees at all public meetings are reminded that other attendees may be sensitive to various chemical-based products.

If any materials related to an item on this agenda have been distributed to the Board after distribution of the meeting packet, those materials are available for public inspection at the Transportation Authority at 1455 Market Street, Floor 22, San Francisco, CA 94103, during normal office hours.

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BD071222 RESOLUTION NO. 22-XX

RESOLUTION MAKING FINDINGS TO ALLOW TELECONFERENCED MEETINGS UNDER CALIFORNIA GOVERNMENT CODE SECTION 54953(E)

WHEREAS, California Government Code Section 54953(e) empowers local legislative bodies to convene by teleconferencing technology during a proclaimed state of emergency under the State Emergency Services Act so long as certain conditions are met; and

WHEREAS, In March, 2020, the Governor of the State of California proclaimed a state of emergency in California in connection with the Coronavirus Disease 2019 ("COVID-19") pandemic, and that state of emergency remains in effect; and

WHEREAS, On February 25, 2020, the Mayor of the City and County of San Francisco (the "City") declared a local emergency, and on March 6, 2020 the City's Health Officer declared a local health emergency, and both those declarations also remain in effect; and

WHEREAS, On September 16, 2021, the Governor signed AB 361, a bill that amends the Brown Act to allow local legislative bodies to continue to meet by teleconferencing during a state of emergency without complying with restrictions in State law that would otherwise apply, provided that the legislative bodies make certain findings at least once every 30 days; and

WHEREAS, While Federal, State, and local health officials emphasize the critical importance of vaccination and consistent mask-wearing, regardless of vaccination status, to prevent the spread of COVID-19, and the City's Health Officer has issued at least one order (Health Officer Order No. C19-07y, available online at www.sfdph.org/healthorders) and one directive (Health Officer Directive No. 2020-33i, available online at www.sfdph.org/directives) that continue to recommend measures to promote safety for indoor gatherings, such as vaccination, masking, improved ventilation, and other measures, in certain contexts; and

WHEREAS, The California Department of Industrial Relations Division of

Occupational Safety and Health ("Cal/OSHA") has promulgated Section 3205 of Title 8 of the California Code of Regulations, which requires most employers in California, including in the City, to train and instruct employees about measures that can decrease the spread of COVID-19; and

WHEREAS, Without limiting any requirements under applicable federal, state, or local pandemic-related rules, orders, or directives, the City's Department of Public Health, in coordination with the City's Health Officer, has advised that for group gatherings indoors, such as meetings of boards and commissions, people can increase safety and greatly reduce risks to the health and safety of attendees from COVID-19 by maximizing ventilation, wearing well-fitting masks regardless of vaccination status (and as required for unvaccinated people by the State of California's indoor masking order), encouraging vaccination (including a booster as soon as eligible), staying home when sick or when experiencing any COVID-19 symptom discouraging consumption of food or beverages in the meeting, following good hand hygiene practices, and making informed choices when gathering with people who vaccination status is not known; and

WHEREAS, The San Francisco County Transportation Authority Board began meeting in person on April 12, 2002, allowing members to participate by teleconferencing from a separate location for COVID-related health reasons and providing members of the public an opportunity to observe and provide public comment either in person or remotely; now, therefore, be it

RESOLVED, That San Francisco County Transportation Authority Board finds as follows:

1. As described above, the State of California and the City remain in a state of emergency due to the COVID-19 pandemic. At this meeting, San Francisco County Transportation Authority Board has considered the circumstances of the state of emergency.

2. As described above, because of the COVID-19 pandemic, conducting

meetings of this body and its committees in person without allowing certain members of this body to attend remotely would present imminent risks to the health or safety of certain attendees due to COVID-19, and the state of emergency continues to directly impact the ability of members to meet safely in person; and, be it further

RESOLVED, That for at least the next 30 days, the San Francisco County Transportation Authority Board and the Personnel Committee will hold in-person meetings, with some members possibly appearing remotely. If all members of the San Francisco County Transportation Authority Board or Personnel Committee are unable to attend in person for COVID-related health reasons, then the San Francisco County Transportation Authority Board or Personnel Committee will hold the meeting remotely without providing an in-person meeting location. The Community Advisory Committee ("CAC") will continue to hold meetings exclusively by teleconferencing technology (and not by any in-person meetings or any other meetings with public access to the places where any legislative body member is present for the meeting). All meetings of the San Francisco County Transportation Authority Board and its committees will provide an opportunity for members of the public to address this body and its committees and will otherwise occur in a manner that protects the statutory and constitutional rights of parties and the members of the public attending the meeting via teleconferencing.

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DRAFT MINUTES

San Francisco County Transportation Authority

Tuesday, June 28, 2022

1. Roll Call

Chair Mandelman called the meeting to order at 10:22 a.m.

Present at Roll Call: Commissioners Chan, Dorsey, Mandelman, Mar, Melgar, Peskin, Preston, Ronen, Stefani, and Walton (10)

Absent at Roll Call: Commissioners Safai (excused) (1)

2. Chair's Report – INFORMATION

Chair Mandelman recognized the importance of city streets for different types of gatherings, including Juneteenth, the Warriors parade, Pride events, and peaceful protests, and thanked public safety personnel, transit operators, and maintenance crews who helped keep the gatherings safe and accessible for all.

The Chair also noted the $400 million Prop A Muni and Safe Streets bond measure loss, which would have funded critical infrastructure for the city's Vision Zero goals, as well as Muni transit facilities and street and signal projects citywide. He commented that it was important to consider lessons learned while the Board of Supervisors prepared to place reauthorization of the half-cent sales tax for transportation on the ballot later in June / July. He added the sales tax expenditure plan development was guided by the Expenditure Plan Advisory Committee comprised of representatives of over two dozen community and civic groups, as well as the Community Advisory Committee. Chair Mandelman spoke on the need to fund important Muni, BART and Caltrain system improvement and maintenance projects, provide local match to projects seeking federal and state grants, and ensure continued funding of neighborhood-serving programs like street repaving, crosswalks, and signals, as well as paratransit for seniors and persons with disabilities.

Chair Mandelman announced that Fitch Ratings Inc. re-affirmed the Transportation Authority's sales tax revenue bonds at the highest possible credit rating of AAA (triple A), for the second consecutive year, placing the Transportation Authority among the highest rated organizations in California. He added it also underscored the Transportation Authority's sound stewardship of the tax revenue entrusted by voters and thanked the Transportation Authority's management team, particularly the finance team led by Deputy Director for Finance and Administration Cynthia Fong.

During public comment, Francisco Da Costa said the services on the western side of the city were subpar. He also claimed the Treasure Island Mobility Management Agency meeting prior to the Transportation Authority Board meeting was held without due notice and talked of corruption in the city.

3. Executive Director's Report – INFORMATION

Tilly Chang, Executive Director, presented the item.

During public comment, Francisco Da Costa spoke on the need to have more transparency about the projects in the meetings. He also asked how the agency was addressing quality of life issues not just funding.

4. Approve the Minutes of the June 7, 2022 Meeting – ACTION

Commissioner Peskin moved to approve the minutes, seconded by Commissioner Walton.

The minutes were approved without objection by the following vote:

Ayes: Commissioners Chan, Dorsey, Mandelman, Mar, Melgar, Peskin, Preston, Ronen, Stefani, and Walton (10)

Absent: Commissioner Safai (1)

Consent Agenda

5. [FINAL APPROVAL] Allocate $6,919,800 in Prop K Funds, with Conditions, and Appropriate $470,000 for Five Requests – ACTION

Projects: BART: Balboa Park Station Area Improvements ($250,000). SFCTA: District 4 Microtransit Business Plan [NTIP Planning] ($310,000), Treasure Island AV Shuttle Pilot ($60,000). SFMTA: 1399 Marin Street Maintenance Facility ($6,619,800). Multi-Agency: Neighborhood Program (NTIP) Coordination (SFCTA: $100,000, SFMTA $50,000).

6. [FINAL APPROVAL] Approve the Fiscal Year 2022/23 Transportation Fund for Clean Air Program of Projects – ACTION

Projects: SFE: Emergency Ride Home ($88,202). SFMTA: Short-Term Bike Parking ($847,113). SFCTA: Program Administration ($43,384).

7. [FINAL APPROVAL] Approve $1,035,626 in San Francisco Lifeline Transportation Program Cycle 2 Funds for the Bay Area Rapid Transit District's Elevator Attendant Program – ACTION

8. [FINAL APPROVAL] Adopt the Proposed Fiscal Year 2022/23 Budget and Work Program – ACTION

Clerk Angela Tsao announced that several public comments had been received for Item 6 related to the bike parking project and had been posted to the website.

Commissioner Melgar moved to approve the Consent Agenda, seconded by Commissioner Walton.

The Consent Agenda was approved without objection by the following vote:

Ayes: Commissioners Chan, Dorsey, Mandelman, Mar, Melgar, Peskin, Preston, Ronen, Stefani, and Walton (10)

Absent: Commissioner Safai (1)

End of Consent Agenda

9. Vision Zero – 2021 Traffic Fatality Report – INFORMATION

Seth Pardo, Ph.D., San Francisco Department of Public Health (DPH) Center for Data Science Director, presented the item.

Chair Mandelman asked when the High Injury Network (HIN) map was last updated and what the ideal schedule for updating the map was. Dr. Pardo responded that the last update was in 2017 and the HIN map was to be updated every three to four years.

Chair Mandelman asked if that schedule for updating was a best practice, or if it was based on data availability or other resource constraints. Dr. Pardo responded that the schedule for updating the map was based on the rate at which the DPH received trauma data from the hospitals. He explained that staff had to manually update the data and cross check it with other data sources.

Chair Mandelman asked why there weren't more frequent updates to the map. Dr. Pardo responded that ideally the map could be updated more frequently, but that DPH did not have the technical capacity or staff resources available for that. Chair Mandelman then inquired what it would take for the HIN map updates to be automated and to happen more frequently. Dr. Pardo responded that he would like to discuss the necessary investment with hospital partners to see what resources would be required to automate the system. Dr. Pardo noted that he would very much appreciate reducing the administrative burden on hospital and city staff for updating the map. Chair Mandelman asked Transportation Authority staff to follow up with DPH staff on what it would take, including funding needed to automate the HIN map updates.

Chair Mandelman asked why there were only six red light cameras and inquired about the costs. Jamie Parks, SFMTA Livable Streets Director, stated that the red light cameras were costly to install and that the first focus was to eliminate red light running through better design engineering and signage. He said that red light cameras were the last resort when there were still problems occurring after the design updates were done. Mr. Parks said that red light cameras cost approximately $500,000 for installation per intersection and that he would need to check the ongoing operating costs.

Chair Mandelman asked about the status of enforcement efforts and how the Focus on the Five traffic safety initiative (focus on the five most common traffic violations causing collisions) was going. Chair Mandelman noted that the San Francisco Police Department was not present and that the Board would have that discussion at a future meeting.

Commissioner Melgar expressed deep frustration over the findings in the presentation. She stated that in District 7 half of their budget from the participatory budgeting process was prioritized for Vision Zero projects. She asked why it took such a long time for projects to be implemented. She questioned if the City was approaching this problem in the best way and said that waiting for a report to show where people have been killed was not the ideal way to guide prioritization. She stated that in District 7 there were collisions on Ocean Avenue and 19th Avenue, which were both in front of colleges. She stated that the goal was to prioritize safety and that she did not want to wait for fatalities to justify improvements and urged a more proactive approach. She commented that it was worth having a future discussion about whether the city was approaching the Vision Zero goal in the most effective way.

Commissioner Preston echoed the concerns raised by Commissioner Melgar and stated that the response needed to be ramped up in a more proactive way with a

systemic approach. He stated concern over rising vehicle miles traveled and the overrepresentation of minorities in the fatality report. He asked when SFMTA was expected to complete the city's speed management plan, present it to the Board, and the length of time required for implementation.

Ryan Reeves, SFMTA Transit Planner, responded that the draft plan was in development and expected to be ready by the end of 2022. She noted that part of the implementation plan was tied to new revenues from the measure that did not pass at the ballot earlier in the month, requiring SFMTA to reassess how to fund some of the elements.

Commissioner Preston asked what were the plan targets. Ms. Reeves responded that the plan outlined the tools available. Mr. Parks added that the implementation timeframe would be dependent on funding availability. He said that San Francisco was leading the state in implementing 20 mph zones in commercial areas.

Commissioner Preston asked for the cost of implementing the speed management plan. Ms. Reeves responded that they estimated the cost at $5-6 million.

Commissioner Preston said that the cost should not deter the effort. He commended SFMTA on its Quick Build Program work, but said that the block by block approach was creating delays in implementing the program quickly. He noted his frustration with delays to the Page Slow Street, the Oak Street bike lane, and the Golden Gate Greenway and stressed the need for a comprehensive, citywide plan to address speed management. He stressed the need for a citywide network for biking and said it was essential to have a public forum on how to address traffic fatalities.

Commissioner Preston commented that the entire Tenderloin neighborhood was on the HIN, but there was only a small portion of residents who owned cars. He asked if there were any proposals in the works to eliminate cars on certain streets in the Tenderloin considering that it was a unique part of the city where vehicle use by residents was low but traffic fatalities were high.

Mr. Parks responded that SFMTA noticed this trend based on the 2017 HIN map and made a lot of investments in the Tenderloin. Mr. Parks continued that SFMTA looked forward to seeing the updated HIN map to see the impacts of the investments. He also said that SFMTA was committed to doing Quick Build projects on every street on the HIN, which means every street in the Tenderloin and that SFMTA was about two-thirds of the way complete. He also stated that SFMTA recognized that more was needed and was open to considering bold changes.

During public comment, Francisco Da Costa spoke on the lack of clarity in the presentation. He said he made suggestions for San Bruno Avenue in 2009 and there were more parking meters than before and the crosswalks had not been painted in four years, while vulnerable seniors travel in the neighborhood. He said that the public needed 10 minutes to speak during public comment.

Brian Haagsman, Walk San Francisco Vision Zero Organizer, said that it was alarming that pedestrians continued to be in the most danger and noted that pedestrian fatality rates in San Francisco were more than double the national average. He said there was a lack of urgency and coordination among city agencies. He said there needed to be more transparency and wanted to hear from all of the city agencies on their role in decreasing traffic fatalities. He said there needed to be an updated HIN map and

wanted to know what approaches had been working to reduce traffic fatalities.

A caller spoke against the closure of Upper Great Highway, which diverted traffic to other parts of the Sunset and created a Vision Zero risk for those in the surrounding neighborhoods.

Luke Bornheimer said that the reactive approach was not fast or effective enough and there were too many hurdles in the way of achieving Vision Zero. He said that the Fire Department often obstructed and delayed certain safe street projects from advancing. He also stated that reactive pushback from people who fear change was a hurdle to implement more projects.

10. Streets and Freeway Strategy Update – INFORMATION

Aliza Paz, Senior Transportation Planner, presented the item.

There was no public comment.

Other Items

11. Introduction of New Items – INFORMATION

There were no new items introduced.

12. Public Comment

There was no general public comment.

13. Adjournment

The meeting was adjourned at 11:50 a.m.

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DRAFT MINUTES

Community Advisory Committee

Wednesday, June 22, 2022

1. Call to Order

Chair Larson called the meeting to order at 6:02 p.m.

Present at Roll: Nancy Buffum, Rosa Chen, Robert Gower, John Larson, Jerry Levine, Kevin Ortiz, Eric Rozell, Kat Siegal, and Peter Tannen (9)

Absent at Roll: David Klein (1)

2. Chair's Report – INFORMATION

Chair John Larson announced that the June CAC meeting fell before the second Transportation Authority Board meeting of the month so the staff would email the link to CAC members for the June 28th Executive Director's Report, which will be postedon the agency's website along with past reports at www.sfcta.org.

The Chair noted that in relation to CAC members' expressed interest, the Board heard an update on Safe Streets on June 7th and would hear a presentation on the 2021 Traffic Fatality Report on June 28th. He encouraged interested parties to watch the meetings at sfgovtv.org. Chair Larson announced the CAC would receive a Vision Zero update at the September 27 meeting (due to police staff availability), including a focus on enforcement and how slow streets could be part of the Vision Zero toolkit.

Chair Larson announced that the California Department of Transportation (Caltrans) was seeking innovative and transformative project nominations for the federal Reconnecting Communities Pilot program. He explained that the pilot funds could be used to equitably and safely restore community connectivity through the removal, retrofit, mitigation, or replacement of eligible transportation infrastructure facilities that created barriers to mobility, access, or economic development.

Chair Larson also announced that BART would celebrate 50 years in September at the Lake Merritt BART Station on September 10 from 11 a.m. to 4 p.m., and would include discounted BART fares at 50% off on top of already discounted fares for the month of September on Clipper. He said more information could be found at bart.gov/50years.

Member Robert Gower requested a moment to acknowledge the Muni incident between West Portal and Castro stations in which one passenger fatally shot another passenger, emphasizing a need for safety on public transit and the efforts of city planners to ensure the system could be as safe as possible.

Member Eric Rozell announced that the Tenderloin had seen three traffic related fatalities within a six or seven week period, as well as some in the Mission neighborhood, and urged everyone to think more about Vision Zero and different approaches in the development of self-enforcing street designs to reduce the amount of traffic fatalities due to reckless driving.

Chair Larson commented that it was a worrying time in terms of traffic behavior and street violence, and it was sobering given that he also rode that particular Muni line and in general with traveling the streets as a pedestrian. The Chair added that the CAC should prepare to have an in depth discussion on these types of topics with city staff presenting at future meetings in upcoming months.

Chair Larson discussed the 50-year anniversary of BART and the history involved in its implementation, including myths and realities associated with its development.

Chair Larson announced that it would be his last meeting as CAC Chair and member, that he was resigning, and that Commissioner Melgar was poised to appoint a new representative for District 7 to the CAC. He added that he valued the several years he had served on the CAC, constantly impressed by the knowledge, caliber, and commitment of the community members that have served on the committee. The Chair also shared that others have been impressed by the CAC for its depth of questioning and thoughtfulness of discussion on transportation issues. He also thanked Transportation Authority staff for their preparation, expertise, and responsiveness in support of the CAC and Board. Chair Larson noted that Peter Tannen would remain the longest tenured member of the CAC, having already been in membership since Chair Larson was appointed by former Supervisor Norman Yee, and said he hoped to meet CAC members at a future in-person meeting.

There was no public comment.

Multiple CAC members expressed appreciation and praised Chair Larson for the capable and respectful way in which he managed the meetings. Chief Deputy Maria Lombardo echoed thanks to Chair Larson for his service on behalf of staff with a special acknowledgement of his leadership during the transition to virtual meetings and his thorough reports to the Board.

Consent Agenda

3. **Approve the Minutes of the May 25, 2022 Meeting – ACTION**
4. **Community Advisory Committee Vacancy – INFORMATION**

There was no public comment.

Member Robert Gower motioned to approve the minutes, seconded by Member Jerry Levine.

The motion was approved by the following vote:

Ayes: Buffum, Chen, Gower, Larson, Levine, Ortiz, Rozell, Siegal, and Tannen (9)

Absent: Klein (1)

End of Consent Agenda

5. **Adopt a Motion of Support to Allocate $17,739,152 in Prop K Funds, with Conditions, and Appropriate $307, 000 for Seven Requests – ACTION**

Projects: BART: BART Tunnel Water Intrusion Mitigation ($1,269, 471). SFMTA: Paratransit ($13,300,000). SFPW: Street Repair and Cleaning Equipment ($983,021), Public Sidewalk and Curb Repair ($637,680), Tree Planting and Establishment ($1,548,980). SFCTA: Duboce Triangle Neighborhood [NTIP Capital] ($7, 000), District 1 Multimodal Transportation Study [NTIP Planning] ($300,000).

Mike Pickford, Senior Transportation Planner, and Rachel Hiatt, Deputy Director for Planning, presented the item per the staff memorandum.

Member Peter Tannen asked for clarification about the project location for the Slow Duboce Triangle intersections and said that Noe and Sanchez don't intersect.

Mr. Pickford responded that staff would follow up on the exact location and correct the packet materials. [During public comment later in the meeting, Hans Galland with Duboce Triangle Neighborhood Association clarified that intersections to be studied were Duboce and Sanchez and 14th and Sanchez.]

Mr. Tannen asked about the UC Berkeley students' experience with hosting public meetings and dealing with contentious issues, such as traffic calming, in regards to their role in the Slow Duboce Triangle study.

Chair John Larson asked about tree establishment and what happens to the trees after three years and how the transfer of responsibility works.

Victoria Chan, San Francisco Public Works, responded that after the three years of tree establishment, the established trees then fall under the Prop E street tree maintenance plan, which provides funding for watering.

During public comment, Edward Mason said that it was sad that Public Works had to come to the Transportation Authority to replace the primary street repair and cleaning equipment they are responsible for. He also said that San Francisco goes through public sidewalk and repair issues annually, including funding repairs to cracks in the new sidewalks and curbs that were recently replaced. He said that the response to the cracks from Public Works is that it is normal for concrete to crack. He also said there is a deficiency in the specifications and preparation for concrete sidewalks and curbs and that every new project has hairline cracks in it and that those cracks had been documented. He asked how many hours it takes to plant a tree and said that he would like to know the rate per hour to plant a tree. He said that advocates should be going to the City budget to plant the trees and not be coming to the Transportation Authority for funding. He asked if the Slow Duboce Triangle study is only happening because of COVID, which he said was the reason other programs, such as Slow Streets, were implemented. He said it just seemed like a feel-good, nice thing to have.

During public comment, Hans Galland from the Duboce Triangle Neighborhood Association (DTNA), clarified that the intersections in the Slow Duboce Triangle Study are Duboce and Sanchez and Sanchez and 14th. He also said that all the work the UC Berkeley students are doing on the study is under the supervision of DTNA, specifically under a subgroup of the Land Use Committee and himself. He said he has 10-15 years of community engagement work experience.

After public comment, Chair Larson asked about the quality of concrete and cement that we use now as compared to what we used in the past that results in hairline cracks appearing. He said he wondered if it was a result of curb cuts. He asked if the hairline cracks reduce the functional lifespan of the concrete.

Nicholas Crawford, Superintendent of the Bureau of Urban Forestry for Public Works, said he would be interested in the details of the data collection that Mr. Mason referenced, regarding the sidewalk cracks. He stated that they use the same specifications for contractors and internal crews to follow for concrete installation. He said he thinks the biggest cause of cracks is the dramatic uplift caused by tree roots. He said he has asked

contractors about hairline cracking and stated that if it's not a structural flaw then it's just cosmetic. He said it is something he would like to look into more.

Chair Larson said that the issue of cracking concrete had been raised routinely in public comment related to concrete construction issues so he said he wanted to follow up on it.

Mr. Pickford clarified regarding the Slow Duboce Triangle Study, that there will be traffic calming on Noe Street and Sanchez Street, not at their intersection. He also said that the study will have Transportation Authority staff oversight, in addition to the DTNA oversight.

Member Ortiz motioned to approve the item, seconded by Member Siegal.

The motion was approved by the following vote:

Ayes: Buffum, Chen, Gower, Larson, Levine, Ortiz, Rozell, Siegal, and Tannen (9)

Absent: Klein (1)

6. Adopt a Motion of Support to Accept the Pennsylvania Avenue Extension Project Initiation Report – ACTION

Yana Waldman, Assistant Deputy Director for Capital Projects, presented the item per the staff memorandum.

Member Eric Rozell asked what the elevation of the tunnel in the study area would be and raised concerns about future sea-level rise in the area which was relatively close to the Bay. He asked what considerations were being made and what impact it would have on the project. He also asked if it was reasonable to build the new alignment on top of the area rather than take it underground.

Ms. Waldman answered the sea-level rise would be studied more during the pre-environmental and environmental phases. She added that the 2018 Railyard Alignment and Benefits (RAB) evaluated whether the trains should remain on the surface or go underground and the preferred option was to place the trains in a below-grade tunnel. Ms. Waldman acknowledged groundwater intrusion was a challenge with tunnels but said are a lot of waterproofing methods that could be used.

Chair Larson asked how the Downtown Rail Extension (DTX) and the Southeast Rail Station Study projects coordinated with Pennsylvania Avenue Extension (PAX) project to make sure all the interfaces would come together as one.

Ms. Waldman answered that as part of the process, the Transportation Authority had a Technical Advisory Group which consisted of the Transportation Authority, Caltrain, California High-Speed Rail Authority, Transbay Joint Powers Authority, San Francisco Planning Department, San Francisco Public Utilities Commission, Caltrans, SFMTA, etc., and the group had all been working together to make sure everything was coordinated. She also noted that a specific point that the PAX study covered was those interfaces, especially at the DTX railyard redevelopment which had a lot of things going on and the timing of it was very important. She continued that one of the reasons the project would continue into a pre-environmental phase for the next 18 months was that the railyards and DTX were continuing to develop, and the project team needed to make sure the interface would be very well coordinated so the project team could move forward with a clear understanding before moving into the environmental phase.

Chair Larson asked if there was any way that the Transportation Authority could access the Federal Reconnecting Communities Pilot program, since the tunnel would reconnect

these communities from Mission Bay, or if there was any planning or other grant funding available.

Ms. Waldman responded that the project team would be pursuing every available funding source that would be potentially applicable to the project and focusing on a robust funding plan would be one of the tasks for the next phase of work.

Chair Larson expressed that it was always exciting to think about things that were going to happen in the future with trains eventually getting into the train box at Salesforce Transit Center, and he would be following the project as a civilian as the project went forward. He thanked Ms. Waldman for the presentation

During public comment, Roland Lebrun commented on the project plans. He said alignment was correct except for using the first 1000 feet as the exiting tunnel and transitioning to an underground tunnel just north of the 23rd Street. Mr. Lebrun suggested a station at 7th Street instead of having stations at Mariposa Street and at 4th and Townsend streets. He also said there was no written explanation about the right of way cost and there was no need to acquire new right of way. Mr. Lebrun said he hoped the project would be done in five years since he started following the project 10 years ago.

Edward Mason asked for clarification if there would be any freight traffic expected in the project alignment or if there would strictly be passenger traffic with Caltrain and high-speed rail. He also asked if there would be any freight from Pier 80 on the spur line, or if there would be any conflicts.

After public comment, Chair Larson asked Ms. Waldman to respond to the freight question.

Ms. Waldman confirmed there was no freight connection points on the current line and the PAX recommended replacement would also not be carrying freight traffic as currently planned and designed.

Member Buffum motioned to approve the item, seconded by Member Tannen.

The motion was approved by the following vote:

Ayes: Buffum, Chen, Gower, Larson, Levine, Ortiz, Rozell, Siegal, and Tannen (9)

Absent: Klein (1)

7. State and Federal Legislation Update – INFORMATION

Amber Crabbe, Public Policy Manager, presented the item per the staff memorandum.

Member Peter Tannen observed that he thought some of the bills on the watch list were worthy of support. He asked staff to explain the procedure for developing recommendations about what positions the Transportation Authority should take on bills.

Ms. Crabbe answered that the agency's state legislation advocate sent regular updates and recommendations on transportation bills. She noted that staff also worked closely with SFMTA and the Metropolitan Transportation Commission, in particular, as well as the other Congestion Management Agencies, the statewide Self Help Counties Coalition, and other advocacy organizations to identify bills that could impact the Transportation Authority and transportation in general. She said that staff tried to keep efforts focused on bills that would have the biggest impact on San Francisco and where the Transportation Authority's advocacy could have the most impact in Sacramento.

Ms. Lombardo added that, when bills came out at the beginning of the session, staff focused on research, and typically added them to the watch list rather than recommending positions before a full analysis of the bill's impacts was performed. She said that sometimes bills were placed on the watch list rather than recommended for a position if substantial amendments were expected.

Ms. Crabbe noted that staff wanted to make sure that the Transportation Authority took a position when it had a strong and compelling reason to do so, and that positions could potentially be seen as more meaningful when they were taken sparingly.

Chair Larson recalled that in a prior job he had encountered a situation where a bill that they weren't following because it was on an unrelated topic was hollowed out and amended to address a completely different matter that was directly related to the work he was doing.

Ms. Crabbe responded that the agency's state legislative advocate carefully watched for amendments like those on the Transportation Authority's behalf.

Chair Larson stated that it was important to understand the process of developing positions on bills and appreciated Member Tannen's questions. He encouraged other members to bring up bills of interest at future meetings for discussion and to inform staff.

There was no public comment.

Other Items

8. Introduction of New Business – INFORMATION

Member Buffum requested a briefing on the future of slow streets, particularly on the District 1 design and placement of neighborways, which would be helpful to the CAC, since there was a lot of information to follow. Member Gower added to Member Buffum's request, citing confusion with stakeholders and appreciated clarification on how the process of implementing slow streets worked. Member Rozell also echoed the request.

Member Ortiz requested an analysis on potential revenue loss related to the Prop A Muni and Safe Streets bond measure fail, and what was the Transportation Authority perspective on that issue, as the city approached the November ballot event.

Member Tannen requested SFMTA bring a presentation to the CAC explaining temporary street closures, particularly related to pedestrian access. He recalled not being allowed by security guards to walk across Grove Street after the Warriors parade and had to make a detour of 10 blocks on Market Street to get back to Grove Street.

Member Levine requested an update on the Van Ness project performance, either in writing or through an SFMTA presentation at a future CAC meeting.

Member Ortiz requested a presentation from SFMTA and BART on transit safety protocols, particularly involving active shooters. Member Rozell echoed Member Ortiz's requested and added that a survey from his organization showed that seniors were greatly concerned about station and bus safety. He also recalled an incident involving assault on a bicyclist. Chair Larson noted that it seemed odd that people are coming out of a shared difficulty like the pandemic with more conflict and incivility.

Member Siegal requested an update, given the state of traffic violence, on city department efforts to employ a fleet of smaller vehicles rather than larger ones. She noted the amount of San Francisco Public Works (SFPW) and Department of Recreation and Parks trucks with empty flatbeds traveling in pedestrian areas of parks. Ms. Siegal also

wanted to know if new restrictions on funding could be made to city fleets and if it was possible to employ smaller, lighter weight vehicles for tasks instead as a way to improve safety. Chair Larson said that people had made multiple requests before about standardizing municipal fleets to be carbon neutral not just meet emissions standards. Ms. Siegal said even an electric truck still a heavy vehicle and hoped there was a way to reduce that presence on the roads. Chair Larson concurred.

Chair Larson requested an update on current corridor plans to address issues on the Muni M line, between West Portal and Park Merced stations, citing past plans to underground the route.

There was no public comment.

9. Public Comment

During general public comment, Edward Mason sent farewell to Chair Larson and appreciated him for his professionalism and presentations to the Board. Mr. Mason requested that SFPW sort street repairs by address since there were duplicate requests in District 8 for the same address. He also commented on the commuter buses in his neighborhood still running idle or without many passengers, contributing to emissions pollution.

Roland Lebrun congratulated Member Tannen for being reappointed to the CAC and echoed the previous caller's comments about Chair Larson's departure, adding that he was going to miss him but also looked forward to the new CAC Chair. He also commented that the CAC should imitate the TJPA CAC and DTX Executive Steering Committee meeting models for public comment access to include real-time Webex access, including a countdown clock.

Mr. Lebrun said he was pushing for a 7th Street station because it was a better connection to Central Subway, noting the lack of a direct connecting from 4th and Townsend to the Central Subway. He said a 7th Street station would allow for a loop above the station that would allow for passengers to transfer between Caltrain and Muni within a span of 40 feet.

Chair Larson appreciated Mr. Mason and Mr. Lebrun's comments. With respect to Mr. Mason's comments on the commuter shuttles, he noted that with more folks working remotely and the large shuttles running near empty, he agreed with Mr. Mason that it really was time to re-evaluate the size of those vehicles. Chair Larson also recognized Mr. Mason's devotion as a member of the public in fulfilling his civic duty.

10. Adjournment

The meeting was adjourned at 7:41 p.m.

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San Francisco
County Transportation
Authority

BD071222 RESOLUTION NO. 22-XX

RESOLUTION APPOINTING ONE MEMBER TO THE COMMUNITY ADVISORY COMMITTEE OF THE SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

WHEREAS, Section 131265(d) of the California Public Utilities Code, as implemented by Section 5.2(a) of the Administrative Code of the San Francisco County Transportation Authority, requires the appointment of a Community Advisory Committee (CAC) consisting of eleven members; and

WHEREAS, There is one open seat on the CAC resulting from a member's resignation; and

WHEREAS, At its July 12, 2022, meeting, the Board reviewed and considered all applicants' qualifications and experience and recommended appointing one member to serve on the CAC for a period of two years; now therefore, be it

RESOLVED, That the Board hereby appoints one member to serve on the CAC of the San Francisco County Transportation Authority for a two-year term; and be it further

RESOLVED, That the Executive Director is authorized to communicate this information to all interested parties.

San Francisco
County Transportation
Authority

1455 Market Street, 22ND Floor, San Francisco, California 94103 415-522-4800 info@sfcta.org www.sfcta.org

Memorandum

AGENDA ITEM 5

DATE: July 6, 2021

TO: Transportation Authority Board

FROM: Maria Lombardo – Chief Deputy Director

SUBJECT: 07/12/2022 Board Meeting: Appoint One Member to the Community Advisory Committee

RECOMMENDATION ☐ **Information** ☒ **Action**	☐ Fund Allocation
Neither staff nor Community Advisory Committee (CAC) members make recommendations regarding CAC appointments.	☐ Fund Programming
	☐ Policy/Legislation
	☐ Plan/Study
SUMMARY	☐ Capital Project Oversight/Delivery
There are two open seats on the 11-member CAC, with one requiring Board action at this time. Commissioner Melgar's office is ready to nominate a candidate (Sara Barz) to fill the vacancy resulting from the resignation of John Larson (District 7 representative) effective June 13th. The District 10 office is currently recruiting and evaluating potential candidates to fill the vacancy for the District 10 CAC representative, and District 8 is also seeking candidates. Applications can be submitted through the Transportation Authority's website at **www.sfcta.org/cac**. The current roster of CAC members is included in Attachment 1. The application for the District 7 candidate is included in Attachment 3.	☐ Budget/Finance
	☐ Contract/Agreement
	☒ Other: CAC Appointment

DISCUSSION

The selection of each member is approved at-large by the Board; however traditionally the Board has had a practice of ensuring that there is one resident of each supervisorial district on the CAC. Per Section 5.2(a) of the Administrative Code, the CAC:

"…shall include representatives from various segments of the community, such as public policy organizations, labor, business, seniors, people with disabilities, environmentalists, and

the neighborhoods, and reflect broad transportation interests. The committee is also intended to reflect the racial and gender diversity of San Francisco residents."

An applicant must be a San Francisco resident to be considered eligible for appointment. Applicants are asked to provide residential location and areas of interest but provide ethnicity and gender information on a voluntary basis. CAC applications are distributed and accepted on a continuous basis. CAC applications were solicited through the Transportation Authority's website, Commissioners' offices, and email blasts to community-based organizations, advocacy groups, business organizations, as well as at public meetings attended by Transportation Authority staff or hosted by the Transportation Authority. Applications can be submitted through the Transportation Authority's website at www.sfcta.org/cac.

All applicants have been advised that they need to appear in person before the Board in order to be appointed, unless they have previously appeared. If a candidate is unable to appear before the Board on the first appearance, they may appear at the following Board meeting in order to be eligible for appointment. An asterisk following the candidate's name in Attachment 2 indicates that the applicant has not previously appeared before the Board.

FINANCIAL IMPACT

The requested action would not have an impact on the adopted Fiscal Year 2022/23 budget.

CAC POSITION

None. The CAC does not make recommendations on the appointment of CAC members.

SUPPLEMENTAL MATERIALS

- Attachment 1 – Matrix of CAC Members
- Attachment 2 – Matrix of CAC Applicants
- Attachment 3 – CAC Application

San Francisco
County Transportation
Authority

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Attachment 1
Updated 07.07.22

Community Advisory Committee Members

NAME	GENDER	ETHNICITY*	DISTRICT	NEIGHBORHOOD	AFFILIATION / INTEREST	FIRST APPPOINTED	TERM EXPIRATION
VACANT			10				
John Larson, Chair	M	NP	7	Miraloma Park	Environment, Neighborhood, Public Policy	Mar 2014	Resignation effective July 13, 2022
Nancy Buffum	F	C	4	Sunset	Business, Disabled, Environment, Labor, Neighborhood, Public Policy, Seniors	Sept 2020	Sept 2022
Robert Gower	M	C	11	Mission Terrace	Disabled, Environment, Neighborhood, Public Policy, Seniors	Sept 2018	Sept 2022
David Klein, Vice-Chair	M	C	1	Outer Richmond	Environment, Labor, Neighborhood, Public Policy, Seniors	Sept 2018	Sept 2022
Jerry Levine	M	C	2	Cow Hollow	Business, Neighborhood, Public Policy	Nov 2018	Nov 2022
Rosa Chen	F	A	3	Chinatown	Business, Disabled, Environment, Neighborhood, Public Policy, Seniors	Mar 2021	Mar 2023
Kevin Ortiz	M	H/L	9	Mission	Neighborhood, Public Policy	Dec 2019	Dec 2023
Eric Rozell	M	C	6	Tenderloin	Disabled, Neighborhood, Seniors	Jan 2022	Jan 2024
Kat Siegal	F	C	5	NP	NP	Feb 2022	Feb 2024
Peter Tannen	M	C	8	Inner Mission	Environmental, Neighborhood, Public Policy	Feb 2008	Feb 2024

*A – Asian | AA – African American | AI – American Indian or Alaska Native | C – Caucasian | H/L – Hispanic or Latino | NH – Native Hawaiian or Other Pacific Islander | ME – Middle Eastern | NP – Not Provided (Voluntary Information)

San Francisco
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Attachment 2

Updated 07.06.22

Community Advisory Committee Applicants

*Applicant has not appeared before the Board.

NO.	NAME	GENDER	ETHNICITY**	DISTRICT	NEIGHBORHOOD	AFFILIATION / INTEREST
1	Sara Barz*	F	C	7	Sunnyside	Business; Environment; Social and Racial Justice; Neighborhood; Public Policy

*Applicant has not appeared before the Board

**A – Asian | AA – African American | AI – American Indian or Alaska Native | C – Caucasian | H/L – Hispanic or Latino | NH – Native Hawaiian or Other Pacific Islander | ME – Middle Eastern | NP – Not Provided (Voluntary Information)

Attachment 3

San Francisco
County Transportation
Authority

1455 Market Street, 22ND Floor, San Francisco, California 94103 415-522-4800 info@sfcta.org www.sfcta.org

San Francisco County Transportation Authority
Application for Membership on the Community Advisory Committee

Sara	**Barz**	**Female**	
FIRST NAME	LAST NAME	GENDER (OPTIONAL)	
Caucasian, European, or White		**No**	
ETHNICITY (OPTIONAL)		IDENTIFY AS HISPANIC, LATINO, OR LATINX? (OPTIONAL)	
District 7	**Sunnyside**	**[redacted]**	**[redacted]**
HOME SUPERVISORIAL DISTRICT	NEIGHBORHOOD OF RESIDENCE	HOME PHONE	HOME EMAIL
[redacted]	**[redacted]**	**[redacted]**	**[redacted]**
STREET ADDRESS OF HOME	CITY	STATE	ZIP
[redacted]	**[redacted]**	**[redacted]**	**[redacted]**
WORK SUPERVISORIAL DISTRICT	NEIGHBORHOOD OF WORKPLACE	WORK PHONE	WORK EMAIL
[redacted]	**[redacted]**	**[redacted]**	**[redacted]**
STREET ADDRESS OF WORKPLACE	CITY	STATE	ZIP

Statement of qualifications:

Since I finished my graduate degree in city planning from U.C. Berkeley in 2015, I have made my career in transportation. As a Product Manger with Apple Pay, I work at the intersection of transportation and user experience technology, a trajectory I started while managing the free-floating car share program at the City of Oakland and the procurement of the next generation of Clipper at the Metropolitan Transportation Commission. As an advocate, I have organized the Slow Hearst group to champion safe streets in Sunnyside and co-founded the transportation advocacy group Seamless Bay Area.

Statement of objectives:

I intend to work with Supervisor Melgar's office to advance the city's commitment to transit and active transportation. While my family has a car, we primarily get around by bike, bus and train. As a new mother, I will champion the interests of families in District 7, who want to safely get around the city. Sustainability, equity and a commitment to neighborhood business motivate my advocacy work, and I intend to represent those values in my work with Supervisor Melgar and the Citizen's Advisory Committee.

Continued on next page

San Francisco County Transportation Authority –
Application for Membership on the Citizens Advisory Committee

Please select all categories of affiliation or interest that apply to you:

Business;Environment;Social and racial justice;Neighborhood;Public Policy

Can you commit to attending regular meetings (about once a month for the Transportation Authority CAC, or once every two to three months for project CACs):

Yes

By entering your name and date below, and submitting this form, you certify that all the information on this application is true and correct.

Sara Barz	**6/3/2022**
NAME OF APPLICANT	DATE

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San Francisco
County Transportation
Authority

BD071222 RESOLUTION NO. 22-XX

RESOLUTION ADOPTING A SUPPORT POSITION ON ASSEMBLY BILL 1938 (FRIEDMAN)

WHEREAS, The Transportation Authority approves a set of legislative principles to guide transportation policy advocacy in the sessions of the Federal and State Legislatures; and

WHEREAS, With the assistance of the Transportation Authority's legislative advocate in Sacramento, staff has reviewed pending legislation for the current Legislative Session and analyzed it for consistency with the Transportation Authority's adopted legislative principles and for impacts on transportation funding and program implementation in San Francisco and recommended adopting a new support position on Assembly Bill (AB) 1938 (Friedman), as shown in Attachment 1; and

WHEREAS, At its July 12, 2022 meeting, the Board reviewed and discussed AB 1938 (Friedman); now, therefore, be it

RESOLVED, That the Transportation Authority hereby adopts a new support position on AB 1938 (Friedman); and be it further

RESOLVED, That the Executive Director is directed to communicate this position to all relevant parties.

Attachment:
1. Attachment 1 – State Legislation – July 2022

San Francisco County Transportation Authority
Agenda Item 6

State Legislation – July 2022
(Updated July 6, 2022)
To view documents associated with the bill, click the bill number link.

Staff is recommending a new support position on Assembly Bill (AB) 1938 (Friedman) as show in **Table 1**.

Table 2 provides an update on AB 1455 (Wicks) on which the Transportation Authority has a support position. Updates are also provided on AB 2594 (Ting) and Senate Bill (SB) 917 (Becker) which are on the watch list.

Table 3 shows the status of active bills on which the Board has already taken a position, or that staff has been monitoring on the watch list.

Additional Material on SB 917 (Becker) – Seamless Transit Transformation Act:

- **Attachment 1** provides a summary of SB 917 provisions and an analysis of how recent amendments have addressed questions and concerns identified with prior versions of the legislation.
- **Attachment 2** includes the latest version of SB 917, as of June 20, 2022.

Table 1. Recommended New Positions and Additions to Watch List

Recommended Positions	Bill # Author	Title and Summary
Support (Bill is currently on the Watch List)	AB 1938 Friedman D	**Traffic safety: speed limits.** Previously, this bill would have required the formation of a new Transit and Intercity Rail Recovery Task Force to make recommendations for how to improve the connectivity and efficiency of rail systems across the state. It was recently gutted and amended to instead clarify the circumstances under which a local authority may lower the speed limit below what is indicated by an engineering and traffic study. This fix is needed to clarify the authority approved last year through AB 43 (Friedman) to allow local jurisdictions to implement speed limit reductions under certain conditions. Speed reduction is a key Vision Zero strategy. We recommend moving the bill from the watch list to a support position in order to ensure consistent implementation of AB 43 statewide. SFMTA is actively supporting the bill, as amended.

Table 2. Notable Updates on Bills in the 2021-2022 Session

Adopted Positions	Bill # Author	Title and Update
Support	AB 455 Wicks D	**San Francisco-Oakland Bay Bridge: bus speed and reliability performance targets.** Previously, AB 455 bill would have authorized the Bay Area Toll Authority (BATA), in consultation with Caltrans, to designate transit-only traffic lanes on the San Francisco-Oakland Bay Bridge. The bill has subsequently been amended to require that Caltrans, in consultation with the Metropolitan Transportation Commission (MTC), BATA, relevant transit operators, and relevant local transportation agencies, to establish speed and reliability performance targets no later than July 1, 2024, for buses traveling in the eastbound and westbound directions through Bay Bridge corridor. It would also require Caltrans to establish an online reporting process to publicly share bus speed and reliability performance results relative to the performance targets on no less than a quarterly basis. Further, it would require Caltrans to submit a report to the Legislature no later than December 1, 2024, that identifies a strategy for achieving bus speed and reliability performance targets in the Bay Bridge corridor.
Watch	AB 2594 Ting D	**Vehicle registration and toll charges.** This bill contains a package of new provisions to reform roadway and bridge tolling practices in California. It is meant to make it easier for drivers to access transponders (such as FasTrak) and to address some equity concerns related to the toll evasion penalty process. It would, among other things, establish requirements for toll agencies regarding the number and timing of violation notices, limit what penalties can be charged and at what point in the process, require transponders to be available to those without access to banking services, require the availability of in-person payment locations, and require the provision of payment plans for outstanding violation penalties for low income drivers making at or below 200% of the federal poverty limit. We understand that the bill is likely in its final form, after many months of coordination among the author, MTC/BATA, other toll operators, and other advocacy and equity organizations. For most provisions in the bill, MTC/BATA already is meeting or exceeding what is required, and it is currently working to implement a payment plan for low-income drivers. Recent amendments to the bill would also require a one-time waiver program for low-income drivers for violations on toll bridges between March 20, 2020 (when cash tolls stopped being collected on toll bridges) through January 1, 2023. This is to accommodate any confusion that may have occurred from MTC/BATA having to switch overnight to an all-electric tolling system when it removed cash toll collectors from the bridge. MTC adopted a support position in June.

Adopted Positions	Bill # Author	Title and Update
Watch	SB 917 Becker D	**Seamless Transit Transformation Act.** This bill would require MTC and transit operators to adhere to a number of different requirements to advance the region's Transit Transformative Action Plan, including a Connected Network Plan, an integrated transit fare structure, universal mapping and wayfinding, and real-time transit data standards. Since our last update, the author has landed on what we believe will be a final version of the bill after much negotiation among the sponsor (Seamless Bay Area), Bay Area transit operators, and MTC. The bill has been amended to address some of the major issues identified by transit operators, and as a result we understand that many of the operators, including SFMTA, are no longer considering opposing the bill. Some, including BART, have adopted support or support and seek amendments positions. As requested by Chair Mandelman at the May 24 Board meeting, Attachment 1 to this memo includes a more detailed review of the various components of the bill and explains how recent amendments have addressed many of the concerns and questions raised by Transportation Authority Commissioners and others over the legislation. Attachment 2 contains the full text of the bill.

Table 3. Bill Status for Positions Taken in the 2021-22 Session

Below are updates for the two-year bills for which the Transportation Authority have taken a position or identified as a bill to watch. Bills that were chaptered, vetoed, or otherwise died during the first year of the 2021-22 session have been removed from the table. Updates to bills since the Board's last state legislative update are italicized.

Adopted Positions / Monitoring Status	Bill # Author	Bill Title	Update to Bill Status[1] (as of 07/06/2022)
Support	AB 117 Boerner Horvath D	**Air Quality Improvement Program: electric bicycles.** Makes electric bicycles eligible to receive funding from the Air Quality Improvement Program.	Senate Appropriations
	AB 455 Wicks D Coauthor: Wiener D	**Bay Bridge Fast Forward Program.** Authorizes Caltrans to set performance standards for public transit on the San Francisco-Oakland Bay Bridge and requires them to develop a strategy to meet them.	*Senate Appropriations*
	AB 2147 Ting D	**Pedestrians.** Generally prohibits the enforcement of jaywalking laws.	*Senate Appropriations*
	AB 2197 Mullin	**Caltrain electrification project: funding.** Appropriates $260 million from the General Fund to the Peninsula Corridor Joint Powers Board for the purpose of completing the Caltrain Electrification Project.	Dead
	AB 2336 Ting D Friedman D	**Vehicles: Speed Safety System Pilot Program.** Authorizes, until January 1, 2028, San Francisco, and four other jurisdictions to establish a Speed Safety System Pilot Program.	Dead
	SB 942 Newman D	**Low Carbon Transit Operations Program (LCTOP) free or reduced fare transit program.** Permits transit agencies to use LCTOP formula funds for free or reduced transit ridership programs on an ongoing basis.	*Assembly Appropriations*
Watch (See Table 1, recommended for support)	AB 1938 Friedman D	**Traffic safety: speed limits.** Clarifies intent of AB 43 (Friedman) to authorize local jurisdictions to implement speed limit reduction strategies	*Senate Transportation*

	AB 2237 Friedman D	**Transportation planning: regional transportation improvement plan: sustainable communities strategies: climate goals.** Imposes new requirements on local, regional, and state agencies that aim to better align transportation planning and investment with state climate goals.	*Senate Transportation*
	AB 2594 Ting D	**Vehicle registration and toll charges.** Implements a package of new provisions to reform roadway and bridge tolling practices in California.	*Senate Appropriations*
	ACA 1 Aguiar-Curry D Lorena Gonzalez D	**Local government financing: affordable housing and public infrastructure: voter approval.** Amends the California Constitution to authorize local ad valorem property taxes to be approved by 55% of the voters if used for transit, streets and roads, and sea level rise protections.	Assembly Local Government
	SB 66 Allen D	**California Council on the Future of Transportation: advisory committee: autonomous vehicle technology.** Establishes an advisory committee to make recommendations regarding the deployment of autonomous vehicles.	Assembly Appropriations
	SB 917 Becker D	**Seamless Transit Transformation Act.** Advances recommendations from the Metropolitan Transportation Commission's Transit Transformative Action Plan, including the development of a Connected Network Plan and the implementation of an integrated transit fare structure.	*Assembly Appropriations*
	SB 922 Wiener D	**California Environmental Quality Act: exemptions: transportation-related projects.** Extends until January 1, 2030 the California Environmental Quality Act (CEQA) statutory exemptions for specified sustainable transportation projects that were authorized in SB 288 (Wiener, 2020), and expands upon them.	*Assembly Floor*
	SB 1049 Dodd D	**Transportation Resilience Program.** Establishes a new competitive grant program for transportation resilience projects, administered by the California Transportation Commission, utilizing new formula funds the state will receive from the federal Infrastructure Investment and Jobs Act.	*Assembly Transportation*

	SB 1050 Dodd D	**State Route (SR) 37 Toll Bridge Act.** Establishes a new SR-37 Toll Authority to operate and maintain a tolling program on SR-37 that funds projects to help make the facility more resilient to sea level rise.	*Assembly Appropriations*

[1]Under this column, "Chaptered" means the bill is now law, "Dead" means the bill is no longer viable this session, and "Enrolled" means it has passed both Houses of the Legislature. Bill status at a House's "Desk" means it is pending referral to a Committee.

Attachments:

1. SB 917 (Becker) – Analysis of Legislation and San Francisco Concerns
2. SB 917 (Becker) – Bill language as of June 20, 2022

Attachment 1

Senate Bill (SB) 917 (Becker) – Analysis of Legislation and San Francisco Concerns

(Updated: 07/06/2022)

At its May 24 meeting, the Transportation Authority Board discussed SB 917, the Seamless Transit Transformation Act at length and Chair Mandelman asked staff to return with more information about what the financial and other impacts to San Francisco would be. As directed at that meeting, we have prepared a short memo summarizing the bill as amended, the questions and concerns that were expressed, and how the latest version addresses those questions and concerns. Attachment 2 to this item contains what we expect is close to the final version of the language, as amended on June 20, 2022. The language, as it currently stands, is the result of many months' negotiations among the author, the sponsor (Seamless Bay Area), MTC, and many transit operators (including BART and SFMTA).

Bill Summary

Some overarching provisions of the bill include:

- It establishes a Regional Transit Coordination Council (RTCC) to undertake designated activities. Membership consists of transit agency Executive Directors, General Managers, or their designees and MTC's Executive Director, or their designee.
- It establishes definitions to be used throughout the initiative:
    - **Local transit service** is defined as bus and light rail transit service within or adjacent to a transit agency's defined service area within the region, excluding bus services that cross a toll bridge over the San Francisco Bay.
    - **Regional transit service** is defined as all heavy rail, commuter rail, ferry, or express bus services, as designated by a transit agency, and bus services that cross a toll bridge over San Francisco Bay.
- Non-compliance with policies established in the bill make transit operators subject to withholding of State Transit Assistance (STA) formula funding, which is mainly used for transit operations. The legislation requires that transit agencies "shall make every effort to comply" with provisions as long as they don't affect existing transit service levels. If a transit agency can demonstrate that implementing a policy would have negative impacts to existing service levels, it can request that MTC provide sufficient funding to maintain service or provide an exemption from the policy. If neither are granted, however, MTC could still withhold the agency's STA funds.

Bill Component	Detail
1. Integrated transit fares	The RTCC, in consultation with MTC, must adopt an integrated transit fare structure by December 31, 2023, that will become effective by July 1, 2024. It will also be brought to transit agency boards for consideration and adoption. The integrated transit fare structure must include common definitions for adults, youths, seniors, persons with disabilities and potentially other categories. It must also include no-cost local transit service transfers (excluding SFMTA's cable cars) and reduced-cost regional transit service transfers. By July 1, 2023, the RTCC, in consultation with MTC, must establish a one- to three-year pilot program of these transfer policies. MTC must approve funding and the pilot must start by July 1, 2024. Transit operators may opt out after 18 months if there is insufficient funding to offset the annual financial impact. The RTCC, in consultation with MTC, must, by March 31, 2024, develop an estimate of the anticipated annual financial impact associated with implementing a common fare structure for regional transit services, as well as an estimate associated with implementing a multi-agency pass that could include access to both local and regional transit services. MTC must implement each of the policies on a pilot basis for three years only if additional funding is secured to offset annual costs.
2. Connected Network Plan	MTC, in consultation with RTCC, must adopt a Connected Network Plan by July 1, 2024, if funding is identified for MTC to complete the plan, or December 31, 2025 otherwise. The plan must identify: • A transit priority network of corridors and hubs for the region • Service-level standards for the identified connected network transit corridors and hubs • Capital and operating funding needs • Potential impact to farebox revenue The plan must also include recommendations regarding an approach for the coordination of right-of-way owners, including Caltrans and local jurisdictions.

3. Regional transit mapping and wayfinding	By July 1, 2025, MTC, in consultation with the RTCC, must develop a comprehensive, standardized regional transit mapping and wayfinding system that includes standards required for information to be accessible and usable by people with disabilities. MTC must develop an implementation and maintenance strategy and a funding plan for a full or phased deployment of the system. By January 1, 2026, any new investments to mapping and wayfinding must adhere to these standards unless MTC adopts and alternate deployment timeline.
4. Open data standards	By July 1, 2023, MTC, in coordination with the RTCC, must establish open data standards to provide transit riders with real-time transit vehicle location, arrival and departure times and predictions, and service alerts. Each of the region's transit agencies shall comply with the established standards and share their data with MTC.

Bill Analysis

At a high level, we believe SB 917, as amended, now better meets the general threshold of "doing no harm" to San Francisco's transit system relative to some of the concerns raised during the bill's development. However, there is still the potential for some indirect impacts discussed below, which will need to be addressed during the RTCC's development of the integrated transit fare structure. As such, SFMTA is not currently considering an oppose position on the bill. Below is additional information regarding how the latest version addresses issues that were raised about potential impacts to San Francisco.

Concern	How Addressed
1. Legislation must make fare integration and transfer policy changes subject to funding availability to hold operators harmless	The RTCC would now lead the development of the integrated transit fare structure (which sets policies for both fares and transfers), in coordination with MTC, which was the other way around in prior versions of the bill. This will allow significant transit operator leadership and engagement in developing the new fare integrations and transfer policies and how they would be implemented. The bill requires MTC to fund a pilot of the transfer policy for at least one year, and up to three years if there is sufficient funding available. MTC has identified funding that is likely sufficient for the first required year of the pilot. The legislation also would allow a transit agency to opt out of a pilot after 18 months if the funding provided is insufficient to cover their revenue losses associated with free and/or reduced cost transfers. The common regional fare requirement still leaves many open design questions and therefore we cannot assess the fiscal impact of this provision. While the bill only requires MTC to pilot the new fares and regional pass if funds are found, the ultimate financial impact to San Francisco will depend on the source of funds and extent to which these would have otherwise come to San Francisco for other uses. The subsidy required to make other transit systems whole is also a de-facto impact to San Francisco in that other systems are subsidized less than Muni.
2. Legislation must give transit operators the ability to opt out of regional policies if they would lead to fare increases or service cuts.	Transit agencies "shall make every effort to comply" with provisions insofar as it doesn't affect existing transit service levels. If a transit agency can demonstrate that implementing a policy would have negative impacts to existing service levels, it can request that MTC provide sufficient funding to maintain service or exempts it from the policy. If neither request is granted, however, MTC could prevent the transit operator from receiving its formula STA operating funds in part or in full and hold those funds until the operator is in compliance.

3. Legislation must maintain the rights and responsibilities that are granted to transit operators and maintain home rule authority for charter cities	For purposes of the integrated transit fare structure, the legislation explicitly states that: • Nothing shall be construed to interfere with or dilute the powers, duties, and responsibilities granted to transit agencies (e.g. the setting of transit fares). • Operation of a transportation system is a core municipal affair and nothing in the bill shall be construed to interfere in or dilute the powers, duties, and responsibilities provided by California's charter city home rule provisions.
4. Legislation allows for transit operators to provide subsidies above what is required	The bill includes language that it "does not prohibit a transit agency from offering distinct free or discounted transit fares" above what would be required as part of the integrated transit fare structure.

Conclusion

As amended, SB 917 appears to address many of the concerns expressed at the May 24 Transportation Authority Board meeting. The question still remains, however, whether state mandates are needed at this time, since most of these reforms were in the process of being advanced through the Blue Ribbon Transit Transformation Action Plan and Fare Integration Task Force.

While a more connected and uniform transit system is certainly desirable, there are opportunity costs associated with these implementation strategies that shouldn't be overlooked. For example, it's important to consider who benefits from investing millions of dollars in cross-regional connectivity improvements compared to improvements in shorter local trips that are heavily utilized by low-income riders. Even if MTC identifies new funding to implement and sustain these transit connectivity programs, it may be funding that could otherwise be spent on other transit priorities or to help sustain transportation budgets as operators recover from the pandemic. For instance, many transit operators are facing a fiscal cliff due to prolonged recovery from the COVID-19 pandemic with ridership and revenues remaining significantly depressed. Funds will be needed in the near term to help avert reductions in service. Other priorities for additional new revenues could include additional fare subsidies or increasing transit service for low income, BIPOC, or transit-dependent riders. Moving forward, as a city and as a region it will be important to transparently evaluate how these types of reforms should be prioritized compared to other needs when transit resources are constrained, especially for operations.

If SB 917 is approved, another consideration during the development of the integrated transit fare structure will be how to ensure that San Francisco is not ultimately disadvantaged in the formula calculation of subsidies to compensate operators for the cost to implement the fare and transfer policies. As a city we

have historically subsidized public transit at a higher level compared to many other jurisdictions and we already provide numerous free and reduced-fare programs. Among other considerations, we would want to have those subsidies factored into any formula applied across all operators so that San Francisco isn't effectively subsidizing more suburban transit operators in jurisdictions that have not chosen to financially support their transit systems to the same extent as San Francisco.

SB-917 Seamless Transit Transformation Act. (2021-2022)

Date Published: 06/20/2022 02:00 PM

AMENDED IN ASSEMBLY JUNE 20, 2022

AMENDED IN SENATE APRIL 18, 2022

CALIFORNIA LEGISLATURE— 2021–2022 REGULAR SESSION

SENATE BILL NO. 917

Introduced by Senator Becker
(Principal coauthor: Assembly Member Quirk)
(Coauthors: Senators Dodd and Wiener)
(Coauthors: Assembly Members Lee, Levine, Mullin, and Ting)

February 03, 2022

An act to amend Section 66502 of, and to add Sections *66513.4,* 66513.5, 66516.1, 66516.7, and 66516.8 to, the Government Code, relating to transportation.

LEGISLATIVE COUNSEL'S DIGEST

SB 917, as amended, Becker. Seamless Transit Transformation Act.

Existing law creates the Metropolitan Transportation Commission, as a local area planning agency and not as a part of the executive branch of the state government, to provide comprehensive regional transportation planning for the region comprised of the City and County of San Francisco and the Counties of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma.

This bill would require the commission to develop and adopt a Connected Network Plan, ~~adopt an integrated transit fare structure,~~ develop a comprehensive, standardized regional transit mapping and wayfinding system, develop an implementation and maintenance strategy and funding plan, and establish open data standards, as specified. The bill would require the region's transit agencies, as defined, to comply with those established ~~integrated fare structure,~~ regional transit mapping and wayfinding system, implementation and maintenance strategy and funding plan, and open data standards, as provided.

This bill would require the transit agencies in the region to establish a regional transit coordinating council and would require the council to, among other things, develop and adopt an integrated transit fare structure. The bill would require the council to submit the integrated transit fare structure to the commission for approval and, after approval, would require each transit agency in the region to present the structure to its board for consideration.

Under existing law, moneys in the Public Transportation Account are continuously appropriated to the Controller for allocation to transportation planning agencies, county transportation commissions, and the San Diego Metropolitan Transit Development Board for purposes of the State Transit Assistance Program. Existing law requires the Controller to allocate those moneys to those entities based on population and qualifying revenue, as specified.

This bill would require the Metropolitan Transportation Commission to notify a transit agency if the commission determines that the transit agency is out of compliance with the integrated *transit* fare structure, regional transit mapping and wayfinding system, implementation and maintenance strategy and funding plan, or open data standards described above, and would require the commission to indicate what steps are needed to comply. If a transit agency does not comply with the compliance parameters set by the commission or if the commission rejects the transit agency's request for additional funding or for an exemption, the bill would make that transit agency ineligible to receive a portion of those moneys in an amount to be determined by the commission. The bill would require a transit agency to regain access to any withheld funds upon demonstration of compliance.

To the extent that this bill would mandate that a transit agency establish a new program or provide a higher level of service as part of an existing program, and by imposing additional duties on the Metropolitan Transportation Commission, the bill would impose a state-mandated local program.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that, if the Commission on State Mandates determines that the bill contains costs mandated by the state, reimbursement for those costs shall be made pursuant to the statutory provisions noted above.

Vote: majority Appropriation: no Fiscal Committee: yes Local Program: yes

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. This act shall be known, and may be cited, as the Seamless Transit Transformation Act.

SEC. 2. The Legislature finds and declares all of the following:

(a) Transit connectivity and integration in the nine-county San Francisco Bay area has been a longstanding challenge. Legislative efforts to mandate and incentivize coordination between dozens of disparate transit agencies date back to 1996 and earlier.

(b) Low-income residents, many of whom have experienced displacement and have long commutes requiring many transfers, are among the most adversely affected by the fragmentation, experiencing a significant financial burden from needing to pay multiple separate transit fares or being forced into costly vehicle ownership.

(c) As of 2017, only 5 percent of all trips in the San Francisco Bay area were made using transit. Per-capita transit ridership in the region decreased 12 percent between 1991 and 2016. "Plan Bay Area 2050," prepared by the Metropolitan Transportation Commission, has identified that to achieve climate, equity, and economic goals, the share of commuters who travel by transit must increase from 13 percent in 2015 to at least 20 percent by 2050.

(d) The COVID-19 pandemic has led to further ridership declines, due to both dramatic shifts in travel patterns and significant transit service cuts across the region. As the region emerges from the pandemic, transit ridership is recovering much more slowly than the economy as a whole; as of November 2021, transit ridership had recovered to just 40 percent of pre-COVID levels, while traffic on a majority of bay area bridges exceeded 90 percent of pre-COVID levels.

(e) In response to the COVID-19 pandemic, in May 2020, the Metropolitan Transportation Commission convened a 32-member Blue Ribbon Transit Recovery Task Force composed of transit agency managers, advocates, and elected officials, to coordinate transit recovery efforts and identify reforms that would position the bay area's transit system to emerge from the pandemic stronger and more connected than before and to help recover and grow transit ridership.

(f) In July 2021, the task force unanimously approved the Bay Area Transit Transformation Action Plan, which included 27 actions to increase ridership and improve fares and payment, customer access to information, transit network management, accessibility, and funding.

(g) In November 2021, the region's Fare Integration Task Force, co-led by Bay Area transit agencies and the Metropolitan Transportation Commission, unanimously adopted a policy vision statement supporting the ~~advancement~~ *further development* of key fare integration ~~policies,~~ *policies pending available resources and technical considerations,* including deployment of an all-agency transit pass, reduced cost transfers, and *a refined vision for* a common fare structure for regional transit services.

(h) Although the Legislature has generally authorized the Metropolitan Transportation Commission to set rules and regulations related to transit fare coordination and transit connectivity, to ~~ensure~~ *preserve local transit agency board authorities and responsibilities, while ensuring* that the recommendations emerging from the Bay Area Transit Transformation Action Plan are implemented by the region's transit agencies in a timely manner and for the benefit of current and future transit riders, this act is necessary.

SEC. 3. Section 66502 of the Government Code is amended to read:

66502. (a) There is hereby created, as a local area planning agency and not as a part of the executive branch of the state government, the Metropolitan Transportation Commission to provide comprehensive regional transportation planning for the region comprised of the City and County of San Francisco and the Counties of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma.

(b) For purposes of this title, the following definitions apply:

(1) "Cable car service" means the historic cable car system operated by the San Francisco Municipal Transportation Agency.

(2) "Commission" means the Metropolitan Transportation Commission.

(3) "Region" means the region described in subdivision (a).

(4) "Local transit service" means bus and light rail transit service within or adjacent to a transit agency's defined service area within the region, excluding bus services that cross a toll bridge over San Francisco Bay.

(5) "Regional transit service" means all heavy rail, commuter rail, ferry, or express bus services, as designated by a transit agency, and bus services that cross a toll bridge over San Francisco Bay. Regional transit service does not include intercity passenger rail or services operated by the San Joaquin Regional Rail Commission.

(6) "Transit agency" means a public agency that meets all of the following requirements:

(A) The public agency provides surface transportation service to the general public, complementary paratransit service to persons with disabilities as required pursuant to Section 12143 of Title 42 of the United States Code, or similar transportation service to people with disabilities or the elderly.

(B) The public agency operates ~~the service~~ *service, as* described in ~~subparagraph (A)~~ *paragraph (1), (4), or (5),* by bus, rail, ferry, or other conveyance on a fixed route, demand response, or otherwise regularly available basis.

(C) The public agency generally charges a fare for the ~~service~~ *service, as* described in ~~subparagraph (A).~~ *paragraph (1), (4), or (5).*

SEC. 4. *Section 66513.4 is added to the Government Code, to read:*

66513.4. *The transit agencies in the region shall establish a regional transit coordinating council to undertake the activities designated for the council in this title. The council shall consist of executive directors or general managers, or their designees, representing transit agencies, as well as the executive director of the commission, or their designee.*

~~**SEC. 4.**~~***SEC. 5.*** Section 66513.5 is added to the Government Code, to read:

66513.5. (a) The commission, in ~~consultation~~ *coordination* with the regional transit coordinating council established pursuant to Section ~~29142.4 of the Public Utilities Code,~~ *66513.4,* shall develop and adopt a Connected Network Plan. Subject to appropriation in the annual Budget Act or the availability of ~~private nonstate~~ *other* funding *provided* for this purpose, the commission shall complete the Connected Network Plan on or before ~~March~~ *July* 31, 2024. In the absence of an appropriation in the annual Budget Act or *other sufficient* funding

made ~~available by a private nonstate source,~~ *available for this purpose,* the commission shall complete the Connected Network Plan by December 31, 2025.

(b) The Connected Network Plan shall do all of the following:

(1) Be consistent with the State Rail Plan required pursuant to Section 14036 and *the* California Transportation Plan updated pursuant to Section ~~65071.~~ *65071 within the timeframe established by the Connected Network Plan.*

(2) Identify connected network transit corridors and hubs of regional significance across the region.

(3) ~~Establish~~ *Identify* a transit priority network for the region that ~~identifies~~ *does both of the following:*

(A) Identifies corridors that will most benefit from improvements that support fast and reliable transit service that avoids conflict with traffic congestion.

(B) Includes recommendations regarding both of the following:

(i) An approach for coordination with right-of-way owners, including the Department of Transportation and local jurisdictions, on the development and implementation of transit priority improvements on corridors, arterials, and roadways where public transit operates.

(ii) Updates to Department of Transportation design standards and policies to include transit priority improvements.

(4) Identify service-level standards for ~~different parts of the network~~ *connected network transit corridors and hubs identified pursuant to paragraph (2)* to optimize access across the region, particularly for low-income and transit-dependent populations, corresponding to different density and land use conditions, including by doing both of the following:

(A) Identifying target travel times between key transit hubs, service frequencies, and operating hours for weekdays, Saturdays, and Sundays.

(B) Quantifying access to jobs, housing, and major regional ~~amenities, including, but not limited to, educational institutions, medical facilities, and major recreational destinations.~~ *amenities.*

(5) Identify operating and capital funding needs associated with the Connected Network ~~Plan.~~ *Plan and its potential impacts to farebox revenue.*

(c) In implementing any provision of this section, transit agencies shall fulfill all applicable requirements under Title VI of the federal Civil Rights Act of 1964 (Public Law 88-352) regarding service and fare changes.

~~**SEC. 5.**~~***SEC. 6.*** Section 66516.1 is added to the Government Code, to read:

66516.1. (a) (1) ~~Consistent with Section 66516, on~~ *On* or before December 31, 2023, the ~~commission~~ *regional transit coordinating council, in coordination with the commission,* shall *develop and* adopt an integrated transit fare ~~structure that will become effective on or before July 1, 2024. The integrated transit fare structure shall be developed in consultation with the regional transit coordinating council established pursuant to Section 29142.4 of the Public Utilities Code.~~ *structure, and shall submit the integrated transit fare structure for review and approval by the commission. After approval by the commission, each of the region's transit agencies shall present the integrated transit fare structure to its governing board for consideration within 90 days. The integrated transit fare structure shall become effective on or before July 1, 2024.*

~~(2)The commission, in consultation with the regional transit coordinating council described in paragraph (1), shall annually review the integrated transit fare structure to determine if updates are necessary, and shall make updates based on the review and consultation.~~

~~(3)Each of the region's transit agencies shall comply with the integrated transit fare structure.~~

(2) The regional transit coordinating council, in consultation with the commission, shall review the integrated transit fare structure to determine if updates are necessary no less than once per year, and shall recommend updates as needed based on that review and consultation. Any changes to the integrated transit fare structure recommended by the regional transit coordinating council shall be subject to the approval of the commission and the board of each transit agency.

(b) *(1)* The integrated *transit* fare structure shall include ~~all of the following:~~ *common definitions for adults, youth, seniors, persons with disabilities, and other categories.*

~~(1)No-cost local transit service transfers and reduced-cost regional transit service transfers, regardless of whether transfers are between the same transit agency or multiple transit agencies, except if the transfer is to a cable car service. In the case of a transfer to a cable car service, the San Francisco Municipal Transportation Agency may determine the appropriate transfer fare policy.~~

~~(2)Common transfer rules for local fares, such as means for validation.~~

~~(3)Common definitions for adults, youth, seniors, persons with disabilities, and other categories.~~

(2) The integrated transit fare structure may include common transfer rules for local fares, such as the duration of transfer validity.

(c) (1) On or before July 1, 2023, the regional transit coordinating council, in coordination with the commission, shall establish a pilot program to develop and adopt, for the purposes of a period of at least one year and no more than three years, a common system of no-cost local transit service transfers and reduced-cost regional transit service transfers, regardless of whether transfers are between the same transit agency or multiple transit agencies, except if the transfer is to a cable car service. In the case of a transfer to a cable car service, the San Francisco Municipal Transportation Agency may determine the appropriate transfer fare policy. The governing board of each transit agency in the region shall approve participation in the common system of no-cost local transit service transfers and reduced-cost regional transit service transfers for the pilot program upon the fulfillment of all applicable requirements of Title VI of the federal Civil Rights Act of 1964 (Public Law 88-352). If the pilot program is longer than 18 months, a transit agency may withdraw from the pilot program after 18 months if it is determined by the commission, in coordination with the regional transit coordinating council, that insufficient funding exists to offset the annual financial impact of the pilot program.

(2) On or before October 30, 2023, the commission shall allocate funding to offset the anticipated annual financial impact for the pilot program established pursuant to paragraph (1).

(3) The pilot program established pursuant to paragraph (1) shall commence no later than January 1, 2024, or upon deployment of the Next Generation Clipper Fare Payment System, whichever is sooner.

(4) The commission, in consultation with the regional transit coordinating council, shall prepare a report evaluating the pilot program established pursuant to paragraph (1) and shall present the report at a public meeting at least 90 days before the conclusion of the pilot program. If the report includes recommendations for the continuation of a common system of no-cost local transit service transfers and reduced-cost regional transit service transfers, the commission shall also propose a long-term funding plan, informed by data generated during the pilot program, in the report.

(5) The common system of no-cost local transit service transfers and reduced-cost regional transit service transfers may be incorporated into the integrated transit fare structure upon the conclusion of the pilot program.

~~(c)~~

(d) On or before March 31, 2024, ~~the commission, in consultation with the~~ regional transit coordinating ~~council described in subdivision (a),~~ *council, in coordination with the commission,* shall develop an estimate of the anticipated annual financial impact associated with implementing each of the following policies:

(1) A common fare structure for regional transit services ~~by which trips involving one or more regional transit services are priced equivalently.~~ *developed pursuant to this paragraph. The member transit agencies of the regional transit coordinating council that provide regional transit services shall develop the common fare structure for regional transit services in coordination with the commission and shall present a draft of the policy at a public meeting at least 30 days before its adoption.*

(2) A multiagency pass, which may include a cap, that allows access to local transit services and regional transit services provided by the region's transit agencies on a daily or monthly ~~basis for one set price,~~ *basis,* except for paratransit service as required by Section 37.121 of Title 49 of the Code of Federal Regulations.

~~(d)If~~

(e) On or before January 1, 2032, if the commission or transit agencies secure sufficient additional funding to offset the annual net cost based on the financial impact estimate prepared pursuant to subdivision ~~(c)~~ *(d)* to implement a multiagency pass, as described in paragraph (2) of subdivision ~~(c),~~ *(d),* over a three-year period, that policy shall be incorporated into the integrated ~~regional~~ *transit* fare structure ~~and implemented~~ on a pilot basis for three years. *Participation in the pilot by a transit agency shall be subject to approval by its governing board.*

~~(e)~~

(f) If the commission or transit agencies secure sufficient additional funding to offset the ongoing annual net cost based on the financial impact estimate prepared pursuant to subdivision ~~(c)~~ *(d)* to implement a common fare structure for regional transit services as described in paragraph (1) of subdivision ~~(c),~~ *(d),* over a three-year period, that policy shall be incorporated into the integrated ~~regional~~ *transit* fare structure and be implemented on a pilot basis for three years. ~~The commission shall develop this common fare structure for regional transit services in consultation with the regional transit coordinating council described in subdivision (a) and shall present a draft of the policy at a public meeting at least 30 days before its adoption.~~ The timing of when the policy shall take effect shall be determined by ~~the commission in consultation with the regional transit coordinating council described in subdivision (a).~~ *the member transit agencies of the regional transit coordinating council that provide regional transit services, in coordination with the commission. Participation in the pilot by a transit agency that provides regional transit service shall be subject to approval by its governing board.*

(g) At the conclusion of the second year of each three-year pilot program established pursuant to subdivision (e) or (f), the commission, in consultation with the regional transit coordinating council, shall prepare a report evaluating the pilot program and shall present the report at a public meeting at least 180 days before the conclusion of the pilot program. If the report includes recommendations for the continuation of a common fare structure for regional transit services or a multiagency pass, as applicable, the commission shall include a long-term funding plan for the continuation of that activity in the report.

~~(f)~~

(h) On or before October 1 of each year, each of the region's transit agencies shall notify the ~~commission~~ *regional transit coordinating council* of any proposed change to its fares in order to facilitate ~~the alignment of fare policies across the region's transit agencies in~~ *changes to* the integrated transit fare structure for the following year. ~~The commission shall disseminate that information to all of the region's transit agencies.~~

~~(g)~~

(i) Transit agencies shall make every effort to comply with the requirements of this section without affecting transit service levels. If the commission determines that one of the region's transit agencies is out of compliance with the integrated *transit* fare structure described in subdivision (a), then the commission shall first notify the transit agency of noncompliance, and indicate what steps are needed to comply. If a transit agency is unable to comply due to ~~a lack of funding,~~ *demonstrated negative impacts to existing transit service levels,* the transit agency shall submit a request for additional funding or for an exemption from the requirements of this section to the commission for approval. If the agency does not comply with the compliance parameters set by the commission or if the commission rejects the transit agency's request for additional funding or for an exemption, that transit agency shall not be eligible to receive a portion of funds pursuant to Section 99313 or 99314 of the Public Utilities Code in an amount to be determined by the commission. The transit agency shall regain access to any withheld funds upon demonstration of compliance.

~~(h)~~

(j) This section does not prohibit a transit agency from offering *distinct* free or discounted transit fares for the categories of riders described in paragraph ~~(3)~~ *(1)* of subdivision (b).

(k) In implementing any provision of this section, transit agencies and the commission shall fulfill all applicable requirements under Title VI of the federal Civil Rights Act of 1964 (Public Law 88-352) regarding service and fare changes. If a transit agency requires additional time to comply with those requirements, the operative dates in this section may be extended by the regional transit coordinating council or the commission.

(l) The operation of a transportation system is a core municipal affair as enumerated in Section 9 of Article XI of the California Constitution. Nothing in this section shall be construed to interfere in or dilute the powers, duties, and responsibilities provided by the California Constitution's charter city home rule provisions.

(m) Nothing in this section shall be construed to interfere with or dilute the powers, duties, and responsibilities granted to transit agencies, including those described in paragraph (6) of subdivision (b) of Section 66502 and those set forth in Division 10 (commencing with Section 24501) and Division 16 (commencing with Section 160000) of the Public Utilities Code.

(n) For purposes of this section, "regional transit coordinating council" means the regional transit coordinating council established pursuant to Section 66513.4.

~~**SEC. 6.**~~ ***SEC. 7.*** Section 66516.7 is added to the Government Code, to read:

66516.7. (a) The Legislature finds and declares both of the following:

(1) The lack of a universal regional transit map and common wayfinding format at transit stops and stations in the region adds to the fragmented experience transit riders encounter, especially when planning a trip across multiple transit agencies.

(2) Research has shown that the way transit lines and stations are displayed on maps strongly influences how travelers use the system.

(b) (1) The commission, in ~~consultation~~ *coordination* with the regional transit coordinating council established pursuant to Section ~~29142.4 of the Public Utilities Code,~~ *66513.4,* shall, on or before July 1, 2025, do both of the following:

(A) Develop a comprehensive, standardized regional transit mapping and wayfinding system, including standards and resources to ~~display~~ *convey* information on print, digital, and interactive media, common branding, and a shared digital mapping platform. The system shall identify the standards that are required and the standards that allow for customization, including the manner in which existing transit agency branding may be permitted. The system shall ~~assess and identify~~ *assess, identify, and incorporate* standards required for wayfinding information to be accessible and usable by people with disabilities.

(B) Develop an implementation and maintenance strategy and funding plan to deploy the comprehensive, standardized regional transit mapping and wayfinding system. The commission may adopt a phased deployment of the system.

(2) Any new investments to mapping and wayfinding, including replacement and upgrades, made by any of the region's transit agencies shall adhere to the standardized regional transit mapping and wayfinding system and implementation and maintenance strategy and funding plan developed pursuant to this subdivision.

(c) Each of the region's transit agencies shall use only the standardized regional transit mapping and wayfinding system for all new mapping and wayfinding investments, including replacements and upgrades, made on or after January 1, 2026, unless the commission adopts a schedule that sets out an alternate deployment timeline.

(d) In ~~consultation~~ *coordination* with the regional transit coordinating council described in subdivision (b), the commission shall update the standardized regional transit mapping and wayfinding system and implementation and maintenance strategy and funding plan, as needed.

(e) Nothing in this section shall prevent a transit agency from displaying their own map on a temporary basis if the regional transit mapping and wayfinding system is unavailable or incapable of addressing the need due to unforeseen circumstances.

(f) Transit agencies shall make every effort to comply with the requirements of this section without affecting existing *transit* service levels. If the commission determines that one of the region's transit agencies is out of compliance with subdivision (b), then the commission shall first notify the transit agency of noncompliance, and indicate what steps are needed to comply. If a transit agency is unable to comply due to ~~a lack of funding,~~ *demonstrated negative impacts to existing transit service levels,* the transit agency shall submit a request for additional funding or for an exemption from the requirements of this section to the commission for approval. If the agency does not comply with the compliance parameters set by the commission or if the commission rejects the transit agency's request for additional funding or for an exemption, that transit agency shall not be eligible to receive a portion of funds pursuant to Section 99313 or 99314 of the Public Utilities Code in an amount to be determined by the commission. The transit agency shall regain access to any withheld funds upon demonstration of compliance.

~~**SEC. 7.**~~ ***SEC. 8.*** Section 66516.8 is added to the Government Code, to read:

66516.8. (a) The Legislature finds and declares all of the following:

(1) Studies have shown that travelers view the wait time at a transit stop as the most inconvenient part of the transit journey experience.

(2) Despite best efforts by the region's transit agencies to adhere to their published schedules, the conditions on the roadway, including congestion and other unplanned delays, create unpredictability for on-time arrivals.

(3) The development of technology enabling real-time transit information, including arrival and departure predictions, vehicle locations, occupancy, and service alerts, has created an opportunity for the region's transit agencies to alleviate the wait-time frustrations and provide riders with other useful trip information.

(4) Transit riders should have access to consistent and uniform real-time information across all transit services in the region.

(b) (1) On or before July 1, 2023, the commission shall establish open data standards, in consultation with the regional transit coordinating council established pursuant to Section ~~29142.4 of the Public Utilities Code,~~ *66513.4,* that are aligned with, but may exceed, any data standards adopted by the state to provide real-time transit vehicle location, arrival and departure times and predictions, and service alerts data to transit riders, and shall assist in the analysis of transit service to improve service quality. A transit agency may elect not to disclose vehicle location information if it can otherwise comply with the open data standards related to providing arrival and departure times and predictions. The commission shall update the open data standards, in consultation with the regional transit coordinating council described in this paragraph, as needed.

(2) The standards shall enable the provision of real-time arrival data and follow generally accepted accessibility standards.

(3) Each of the region's transit agencies shall comply with the standards established pursuant to this subdivision and shall share their data with the commission in a format that is compatible with the ~~standards.~~ *standards or other format approved by the commission on an interim basis.*

(c) The commission shall coordinate the activities of the region's transit agencies pursuant to subdivision (b), disseminate data collected pursuant to this section to third parties, and develop an implementation and funding plan for deployment of real-time information.

(d) Nothing in this section shall preclude transit agencies from using real-time data that they collect for any purpose, such as in the development of a transit agency's own mobile application or powering real-time arrival or departure information on their internet website, as long as the data are also shared with the commission.

(e) Nothing in this section shall preclude transit agencies from sharing real-time data directly with third parties, as long as the data are also shared with the commission.

(f) Transit agencies shall make every effort to comply with the requirements of this section without affecting *existing* transit service levels. If the commission determines that one of the region's transit agencies is out of compliance with subdivision (b), then the commission shall first notify the transit agency of noncompliance, and indicate what steps are needed to comply. If a transit agency is unable to comply due to ~~a lack of funding,~~ *demonstrated negative impacts to existing transit service levels,* the transit agency shall submit a request for additional funding or for an exemption from the requirements of this section to the commission for approval. If the transit agency does not comply with the compliance parameters set by the commission or if the commission rejects the transit agency's request for more funding or for an exemption, that transit agency shall not be eligible to receive a portion of funds pursuant to Section 99313 or 99314 of the Public Utilities Code in an amount to be determined by the commission. The transit agency shall regain access to any withheld funds upon demonstration of compliance.

~~**SEC. 8.**~~***SEC. 9.*** If the Commission on State Mandates determines that this act contains costs mandated by the state, reimbursement to local agencies and school districts for those costs shall be made pursuant to Part 7 (commencing with Section 17500) of Division 4 of Title 2 of the Government Code.

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San Francisco
County Transportation
Authority

BD071222 RESOLUTION NO. 22-XX

RESOLUTION ALLOCATING $17,739,152 IN PROP K FUNDS, WITH CONDITIONS, AND APPROPRIATING $307,000 FOR SEVEN REQUESTS

WHEREAS, The Transportation Authority received seven requests for a total of $18,046,152 in Prop K local transportation sales tax funds, as summarized in Attachments 1 and 2 and detailed in the enclosed allocation request forms; and

WHEREAS, The requests seek funds from the following Prop K Expenditure Plan categories: Guideways – BART, Paratransit, Street Repair & Cleaning Equipment, Pedestrian and Bicycle Facility Maintenance, Tree Planting and Maintenance, and Transportation/ Land Use Coordination; and

WHEREAS, As required by the voter-approved Expenditure Plan, the Transportation Authority Board has adopted a Prop K 5-Year Prioritization Program (5YPP) for each of the aforementioned Expenditure Plan programmatic categories; and

WHEREAS, The adopted Prop K Strategic plan has funds programmed to the Paratransit category, which has no 5YPP requirement; and

WHEREAS, Six of the seven requests are consistent with the Prop K Strategic Plan and/or relevant 5YPPs for their respective categories; and

WHEREAS, The Department of Public Works' (SFPW's) request for the Street Repair and Cleaning Equipment requires a 5YPP amendment as summarized in Attachment 3 and detailed in the enclosed allocation request forms; and

WHEREAS, After reviewing the requests, Transportation Authority staff recommended allocating a total of $17,739,152 in Prop K funds, with conditions, and appropriating $307,000 for seven requests, as described in Attachment 3 and detailed in the enclosed allocation request forms, which include staff recommendations for Prop K allocation amounts, required deliverables, timely use of funds requirements, special conditions, and Fiscal Year Cash Flow Distribution Schedules; and

WHEREAS, There are sufficient funds in the Capital Expenditures line item of the Transportation Authority's approved Fiscal Year 2022/23 budget to cover the proposed actions; and

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WHEREAS, At its June 22, 2022 meeting, the Community Advisory Committee was briefed on the subject request and unanimously adopted a motion of support for the staff recommendation; now, therefore, be it

RESOLVED, That the Transportation Authority hereby amends the Prop K Street Repair & Cleaning Equipment 5YPP, as detailed in the enclosed allocation request form; and be it further

RESOLVED, That the Transportation Authority hereby allocates $17,739,152 in Prop K funds, with conditions, and appropriates $307,000 for seven requests, as summarized in Attachment 3 and detailed in the enclosed allocation request forms; and be it further

RESOLVED, That the Transportation Authority finds the allocation of these funds to be in conformance with the priorities, policies, funding levels, and prioritization methodologies established in the Prop K Expenditure Plan, the Prop K Strategic Plan and the relevant 5YPPs; and be it further

RESOLVED, That the Transportation Authority hereby authorizes the actual expenditure (cash reimbursement) of funds for these activities to take place subject to the Fiscal Year Cash Flow Distribution Schedules detailed in the enclosed allocation request forms; and be it further

RESOLVED, That the Capital Expenditures line item for subsequent fiscal year annual budgets shall reflect the maximum reimbursement schedule amounts adopted and the Transportation Authority does not guarantee reimbursement levels higher than those adopted; and be it further

RESOLVED, That as a condition of this authorization for expenditure, the Executive Director shall impose such terms and conditions as are necessary for the project sponsors to comply with applicable law and adopted Transportation Authority policies and execute Standard Grant Agreements to that effect; and be it further

RESOLVED, That as a condition of this authorization for expenditure, the project sponsors shall provide the Transportation Authority with any other information it may request regarding the use of the funds hereby authorized; and be it further

RESOLVED, That the Capital Improvement Program of the Congestion Management Program and the relevant 5YPPs are hereby amended, as appropriate.

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Attachments:
1. Summary of Requests Received
2. Project Descriptions
3. Staff Recommendations
4. Prop K Allocation Summaries - FY 2022/23

Enclosure:
Prop K/Prop AA Allocation Request Forms (7)

Attachment 1: Summary of Requests Received

Source	EP Line No./ Category [1]	Project Sponsor [2]	Project Name	Current Prop K Request	Total Cost for Requested Phase(s)	Leveraging: Expected Leveraging by EP Line [3]	Leveraging: Actual Leveraging by Project Phase(s)[4]	Phase(s) Requested	District(s)
Prop K	22B	BART	BART Tunnel Water Intrusion Mitigation	$ 1,269,471	$ 36,070,000	78%	96%	Construction	3, 5, 6, 9
Prop K	23	SFMTA	Paratransit	$ 13,300,000	$ 33,021,532	27%	60%	Operations	Citywide
Prop K	35	SFPW	Street Repair and Cleaning Equipment	$ 983,021	$ 983,021	29%	0%	Construction	Citywide
Prop K	37	SFPW	Public Sidewalk and Curb Repair	$ 637,680	$ 858,252	48%	26%	Construction	Citywide
Prop K	42	SFPW	Tree Planting and Establishment	$ 1,548,980	$ 1,548,980	57%	0%	Construction	Citywide
Prop K	44	SFCTA	Slow Duboce Triangle Study [NTIP Planning]	$ 7,000	$ 12,000	40%	42%	Planning	8
Prop K	44	SFCTA	District 1 Multimodal Transportation Study [NTIP Planning]	$ 300,000	$ 300,000	40%	0%	Planning	1
			TOTAL	**$ 18,046,152**	**$ 72,793,785**	**53%**	**75%**		

Footnotes

[1] "EP Line No./Category" is either the Prop K Expenditure Plan line number referenced in the 2021 Prop K Strategic Plan or the Prop AA Expenditure Plan category referenced in the 2022 Prop AA Strategic Plan, including: Street Repair and Reconstruction (Street), Pedestrian Safety (Ped), and Transit Reliability and Mobility Improvements (Transit) or the Traffic Congestion Mitigation Tax (TNC Tax) category referenced in the Program Guidelines.

[2] Acronyms: BART (Bay Area Rapid Transit District); SFCTA (San Francisco County Transportation Authority); SFMTA (San Francisco Municipal Transportation Agency); SFPW (San Francisco Public Works)

[3] "Expected Leveraging By EP Line" is calculated by dividing the total non-Prop K funds expected to be available for a given Prop K Expenditure Plan line item (e.g. Pedestrian Circulation and Safety) by the total expected funding for that Prop K Expenditure Plan line item over the 30-year Expenditure Plan period. For example, expected leveraging of 90% indicates that on average non-Prop K funds should cover 90% of the total costs for all projects in that category, and Prop K should cover only 10%.

[4] "Actual Leveraging by Project Phase" is calculated by dividing the total non-Prop K, non-Prop AA, or non-TNC Tax funds in the funding plan by the total cost for the requested phase or phases. If the percentage in the "Actual Leveraging" column is lower than in the "Expected Leveraging" column, the request (indicated by yellow highlighting) is leveraging fewer non-Prop K dollars than assumed in the Expenditure Plan. A project that is well leveraged overall may have lower-than-expected leveraging for an individual or partial phase.

Attachment 2: Brief Project Descriptions [1]

EP Line No./ Category	Project Sponsor	Project Name	Prop K Funds Requested	Project Description
22B	BART	BART Tunnel Water Intrusion Mitigation	$ 1,269,471	This request will fund the construction phase for repairs to mitigate water intrusion in the tunnels along BART's M-line, which includes all of BART's tracks in San Francisco. The M-line was constructed over 50 years ago and has sections that are either steel-lined or are concrete. Currently, water seeps into the steel-lined tunnel areas via joints of the tunnel and into the concrete areas through cracks. The Project's goal is to mitigate this water intrusion with repairs in the concrete and curtain grouting in the steel areas. These repairs will increase safety and security for customers, employees, and train operations. Construction is expected to be complete in Spring 2027.
23	SFMTA	Paratransit	$ 13,300,000	The SFMTA provides paratransit services to persons with disabilities. Since inception of the Prop K program, sales tax funds have supported the program's taxi trips, pre-scheduled van trips, inter-county trips, and group van trips to senior centers. This request will help fund the Fiscal Year 2022/23 paratransit broker contract. The requested amount reflects the increased programming in the 2021 Prop K Strategic Plan from $10.1 million to $13.3 million for the next three fiscal years to provide near-term stability for the paratransit program.
35	SFPW	Street Repair and Cleaning Equipment	$ 983,021	Purchase 3 pieces of street repair and cleaning equipment to replace equipment that has exceeded its useful life, including 1 full size street sweeper, 2 full size electric pickup trucks, and 1 10-wheel dump truck. All requested equipment is California Air Resources Board compliant and meet current emissions standards. Public Works expects all equipment to be accepted for use by Fall 2023.
37	SFPW	Public Sidewalk and Curb Repair	$ 637,680	SFPW is responsible for repairing sidewalks around City-maintained trees, adjacent to City properties, and at the angular returns of all intersections. Requested funds will be used to repair non tree-related damage to public sidewalks, curb and gutters, and angular returns at approximately 300 locations. See page E5-44 of the enclosure for the list of backlog locations as of May 2022. A portion of the Tree Maintenance Fund established by Prop E (2016) will be used to repair sidewalks damaged by City maintained trees. SFPW expects all repairs funded by this request to be done by June 2023. Members of the public can request sidewalk repairs by calling 311.

Attachment 2: Brief Project Descriptions [1]

EP Line No./ Category	Project Sponsor	Project Name	Prop K Funds Requested	Project Description
42	SFPW	Tree Planting and Establishment	$ 1,548,980	Requested funds will be used to plant approximately 660 trees in the public right-of-way and water newly planted trees on a regular basis for three years to ensure successful establishment. Once established, these trees will be maintained with funds from the Tree Maintenance Fund. To identify priority planting sites, SFPW will use data from the comprehensive street tree census, which identified all street trees in the public right-of-way as well as existing empty basins and potential new planting sites. Requested funds will be used for tree planting in the Tenderloin and South of Market areas where tree canopy levels are some of the lowest in the City. The full list of priority locations for planting based on SFPW's tree database is available upon request to staff. Plantings will be complete by June 2023. Members of the public can request a tree planting by calling 311.
44	SFCTA	Slow Duboce Triangle Study [NTIP Planning]	$ 7,000	The Duboce Triangle Neighborhood Association is working with the District 8 office to engage two UC Berkeley students to run community workshops and develop concept designs for "Vision Slow Triangle" based on research they have already conducted on walkability and mobility, sustainability, and public space activation. This request, recommended by Chair Mandelman, will help fund Public Realm Design Values & Guidelines and Critical Concept Designs for locations around the neighborhood, including the intersection of Duboce and Sanchez, and on Noe and on Sanchez. All work will be done by the end of Summer 2022.
44	SFCTA	District 1 Multimodal Transportation Study [NTIP Planning]	$ 300,000	This study, requested by Commissioner Chan, will engage the community to identify known mobility challenges and develop up to three near- to medium-term concepts to improve transit reliability and pedestrian and bicycle safety within District 1. The study will also identify trip patterns and markets for trips within District 1 that have a high potential for mode shift, and identify one high-level concept to support mode shift for trips that start and end within the District. Upon completion, expected by December 2023, the final report will be presented to the Board for approval.
		TOTAL	**$18,046,152**	

[1] See Attachment 1 for footnotes.

Attachment 3: Staff Recommendations [1]

EP Line No./ Category	Project Sponsor	Project Name	Prop K Funds Recommended	Recommendations
22B	BART	BART Tunnel Water Intrusion Mitigation	$ 1,269,471	
23	SFMTA	Paratransit	$ 13,300,000	
35	SFPW	Street Repair and Cleaning Equipment	$ 983,021	**5-Year Prioritization Program (5YPP) Amendment:** The recommended allocation is contingent upon a minor amendment of the Street Repair and Cleaning Equipment 5YPP to reprogram $5,706 in deobligated funds from projects completed under budget, to the subject project. See attached 5YPP amendment for details.
37	SFPW	Public Sidewalk and Curb Repair	$ 637,680	
42	SFPW	Tree Planting and Establishment	$ 1,548,980	
44	SFCTA	Slow Duboce Triangle Study [NTIP Planning]	$ 7,000	**Special Conditions:** The recommended allocation is contingent upon a waiver of Prop K policy prohibiting reimbursement of project costs incurred prior to execution of the Standard Grant Agreement. Costs will be eligible for reimbursement beginning June 1, 2022. Recommendation is also conditioned upon a waiver of NTIP policy requiring that the Board accept or approve the final report for NTIP planning projects.
44	SFCTA	District 1 Multimodal Transportation Study [NTIP Planning]	$ 300,000	**Special Condition:** Upon completion (anticipated December 2023), staff will present the draft final report, including key findings, recommendations, next steps, implementation, and funding strategy, to the Board for approval.
		TOTAL	**$ 18,046,152**	

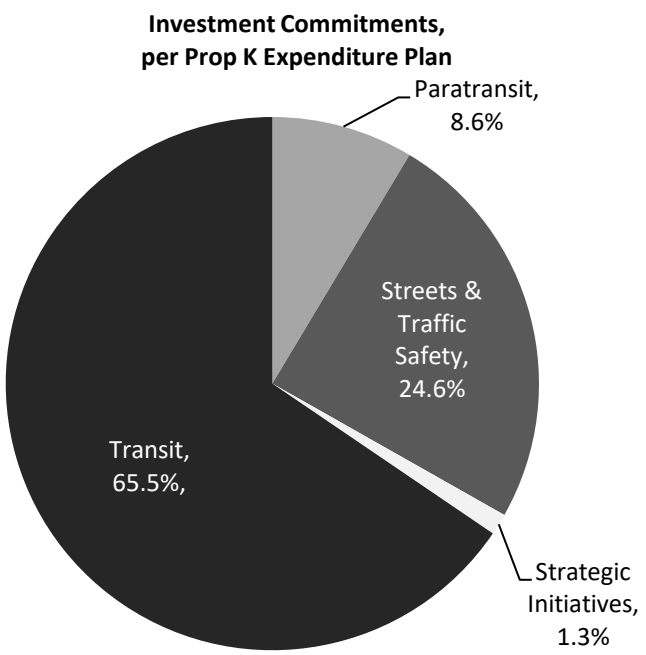
[1] See Attachment 1 for footnotes.

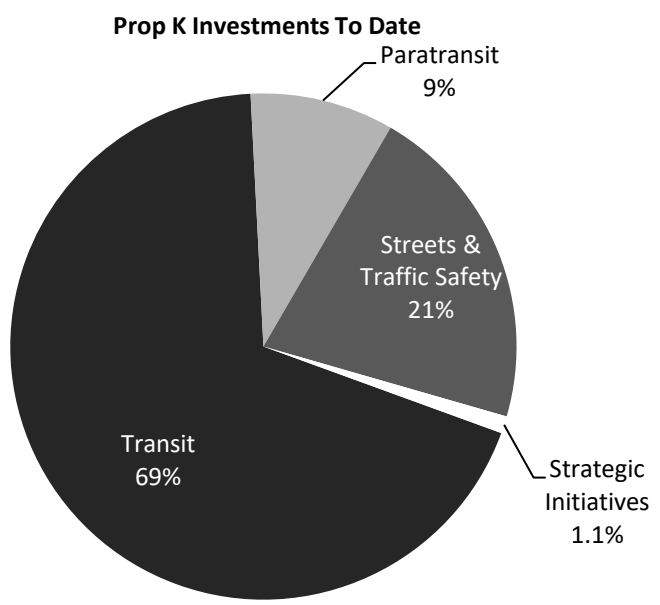
Attachment 4.
Prop K Allocation Summary - FY2022/23

PROP K SALES TAX

FY2021/22	Total	FY 2022/23	FY 2023/24	FY 2024/25	FY 2025/26
Prior Allocations	$ 7,389,800	$ 2,440,667	$ 4,188,462	$ 760,671	$ -
Current Request(s)	$ 18,046,152	$ 12,839,334	$ 4,606,818	$ 300,000	$ 300,000
New Total Allocations	$ 25,435,952	$ 15,280,001	$ 8,795,280	$ 1,060,671	$ 300,000

The above table shows maximum annual cash flow for all FY 2022/23 allocations and appropriations approved to date, along with the current recommended allocation(s) and appropriation.





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1455 Market Street, 22ND Floor, San Francisco, California 94103 415-522-4800 info@sfcta.org www.sfcta.org

Memorandum

AGENDA ITEM 7

DATE: June 30, 2022

TO: Transportation Authority Board

FROM: Anna LaForte – Deputy Director for Policy and Programming

SUBJECT: 7/12/2022 Board Meeting: Allocate $17,739,152 in Prop K Funds, with Conditions, and Appropriate $307,000 for Seven Requests

RECOMMENDATION ☐ Information ☒ Action

Allocate $1,269,471 to the Bay Area Rapid Transit District (BART) for:

1. BART Tunnel Water Intrusion Mitigation

Allocate $13,300,000 in Prop K funds to the San Francisco Municipal Transportation Agency (SFMTA) for:

2. Paratransit

Allocate $3,169,681 in Prop K funds to San Francisco Public Works (SFPW) for:

3. Street Repair and Cleaning Equipment ($983,021)
4. Public Sidewalk and Curb Repair ($637,680)
5. Tree Planting and Establishment ($1,548,980)

Appropriate $307,000 in Prop K funds for:

6. Slow Duboce Triangle Study [NTIP Planning] ($7,000)
7. District 1 Multimodal Transportation Study [NTIP Planning] ($300,000)

SUMMARY

Attachment 1 lists the requests, including phase(s) of work and supervisorial district(s). Attachment 2 provides brief descriptions of the projects. Attachment 3 contains the staff recommendations. Project sponsors will attend the meeting to answer any questions the Board may have regarding these requests.

- ☒ Fund Allocation
- ☒ Fund Programming
- ☐ Policy/Legislation
- ☐ Plan/Study
- ☐ Capital Project Oversight/Delivery
- ☐ Budget/Finance
- ☐ Contract/Agreement
- ☐ Other: _____

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DISCUSSION

Attachment 1 summarizes the subject requests, including information on proposed leveraging (e.g. stretching Prop K sales tax dollars further by matching them with other fund sources) compared with the leveraging assumptions in the Prop K Expenditure Plan. Attachment 2 includes brief project descriptions. Attachment 3 summarizes the staff recommendations for each request, highlighting special conditions and other items of interest. An Allocation Request Form for each project is enclosed, with more detailed information on scope, schedule, budget, funding, deliverables and special conditions.

FINANCIAL IMPACT

The recommended action would allocate and appropriate $18,046,152 in Prop K funds. The allocations and appropriations would be subject to the Fiscal Year Cash Flow Distribution Schedules contained in the enclosed Allocation Request Forms.

Attachment 4 shows the Prop K Fiscal Year 2022/23 allocations and appropriations approved to date, with associated annual cash flow commitments as well as the recommended allocation and cash flow amounts that are the subject of this memorandum.

Sufficient funds are included in the proposed Fiscal Year 2022/23 annual budget. Furthermore, sufficient funds will be included in future budgets to cover the recommended cash flow distributions in those fiscal years.

CAC POSITION

The Community Advisory Committee was briefed on this item at its June 22, 2022, meeting and unanimously adopted a motion of support for the staff position.

SUPPLEMENTAL MATERIALS

- Attachment 1 – Summary of Requests
- Attachment 2 – Project Descriptions
- Attachment 3 – Staff Recommendations
- Attachment 4 – Prop K Allocation Summary – FY 2022/23
- Enclosure – Allocation Request Forms (7)

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BD071222 RESOLUTION NO. 22-XX

RESOLUTION ACCEPTING THE PENNSYLVANIA AVENUE EXTENSION PROJECT INITIATION REPORT

WHEREAS, In 2018, the San Francisco Planning Department, in partnership with the Transportation Authority and other partner agencies, concluded the Railyard Alignment and Benefits (RAB) Study; and

WHEREAS, The RAB Study assessed options for the alignment of the Caltrain corridor through San Francisco and identified the City's preferred alignment as a tunnel beneath 7th Street and Pennsylvania Avenue, which would connect directly to the Downtown Rail Extension (DTX) and extend the below-grade rail alignment southward; and

WHEREAS, In September 2018, through approval of Resolution 19-12, the Transportation Authority Board adopted the 7th Street to Pennsylvania Avenue alignment as the preferred configuration for grade separating the Caltrain corridor south of the DTX; and

WHEREAS, the Pennsylvania Avenue Extension (PAX) project will grade-separate existing Caltrain and future California High-Speed Rail passenger rail operations from local vehicular and pedestrian traffic patterns at Mission Bay Drive and 16th Street, removing barriers between the Mission Bay and Potrero Hill neighborhoods; and

WHEREAS, In November 2019, through approval of Resolution 20-16, the Transportation Authority Board appropriated $1.6 million in Prop K sales tax funds for the PAX Project Initiation Study (Study), to develop viable PAX alternatives to advance into the subsequent phases of planning and environmental review; and

WHEREAS, In June 2020, through approval of Resolution 20-55, the Transportation Authority Board awarded a consulting contract to McMillen Jacobs Associates to undertake the PAX Project Initiation Study's technical work program; and

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WHEREAS, The Transportation Authority staff conducted the Study with the consultant team and with the support and input of partner agencies, including Caltrain, California High-Speed Rail Authority, the Transbay Joint Powers Authority, Caltrans, and multiple City departments; and

WHEREAS, The Study developed a range of alternatives and undertook a technical evaluation process to screen and evaluate alternatives through design development, technical analysis, risk assessment, cost estimation, partner input, and third-party peer review; and

WHEREAS, The Study developed three feasible alignment alternatives, including long, mid-length, and short tunnel alternatives, reflecting differing approaches to alignment configuration, tunnel design, and impacts to the existing 22nd Street Caltrain Station; and

WHEREAS, Long Alternative A would provide a tunneled rail alignment from DTX to a point immediately north of Cesar Chavez Street, bypassing the existing 22nd Street Caltrain Station and requiring relocation of the existing station; and

WHEREAS, Mid-Length Alternative B would provide a tunneled rail alignment from DTX to a point immediately north of the existing 22nd Street Caltrain Station, requiring modifications to the existing station and an interface with existing Caltrain tunnels; and

WHEREAS, Short Alternative C would provide separated southbound and northbound tunnels, resulting in an interface point north of the existing 22nd Street Caltrain Station and in a more significant impact on corridor operations during construction.

WHEREAS, The Study developed planning-level capital cost estimates and schedules for the three PAX alternatives; and

WHEREAS, The estimated capital cost of these alternatives is approximately $2.0-2.5 billion, excluding potential costs to relocate or modify the existing 22nd Street Station; and

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WHEREAS, Development and implementation of PAX will require a minimum of approximately 12-15 years, in order to complete further planning, environmental review, design, procurement, and construction; and

WHEREAS, The Study was developed in parallel to the San Francisco Planning Department's Southeast Rail Station Study (SERSS), which considered potential future station locations along the PAX alignment; and

WHEREAS, The next phase of PAX work will incorporate the SERSS work to date, in order to incorporate station design and cost considerations into the further refinement and evaluation of PAX alternatives; and

WHEREAS, The Study recommends the PAX Pre-Environmental Study as a next step, to prepare for future environmental review by identifying the most viable alternatives and developing the organizational and technical approach to the environmental phase; and

WHEREAS, The attached PAX Initiation Report documents Study activities and analysis and presents Study findings and recommendations; now, therefore, be it

RESOLVED, That the Transportation Authority hereby accepts the PAX Project Initiation Report; and be it further

RESOLVED, That the Executive Director is hereby authorized to prepare the document for final publication and distribute the document to all relevant agencies and interested parties.

Attachment:

1. PAX Project Initiation Report – Draft

San Francisco County Transportation Authority

Pennsylvania Avenue Extension Study

Project Initiation Report (Draft)

McMILLEN JACOBS ASSOCIATES

PGH Wong Engineering, Inc. Consulting Engineers

ESA

Report Date: June 2022

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Distribution

To: Yana Waldman, PE
San Francisco County Transportation Authority

Jesse Koehler
San Francisco County Transportation Authority

From: Sarah Wilson, PE
McMillen Jacobs Associates

Prepared By: John Kaplin, CEG
McMillen Jacobs Associates

Tom Pennington, PE, P.Eng
McMillen Jacobs Associates

John Stolz, PE
McMillen Jacobs Associates

Kush Chohan, PE, GE
McMillen Jacobs Associates

Keith Abey, PE, SE
PGH Wong Engineering, Inc.

Julie Watson
Environmental Science Associates

Reviewed By: Sarah Wilson, PE
McMillen Jacobs Associates

Dingxin Cai
McMillen Jacobs Associates

Abbreviations and Acronyms

Abbreviation/Acronym	Term
APEZ	Air Pollutant Exposure Zone
AT&T	American Telephone and Telegraph
BAAQMD	Bay Area Air Quality Management District
BLS	Blue Light Stations
CHSRA	California High-Speed Rail Authority
Caltrain	California Department of Transportation
CCF	Central Control Facility
CCSF	City and County of San Francisco
CCTV	Closed Circuit Television
CEQA	California Environmental Quality Act
CHSR	California High-Speed Rail
CWA	Clean Water Act
dBA	A-weighted decibels
DOT	U.S. Department of Transportation
DTSC	California Department of Toxic Substances Control
DTX	Downtown Rail Extension
EMU	electric multiple units
EPB TBM	Earth Pressure Balance Tunnel Boring Machine
ESA	Environmental Science Associates
ESL	Environmental Screen Level
FLS	fire/life safety
FTA	Federal Transit Administration
HSR	High-Speed Rail
LNAPL	light non-aqueous phase liquid
LOS	level of service
LUST	Leaking Underground Storage Tank
MJ	McMillen Jacobs Associates
MRI	magnetic resonance imaging
NATM	New Austrian Tunnelling Method
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act, as Amended
NOA	naturally occurring asbestos
NPDES	National Pollutant Discharge Elimination System
OCII	Office of Community Investment and Infrastructure
OCS	Overhead Catenary Systems
OD	outside diameter
PAX	Pennsylvania Avenue Extension Project
PAX	Pennsylvania Avenue Extension

Abbreviation/Acronym	Term
PCJPB	Peninsula Corridor Joint Powers Board
PG&E	Pacific Gas and Electric
RAB	Rail Alignment and Benefits
ROW	right-of-way
RWQCB	Regional Water Quality Control Board
RWQCB	Bay Regional Water Quality Control Board
SEM	Sequential Excavation Method
SFCTA	San Francisco County Transportation Authority
SFDBI	San Francisco Department of Building Inspection
SFMTA	San Francisco Metropolitan Transit Agency
SFPUC	San Francisco Public Utilities Commission
SHPO	State Historic Preservation Office
SOMA	South of Market Area
SPTC	soldier piles in tremie concrete
SSIP	Sewer System Improvement Program
TAG	Technical Advisory Group
TBM	tunnel boring machine
TCRP	Transit Cooperative Research Program
TJPA	Transbay Joint Powers Authority
TPH-G	total petroleum hydrocarbons as gasoline
TPHPD	trains per hour per direction
YBM	Young Bay Mud
TRP	Transportation Research Board

Executive Summary

Alternative rail alignments for the Pennsylvania Avenue Extension Project (PAX project) were studied by SFCTA and its consultants to underground a section of existing at-grade Caltrain rail in the southern part of San Francisco. An adjacent and connected project, the Downtown Rail Extension (DTX), will extend Caltrain and future California High-Speed Rail (CHSR) service from the existing 4th Street and King Railyard to the completed Salesforce Transit Center. DTX is environmentally cleared by the CEQA and NEPA process; PAX is in the planning stage and is not yet environmentally cleared. PAX will extend the tunnel portion of the planned DTX alignment south from the Fourth and Townsend Street Station and is planned to underground the existing at-grade rail crossings at 16th Street and Mission Bay Drive to create new street connections with the Mission Bay District. This Project Initiation Report (PIR) culminates the PAX studies conducted in this phase.

Section 1.0 describes the purpose and goals of the project. To summarize, PAX is driven by four primary goals:

- Increase Connectivity between Mission Bay, Potrero Hill, and Design District/SOMA Neighborhoods
- Improve Safety of Pedestrian, Bicycle, and Vehicular Traffic on Surface Streets
- Enable Improved Efficiency of Caltrain Operations and Service Planning
- Improve Quality of Life in Surrounding Neighborhoods

The predecessor study to this current work was the 2018 Rail Alignment and Benefits (RAB) Study prepared for the City of San Francisco Planning Department. The RAB Study examined alternative rail alignments to connect the fast-growing South of Market and Mission Bay neighborhoods with the rest of San Francisco. The recommended alternative from the RAB Study was a 1.6-mile-long tunnel from the DTX interface at the 4th and King railyard, down 7th Street and Pennsylvania Avenue, connecting to the existing at-grade Caltrain tracks near Cesar Chavez. This broad alignment was carried forward for further development and refinement through this current pre-environmental phase PAX study.

The initial steps of this PAX study were to collect and analyze existing data on existing and planned rail operations, geotechnical conditions, environmental constraints, traffic impacts, right-of-way impacts, and buried utilities. Caltrain and California High-Speed Rail Authority (CHSRA) requirements and constraints were assessed through meetings with representatives from these agencies. Additional information was collected by meetings and desktop studies. An Evaluation Framework process was implemented to evaluate available data and criteria consistently and uniformly for identified alternatives on a qualitative and semi-quantitative basis.

A total of six alternative configurations were initially identified. The range of alignments is fully described in **Section 2.0** and is summarized as follows:

- Two configurations included a full-length (DTX interface to Cesar Chavez Street) tunnel alignment in either single bore (two tracks in one larger tunnel) or twin bore configuration. This alignment bypasses the existing 22nd Street Station.

- Four of the six are short- and mid-length tunnels that connect the DTX interface to the existing rail alignment at points north of the existing 22nd Street Station, allowing for continued use of the 22nd Street Station and for service to stations at points south. The Southeast Rail Station Study, developed in parallel to this study by the San Francisco Planning Department, studied potential locations for a station or stations in the area.

As a result of the Evaluation Framework analysis, a total of three "shortlisted" alignment alternatives are identified in this pre-environmental Project Initiation Report.

The evaluation of these three alignments using a project-specific Evaluation Framework is presented in this report. Engineering and environmental benefits associated with each, as well as a brief discussion of alignments screened from further study, are documented in **Section 3.0** of this report. The three alignment alternatives are long, mid-length, and short, and some can be built by using either one tunnel or two.

To summarize, the three shortlisted alignments are:

- Alternative A1/A2: Long Alignment – Single Bore/Twin Bore Tunnels
- Alternative B1/B2: Mid-Length Alignment – Single Bore/Twin Bore + SEM Tunnels
- Alternative C: Short Alignment – Split Tunnels

Technical studies on the alignment alternatives selected were conducted. This report summarizes the information and findings of the technical studies, and identifies major benefits and risks associated with each of the recommended alignment alternatives.

Section 4.0 provides an overview of planned conceptual framework for Rail Operations and Interfaces. Caltrain and CHSRA operations are addressed, and interfaces with DTX and the 4th and King Railyards and associated issues are described. **Section 5.0** defines a conceptual framework for Rail Infrastructure and Systems that will be required for PAX.

Geologic conditions along the PAX corridor will be challenging for tunneling. Soft, weak soils mixed with more competent granular soils are anticipated at the north end of the corridor, transitioning to mixed-face soil and rock towards the center of the corridor. The alignments are in weak and fractured rock with possible mixed-face conditions from the center to south end. **Section 6.0** summarizes geologic and hydrologic conditions.

Section 7.0 provides a technical evaluation of tunneling and constructability factors that will impact each of the alignments. Single bore configurations are favorable for the available ROW and some rail operational aspects but have the downside of very low ground cover to meet grade restrictions for Caltrain and CHSRA. The twin bore tunnels are difficult to fit side-by-side in the available ROW in the northern portion and have some rail operational downsides but have reduced risk because of increased ground cover. The alternatives that involve undergrounding the rail only north of 22nd Street Station so that the existing station may remain in operation all carry significantly more surface impacts from construction, potential utility interference issues, and challenging tunnel excavation methods where a tunnel boring machine (TBM) cannot be used.

Section 8.0 examines the existing utilities and infrastructure that will provide constraints to the tunnel alignments. Some of the more challenging issues include the large four-compartment, SFPUC-owned, Division Street box sewer that sits on piles and controls the minimum PAX vertical alignment depth at the crossing. The planned SFPUC Folsom Street Sewer tunnel in the same area will also impact the PAX tunnel depth. Nearly all the alignments are constrained to some degree by deep foundation elements that support the Interstate 280 (I-280) viaduct. Other utilities including advanced relocations are discussed in this section.

A preliminary assessment of right-of-way (ROW) impacts from each of the alignments was conducted. The number of full property acquisitions is limited and ranges from none to four among the alternatives. The greatest impact will be the need for underground property easements. The total ROW property costs for the various alignments are estimated to range from approximately $20 million to $150 million. Note that the difference between this estimate and the ROW estimate shown in Table ES-1 reflects the anticipated leasing cost for staging areas during construction, which are included in Table ES-1. **Section 9.0** offers a summary of the ROW impacts of the three alternatives.

Several risk workshops were conducted as part of the PAX study. **Section 10.0** summarizes the approach used in evaluating project risks and findings, and summarizes a scoring of risks for each alternative in three general categories: low, medium, and high. It is expected that risk findings will be carried forward for continued study in future project phases.

Preliminary project schedules, from planning through design and construction, were prepared for each alternative alignment. The alternatives are anticipated to take approximately 12 to 15 years to complete further planning, environmental studies, and construction. The range of estimated construction costs is summarized in Table ES-1. **Section 11.0** addresses schedule and cost.

Table ES-1. Cost Estimate Summary for Each of the Alternatives

Component	A1 – Long Alignment – Single Bore Tunnel	A2 – Long Alignment – Twin Bore Tunnels	B1 – Mid-Length Alignment – Single Bore + SEM Tunnels	B2 – Mid-Length Alignment – Twin Bore + SEM Tunnels	C – Short Alignment – Split Tunnels
Construction Costs (2021)[1]	**$730 M**	**$780 M**	**$710 M**	**$700 M**	**$690 M**
Construction Midpoint[2]	10.1 years	10.2 years	10.3 years	10.1 years	9.5 years
Escalated Construction Costs[3]	**$1,200 M**	**$1,290 M**	**$1,180 M**	**$1,150 M**	**$1,100 M**
ROW (2021)[1]	$90 M	$170 M	$50 M	$120 M	$40 M
ROW Acquisition Midpoint	3.1 years	3.1 years	3.1 years	3.1 years	3.1 years
Escalated ROW Costs[3]	**$110 M**	**$200 M**	**$60 M**	**$140 M**	**$50 M**
Soft Costs[4]	**$310 M**	**$310 M**	**$310 M**	**$310 M**	**$310 M**
Contingency	**$600 M**	**$650 M**	**$590 M**	**$580 M**	**$550 M**
Total Project Cost	**$2,220 M**	**$2,450 M**	**$2,140 M**	**$2,180 M**	**$2,010 M**
Total Project Duration	**13.3 years**	**13.5 years**	**13.6 years**	**13.2 years**	**11.9 years**

[1] Q4 2021 Cost Basis.

[2] Based on construction schedule prepared on 2/24/2022.

[3]Escalation carried at 5% PA

[4]Including $2M Bridging Study

Section 12.0 provides a summary of findings related to environmental issues. In general, the effects of the PAX project would be temporally limited to project construction, spatially limited to the project corridor,

and could be mitigated with the implementation of a variety of measures. The longer alignments (Alternative A1/A2) would likely result in slightly more impacts because of their overall longer as compared to the mid-length (Alternative B1/B2) alignments. Alternative C, which involves a shorter alignment and the use of cut-and-cover construction techniques, would have the greatest construction impacts compared to the mid-length alignments as it would result in additional impacts on air quality and noise because of the construction method. During operation, the project would provide a range of project benefits for the local community, and adverse effects are expected to be minimal. In operation, the longer alternatives would offer greater environmental benefits as a result of the extended undergrounding of the existing Caltrain alignment compared to the three shorter alternatives.

Section 13.0 presents preliminary findings on the anticipated permits that will have to be acquired for the selected PAX alternative. **Section 14.0** provides recommendations for further technical studies, including recommended priorities in the following areas:

- DTX interface coordination and PAX project configuration;
- Engineering studies to refine/mitigate specific risks for the twin bore and single bore configurations;
- Infrastructure location and analysis;
- Conceptual engineering for 22nd Street Station and/or its replacement location; and
- Caltrain and CHSRA coordination.

In order to advance the PAX study most efficiently, these technical studies should be completed as part of a bridging phase prior to generation of the environmental documents. There are several items for which potential impacts should be better understood prior to configuration advancement. Collaboration with infrastructure stakeholders must also be advanced; for example, rail operations improvements resulting from the PAX project implementation and temporary operations required to accomplish PAX construction must satisfy Caltrain's needs. Finally, stations are integral to the full picture of what a PAX project could mean for San Francisco and should therefore be studied along with rail alignments in the next phase.

1.0 Project Purpose and Goals

1.1 Introduction

In 2014, the City and County of San Francisco (CCSF) initiated a multi-agency analysis of potential land use and transportation issues associated with several major infrastructure projects planned for the downtown area and the southeast portion of San Francisco. This analysis was presented in the Rail Alignment and Benefits (RAB) Study (CCSF, 2018a). More details of the RAB study are provided in Section 1.3. The RAB Study considered options for addressing the construction and operation of these major projects and evaluated how to best address existing connectivity and congestion challenges in the area while accommodating the rapid population growth that has occurred in the region over the past two decades and that is projected to continue in the future.

The RAB study evaluated the City of San Francisco's plan to connect the Peninsula Caltrain rail corridor (Caltrain) to the Salesforce Transit Center (located between Natoma and Minna Streets and Beale and Second Streets) via the construction of the Downtown Rail Extension (DTX) (Figure 1-1). This connection will facilitate future access by high-speed rail trains to San Francisco and support an increased number of Caltrain trains serving the Peninsula.

The RAB study confirmed the DTX alignment, which is environmentally cleared by the CEQA process and under design as of this writing, as the preferred alternative. The RAB study proposed an extension of underground rail service from the southern limit of DTX, under Pennsylvania Avenue, to reconnect with existing tracks near Cesar Chavez Street. The scope of the pre-environmental phase PAX Study is to evaluate tunnel alternatives and develop a Project Initiation Report for underground rail extension south of the current DTX project limits.

The proposed DTX project alignment transitions from a tunnel under Townsend Street to daylight at-grade adjacent to 7th Street just north of Mission Bay Drive. The DTX project includes a stub tunnel that is intended to tie into the future PAX tunnel and provide a construction interface between the two projects.

1.2 Project Description

Figure 1-1. PAX Index Map Showing Corridor, Relationship with DTX, and Stations

The PAX corridor is located in the City of San Francisco (the City) between the Mission Bay and Potrero Hill neighborhoods (Figure 1-1). The corridor is aligned approximately north to south, just west of Interstate Highway 280 (I-280) beginning at the intersection of 7th and Townsend Streets in the north and extending to the intersection of Cesar Chavez Street and Pennsylvania Avenue in the south. Historically, this was an industrial area with limited residential and community use. In recent decades, the South of Market Area (SOMA) has experienced significant changes. Increased residential and office development and the expansion of several major Bay Area regional transportation infrastructure networks have transformed the area.

The PAX corridor is adjacent to the I-280 freeway, which connects San Francisco to the South Bay. Caltrain surface rail, which connects San Francisco to the South Bay and beyond, extends along the corridor in a north–south direction terminating at the 4th/King (San Francisco) Station. I-280 runs on a viaduct above Caltrain throughout the corridor (from 25th Street to the 4th/King area), creating a physical and visual barrier that adversely impacts neighborhood connectivity. The Caltrain at-grade alignment through the corridor results in numerous bisections of local streets and requires two at-grade rail crossings located at the Mission Bay Drive and at 16th Street.

The PAX project will underground the existing at-grade Caltrain alignment at Mission Bay Drive and 16th Street, which will improve street connections between the Mission Bay District and SOMA/Potrero Hill. The PAX Project Initiation Report provides detailed technical evaluation of alternatives identified in the Alternatives Analysis Report (provided in Appendix A). This Project Initiation Report will serve as the basis for future Environmental Impact Studies for the project.

The overall objective of this study is to identify and evaluate feasible rail tunnel alignments that can be carried forward to the next stage. Future phases of planning and development for PAX will include environmental review and preliminary engineering. It is anticipated that a single, preferred rail alignment that could be designed and constructed would result from the CEQA/NEPA process.

1.3 Project History

Previous study has examined concepts for extending rail operations underground through the PAX study area:

- City and County of San Francisco Planning Department Rail Alignment and Benefits Study. Published September 2018 (CCSF, 2018b).

The 2018 Rail Alignment and Benefits (RAB) Study Final Technical and Executive Summary reports (CCSF, 2018b and 2018c) prepared by CH2M Hill for the San Francisco Planning Department summarized the evaluation process and alternatives for addressing the major transportation and land use issues resulting from electrification of Caltrain, the arrival of High-Speed Rail, and the DTX project. The technical report provides details of the relative advantages and disadvantages for the various alternatives as well as supporting documentation.

The RAB Study Final Technical and Executive Summary reports identified and recommended the Pennsylvania Avenue alignment as the preliminary preferred alignment for extending underground rail south from the environmentally cleared DTX project. The recommended alternative from the RAB Study was a 1.6-mile-long twin tunnel (split, or two tunnels with one track each) alignment from the DTX interface at the 4th and King railyard, down 7th Street and Pennsylvania Avenue, and connecting to the existing at-grade Caltrain tracks near Cesar Chavez. The PAX Study developed and evaluated multiple alternatives consistent with the broad definition of the preferred alternative from the RAB Study.

1.4 Existing Rail System Within Project Area

The existing commuter at-grade rail alignment along 7th Street includes two at-grade crossings at Mission Bay Drive and 16th Street. These are the only two major heavy rail grade crossings in use in San Francisco. In 2020 Caltrain operated five trains per hour in each direction at these grade crossings, and that number is expected to increase to 12 trains per hour (8 Caltrain and 4 HSR) in each direction by 2035.

The DTX project received its federal environmental Record of Decision in 2019, and engineering to develop the DTX is ongoing. The DTX alignment will transition trains from at-grade in the Caltrain ROW (adjacent to 7th Street) to a new below-grade station in the Caltrain ROW (adjacent to Townsend Street) between 4th and 5th Streets. The DTX project will also provide a stub tunnel that will accommodate the future PAX tunnel extension south along 7th Street, which is the subject of this report.

Within the PAX study area limits, the only currently existing commuter rail station is the 22nd Street Station, located at the corner of 22nd Street and Pennsylvania Avenue. The next station to the north is the San Francisco Station, currently located on the northwest corner of 4th and King Streets. The next station to the south is Bayshore, which is located primarily in the City of Brisbane on the west side of Tunnel Avenue north of its intersection with Beatty Avenue.

The Southeast Rail Station Study, undertaken by the San Francisco Planning Department, is currently evaluating future station locations within and adjacent to the PAX corridor to provide improved functionality and accessibility. The results of that study have not been finalized, and specific station

locations are not addressed in this report with the exception of discussion regarding options available to continue operation of the 22nd Street Station with the various alternative alignments. The long tunnel alignment alternatives completely bypass the existing 22nd Street Station and would result in its decommissioning. Short- and mid-length PAX alignment alternatives offer the ability to make continued use of the 22nd Street Station.

1.5 Project Goals

The primary purpose of the PAX project is to grade-separate the Caltrain rail alignment from surface streets within San Francisco. This purpose is driven by four primary goals.

- **Increase Connectivity between Mission Bay, Potrero Hill, and Design District/SOMA Neighborhoods:** The PAX project would reduce existing restrictions on local trips of all modes in the project corridor and would remove the physical and visual barrier of the at-grade Caltrain tracks that currently separates these neighborhoods. The delay experienced by bus transit passengers, pedestrians, bicyclists, and motorists at the at-grade crossing would increase without the project as the number of trains in the peak hour increases in the future; therefore, the gate closing occurrences would increase from ten trains/times per hour in pre-pandemic peak hours to 24 trains/hour in both directions in the peak hours in 2035. By alleviating vehicle congestion (especially on 16th Street), the PAX project would support and improve transit connections, and encourage pedestrian and bike trips.
- **Improve Safety of Pedestrian, Bicycle, and Vehicular Traffic on Surface Streets:** Growth along the project corridor and surrounding neighborhoods has resulted in greater demand for all modes of transportation in the area. The elimination of the existing at-grade Caltrain alignment would reduce congestion and potential safety concerns associated with street-level rail crossings and would allow for separation of travel modes through the corridor.
- **Enable Improved Efficiency of Caltrain Operations and Service Planning:** The PAX project would allow Caltrain and future CHSRA trains to travel at greater speed and frequency than is currently possible. Increasing the volume of trains would accommodate future population growth in the project corridor and the greater Bay Area and support the regional goal of decreasing VMT through increasing transit use (CCSF, 2018a).
- **Improve Quality of Life in Surrounding Neighborhoods:** Implementation of the PAX project would substantially reduce existing congestion, air quality, and noise effects associated with existing Caltrain and future rail traffic expansion. It would also improve the suitability of numerous city blocks that currently face the rail alignment for potential housing, retail, office, and other community uses.

1.6 Stakeholder Participation

Multiple meetings were held with stakeholders that make up the Technical Advisory Group (TAG). Organization members included the following entities:

- San Francisco County Transportation Authority (SFCTA)
- Caltrain

- California High-Speed Rail
- ProLogis (Railyards Development Project)
- Transbay Joint Powers Authority (TJPA), representing the Downtown Rail Extension (DTX) Project, and their Program Management and Program Controls Consultant AECOM/Mott MacDonald
- Caltrans
- San Francisco Public Utilities Commission
- San Francisco Planning Department, which is conducting a Stations Study along and near the PAX alignment

The purposes of the meetings were to: (1) keep stakeholders abreast of developments in the analysis of alternatives; (2) ensure the PAX team was aware of developments with advancement of interfacing projects like DTX, the stations study, and the railyards development; (3) facilitate coordination with Caltrain and CHSRA on design criteria and project needs; and (4) gain the input of stakeholders in the screening and alternatives evaluation process.

1.7 Report Authors

McMillen Jacobs is the prime consultant for this PAX Study under contract to SFCTA and led the development of the Project Implementation Report and the associated studies. McMillen Jacobs was supported by the following subconsultants: PGH Wong (rail and systems), Environmental Science Associates (ESA; environmental studies), Slate Geotechnical Consultants (geotechnical), CHS Consulting (traffic), and Freyer & Laureta, Inc. (utilities).

2.0 Alternatives Definition

2.1 Description of Alternatives

The purpose of this section is to define each of the alternatives that were considered. The alternatives presented herein are A1/A2, B1/B2, and C. Alternatives D, E, and F are also briefly described in this section, and the reasons for their elimination during the screening process are explained in Section 3.0.

2.1.1 Alternative A1: Long Alignment – Single Bore Tunnel

This alternative is a single tunnel bore with a 42-foot outside diameter (OD), excavated with a large-diameter tunnel boring machine (TBM) from north to south along 7th Street and Pennsylvania Avenue. A TBM would be launched from within a launch box constructed at the DTX/PAX interface (see Figure 2-1). A TBM launch from the south end of this alignment is also feasible. From the north launch area, the tunnel grade will slope down at a 2% grade to minimize potential for conflicts with existing and planned SFPUC utilities along 7th Street, including existing deep foundations for the Division Street Box Sewer. After passing beneath these utilities, the tunnel would then proceed flat to cross under 16th Street and then slope upwards, first at a 1% and then at a 2% grade to terminate adjacent to the existing Caltrain Tunnel 2 portal just north of Cesar Chavez. At the north end, the PAX alignment would connect to DTX below grade within a cut-and-cover structure constructed as part of DTX and connecting to PAX tracks installed as part of DTX. At the south end, the PAX alignment would connect to the existing Caltrain tracks near Cesar Chavez, just south of the new tunnel portal. The existing 22nd Street Station would be decommissioned.

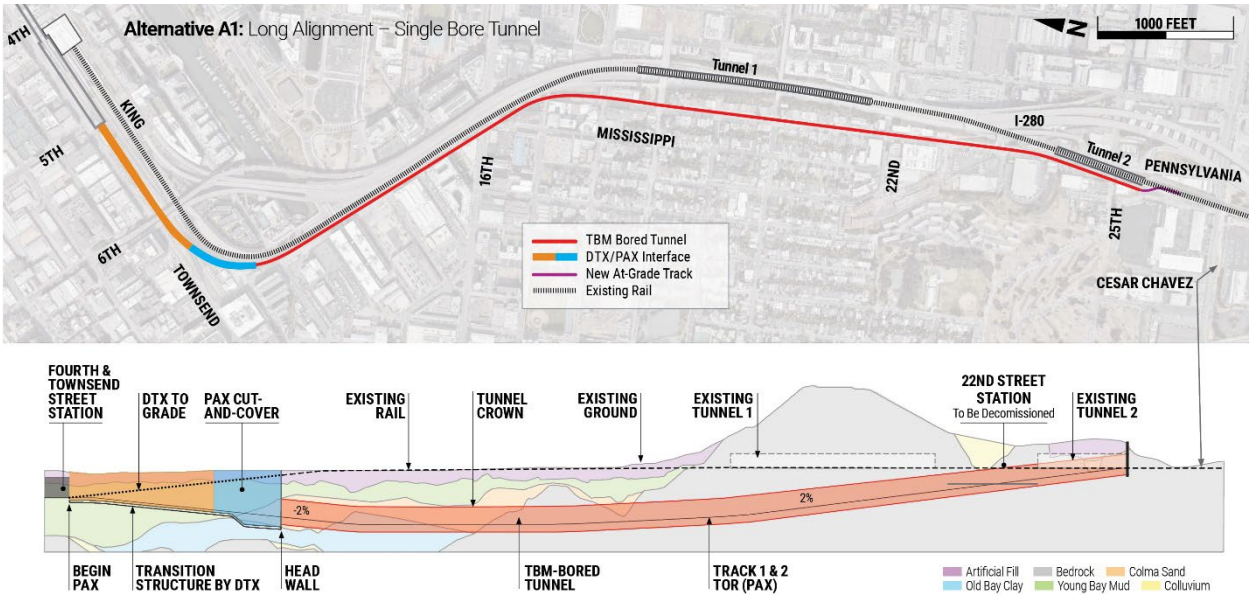


Figure 2-1. Long Alignment – Single Bore Tunnel. Rail and Existing Caltrain Tunnels noted. See also Appendix B.

2.1.2 Alternative A2: Long Alignment – Twin Bore Tunnels

This alternative consists of twin 26-foot OD tunnels, excavated by TBM under 7th Street and Pennsylvania Avenue (see Figure 2-2). New portals will be constructed for the tunnels near the existing

Caltrain Tunnel 2 portals just north of Cesar Chavez. The TBMs can be launched from the north or south end. The north connecting point is the DTX/PAX interface at the transition structure constructed by DTX. At the south end the PAX alignment connects to the existing Caltrain tracks at the surface near Cesar Chavez Street and just south of the new tunnel portals. Of note is that the two tunnels run closer than one diameter apart because of the constricted tunnel corridor between existing I-280 deep foundation elements and the 7th Street right-of-way (ROW). Appendix B indicates the tunnels could be as close as 5 feet apart, though a center column of 13 feet may eliminate the need for pre-excavation ground treatment, as discussed in Section 7.2.2. The existing 22nd Street Station would be decommissioned.

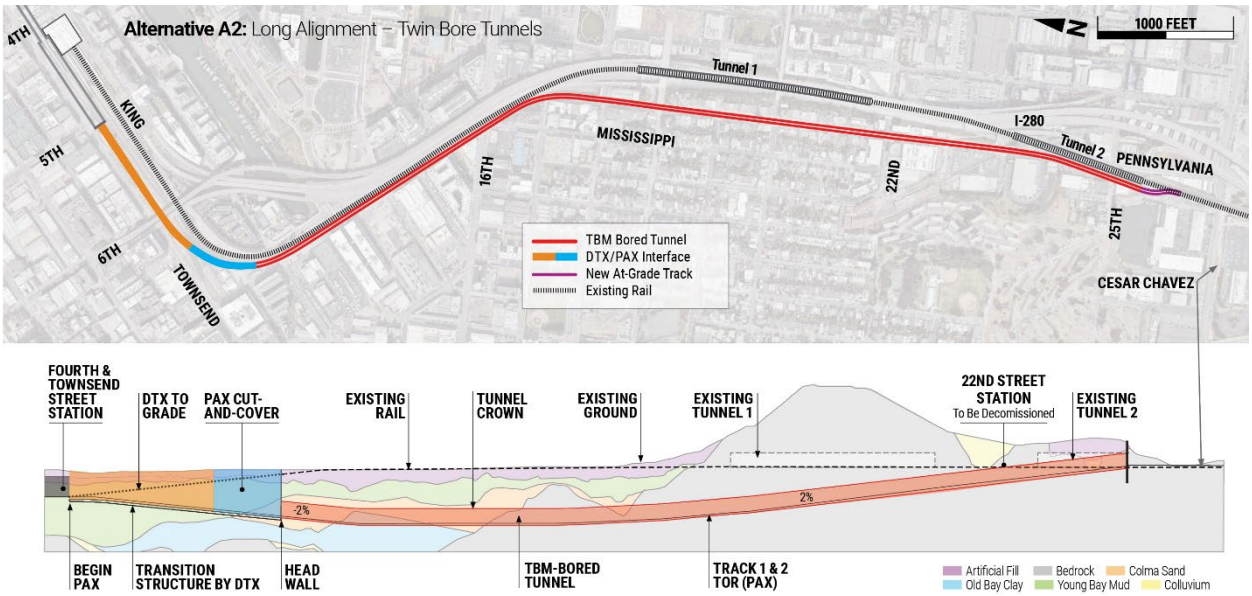


Figure 2-2. Long Alignment – Twin Bore Tunnels. Rail and Existing Caltrain Tunnels noted. See also Appendix B.

2.1.3 Alternative B1: Mid-Length Alignment – Single Bore + SEM Tunnel

This alternative is a single tunnel bore (42-foot OD), excavated with a large-diameter TBM from north to south along 7th Street and Pennsylvania Avenue, as shown in Figure 2-3. TBM excavation would terminate between 19th and 20th Streets. TBM drives from south to north are not feasible for this alternative. A 22-foot-wide, horseshoe-shaped spur tunnel would extend to the southeast from the point of TBM termination to connect into the existing Caltrain Tunnel 1 just north of the existing southern portal and south of 20th Street. This tunnel would contain the northbound (easterly) track. The southbound (westerly) tunnel would also be 22 feet wide and would extend from the TBM termination point to a new portal adjacent to the existing south portal of Caltrain Tunnel No. 1. Both spur tunnels would be mined by SEM. Refinements to the limits of these excavation types can be examined during the subsequent project phases.

This alternative would allow continued use of the 22nd Street Station, with some modifications. (Note that station use could likely also remain unchanged with a different tie-in configuration similar to the connection used in Alternative C.) The city street bridge abutment at 22nd Street will likely require partial, but significant, demolition and reconstruction. A new retaining wall would be required along the west side of the station to allow new rail to be constructed at grade for the southbound track. The reason

for proposing new southbound rail as opposed to tying the new southbound track into the existing southbound track north of the station is to avoid demolition and reconstruction of an existing I-280 support column that interferes with a track alignment that ties directly into the existing southbound rail between the new portal and the 22nd Street Station. For this option, the 22nd Street Station would be converted to a center platform arrangement, which would require platform modifications. The southbound tracks continue southward from the 22nd Street Station via a rehabilitated abandoned Caltrain Tunnel 2, while the northbound line would remain in active Caltrain Tunnel 2. The tie-in to the existing southbound tracks would occur near Cesar Chavez Street just south of the existing portals.

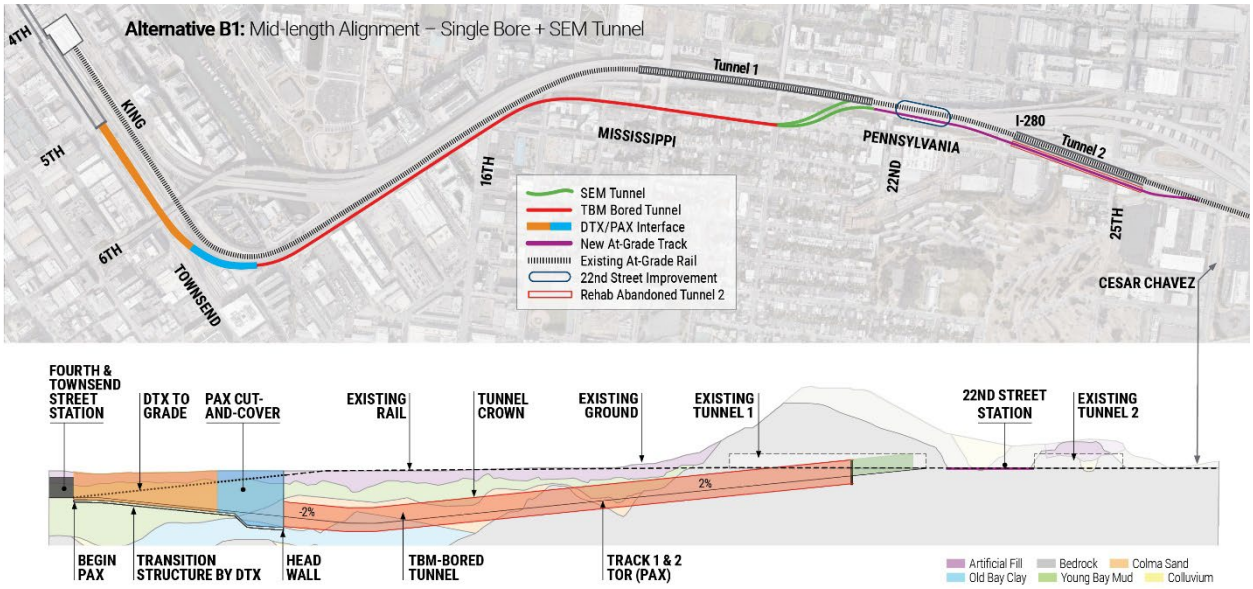


Figure 2-3. Mid-Length Alignment – Single Bore + SEM Tunnel. Rail and Existing Caltrain Tunnels Noted. See also Appendix B.

2.1.4 Alternative B2: Mid-Length Alignment – Twin Bore + SEM Tunnels

This alternative consists of twin 26-foot OD tunnels, excavated by TBM from north to south along under 7th Street and Pennsylvania Avenue as shown in Figure 2-4. TBM drives from south to north are not feasible for this alternative. The TBM for the northbound (easterly) tunnel drive curves southeast under private property to terminate at or near a new break-in to existing Caltrain Tunnel No. 1. The TBM drive for the southbound (westerly) tunnel also curves southeast under private property to a termination point at or near a new portal adjacent to the existing southern portal of Caltrain Tunnel 1, just north of the 22nd Street Station. Some portion of one or both new tunnels will likely require some amount of SEM mining from the TBM termination point to the break-in points at the new portal or into Tunnel No. 1. Refinements to the limits of these excavation types can be examined during subsequent project phases.

This alternative is similar to Alternative B1 in that it would allow continued use of the 22nd Street Station with some modifications. (Note that station use could also remain unchanged with a tie-in configuration similar to Alternative C.) The city street bridge abutment at 22nd Street may require modification. A new retaining wall would be built along the west side of the station to allow new rail to be constructed at grade for the southbound track. The 22nd Street Station would be converted to a center platform arrangement, which would require platform modifications. The southbound tracks continue southward from the 22nd Street Station via a rehabilitated abandoned Caltrain Tunnel 2, while the northbound line remains in

Active Caltrain Tunnel 2. Tie-in to the existing southbound tracks occurs near Cesar Chavez, just south of the existing portals.

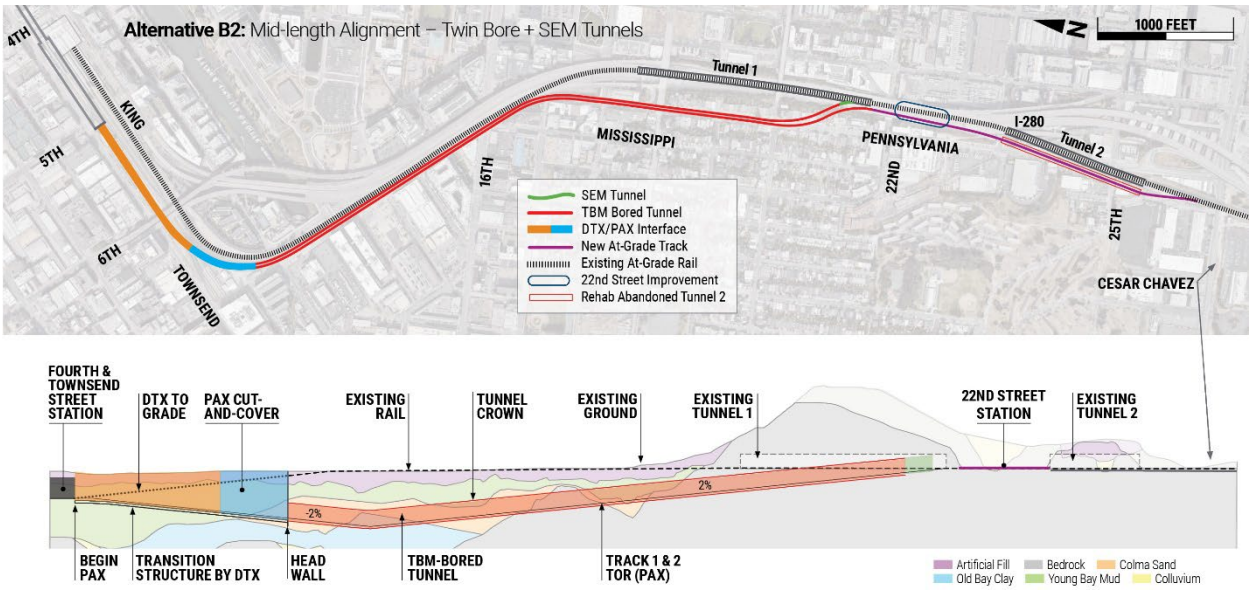


Figure 2-4. Mid-Length Alignment – Twin Bore + SEM Tunnels. Rail and Existing Caltrain Tunnels Noted. See Appendix B.

2.1.5 Alternative C: Short Alignment – Split Tunnels

This alternative involves two different types of excavations for the northbound and southbound tracks. The 26-foot-OD southbound (westerly) tunnel would be excavated by a single TBM from north to south along 7th Street and Pennsylvania Avenue, curving under private property and terminating at a new portal near the existing Caltrain Tunnel 1 south portal (see Figure 2-5). TBM mining from south to north is not feasible for this alternative. The southbound track would tie-in with existing southbound track just north of the 22nd Street Station. This tie-in may require modification of I-280 viaduct support that interferes with the rail alignment that is necessary to avoid modifications to the 22nd Street Station. The existing 22nd Street Station can be used in its current configuration without modification.

For the northbound tracks, a 20-foot-wide rectangular northbound (easterly) cut-and-cover tunnel would be excavated and supported within the Caltrain ROW from the DTX/ PAX interface, down under the existing Caltrans viaduct, to a location between Mariposa Street and 18th Street, where the PAX elevation meets the existing Caltrain track elevation at the northern portal of Caltrain Tunnel 1. Between approximately 16th Street/Mississippi Street and Mariposa Street, the PAX northbound track alignment would be in a trench with no cover as the vertical grade rises southward to meet the existing at-grade track. The northbound tunnel crossings of 16th Street and Mission Bay Drive will be constructed using cut-and-cover methods and will require partial closures of these intersections during construction.

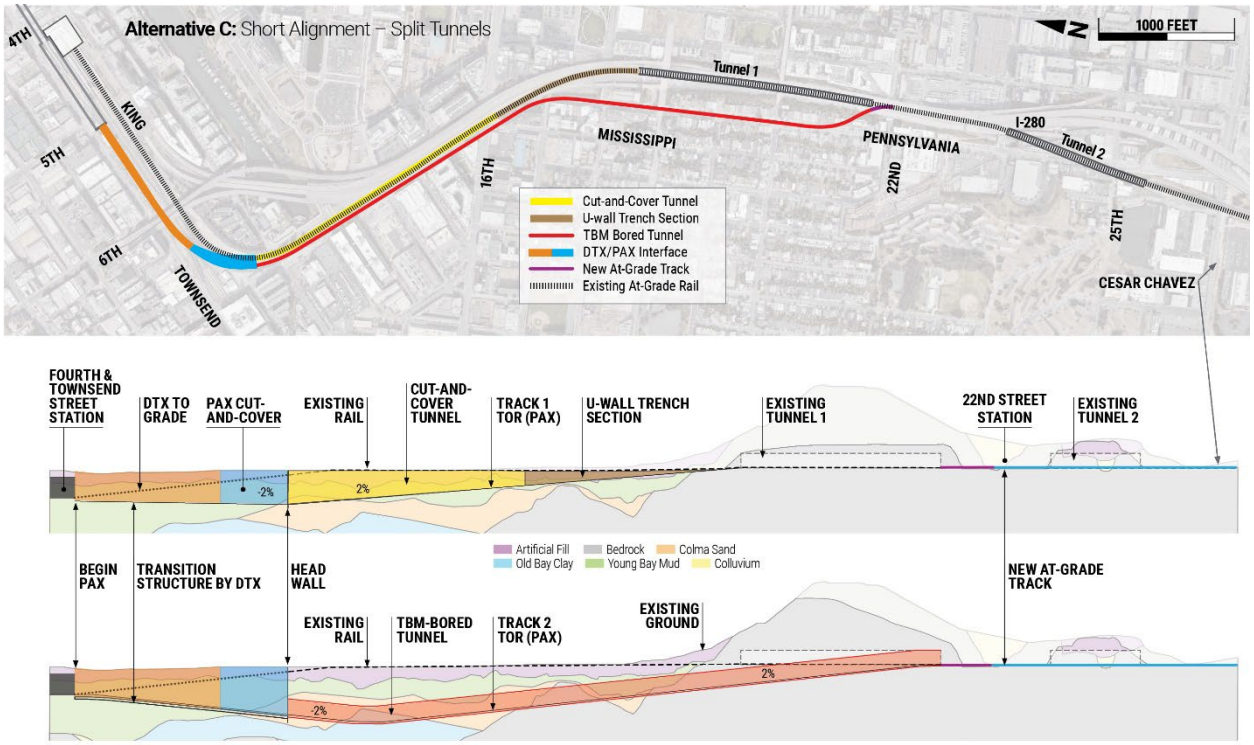


Figure 2-5. Short Alignment – Split Tunnels. Rail and Existing Caltrain Tunnels Noted. See also Appendix B.

2.1.6 Alternatives D, E, and F

Alternatives D, E, and F were removed from further consideration in the screening process as described in Section 3.0. These alternatives are briefly described below.

- **Alternative D:** This alternative is a single tunnel bore (42-foot OD) excavated with a large-diameter TBM from north to south along 7th Street and Pennsylvania Avenue, launched from within the DTX transition structure at the DTX/PAX interface. The TBM would excavate to approximately 20th Street. At this point, a 22-foot spur tunnel would extend to the southeast toward the southern portal of the existing Caltrain Tunnel 1. The spur tunnel would carry the northbound (easterly) track and would be mined by SEM. This alternative would allow continued use of only the northbound tracks the 22nd Street Station. The TBM continues for the southbound (westerly) track to tie into the existing Caltrain track at 23rd Street, making use of the abandoned Caltrain Tunnel 2 for the final southern-most segment. Lowering of the existing Caltrain tunnel invert is required for the length of Tunnel 2. This alternative was abandoned because it was functionally similar to Alternative A but was more costly and reduced train operating speeds.
- **Alternative E:** This alternative is similar to Alternative C except that the southbound tunnel and track connection is between 22nd and 23rd Streets, rather than north of 22nd Street. This alternative would allow continued use of only the northbound platform of the 22nd Street Station. Lowering of the abandoned Caltrain Tunnel 2 is also required. This alternative was abandoned because it was functionally similar to Alternative A but was more costly and reduced train operating speeds.

- **Alternative F:** This alternative is a single bore tunnel (42-foot OD) excavated with a large diameter TBM from north to south on 7th Street and Pennsylvania Avenue. The TBM excavation termination point is between 22nd and 23rd Streets. From this point southward, a cut-and-cover tunnel would be constructed to daylight south of the existing 22nd Street Station and tie into the existing Caltrain tracks before the Caltrain Tunnel 2 and just south of the existing 22nd Street Station. This alternative was abandoned because of low cover requiring cut-and-cover construction on Pennsylvania Avenue.

3.0 Alternatives Evaluation

3.1 Alignment Validation Process

During January and February of 2021, the project team participated in a validation process together with the SFCTA and an independent consultant, Brierley Associates, under separate contract to SFCTA. The process reviewed major constraints and risks to the project posed by the selection of six different project alternatives (A1/A2, B1, C, D, E, and F). Following the validation process, three of the original alignment alternatives were eliminated from further study: Alternatives D, E, and F. One variation of alignment Alternative B1, Alternative B2, was added, for a total of three alternatives, two of which can be accomplished in two different configurations. The three screened alignment alternatives that were dropped are presented below, along with reasons why they were not selected for further study. The alignments carried forward for study were then scored using the evaluation framework matrix described herein.

3.2 Alignment Alternatives Screened Out

Alternative D Alignment: This alternative was eliminated from further consideration because its disadvantages would not be offset adequately by achievement of project goals. Disadvantages include the introduction of multiple tunneling methods and risks associated with the required lowering of the existing abandoned Caltrain Tunnel 2. Although the single bore would allow for crossovers and cross passages to be constructed inside the running tunnel, this alternative carries an increased risk ground settlement between 16th and Mariposa Streets and between 22nd and 23rd Streets. In this portion of the alignment, track grade constraints and required connections to the existing system result in less than one tunnel diameter of ground cover above the tunnel crown. In addition, only one of the tracks could make use of the existing 22nd Street Station.

Alternative E Alignment: This alternative was eliminated from further consideration because it presents disadvantages that would not be offset by adequate achievement of project goals. Disadvantages include the introduction of multiple tunneling methods, and the required lowering of the existing abandoned Caltrain Tunnel 2, as well as potentially significant interruptions to Caltrain operations during construction work windows. The construction of this option would cause significant surface disruptions, including risky and costly construction of required cross passages and crossovers, and a potential requirement for a shoofly south of 16th Street. In addition, only one of the tracks could make use of the existing 22nd Street Station.

Alternative F Alignment: This alternative was eliminated from further consideration because it presents disadvantages that would not be offset by adequate achievement of project goals. The SFPUC's new Folsom Street Tunnel and existing Division Street Sewer potentially conflict with this alignment. Although the single bore would allow for crossovers and cross passages to be constructed inside the running tunnel, this alternative also requires cut-and-cover construction in Pennsylvania Avenue South of 22nd Street and presents possible impacts to the 23rd Street bridge. In addition, this option completely bypasses the existing 22nd Street Station. Finally, a tight radius S-curve needed to tie into Caltrain at the south end of the alignment will limit train speeds.

3.3 Evaluation Framework Matrix

The use of an evaluation framework matrix allows qualitative comparison of project alternatives by applying a defined set of evaluation criteria consistently to all alternatives and then weighting the criteria based on relative importance.

The evaluation framework enables differentiation between alternatives by:

- Identifying distinct assessment criteria against which alternatives can be evaluated. These criteria reflect factors that relate to the construction and operation of the project.
- Comparing each alternative against the criteria and giving each a numeric rating that indicates whether the alternative contributes to, detracts from, or is neutral with respect to each criterion.
- Weighing criteria categories and individual criteria to assign relative importance of one criterion over another and providing a means to balance groupings of criteria that have an unequal number of criteria within each category. This method assigns greater priority to those criteria that are considered most important and reduced priority to those that are of less importance.

Using this methodology to evaluate each alternative ensures that all alternatives are treated consistently and can be ranked on advantages or disadvantages in an equal manner. The percentages shown below are the initially identified values for weighting and may be modified during future evaluation exercises.

3.4 Overview of the PAX Evaluation Framework Matrix

To develop the evaluation framework matrix shown in Table 3-1, the PAX project team identified the key criteria that were considered important issues, including impacts associated with the construction and operation of the PAX project. In addition to project total cost and schedule duration, the team identified temporary impacts associated with construction, potential risks/impacts associated with third-party entities and actions, and the ultimate benefits afforded by each alternative with respect to the project objectives.

The concept of using an evaluation framework was first introduced to the PAX Technical Advisory Group (TAG) in mid-August 2020. An early version of the matrix was circulated to the TAG for input in late August. Over subsequent months the framework matrix was further refined based on discussions within the project team and input from TAG.

Table 3-1. Evaluation Framework

Criteria Category	Criteria	Weight Within Category (%)	Category Weight (%)	Overall Individual Weights (%)
Project Goals	Improves Street Connectivity	25	25	6.3
	Improves Quality of Life	25		6.3
	Improves Rail Operations	25		6.3
	Improves Surface Safety	25		6.3

Criteria Category	Criteria	Weight Within Category (%)	Category Weight (%)	Overall Individual Weights (%)
Project Interfaces	DTX Compatibility	30	20	6.0
	Railyard Compatibility	20		4.0
	22nd Street Compatibility	30		6.0
	Infrastructure Compatibility	10		2.0
	ROW Needs	10		2.0
Construction	Constructability	20	15	3.0
	Geologic Profile	20		3.0
	Disruption to Rail Operations	40		6.0
	Access and Laydown Areas	20		3.0
Environmental	Traffic and Transit	20	10	2.0
	Air Quality	10		1.0
	Noise and Vibrations: Construction	20		2.0
	Noise and Vibrations Operations	20		2.0
	Cultural Resources: Archaeology	10		1.0
	Cultural Resources: Historic Properties	10		1.0
	Community Disruption	10		1.0
Programming	Cost	40	30	12.0
	Schedule	30		9.0
	Risk	30		9.0

3.5 Evaluation Methodology

The following methodology was used to determine the performance rating for each alignment alternative by criteria. Project Goals, Project Interfaces, Construction, and Environmental are category headings and are further broken down into subcategories. Cost, Schedule, and Risk are presented as subcategories under the heading Programming.

3.5.1 Project Goals

The long-term benefits of each alternative were also assessed for a variety of criteria that represent the performance of each alternative with respect to the purpose, need, and objectives of the project. These include enhanced street connectivity, improved seismic performance, improved rail operations, and surface safety. Each of these is further described below.

3.5.1.1 Improves Street Connectivity

A key aspect of the purpose and need for this project,[1] street connectivity, assesses the amount of enhanced street connectivity for all travel modes (vehicle, bike, pedestrian) that would be created from each alternative, and is assessed by a qualitative assessment of post-project grade separated intersections within the study area that the Caltrain alignment would intersect as follows:

- 1 = Marginal increase in street connectivity.
- 2 = Moderate increase in street connectivity.
- 3 = Significant increase in street connectivity.

3.5.1.2 Improves Quality of Life

This criterion is a measurement of how each alternative improves quality of life in surrounding neighborhoods over and above existing conditions. It is primarily related to substantial reductions in existing congestion, air quality, and noise effects associated with existing Caltrain and future rail traffic expansion. It also relates to improvements in the suitability of numerous city blocks currently facing the rail alignment for potential use as housing, retail, offices, and other community uses.

- 1 = No improvements to quality of life along a percentage of the journey.
- 2 = Improvements made to quality of life.
- 3 = Significant improvements made to quality of life.

3.5.1.3 Improves Rail Operations

This criterion reflects each alternative's enhancement of Caltrain rail operations as measured by flexibility in operations, and enhancements in rail operations. The ability to install track crossovers is one potential differentiator for this criterion.

- 1 = Offers the least amount of flexibility and enhancements to rail operations.
- 2 = Offers some flexibility and enhancements in rail operations.
- 3 = Offers the most flexibility and enhancements in rail operations.

3.5.1.4 Improves Surface Safety

Although similar to street connectivity, this criterion assesses the overall safety benefits of undergrounding the Caltrain operations in the study area, which will result in a decrease of risk of conflicts with automobiles, bicycles, and pedestrians along the entire rail corridor (rather than only at intersections), and therefore is quantified in terms of linear feet of Caltrain grade separation through the study area.

- 1 = Marginal increase in automobile, pedestrian, and bicycle safety.

[1] See Appendix C for the "Pennsylvania Avenue Tunnel Extension Project Preliminary Draft: Purpose and Need."

- 2 = Moderate increase in automobile, pedestrian, and bicycle safety.
- 3 = Significant increase in automobile, pedestrian, and bicycle safety.

3.5.2 Project Interfaces

The alternatives were also assessed for their potential to affect or be affected by outside stakeholder actions and their potential to require negotiations with third parties, including right-of-way requirements/easements and compatibility with railyard design. These impacts are not limited to the construction phase of the project.

3.5.2.1 Compatibility with DTX Design

This criterion is a qualitative evaluation of the interface and coordination required between the PAX configuration and the DTX design.

- 1 = The coordination between PAX and DTX is complicated and costly, and there are anticipated to be significant impacts to station or staging, during PAX construction and final configuration.
- 2 = Moderate coordination and impacts to station or staging, during PAX construction.
- 3 = Minimal coordination and impacts to station or staging, during PAX construction.

3.5.2.2 Compatibility with Railyard

This criterion is a qualitative evaluation of the interface and coordination required between the PAX configuration and the operating railyard as well as a proposed subsurface railyard.

- 1 = The coordination between PAX the railyard is complicated and costly, and there are anticipated to be significant impacts to staging, and/or storage/maintenance during PAX construction and final configuration.
- 2 = Moderate coordination and impacts to staging and/or storage/maintenance during PAX construction.
- 3 = Minimal coordination and impacts to staging and/or storage/maintenance during PAX construction.

3.5.2.3 Compatibility with 22nd Street Station

This criterion is reflective of an alignment's ability to service the existing surface station at 22nd Street. For alignments that score low for this criterion, major modifications to station elevation and passenger movements would be required to retain a 22nd Street Station. Modifications to the surface station may be required for alignments which make use of the surface station.

- 1 = Neither track passes through existing station.
- 2 = Partial station use: One track only.
- 3 = Both tracks can service existing station.

3.5.2.4 Compatibility with Existing and Major Planned Infrastructure

This criterion is an assessment of known significant existing infrastructure (e.g., Caltrans foundations and Folsom Sewer) situated near or crossing the proposed alignment that conflicts with the proposed construction. These conflicts may cause limits to design or construction options, increased costs or longer schedule, unfavorable vertical or horizontal alignment to avoid the conflict, or the risk of damage to the adjacent infrastructure.

- 1 = Conflict with multiple large existing infrastructure components that can add significant complexity, cost, and risk to relocations or adjustments to alignment to resolve the conflicts.
- 2 = A moderate level of relocations are required, and existing large infrastructure facilities are largely avoided.
- 3 = Alternative with the least number of conflicts with existing infrastructure.

3.5.2.5 ROW Requirements and Easements

This criterion assesses the number of right-of-way takes (either partial or full) and temporary and permanent easements that would be required to construct and operate the alternative. For the purposes of this assessment, greater weight was given to those right-of-way needs from private owners rather than those needed from public or quasi-public entities. By way of example, alternatives that are confined to a public street ROW will score highest. Alternatives that include long sections that cross private property to tie into the existing Caltrain line will score lowest.

- 1 = A significant number of temporary and permanent easements and takes will be required.
- 2 = A moderate level of temporary and permanent easements and takes will be required.
- 3 = The alternative is largely in the public ROW with the least number of takes required.

3.5.3 Construction Impacts

A variety of criteria were developed to capture a range of potential considerations associated with construction impacts. These considerations are associated with the construction of each alignment alternative (vs. operations and maintenance).

3.5.3.1 Constructability

This criterion is a representation of the ease and efficiency with which each alternative can be constructed. Included in consideration are risk mitigations that will be required to facilitate project excavations and support installation.

- 1 = Significant mitigations and/or complex design and construction.
- 2 = Moderate mitigations and complexity of design and construction.
- 3 = Least risk mitigations required; simple/efficient design and construction.

3.5.3.2 Geologic Profile

This criterion captures the potential to encounter unanticipated or uncertain subsurface conditions that strongly influence the project construction approach and, ultimately, project success.

- 1 = High likelihood or high potential impact of detrimental subsurface conditions.
- 2 = Moderate likelihood or moderate potential impact of detrimental subsurface conditions.
- 3 = Mild likelihood or low potential impact of detrimental subsurface conditions.

3.5.3.3 Disruption to Rail Operations

This criterion addresses disruption to Caltrain operations during construction of the PAX alternative. This criterion assesses both service interruptions/outages and required modifications to operations by qualitatively comparing disruption including outages to Caltrain service and required single track service caused by the PAX construction.

- 1 = Significant, complicated, and lengthy interruptions to existing operations.
- 2 = Moderate level of disruption and not overly complicated with respect to operations coordination and construction implementation.
- 3 = Alternative that is the least disruptive with fewest interruptions to existing service.

3.5.3.4 Access and Laydown Areas

This criterion is an assessment of feasible access and laydown areas in proximity to support construction of the alternative. It captures the increased cost, schedule, emissions, traffic, and construction complexity for alternatives that require use of access/laydown staging areas at further distances from the proposed alignment.

- 1 = Remote: No potential construction staging areas were identified near the portal or entry point that can support construction of the alternative.
- 2 = Nearby: Potential staging areas are not in the immediate vicinity to the alternative but are reasonably close by the portal or entry point that can support construction of the alternative.
- 3 = Adjacent: A potential staging area is immediately adjacent to a portal or entry point that can support construction of the alternative.

3.5.4 Environmental Impacts

The potential to introduce environmental impacts, either during the construction phase or the operation phase, was evaluated for each alignment.

3.5.4.1 Traffic and Transit

The traffic and transit impacts of construction activities for each alternative are assessed. This criterion will examine impacts to local vehicle, pedestrian, and transit traffic from construction activities. It will

include such factors as the likelihood that construction sites will require major detours that will disrupt traffic or increase localized congestion, close pedestrian walkways, or reroute existing transit service.

- 1 = Construction activities will have a significant and lengthy impact on local traffic and/or transit.
- 2 = Construction activities will have a moderate impact on local traffic and/or transit.
- 3 = This is the alternative that is anticipated to have the least impact to traffic and transit.

3.5.4.2 Air Quality

This criterion is a qualitative assessment of construction impacts associated with air quality (e.g., dust), to nearby receptors. It is driven by factors such as the duration of construction, type of construction (e.g., open cut versus subsurface excavation), and proximity of construction and staging areas to sensitive receptors such as residences.

- 1 = Generally the most disruptive alternatives, with the greatest impact on sensitive receptors.
- 2 = Alternatives that result in a moderate amount of community disruption with shorter duration of impacts or proximity to less sensitive land uses.
- 3 = Generally the least or commensurate with the least disruptive of considered alternatives; construction sites are located in industrial or nonresidential areas.

3.5.4.3 Noise and Vibration: Construction

This criterion is a qualitative assessment of construction impacts associated with noise and vibration with respect to nearby receptors. It is driven by factors such as the duration of construction, type of construction (e.g., pile driving), and proximity of construction and staging areas to sensitive receptors such as residences.

- 1 = Generally the most disruptive alternatives, with the greatest impact on sensitive receptors.
- 2 = Alternatives that result in a moderate amount of community disruption with shorter duration of impacts or proximity to less sensitive land uses.
- 3 = Generally the least or commensurate with the least disruptive of considered alternatives; construction sites are located in industrial or nonresidential areas.

3.5.4.4 Noise Vibration: Operations

This criterion is a qualitative assessment of permanent impacts associated with noise and vibration to nearby receptors. It is driven by factors such as the depth of installed tunnels and proximity of tunnels to sensitive receptors such as residences.

- 1 = Generally the most disruptive alternatives, with the greatest impact on sensitive receptors.
- 2 = Alternatives that result in a moderate amount of vibration impacts with shorter duration of impacts or proximity to less sensitive land uses.

- 3 = Generally the least or commensurate with the least disruptive of considered alternatives; tunnel locations would be located in industrial or nonresidential areas.

3.5.4.5 Cultural Resources: Archaeology

This criterion is a qualitative assessment used to assess potential significant impacts on archaeological resources such as adverse effects or significant impacts on archaeological resources that qualify for listing on the California Register of Historical Resources (California Register) or the National Register of Historic Places (National Register), or soils and landforms that may contain archaeological resources potentially eligible for either register. It is driven by factors such as sensitivity of landform for buried archaeological resources, and the potential to affect during construction archaeological resources potentially eligible for either the California Register or the National Register.

- 1 = Generally the most or commensurate with the greatest anticipated effects on eligible or potentially eligible archaeological resources and significant disturbance of soils sensitive for archaeological resources
- 2 = Alternatives that result in a moderate amount of potential effects to archaeological resources and moderate disturbance of soils sensitive for archaeological resources within the alignment corridor
- 3 = Generally the alternative with the least or commensurate with the least disruptive of soils sensitive for archaeological resources within the alignment corridor.

3.5.4.6 Cultural Resources: Historic Properties

This criterion is a qualitative assessment used to assess potential adverse effects or significant impacts on historic architectural resources such as adverse impacts on historic architectural resources that qualify for listing on the California Register and/or the National Register. It is driven by factors such as the number of historic architectural resources eligible for either the California Register or the National Register potentially effected during construction and the anticipated level of effect for each resource.

- 1 = Generally the most or commensurate with the greatest anticipated effects on one or more historic architectural resource and the most disruptive of considered alternatives.
- 2 = Alternatives that result in a moderate amount of potential effects to known historic architectural resources within the alignment corridor.
- 3 = Generally the alternative with the least number of potential effects to known historic architectural resources within the alignment corridor.

3.5.4.7 Community Disruption

This criterion is a qualitative assessment that combines a variety of impacts to community cohesion that may occur during construction, including impacts to pedestrian and bicycle access necessitated by direction travel, impacts to access and use of community features (e.g., Tunnel Top Park), and aesthetic impacts of construction (amount of visible construction fencing).

- 1 = Most or commensurate with the most disruptive of considered alternatives.

- 2 = Alternatives that result in a moderate amount of community disruption when compared to other alternatives considered.
- 3 = Least or commensurate with the least disruptive of considered alternatives.

3.5.5 Programming

Anticipated cost, schedule, and risks were quantified and analyzed for the purpose of evaluating each alignment alternative.

3.5.5.1 Cost

The evaluation of cost is intended to allow the consideration of the total cost of each alternative in terms of design, management, and construction. All options evaluated in the Alternatives Analysis phase have a Class V cost estimate prepared. This allows comparison of estimated cost between the alternatives. Alternatives that are estimated to cost within 10% of each other were given the same score.

- 1 = Highest cost alternative.
- 2 = Middle cost alternative.
- 3 = Lowest cost alternative.

3.5.5.2 Construction Schedule

The time taken to construct each alternative is directly related to several factors including anticipated construction means and methods and estimated productivity. To the extent they are known at the time of the evaluation, schedule durations consider anticipated sequencing or impacts from external factors such as major utility relocations, tie-ins to existing Caltrain service, and special construction procedures that will likely be required to mitigate public impacts. Project schedule is evaluated in terms of estimated years of variation from the alternative with the shortest construction schedule.

- 1 = Three or more years longer than the schedule for the alternative with the shortest schedule.
- 2 = One to two years longer than the schedule for the alternative with the shortest schedule.
- 3 = Alternative with the shortest construction schedule.

3.5.5.3 Risk

A risk register has been developed to capture key potential hazards and risks associated with the design and construction of the project and to discuss potential impacts of those risks if mitigations are not implemented.

- 1 = Unlikely to meet project objectives without significant additional risk to the SFCTA or the construction contractor.
- 2 = Likely to meet project objectives with the SFCTA and construction contractor accepting some risk; requires implementation of risk mitigation measures.

- 3 = Likely to meet or exceed project objectives with lowest reasonable risk to SFCTA or construction contractor.

3.6 Analysis Results

The scores for the alternatives being carried forward for further study can be found in Table 3-2.

Table 3-2. Evaluation Framework with Scoring

Criteria Category	Criteria	Alternatives				
		A1: Long Alignment – Single Bore Tunnel	A2: Long Alignment – Twin Bore Tunnels	B1: Mid-Length Alignment – Single Bore + SEM Tunnels	B2: Mid-Length Alignment – Twin Bore + SEM Tunnels	C: Short Alignment – Split Tunnels
Project Goals	Improves Street Connectivity	3	3	2	2	1
	Improves Quality of Life	3	3	2	2	2
	Improves Rail Operations	3	2.5	2	1.5	2
	Improves Surface Safety	3	3	2.5	2.5	2.5
	TOTAL	12	11.5	8.5	8	7.5
Project Interfaces	DTX Compatibility	3	3	3	3	2
	Railyard Compatibility	2	2	2	2	1
	22nd Street Compatibility	1	1	3	3	3
	Infrastructure Compatibility	3	2	2	2	1
	ROW Needs	2	1	3	3	3
	TOTAL	10	10	12	11.5	10
Construction	Constructability	2	2	1	2	1
	Geologic Profile	2.5	3	2	2	1
	Disruption to Rail Operations	3	3	2.5	2	1
	Access and Laydown Areas	2.5	3	1.5	2	1
	TOTAL	10	11	7	8	4
Environmental	Traffic and Transit	2	1	2	1	2
	Air Quality	1	1.5	2	2.5	2.5
	Noise and Vibrations: Construction	1	1	2	2	1
	Noise and Vibrations: Operational	3	3	2	2	1
	Cultural Resources: Archaeology	2	1.5	2	2	1
	Cultural Resources: Historic Properties	2	2	1	1	1.5
	Community Disruption	1.5	2	2.5	3	1
	TOTAL	12.5	12	13.5	13.5	10

Criteria Category	Criteria	Alternatives				
		A1: Long Alignment – Single Bore Tunnel	A2: Long Alignment – Twin Bore Tunnels	B1: Mid-Length Alignment – Single Bore + SEM Tunnels	B2: Mid-Length Alignment – Twin Bore + SEM Tunnels	C: Short Alignment – Split Tunnels
Programming	Cost	3	2	3	3	3
	Schedule	2	2	2	2	3
	Risk	2	2	2	2	1
	TOTAL	7	7	7	7	7
Total Score		***50***	***49.5***	***48.5***	***47.5***	***39.5***
Weighted Score		***2.2***	***2.1***	***2.1***	***2.1***	***1.9***

3.6.1 Alternative A1: Long Alignment – Single Bore Tunnel

This alternative scored highest in the evaluation process with an overall weighted score of 2.2. Primarily because of its long length underground, this alternative scored the highest for meeting project goals, including improving rail operations and improving street connectivity and surface safety. Quality of life is also expected to be most improved by the long and mid-length alternatives. The longer alternatives scored lower than the mid-length and short alternatives for the project interface criteria, in part because they bypass the existing 22nd Street Station. This alignment requires right-of-way takes at its south end, so it scored a 2 for that criterion. All A and B alignments are assumed at this point to be viable for DTX and Railyard compatibility and were given 3s and 2s for those criteria, respectively.

A minimal impact of short duration is expected for rail service phase-in at the southern tie-in for the long alternatives (A1 and A2), so these alternatives qualify as the highest for that criterion. Alternative A1 scored highest for constructability (tied with Alternatives A2 and B2) and second highest for access and laydown areas. This alternative came in second for the geologic profile criterion because it is expected to encounter soft soils and mixed-face conditions for more of the excavation than the twin bore.

A feature of the large-diameter and long alignment is a slightly lower score for environmental criteria during construction than for the shorter and twin bore alignments, due in large part to the greater volume of trucks needed to remove muck and deliver tunnel lining segments, which contributes to air and noise impacts. However, once construction is complete, operational noise and vibrations are expected to be lowest for this alternative and for Alternative A2. During a tunnel drive excavated from the south end of the alignment, the LOS in the morning peak at Pennsylvania Avenue / Cesar Chavez Street / NB I-280 off-ramp is expected to degrade from LOS E to LOS F. During a tunnel drive excavated from the north end of the alignment, the LOS in the afternoon peak at 7th Street / Brannan Street and 7th Street / 16th Street is expected to degrade from LOS D to LOS E. There is an area of low cover over the tunnel that requires further investigation and will likely require either ground treatment or underpinning of the I-280 pile foundations, and ground treatment will be required in a zone near TBM launch. However, minimal ground improvement will be required because this alternative allows for crossovers between the northbound and southbound tracks, and required emergency cross passages, to be installed inside the

tunnel structure, and this means lower anticipated traffic and transit impacts as compared to Alternative A2.

This alignment tied with all alignments other than A2 for the programming scores. The estimated project schedules and risk scores of Alternatives A1, A2, B1, and B2 are comparable. The estimated costs for Alternatives A1, B1, B2, and C are lower than the estimate for Alternative A2, and are all within 10% of each other, so they received the same score.

3.6.2 Alternative A2: Long Alignment – Twin Bore Tunnels

This alternative tied with Alternatives B1 and B2 for second in the evaluation process with an overall weighted score of 2.1. Primarily because of its long length underground, this alternative scored quite high for meeting project goals, including improving rail operations (where it scored just below Alternative A1) and improving surface safety. Quality of life is also expected to be most improved the long and mid-length alternatives.

The longer alternatives (A1 and A2) scored lower than the mid-length alternatives and short alternative for the project interface criteria, in part because they bypass the existing 22nd Street Station. This alignment will have right-of-way impacts to private properties and scored the lowest for that criterion. This alignment has a greater potential for conflict with existing Caltrans footings for I-280, so it received a middle score for that criterion. All A and B alignments are assumed at this point to be viable for DTX and Railyard compatibility and were given 3s and 2s for those criteria, respectively.

A minimal impact of short duration is expected for rail service phase-in at the southern tie-in for the long alternatives (A1 and A2), so these alternatives qualify as the highest for disruption to rail operations. Alternatives A2 scored highest for constructability (tied with Alternatives A1 and B2) and highest for access and laydown areas. This alternative scored highest for the geologic profile criterion as well because it has been best optimized to pass through favorable ground conditions.

This alignment requires two adjacent tunnels to be excavated with significantly less separation than is typically desired, and the required emergency cross passages and crossovers must be excavated outside the tunnel structure. Significant lengths (1,000+ feet) of ground treatment installed from the ground surface are anticipated to be required, resulting in a low score for traffic and transit impacts for this alignment. Other environmental criteria that relate to muck volume during construction, including air and noise impacts as well as archaeology, were scored lower for this alignment than for the shorter alignments. However, once construction is complete, operational noise and vibrations are expected to be lowest for this alternative and for Alternative A1.

This alignment has a slightly lower programming score than the other alignments. The estimated project schedules and risk scores of Alternatives A1, A2, B1, and B2 are comparable. The cost for this alternative is the highest and is just over 10% higher than the cost for Alternative A1, resulting in a lower score.

3.6.3 Alternative B1: Mid-Length Alignment – Single Bore + SEM Tunnels

This alternative tied with Alternatives A2 and B2 for second in the evaluation process with an overall weighted score of 2.1. Primarily because of its shorter length underground, this alternative garnered

intermediate scores for meeting project goals, including improving rail operations (where it scored just above Alternative B2) and improving surface safety. Quality of life is expected to be improved the most by the long and mid-length alternatives.

The mid-length alternatives and short alternative (B1, B2, and C) scored higher than the long alternatives for the project interface criteria, in part because they make use of the existing 22nd Street Station. Alignments B1, B2, and C have the fewest right-of-way impacts, so they scored the highest for that criterion. Alternatives B1 and B2 have a greater potential for conflicts with SFPUC's Division Street Sewer at the north end of the alignment because they are shallower to allow for mid-alignment tie-ins to existing tracks, so they received middle scores for infrastructure compatibility. All A and B alignments are assumed at this point to be viable for DTX and Railyard compatibility and were given 2s for those criteria, respectively.

The use of SEM construction of the southernmost sections of this alignment and Alignment B2 minimizes construction time on active and inactive Caltrain tracks, but there will be impacts, so these alternatives scored in the middle for disruption to rail operations. This alternative tied with Alternative C for the lowest score for constructability and second lowest for access and laydown areas. This alternative and Alternative B2 were given scores of 2 for the geologic profile criterion because they are expected to encounter soft soils and mixed-face conditions for more of the excavation than the longer, deeper alignments.

This alternative tied with Alternative B2 for the highest environmental criteria scores. When compared with A1 and A2, the shorter tunnel lengths of B1 and B2 are related to decreased air quality and noise impacts, as well as decreased likelihood of archaeological impacts. During tunnel excavation, the LOS in the afternoon peak at 7th Street / Brannan Street is expected to degrade from LOS D to LOS E. There is an area of low cover over the tunnel that requires further investigation and will likely require either ground treatment or underpinning of the I-280 pile foundations, and ground treatment will be required in a zone near TBM launch. However, minimal ground improvement will be required because this alternative allows for crossovers between the northbound and southbound tracks, and required emergency cross passages, to be installed inside the tunnel structure, and this means lower anticipated traffic and transit impacts as compared to Alternative B2.

This alignment tied with all alignments other than A2 for the programming scores. The estimated project schedules and risk scores of Alternatives A1, A2, B1, and B2 are comparable. The estimated costs for Alternatives A1, B1, B2, and C are lower than the estimate for Alternative A2, and are all within 10% of each other, so they received the same score.

3.6.4 Alternative B2: Mid-Length Alignment – Twin Bore + SEM Tunnels

This alternative tied with Alternatives A2 and B1 for second in the evaluation process with an overall weighted score of 2.1. Primarily because of its shorter length underground, this alternative garnered the second lowest score for meeting project goals, including improving rail operations (where it scored just below Alternative B1) and improving surface safety. Quality of life is expected to be improved the most by the long and mid-length alternatives.

The mid-length and short alternatives (B1, B2, and C) scored higher than the long alternatives for the project interface criteria, in part because they make use of the existing 22nd Street Station. Alignments B1, B2, and C have the fewest right-of-way impacts, so they scored the highest for that criterion. Alternatives B1 and B2 have a greater potential for conflicts with SFPUC's Division Street Sewer at the north end of the alignment because they are shallower to allow for mid-alignment tie-ins to existing tracks, so they received middle scores for infrastructure compatibility. All A and B alignments are assumed at this point to be viable for DTX and Railyard compatibility and were given 3s and 2s for those criteria, respectively.

The use of SEM construction of the southernmost sections of this alignment and Alignment B1 minimizes construction time on active and inactive Caltrain tracks, but there will be impacts, so these alternatives scored in the middle for disruption to rail operations. This alternative scored the highest in constructability (tied with A1 and A2) but in the middle for access and laydown areas. This alternative and Alternative B1 were given scores of 2 for the geologic profile criterion because they are expected to encounter soft soils and mixed-face conditions for more of the excavation than the longer, deeper alignments.

This alternative tied with Alternative B1 for the highest environmental criteria scores. The shorter tunnel length as compared to Alternatives A1 and A2 is related to decreased air quality and noise impacts, as well as decreased likelihood of archaeological impacts. During tunnel excavation, the LOS in the afternoon peak at 7th Street / Brannan Street is expected to degrade from LOS D to LOS E. Traffic impacts are expected to be worse for this alternative because the two adjacent tunnels will be excavated with significantly less separation than is typically desired, and the required emergency cross passages and crossovers must be excavated outside the tunnel structure. This means that significant lengths (1,000+ feet) of ground treatment installed from the ground surface are anticipated to be required, resulting in a low score for traffic and transit impacts for this alignment.

This alignment tied with all alignments other than A2 for the programming scores. The estimated project schedules and risk scores of Alternatives A1, A2, B1, and B2 are comparable. The estimated costs for Alternatives A1, B1, B2, and C are lower than the estimate for Alternative A2, and are all within 10% of each other, so they received the same score.

3.6.5 Alternative C: Short Alignment – Split Tunnels

This alternative scored the lowest in the evaluation process with an overall weighted score of 1.9. Alternative C moves the shortest length of track underground, and therefore earned middle and low scores for meeting project goals, including improving rail operations and improving surface safety (where it is in a three-way tie with Alternatives B1 and B2). Notably, this alternative received the lowest score for improving street connectivity, primarily because it keeps more trains operating on the surface and does not allow for other uses of the land. Quality of life is expected to be improved the least by this alternative.

Alternative C scored higher than the long alternatives (A1 and A2) and lower than the mid-length alternatives (B1 and B2) for the project interface criteria. This alignment does make use of the existing 22nd Street Station, and has few right-of-way impacts, so it scored high for those criteria. But it also carries with it numerous risks related to unanticipated conditions because of its tight alignment between Caltrans I-280 bridge piers, possible impacts to those bridge piers, and possible conflicts with SFPUC's

Folsom Tunnel and Division Street Sewer at the north end of the alignment because it is shallow to allow for mid-alignment tie-in to existing tracks. As a result of all this, it received the lowest score for infrastructure compatibility. Alternative C will be most disruptive in the railyard and was therefore given a score of 2 for compatibility with DTX and 1 for compatibility with the Railyard.

This alternative scored low across the board for construction criteria. Major disruption at the Caltrain tracks is required for this option, so it scored low for disruption to rail operations. It also scored low for constructability, in large part because of the risk of unanticipated conditions along the long cut-and-cover portion of the alignment, and for access and laydown areas, which are not well aligned with construction locations. Finally, Alternative C scored low for geologic profile, because it is expected to encounter the greatest proportion of soft soils of any of the alignment alternatives.

This alternative received the lowest environmental criteria scores, primarily because of the large portion of work to be performed at the surface. One post-construction feature of this alignment that is expected is vibration impacts related to train operations. Community disruption is expected to be highest with this alignment.

This alignment tied with all alignments other than A2 for overall programming score. The risk is expected to be highest for this alternative. The short and mid-length alignments are forced to be shallower by tie-in elevations at each end, and therefore pass through less favorable ground conditions. However, based on available information, this alignment is expected to take slightly less time than other alternatives, and therefore has a favorable project schedule. The estimated costs for Alternatives A1, B1, B2, and C are lower than the estimate for Alternative A2, and are all within 10% of each other, so they received the same score.

3.7 Alternatives Evaluation Summary

The evaluation framework yielded a close range in overall scoring, from a low of 1.9 for Alternative C to a high of 2.2 for Alternative A1. The greatest disparity on scoring is for construction, which resulted in Alternatives A1 and A2 having scores of 10 to 11 versus 4 to 8 for B1, B2, and C. The scoring for the project goals criteria also resulted in a clear separation, with A1 and A2 having scores of 11.5 and 12, respectively, while B1, B2, and C ranged from 7.5 to 8.5. It must be noted that the scoring does not factor in the final selection of station location in a meaningful way, as a study of a PAX station is outside the scope of this study. It is anticipated that a decision on making use of the existing 22nd Street Station versus decommissioning it would push either the A1/A2 group (decommissioning) or the B1/B2/C group (make use of) to the favored alternative shortlist. Features that relate to a number of the criteria evaluated, including project goals and impacts, are summarized in Table 3-3. Alignment Alternative Features (from Alternatives Analysis Report)

Table 3-3. Alignment Alternative Features (from Alternatives Analysis Report)

Alternative	Screening Criteria					
	Grade Separation at 16th, Mission Bay Drive	Supports Future Train Operations (meets grade and radius requirements)	Minimizes Impacts on Adjacent Projects	Minimizes Impacts to Rail Operations	Maintains Minimum One Diameter (1D) of Ground Cover (for tunneled sections)[1]	Minimizes Length of Tunnel Excavation in Unstable Soils
A1: Long Alignment – Single Bore Tunnel	X	X	X	X	X	X
A2: Long Alignment – Twin Bore Tunnels	X	X	X	X	X	X
B1: Mid Alignment – Single Bore + SEM Tunnel	X	X	X			
B2: Mid Alignment – Twin Bore + SEM Tunnels	X	X	X		X	
C: Short Alignment - Split Tunnels	X	X			X	

[1] One diameter of ground cover maintained for most (85%) of tunnel length. Remainder of tunnel length (15%, or approximately 1,300 feet) maintains at least 0.75 x diameter (0.75xD).

4.0 Rail Operations and Interfaces

The PAX corridor will be configured and designed to support operations of Caltrain commuter rail trains and future CHSR trains under blended operations. The operations, fire/life safety, and rail systems design for PAX will conform to both Caltrain and High-Speed Rail design criteria and requirements.

4.1 System Capacity

Caltrain and High-Speed rail are both intended to operate on the PAX corridor under blended operations.

Planned Blended Operations: Caltrain's 2035 Business Model projects 2035 service of 8 Caltrain Trains and 4 HSR trains during peak hours in each direction. Off-peak projections call for 6 Caltrain and 3 HSR trains per hour in each direction.

Operating Speeds: Caltrain and High-Speed Rail are intended to operate at speeds of up to 110 mph where permitted and achievable by alignment constraints between San Francisco and San Jose. For the PAX corridor, the minimum horizontal curve radius is 650 feet, which corresponds to 30 mph operating speed. Horizontal curve radius in the northern railyard area will roughly match the planned DTX alignment and will have an operating speed of 30 mph. On average, all PAX alignment alternatives have similar horizontal curves and are expected to have similar reduced operating speeds through curves.

4.2 Caltrain Operations

Caltrain service will operate through the PAX corridor with planned station stops at the existing 22nd Street or a new mid-project station as well as at Fourth and Townsend Street and the Salesforce Transit Center. The following are detailed operation descriptions for the three main alternatives (see Section 5.1):

- **Alternative A1/A2 – Long Alignment:** A new interlocking near Cesar Chavez Street will be provided to redirect trains traveling in both directions from the current rail alignment to the west and into a new tunnel portal near 25th Street and Pennsylvania Avenue. Trains will remain in this new tunnel for the full length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in area of 6th Street and Townsend Street.
- **Alternative B1/B2 – Mid-Length Alignment:** Southbound trains will tie into the existing blended rail system south of Tunnel 2 through an interlocking near Cesar Chavez Street. This will be necessary because the southbound alignment is routed through the currently abandoned section in Tunnel 2 that will be rehabilitated. Northbound trains will remain on the existing blended system tracks north through Tunnel 2 and will tie into the new PAX system through a new interlocking inside Tunnel 1 near the existing south portal. Caltrain will operate in a new tunnel for the remaining length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in area of 6th Street and Townsend Street.

  Caltrain trains will stop at a reconfigured, at-grade 22nd Street Station. A passing track could be provided for northbound trains to allow "skip-stop" service at 22nd Street Station, where express trains could use the existing northbound tracks through the 22nd Street Station to pass dwelling Caltrain trains since a new, third set of tracks could be provided through the 22nd Street Station area. The extent of passing tracks would be from the north portal of Tunnel 2 to the south portal

of Tunnel 1. For operational flexibility, crossovers could be provided beyond each end of the passing to allow southbound Caltrain express trains to also access the passing track through the 22nd Street Station by locally crossing over to the northbound tracks. On the north end, this crossover exists on Alternative B2 to meet fire/life safety criteria; on Alternative B1, an additional crossover could be added. On the south end, a crossover in the vicinity of Cesar Chavez Street near CP Army could be included.

- **Alternative C – Short Alignment:** Southbound tracks will tie into the existing blended rail system through a new interlocking between the south portal of Tunnel 1 and the 22nd Street Station. Southbound trains will continue in a new PAX tunnel for the remaining length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in area of 6th Street and Townsend Street The northbound tracks will tie into the existing blended system at the north portal of Tunnel 1 near Mariposa Street. The northbound track will be directly tied to the existing rail without an interlocking. Caltrain service will stop at the existing 22nd Street Station; however, there is no passing track provided in this alternative to allow express trains to pass station dwelling Caltrain trains.

4.3 HSR Operations

High-Speed Rail service will operate through the PAX corridor with planned station stops at Fourth and Townsend Street and the Salesforce Transit Center. HSR trains will not stop at the current 22nd Street Station, and HSR stops are not planned at a potential future, relocated station within the PAX project limits.

- **Alternative A1/A2 – Long Alignment:** A new interlocking near Cesar Chavez Street will be provided to redirect trains traveling in both directions from the current rail alignment to the west and into a new tunnel portal near 25th Street and Pennsylvania Avenue. Trains will remain in this new tunnel for the remaining length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in the area of 6th Street and Townsend Street. HSR trains will not stop at a mid-PAX station; however, there is no passing track provided in this alternative to allow HSR trains to pass station-dwelling Caltrain trains.
- **Alternative B1/B2 – Mid-Length Alignment:** Southbound trains will tie into the existing blended rail system south of Tunnel 2 through an interlocking near Cesar Chavez Street. Northbound trains will remain on the existing blended system tracks north through Tunnel 2 and will tie into new the PAX system through an interlocking inside Tunnel 1 near the existing south portal. HSR trains will operate in a new tunnel for the full length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in the area of 6th Street and Townsend Street. HSR trains will not stop at a reconfigured, at-grade 22nd Street Station. No passing track will be provided for southbound trains, but northbound trains could use the existing northbound tracks through the 22nd Street Station to pass dwelling Caltrain trains since a new, third set of tracks will be provided through the 22nd Street Station area. The extent of passing tracks would be from the north portal of Tunnel 2 to the south portal of Tunnel 1. Crossovers could be provided beyond each end of the passing to allow southbound High-Speed Rail trains to also access the passing track through the 22nd Street Station by locally crossing over to the northbound tracks. On the north end, this crossover exists on Alternative B2 to meet fire/life safety criteria; on Alternative B1, an additional crossover could be added. On the south

end, a crossover at Cesar Chavez Street (which is an existing Caltrain control point at Cesar Chavez Street) could be included.

- **Alternative C – Short Alignment:** Southbound tracks will tie into the existing blended rail system through a new interlocking between the south portal of Tunnel 1 and the 22nd Street Station. Southbound trains will continue in a new PAX tunnel for the remaining length of the PAX project and will enter the Fourth and Townsend Street Station at the interface with the DTX project in area of 6th Street and Townsend Street The northbound tracks will tie into the existing blended system at the north portal of Tunnel 1 near Mariposa Street. The northbound track will be directly tied to the existing rail without an interlocking. HSR trains will not stop at the existing 22nd Street Station; however, there is no passing track provided in this alternative to allow HSR trains to pass station dwelling Caltrain trains.

4.4 Downtown Rail Extension (DTX)

The blended PAX service will tie into the future underground DTX system just south of the future Fourth and Townsend Street Station. Coordination with the DTX project was conducted to optimize this interface. This interface includes a four-track configuration south of the Fourth and Townsend Street Station whereby PAX construction and revenue service in a completed DTX can proceed concurrently. This configuration also shows that it is feasible to connect via a stub track to the future subsurface railyard. These elements are expected to significantly minimize service interruption to the Salesforce Transit Center to accommodate the installation, testing, and commissioning of PAX.

The cut-and-cover tunnel for northbound trains for Alternative C will be east of the DTX ramp at the railyards. This cut-and-cover tunnel will cross under the surface rail connection to the railyards. Methods of installation that could minimize or eliminate impacts to rail operations should be researched during the next design phase; otherwise, a temporary shutdown of existing tracks will be necessary. Coordination with the DTX project will be needed to accommodate a tie-in for this cut-and-cover tunnel because the tie-in configuration is different than for Alternatives A and B.

4.5 Railyards

Caltrain operates the 4th and King Station and the existing railyard to the east of the interface between PAX and DTX. This railyard is subject to future development, and several possible scenarios must be accounted for to ensure the PAX project is able to accommodate access to all potential future railyard configurations. Those possible configurations include the following:

- The railyard remains in its current configuration at the surface.
- The railyard remains at the surface but is shifted to terminate at 5th Street.
- The railyard is depressed below grade with access from the south only.
- The railyard is depressed below grade with access from both the north through a DTX connection and the south through a PAX connection.
- The railyard is reduced in size.

Timing for railyard development is uncertain, so the PAX project should account for multiple scenarios for phasing of the railyard and PAX. For example, PAX may be initially operated to provide access to a surface railyard but should be able to accommodate development of depressed railyard access with minimal disruption to revenue service.

The decision of whether to keep or remove at-grade rail tracks after project completion has not yet been made. It is assumed in this section that the at-grade rail tracks that are not removed as part of the PAX construction would remain after projection completion. Alignments A1, A2, B1, and B2 provide rail access to the current at-grade rail yards through the following rail movements:

- Southbound trains: Southbound trains would access railyards via the DTX ramp, cross Mission Bay Drive at grade, reverse at the DTX at grade siding under I-280 and enter the railyards.
- Northbound trains: Northbound trains would access the at-grade rail yard using the existing track from the southern interface of PAX as a railyard lead. Specific movements for each Alternative are as follows:
  - For Alternatives A1 and A2, the interface of the rail yard lead would occur just north of Cesar Chavez Street. Northbound trains would pass through existing Tunnels 2 and 1 and would cross 16th Street and Mission Bay Drive at grade to access the at-grade rail yard.
  - For Alternatives B1 and B2, the interface of the rail yard lead would occur just north of 22nd Street Station. After proceeding through the existing Tunnel 2 and 22nd Street Station, Northbound trains would remain in the existing Tunnel 1 instead of entering the PAX tunnels and would cross both 16th Street and Mission Bay Drive at grade to enter the surface rail yards.
  - If at-grade tracks are removed, northbound trains in Alternatives A1, A2, B1, and B2 would need to use the same movements as outlined below for northbound trains in Alternative C.

See Figure 4-1 for the rail yard connection train movement schematic for Alternatives A1 and A2 at surface rail yard tie-in.

Alternative C southbound railyard access is the same as the other alternatives. This alternative does not provide direct at-grade railyard access for northbound trains because the northbound decline section just north of existing Tunnel 1 would block at-grade train movement between the north portal of Tunnel 1 and 16th Street. Alternative C northbound trains would have to proceed to the Fourth and Townsend Street Station and reverse up the current DTX incline to grade and then reverse again to access the at-grade rail yard.

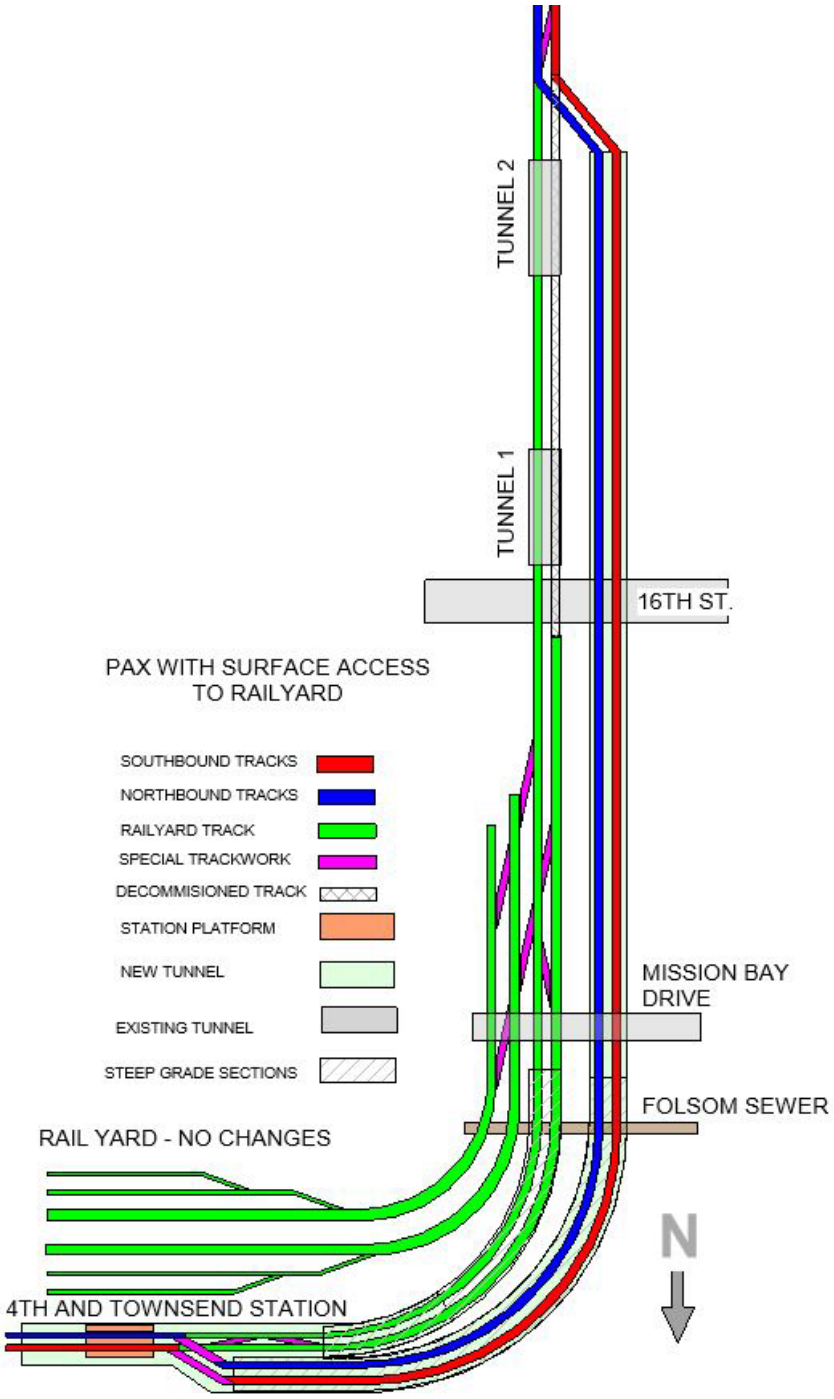


Figure 4-1. Surface Railyard Access Schematic for Alternative A1/A2

4.6 Rail Service Implementation

Blended rail service through the PAX project limits will need to be tested and commissioned prior to revenue service. This process typically takes 120 days. To minimize disruption to the current revenue service, trains should still be able to operate on the existing blended system while testing and commissioning is done on the PAX project during nonrevenue hours. The DTX interface has been

optimized to allow for operation of DTX while PAX is tested and commissioned. However, for Alternative C, multiple in-service tracks must be permanently removed from service to allow for the PAX northbound track installation and operation. Service implementation at the DTX interface is under development, so this section will focus on how service can be implemented at the southern limits of the project for each major alignment alternative to minimize service disruption.

4.6.1 Alternative A1/A2 – Long Alignment

The interlocking for both train directions of PAX will occur near the Cesar Chavez grade crossing and can be installed during a weekend shutdown to allow trains to switch over from the current system to PAX. This will allow revenue service to continue on both blended rail tracks while commissioning is performed on both PAX tracks during nonrevenue hours. Because both PAX tracks can be commissioned together, the commissioning schedule can be compressed and revenue switchover for both northbound and southbound trains can happen together.

4.6.2 Alternative B1/B2 – Mid-Length Alignment

The southbound PAX alignment will run through the abandoned Tunnel 2, west of the current alignment, and be connected to the existing blended rail system with an interlocking south of the existing Tunnel 2. The southbound PAX trains will be commissioned first during nonrevenue hours while the current blended system continues revenue service (see Figure 4-2.). An interim implementation phase will then be required where PAX operates revenue service for southbound trains through the new PAX tunnel under Potrero Hill while the northbound PAX tunnel connection into existing Tunnel 1 is completed during night and weekend shifts. During this interim phase, northbound trains will continue to operate on a single track through existing Tunnels 1 and 2. When the northbound PAX tunnel tie-in is complete, the existing interlocking south of Tunnel 2 at Cesar Chavez will be used to shift northbound trains being tested for commissioning from the current northbound tracks to the current southbound tracks (shifting PAX trains undergoing commissioning from MT1 to MT2 while continuing northbound revenue on MT1). This will allow revenue trains to continue to operate through Tunnel 1 while testing and commissioning for northbound trains is completed during night and weekend outages. The 22nd Street Station can remain in operation during the interim phase, with northbound trains remaining on the current northbound tracks and access continuing via the existing east platform. In the interim phase, southbound trains will be accessed from an extension to the existing southbound platform with passengers boarding the trains from the east. This platform will become a center platform serving both northbound and southbound trains when PAX is in revenue service.

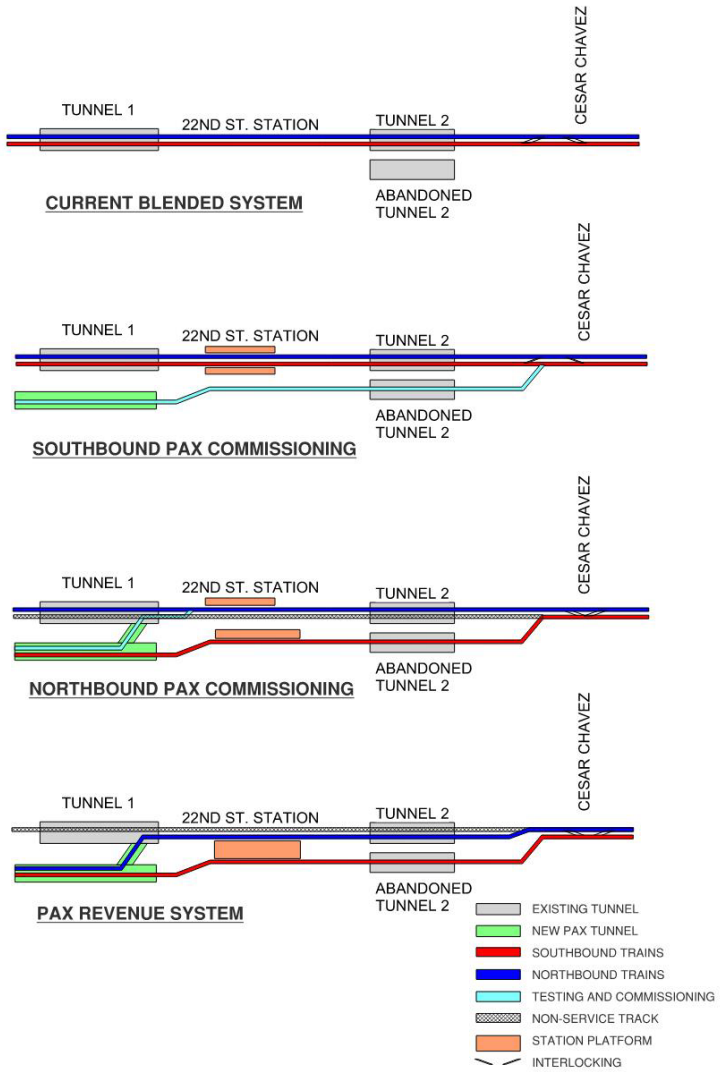


Figure 4-2. Alternative B1/B2: PAX Commissioning and Revenue Service

4.6.3 Alternative C – Short Alignment

The southbound PAX tunnel under Potrero Hill will connect to the current blended alignment southbound train with an interlocking just north of the current 22nd Street Station. This interlocking can be installed during a weekend closure and will be used to test and commission southbound PAX trains while the current blended alignment remains in revenue service (see Figure 4-3.). Once southbound commissioning is complete, an interim phase will be required where both northbound and southbound trains are singled tracked though the new PAX between 22nd Street Station and the tie-in with DTX. The distance of single tracking is approximately 1.1 miles. Single tracking will be required while a 1,100-foot-long U-wall trench is constructed north of the Tunnel 1 portal. Single tracking refers to routing both northbound and southbound trains on a single track for a given section. The U-wall trench will tie into a new cut-and-cover tunnel that runs under the Caltrans I-280 viaduct. The cut-and-cover tunnel will run to the east of the current at-grade alignment. The cut-and-cover tunnel from the DTX tie-in at the north to the south side of 16th Street can be constructed concurrently with the TBM tunnel under 7th Street. Both the TBM and cut-and-cover tunnels can be built while trains are operating on the current blended system. Single

tracking during construction of the trench section and commissioning of the northbound PAX system are expected to be needed for nine to twelve months. Once northbound commissioning is complete, PAX service will be implemented in both directions.

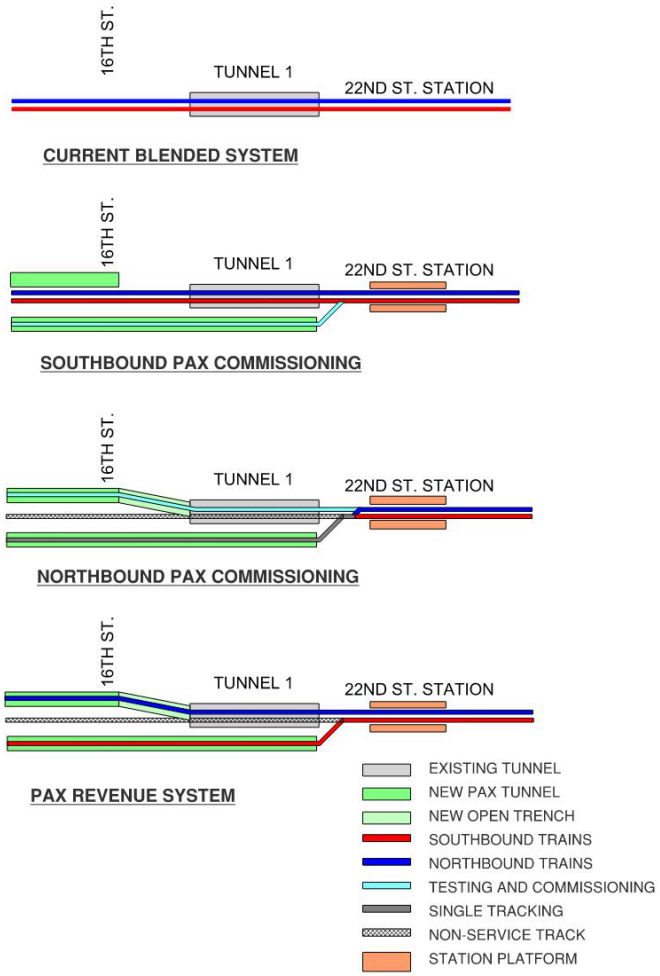


Figure 4-3. Alternative C: PAX Commissioning and Revenue Service

5.0 Rail Infrastructure and Systems

Figure 5-1 through Figure 5-5 identify on a conceptual basis where key rail and fire/life-safety infrastructure that is discussed in this section could be located for each of the alignments.

5.1 Fire/Life Safety and Ventilation

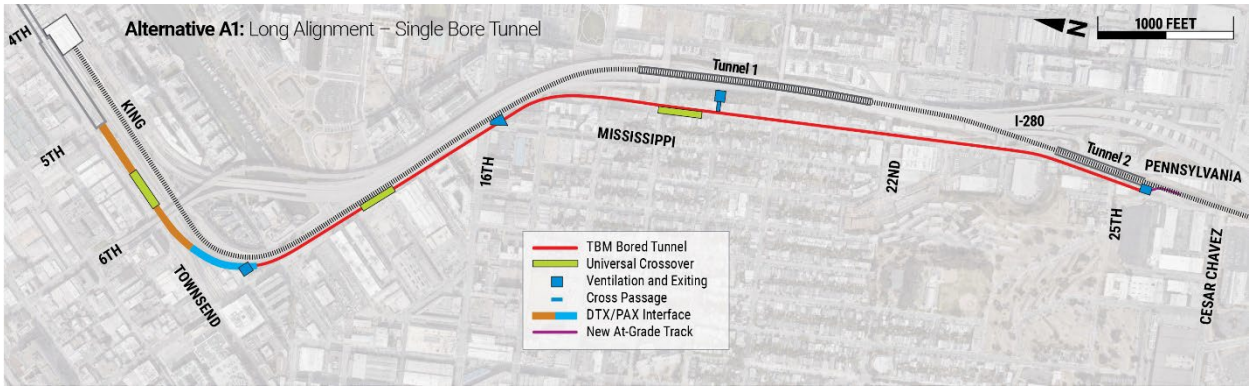


Figure 5-1. Fire/Life Safety Features for Long Alignment – Single Bore Tunnel

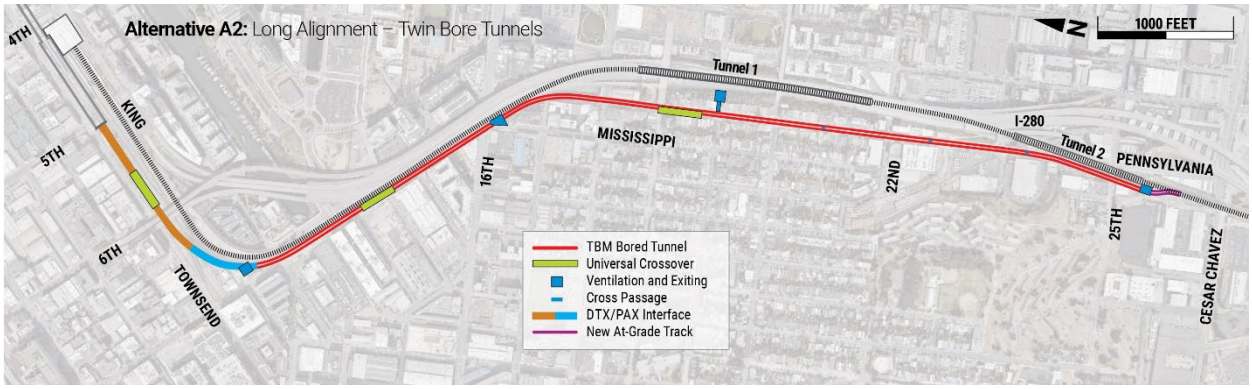


Figure 5-2. Fire/Life Safety Features for Long Alignment – Twin Bore Tunnels

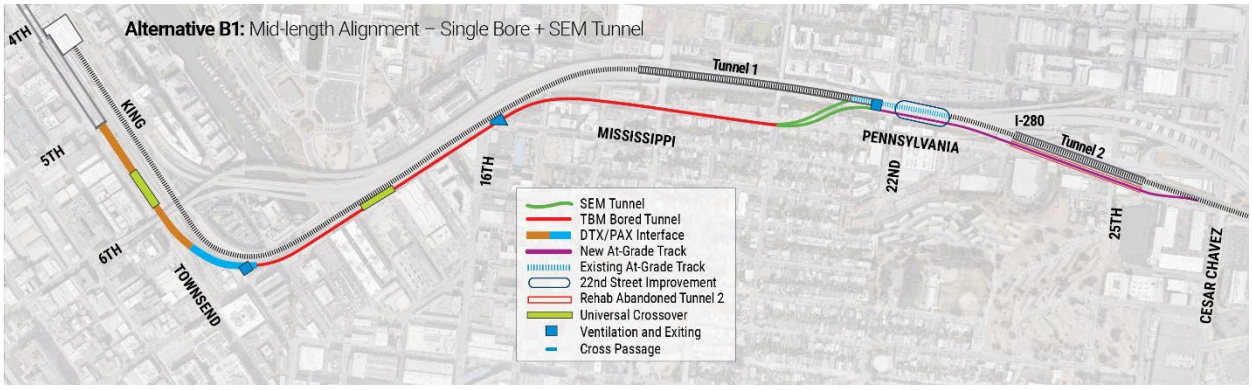


Figure 5-3. Fire/Life Safety Features for Mid-Length Alignment – Single Bore + SEM Tunnel

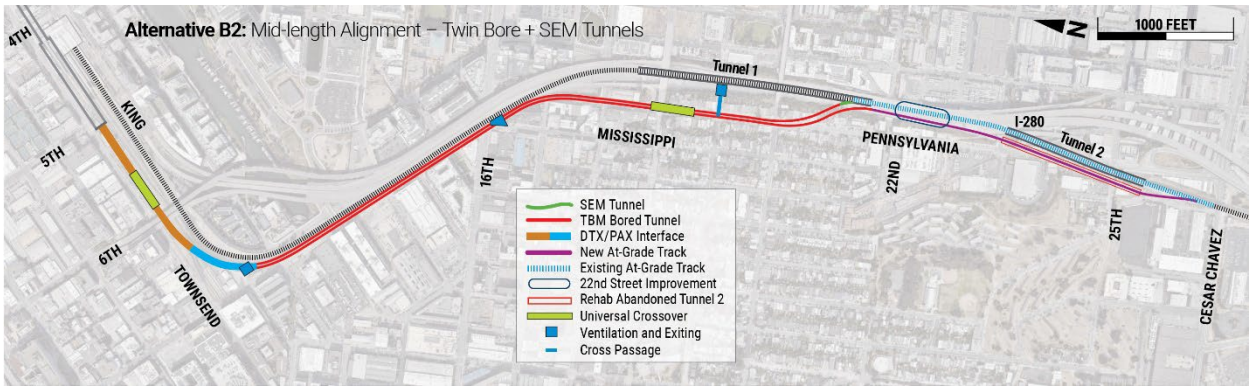


Figure 5-4. Fire/Life Safety Features for Mid-Length Alignment – Twin Bore + SEM Tunnels

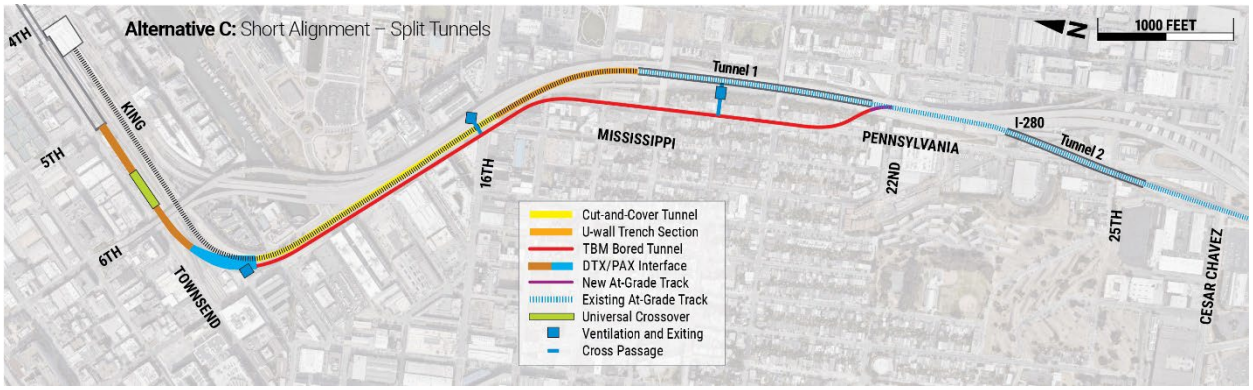


Figure 5-5. Fire/Life Safety Features for Short Alignment – Split Tunnels

The basis for tunnel ventilation and exiting includes the National Fire Protection Association Standard for Fixed Guideway Transit and Passenger Rail Systems (NFPA 130) as well as requirements for the Caltrain and High-Speed Rail Blended System.

Ventilation Zones: NFPA 130 requires that no more than one train in each direction should occupy a ventilation zone at a given time. The maximum spacing of ventilation zones through the PAX alignment assumes a minimum operating speed of 25 mph and a minimum operating headway of 2 minutes. Based on these criteria, ventilation zones should be no more than 4,400 feet apart.

Tunnels shorter than 300 feet do not require mechanical ventilation. Tunnels between 300 feet and 1,500 feet long are assumed to be ventilated using jet fans placed at regular intervals since this a more cost-effective method for venting shorter tunnels. Longer tunnels will require conventional fan plants spaced at no greater than 4,400 feet.

Exiting Facilities: Exiting facilities are intended to meet the criteria of NPFA 130 and the Caltrain and High-Speed Rail Design Criteria. These requirements call for cross passages spaced at a maximum of 800-foot centers where twin bore tunnels are used or where a central divider wall provides separation between northbound and southbound tracks. Alternatively, dedicated exiting facilities that lead directly to the surface are permitted at 2,500-foot maximum spacing.

Crossovers: Where crossover tracks in the tunnels create a gap in the separation wall between tracks, we have assumed for this study that the separation wall is ineffective between ventilation facilities, and therefore dedicated exiting facilities are required at 2,500-foot spacing around track crossovers.

Ventilation Facilities: Ventilation facilities are identified for each alternative in Figure 5-1 through Figure 5-5. Mid-tunnel ventilation facilities will consist of above-grade exhaust structures constructed within a shaft excavated over or adjacent to the train tunnel with adit connections between shaft and rail tunnel(s) to exhaust smoke and provide emergency egress. At tunnel portals, these facilities will be at-grade with ventilation louvers placed above the tunnel portal.

Mid-tunnel ventilation facilities are significantly more expensive than portal facilities because of the additional underground work required. Mid-tunnel facilities also have greater right-of way impacts because above-grade structures require right-of-way takes while portal facilities are generally placed above the existing rail right-of-way.

Blue Light Stations: Blue Light Stations (BLSs) will be provided at approximately 800-foot spacings along the tunnel walkways. The BLSs will be configured to permit a patron during an emergency situation to activate an emergency shutdown of the overhead contact system and to contact the Central Control Facility (CCF) via an emergency telephone.

5.2 Traction Power Electrification

Both Caltrain EMU trains and High-Speed Rail trains will operate via a 25 kV overhead catenary system power. Caltrain is currently completing electrification of the entire system. Upon completion, existing traction power facilities can be reconfigured to provide power for the PAX project alignment.

Overhead Catenary Systems (OCS): In tunnels, overhead catenary wires will be supported by drop tubes connected to the concrete tunnel lining. In addition, Autotransformer Feeder Cables and static wires will also be routed through the tunnel, supported on tunnel linings or drop tubes. Motorized disconnect switches will be provided at crossovers and tie-in locations to enable sectionalization of the OCS for maintenance and in the event of outages.

Tie-in to Caltrain Electrification System and DTX: The PAX OCS will tie into the existing Caltrain Electrification system near Cesar Chavez Street. New traction power feeder cables will extend from the existing 25 kV Paralleling Station No. 1, near Mariposa Street to the PAX tunnel. The PAX OCS will tie into the DTX OCS in the stub track area south of the proposed underground DTX Station at Fourth and Townsend Street.

5.3 Communication

Communications systems will be provided for the PAX alignment and tunnel. The major communications subsystems will include:

- Extension of the Caltrain fiber optic backbone system through the tunnel with network switching equipment provided in each signaling room, ventilation plant, and related facilities.
- Closed circuit television (CCTV) to monitor tunnel portals and emergency exits.

- Intrusion detection for PAX facilities.
- Station communications subsystems at a modified or new 22nd Street Station.
- Emergency telephone for Blue Light Stations.

The PAX communications systems will be compatible with Caltrain's headend communications systems at the CCF. It is anticipated that some modifications to existing software databases and minor expansion of hardware may be needed at CCF to accommodate PAX.

5.4 Track and Switches

Both Caltrain and High-Speed Rail operate on standard-gauge tracks. In tunnels, track will be the continuously welded type with the tracks connected to the invert with concrete plinths and direct fixation fasteners. This is the same track structure system used in the DTX project. At-grade track will be standard ballasted track on concrete ties.

Special Trackwork: Track switches allow trains to move from one set of tracks to another and provide flexibility for operation during maintenance service disruptions. The PAX alignment alternatives provide up to three crossover switches along the alignment. Fewer crossover switches are used where the tunnel is shorter or where it is not feasible to provide three crossovers. The following is a breakdown of indicated crossovers by alignment alternative. In order to facilitate switchover from the DTX to PAX at their interface, the DTX could install special trackwork to transition to PAX and an appropriate length of trackway in the tunnel stub at the time of DTX construction.

- Alternative A1 – Three Crossovers
- Alternative A2 – Two Crossovers
- Alternative B1 – Two Crossovers
- Alternative B2 – Two Crossovers
- Alternative C – One Crossover

6.0 Geotechnical and Hydrology

6.1 Geotechnical Study and Tunneling Considerations

6.1.1 Approach

The Geotechnical Study Report (MJ/Slate, 2022b) presents the results of preliminary geotechnical studies carried out along the PAX project corridor. The purpose of the preliminary study was to identify potential geologic and geotechnical constraints along the PAX project. This Geotechnical Study Report provides a detailed review of background information including existing geotechnical reports for facilities near the proposed alignments, laboratory testing, geologic maps, and other readily available information pertaining to the project. The information gathered from the study was used to prepare geologic cross sections, preliminary geotechnical properties, and recommendations regarding tunneling feasibility.

The Geotechnical Study Report was limited to a desktop study and site walks and did not include field explorations such as borings or geophysical surveys. Geotechnical reports from the San Francisco Department of Building Inspection (SFDBI) were obtained. Because of time constraints related to the closure of the DBI during the pandemic, reports requested from the SFDBI focused on areas along the alignment where there were gaps in available data and areas near contact points of surficial geologic units, and do not represent the full alignment. The Geotechnical Study Report concludes with recommendations for additional investigations to be considered to support future planning, design, and construction evaluations for the project. The Geotechnical Study Report is presented in Appendix D.

6.1.2 Summary of Findings

The following sections summarize the anticipated subsurface conditions along the alignment corridor. The geologic constraints and key geotechnical tunneling considerations were characterized in three segments (North, Central, and South), as shown in Figure 6-1. For Alternative A1, the North Segment is the longest segment and spans approximately 4,000 feet, from Station 1001+00 to Station 1041+00. The Central Segment covers an area between Station 1041+00 and Station 1057+00 for a total of 1,600 feet. The South Segment is approximately 2,900 feet long, from Station 1057+00 to Station 1086+00.

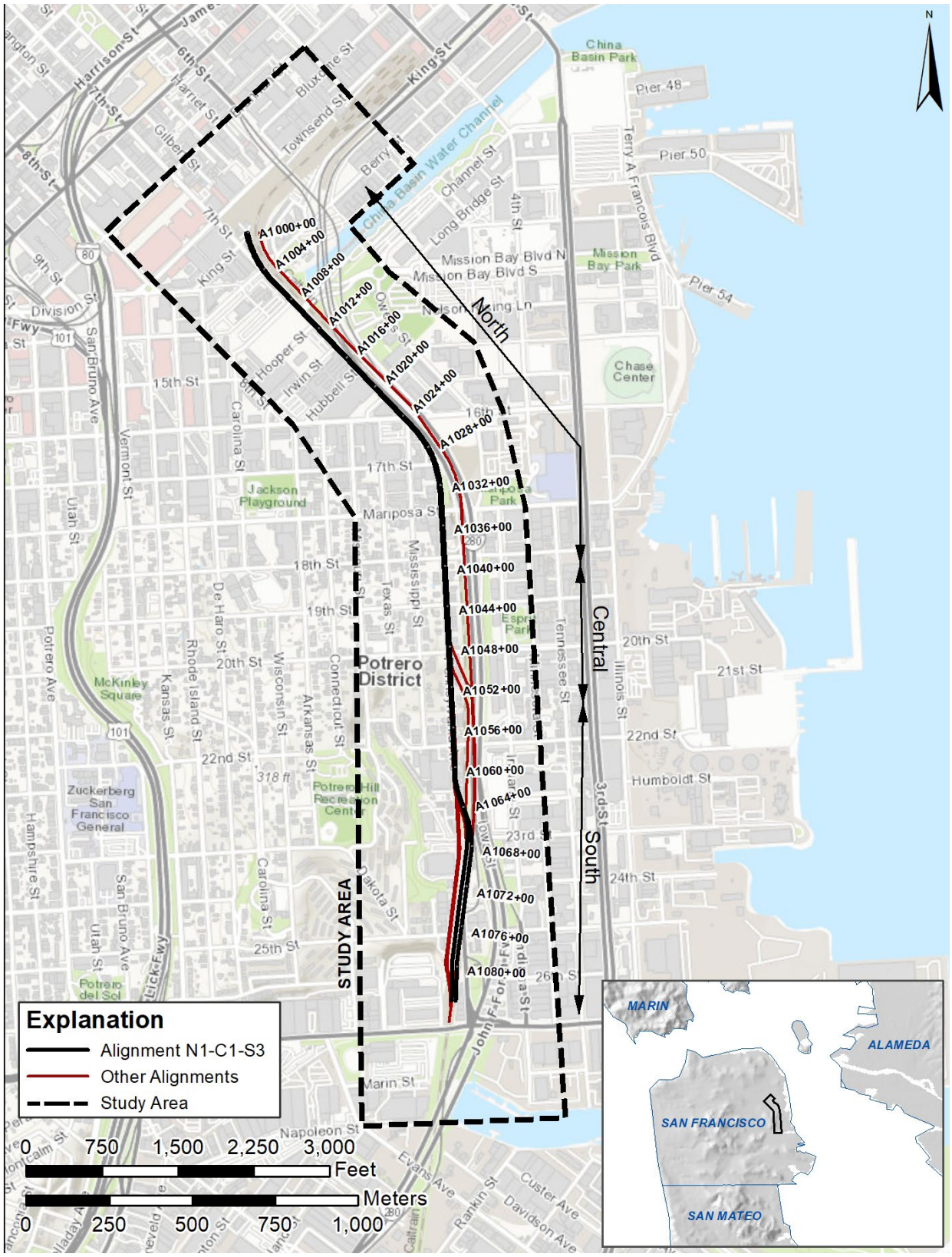


Figure 6-1. Index Map of Corridor Segments

6.1.2.1 North Segment

The Geotechnical Study found the North Segment is located in an area mapped as artificial fill and, depending on the final alignment, is expected to encounter artificial fill, Young Bay Mud, Colma Sand, and Franciscan Complex bedrock. The entire length of the tunnel within the North Segment will be located below the anticipated groundwater level. Potential geotechnical hazards include liquefaction of the artificial fill and disturbed Colma Sand during and after strong ground shaking. Lateral spreading caused by liquefaction of the artificial fill could also occur in areas of gently sloping ground.

Key tunneling considerations within this segment include effects of soil strength loss and potential for tunnel uplift in areas where liquefiable materials are present. Potential tunnel construction risks include mixed-face conditions, ground settlement, ground heave, presence of contaminated soils and groundwater, and damage to nearby existing foundations and other buried structures. Groundwater control measures will also need to be considered for design and construction for portal and cut-and-cover sections. The current tunnel alignments will also encounter a variable bedrock surface that is generally rising towards the ground surface as the alignment extends from the North Segment to the Central Segment. Design of excavation support systems for cut-and-cover excavations in this area will need to account for this variability. Tunnel excavations will need to plan for mixed-face conditions consisting of soft soils overlying bedrock and the associated settlement risks that accompany these conditions.

6.1.2.2 Central Segment

The Central Segment is located in an area mapped as Franciscan Complex bedrock, primarily consisting of sandstone with local serpentinite. Alignment alternatives are anticipated to encounter only rock along the full segment length. Subsequent site-specific investigations should seek to identify the depth and extent of sandstone and serpentinite bedrock along the alignment in addition to other rock that may be encountered, as well as to determine more refined strength and durability properties to guide design specifications and tunneling equipment. Locally, serpentinite could include naturally occurring asbestos (NOA).

Potential tunnel construction risks include mixed-face conditions (both soil and rock encountered in the tunnel face at the same time during mining), ground settlement in areas where ground cover is low, and excavation-induced vibrations when mining near existing structures. Groundwater control measures will also need to be considered for design and construction of tunnel and portal structures. The existing bedrock may act as a groundwater barrier where water may effectively pool against the bedrock. Because the Central Segment will include relatively deep tunneling through rock, groundwater may be expected during construction and can likely be handled with standard drainage measures within excavation, such as collection piping and sumps. Portal structures will also need to consider the presence of groundwater and will likely require drainage measures such as geotextiles, drainage mats, and collection drains.

6.1.2.3 South Segment

The South Segment is in an area mapped as serpentine Franciscan Complex bedrock with local areas of artificial fill, Young Bay Mud, and/or Undifferentiated Quaternary Soils. Bedrock is likely to include serpentinite and shale. Available subsurface information regarding depth and lateral extent of soil units is relatively sparse; depth and extent of surficially mapped rock types are also unknown. While the geologic

profile for the South Segment provides a general understanding of the geology along the segment, subsequent investigations should seek to better characterize the subsurface conditions, depths of soil units, and rock types expected to be encountered. Locally, serpentinite in this reach could include NOA.

Potential tunnel construction risks include mixed-face conditions, ground settlement, and excavation-induced vibrations when mining near existing structures. Groundwater control measures will also need to be considered for design and construction of tunnel and portal structures. Groundwater may be relatively shallow in areas of soil, which may result in groundwater being encountered during excavation, particularly in areas where an open crown and shallow earthwork are expected; groundwater control measures will need to be considered for these areas. Portal structures will also need to consider the presence of groundwater and will likely require drainage measures such as geotextiles, drainage mats, and collection drains.

6.1.3 Geologic Constraints and Considerations

As mentioned above, potential geologic hazards include liquefaction and lateral spreading of artificial fill and Colma Sand disturbed during construction. Subsequent investigations should seek to characterize the extent and depth of artificial fill along the North and South Segments, as well as investigate more refined estimates of residual strength of disturbed Colma Sand. Volatile organic compounds also may be present in the artificial fill, and site-specific testing is recommended to be performed to characterize possible locations of hazardous materials.

For rock, serpentinite could include NOA and heavy metals, which pose significant hazards to humans when airborne or ingested. Subsequent investigations should seek to identify locations and extent of serpentinite along tunneling locations, and testing for NOA and heavy metals should be performed to inform mitigation and remediation measures during construction.

Groundwater control measures will need to be considered for areas of shallow groundwater encountered in portal and cut-and-cover sections in the North and South Segments. Groundwater control measures for tunneling in rock should also be considered. Use of watertight excavation support systems for deep excavations and use of pressurized-face TBMs and gasketed precast concrete segments for tunnel excavation will be required where shallow groundwater is encountered in the portions of the project excavated in soil.

Tunnel and portal excavations within sections of the Central Segment that are anticipated to be within Franciscan Complex bedrock can likely control groundwater through the use of localized measures, such as sumps installed within excavations. Permanent structures in this area will likely require the use of waterproofing or drainage measures to ensure the structures remain dry and maintenance free during track operation.

6.1.4 Tunneling Considerations

Based upon the existing geologic and geotechnical information, the subsurface conditions along the PAX project corridor are suitable for tunneling methods. In areas of soft ground below the groundwater table, tunneling methods that utilize positive support measures, such as pressurized-face tunnel boring machines (TBMs), will be necessary to support the ground during excavation. In areas of Franciscan Complex

bedrock and where stable soils are anticipated, the sequential excavation method (SEM) and TBM tunneling in open mode are considered feasible methods of tunnel construction.

Although preliminary studies suggest that conditions are suitable for tunneling, there are several challenges that will require further study as part of subsequent project phases, including:

- Evaluation of liquefaction and lateral spreading potential
- Effects of ground shaking on underground structures resulting from earthquakes
- Extents of Young Bay Mud within the proposed tunnel alignment
- Presence and extents of existing structures along the alignment, including deep foundations and buried utilities
- Location of the bedrock surface and extents of potential mixed-face tunneling
- Existing surface constraints in areas of low ground cover and risks associated with unanticipated excess settlement of the ground during tunnel construction
- Presence of ground and groundwater contamination, including NOA within Franciscan Complex bedrock
- Potential for vibrations and ground settlement induced by tunneling and other underground excavations (i.e., portals and break-ins to existing tunnel infrastructure)

Given the dense urban corridor and challenging geologic conditions anticipated along the PAX project corridor, it is anticipated that significant additional subsurface investigations will be needed to better characterize geotechnical conditions and to assist in evaluating the tunneling methods discussed in this report.

6.2 Hydrology

6.2.1 Approach

A preliminary hydrology study was prepared to identify the geologic and hydrologic setting and expected groundwater conditions along the PAX corridor (MJ/Slate, 2022a). The hydrology study considered influences of historical alteration of hydrogeologic features in the project's vicinity, existing groundwater levels and flow direction, and possible future conditions under modeled sea level rise scenarios. Sea level rise of 3.4 feet is projected for the end of the century, which is near the conclusion of the project's anticipated lifespan. The study provided recommendations for the project's excavation and construction methods, and generally identifies potential impacts on groundwater systems, such as groundwater drawdown, induced settlement, alteration of subsurface flow direction, and the potential for release of contaminants into groundwater.

The study was completed by reviewing hydrologic information along the PAX corridor including hydrologic setting, sea level projections, groundwater sensitive areas, and sources of groundwater contamination. Known groundwater level data were compiled from nearby subsurface investigations and geotechnical reports. The study was limited to a desktop study and did not include field explorations such as borings or geophysical surveys. This study also provides a preliminary review of expected groundwater

conditions. Further evaluations should be completed in subsequent project phases. The Hydrology Study is presented in Appendix E.

6.2.2 Summary of Findings

The Hydrology Study Report primary findings include the following:

- Groundwater along the northern portion of the project corridor is generally shallow (nearest to the ground surface), deepens as the alignment extends through the topographic high of Potrero Hill, and becomes relatively shallow again in the southern portion near Cesar Chavez Street.
- Sea level rise is most likely to impact the area of the project that is in close proximity to the Mission Creek Channel. Construction in this area may require additional pumping to ensure the tidal water from the San Francisco Bay and potential higher groundwater table do not affect the excavation/mining of the tunnel. Design of permanent structures will need to account for potential sea level and its potential effects on groundwater levels adjacent to the Bay margins.
- Potential settlements due to construction dewatering should be assessed by considering historical changes in soil-effective stresses caused by human and natural activities, including seasonal and tidal variations, and other dewatering activities around the site. If groundwater levels are expected to be lowered below the lowest historical range, ground settlements should be expected, particularly where groundwater levels within the Young Bay Mud soils are affected. Temporary excavations will have to be designed to prevent the inflow of groundwater and subsequent drawdown and ground settlement of the surrounding soils.

The extent of the longest PAX project alignments is almost entirely within areas that are either contaminated or suspected of being contaminated (MJ/Slate, 2022a). Of primary concern is that excavation and groundwater control of the project could mobilize contaminants in the soil or groundwater. These areas would be subject to requirements pursuant to San Francisco Public Health Code Article 22 (Maher Ordinance), administered by the Department of Public Health. Dewatered groundwater should be tested for contaminants and contaminated groundwater should be pumped and treated at treatment plants, prior to discharge. Possible impacts on groundwater quality could also occur as a result of groundwater drawdown. Issues include the potential for existing groundwater contamination to mobilize toward the project and/or into previously unaffected areas. Groundwater acidification (associated with mobilization of contaminants) could compromise underground structures.

Groundwater quality could also become degraded because of saline water intrusion from nearby estuaries and coastal waters or as a result of construction-related surface spills. Because of the likely presence of contaminated groundwater in the area, handling of groundwater and saturated soils/rock will likely require special treatment before discharge or disposal at approved facility. A gasketed, precast concrete tunnel lining design installed during mining is one way to minimize water intrusion into the tunnel and mitigate this risk.

7.0 Tunneling and Constructability

7.1 Construction Methods

7.1.1 Tunneling Methods

Typical tunneling methods and construction requirements that were used in the development of the conceptual tunnel alignments, cost estimates, and schedules are described here in more detail. Various elements of construction means and methods, including tunnel excavation method and shaft support approach, are often left to the contractor to select. However, in some cases it may be necessary to restrict construction methods to preclude those that are determined to have unacceptable risks or impacts. Given the anticipated ground conditions and the history of tunneling in the area, it is likely that several methods are acceptable for a given project element. The construction methods described herein, therefore, are not the only feasible ones, but were selected by balancing risk, cost effectiveness, and industry practice.

Based on the available geologic data, the project team anticipates that the proposed tunnel alignments will be constructed within a mix of soil and weak rock units below the groundwater table, including mixed-face conditions in some locations. In general, the northern section of the project is located in soils, and the southern section in weak rock.

7.1.1.1 TBM Mining

There are several types of TBMs, and technologies have advanced significantly since the first uses. For this project, a closed-face shielded TBM capable of applying pressure to the full face of the excavation (i.e., a soft ground TBM) will be required where mining soil and weak rock below the groundwater table is anticipated.

Closed-face TBMs are designed to apply pressure at the tunnel face to maintain stability of the excavation in soft or unconsolidated ground, or in ground that requires positive face support to prevent ground movement around the excavation. There are two major types of closed-face TBMs: earth pressure balance TBMs (EPB TBMs) and slurry TBMs. Closed-face TBMs are typically designed for excavation of soils below the groundwater table, where active face pressure is needed to prevent water inflows or prevent excessive ground movement that can lead to large surface settlements and potential damage to existing utilities and structures.

Further evaluation of a preferred TBM type will be needed as the project design advances and additional subsurface information is collected. Final selection of the preferred closed-face TBM type will require consideration of additional factors that are beyond the scope of this study. Some key considerations that will need to be evaluated include the availability of construction staging area, required TBM size, anticipated soil gradation, depth of cover above the tunnel, and groundwater conditions. An example of a closed-face TBM is shown below in Figure 7-1 (Herrenknecht, n.d.).

For closed-face TBMs, a tunnel lining system must be assembled and installed within and behind the tunnel shield as shown in Figure 7-1. The tunnel lining typically consists of a segmental precast concrete lining with the segments connected by steel bolts. The segments are typically fabricated off site at a precast concrete yard where high quality control standards are maintained and delivered to the site. The

segments have a gasket system to provide an impermeable seal to prevent infiltration of groundwater and are typically designed to accommodate seismic demands from strong ground shaking. Depending on staging area size, there is typically at least a few days' supply of segments stored on site, where they are hoisted down to tunnel level, transported to the tunnel heading, and installed in place with a mechanical arm in the TBM that has been specifically designed for this purpose. The segments are bolted into place by tunnel workers. For the purposes of this study, a 24-inch-thick lining has been assumed for the 42-foot OD single bore alternatives and a 12-inch-thick lining for the 26-foot OD twin bore alternatives.

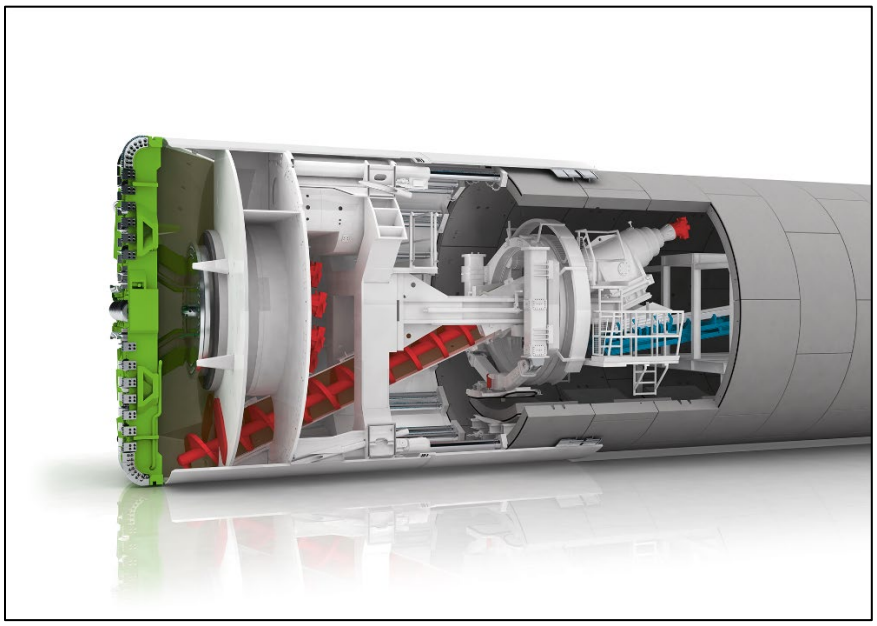


Figure 7-1. EPB TBM (source: Herrenknecht)

7.1.1.2 SEM Mining

The Sequential Excavation Method (SEM), also known as the New Austrian Tunnelling Method (NATM), can be used to create underground excavations of varying geometry in ground that is expected to stand up long enough for support to be installed. The basic principle is to allow flexibility in how the tunnel excavation is supported based on real-time observations of the ground and installed support elements. To the extent that ground conditions permit, the inherent strength of the ground is used to facilitate economical excavation and installation of ground support as part of the mining process. Essentially, SEM tunnel excavation proceeds in incremental excavations using conventional mechanical equipment, such as an excavator, that is advanced forward a few feet at a time and installing ground support elements such as shotcrete, lattice girders, presupport, and other measures to maintain stability of the opening and limit ground movements. Adjustments are made to the initial ground support in real time based on actual ground conditions encountered and deformations in the ground support system. Once the excavation of the opening is complete and the full ground support system is installed, the resulting excavation is integrated into an overall ring-like support structure that is capable of carrying ground loads and maintaining a stable underground opening. Figure 7-2 below shows an example of an SEM excavation.

Figure 7-2. SEM Construction Example, Showing Pipe Support Over Tunnel Crown and Sequentially Excavated Tunnel Drifts (Beacon Hill Station, Sound Transit, Seattle)

The SEM method is most often employed where an underground opening is too short for TBM mining to be economical, where the permanent underground structure does not have a constant circular cross section, or when TBM mining is otherwise infeasible because of design requirements or other reasons (e.g., limited ground cover above the tunnel, limited staging area for TBM launching). This is the case for the PAX study where SEM mining is considered appropriate for connections from the TBM tunnel to the existing Caltrain track near 20th Street, and for cross passages, crossovers, and ventilation structure connections. The final tunnel lining for SEM mined tunnels typically consists of cast-in-place concrete.

7.1.1.3 Cut-and-Cover Methods

Cut-and-cover is the oldest method of creating underground space. The basic concept involves the digging of a trench, the construction of a concrete box structure, and the backfilling around and above the structure to return the surface to its original state. It is a disruptive technique with respect to the area around the trench, but depending on the depth of the excavation, often the most economical construction method. If the tunnel alignment is beneath a city street, the construction will cause significant interference with traffic, utilities, businesses, and other urban activities. The disruption, however, can be lessened through the use of staging, decking over the excavation to restore traffic, or by implementing what is called a top-down construction technique. Often on cut-and-cover projects in dense urban areas, surface construction is restricted to nights and weekends to avoid major traffic disruption but increases during normal weekday hours once decking is in place and traffic restored. While cut-and-cover is a technique usually reserved for relatively shallow tunnels, it is not uncommon to see it used at depths of around 60 feet, but rarely does it exceed 100 feet.

Cut-and-cover is used to construct tunnels for transport facilities, transit stations, underground structures, deep excavation for buildings, and water conveyance facilities. The cut-and-cover construction method can use various types of excavation support systems, including soldier piles and lagging, slurry walls, soldier piles in tremie concrete (SPTC) systems, tangent pile walls, jet grout walls, secant pile walls, soil

mix walls, and element walls. The method is significantly more complicated when performed below the groundwater table where dewatering cannot be performed and a watertight seal is required at the base of the excavation.

Temporary ground support may consist of soldier piles and lagging, sheet pile walls, secant piles, or tangent piles. Soil type, depth of groundwater, and feasibility of dewatering are all factors in the selection of temporary support type. Typically, temporary support does not contribute to the final structure's load-bearing support. When supports are permanent, these supporting elements are a part of the final structure and are designed to be left in place after the construction is complete. These include techniques like diaphragm (slurry) walls, secant piles, and tangent piles.

7.1.2 Cross Passages

The need and purpose for cross passages are described in Section 5.1. For single bore alternatives, the need, location, and extent of wall dividers between two tracks in the single bores will be determined in later phases. Where divider walls exist in the single bore, and a cross passage is required, the installation is straightforward and consists of an access door to allow passage through the wall.

For twin bore options, the creation of a cross passage is more complicated. The passage has to be created by mining between the two tunnels. Figure 7-3 below shows an example of a cross passage between two running tunnels. In general, construction of cross passages in soft soils below the water table is the riskier operation, less so in soils above the water table, and least risky in rock that has some ability for self-support during mining. The sequence of this construction can vary but is essentially as follows:

1. Immediately around the planned passage location, the tunnel precast concrete lining is stiffened, supported, braced internally, or bolted to the ground to maintain the integrity of the tunnel lining system when a section of tunnel lining is removed to provide access to the ground behind the lining.
2. The ground between the two linings surrounding the passage is improved and presupported to control groundwater flow and the stability of the ground during mining. For soil this can likely be achieved through ground freezing, grouting, dewatering, spiling, or a combination of these. For rock, some of the same ground treatment methods and presupport can also be used.
3. An opening is cut into the tunnel lining exposing the ground to be mined for the cross passage.
4. The ground is mined using SEM techniques described herein.
5. A final concrete lining is cast in place; utilities and finishing architectural, mechanical, electrical, and ventilation systems are installed to complete the cross passage.

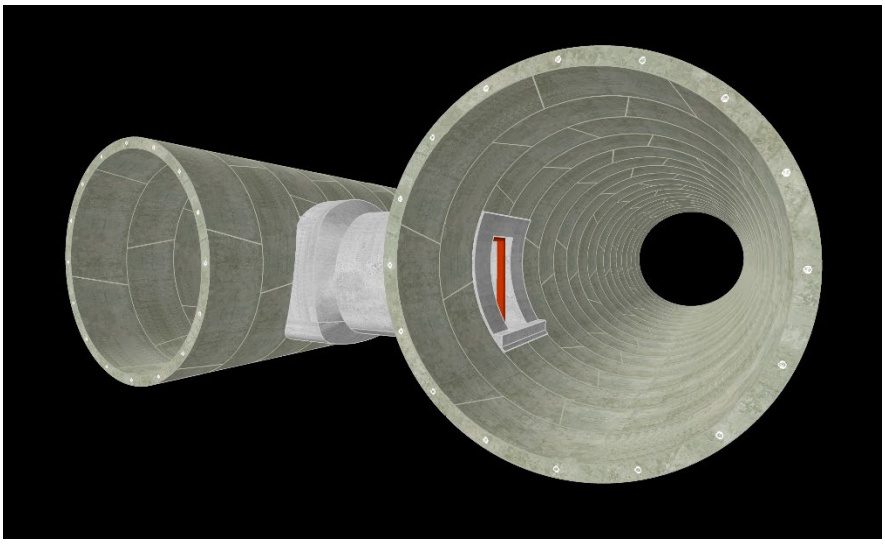


Figure 7-3. Example of a 3D Rendering of a Cross Passage between Two Running Tunnels for a Subway (Northlink, Sound Transit)

7.1.3 Track Crossover Sections

The need for track crossover sections is described in Section 5.1, and locations are given in Section 5.4. The difference between construction of track crossover sections between single bore and twin bore is similar to that for cross passages. Crossover sections in a single bore tunnel are straightforward and accomplished entirely within the single bore tunnel envelope without the need for any further excavation outside the tunnel. Crossover sections in a twin tunnel setting require the mining of the ground and creation of an open, supported area between the two tunnels for the entire length of the crossover. The methodology for twin bore tunnels is similar to that for a cross passage in that the tunnel lining adjacent to the opening must be strengthened, the ground to be mined must be pretreated using similar methods as described for cross passages, the ground is mined, and a final cast-in-place lining in the opened area between tunnels is placed.

Track crossover sections for twin bore tunnels will be several hundred feet long and will require a detailed SEM excavation sequence for the entire length to safely expose the ground between the two bored tunnels. As with cross passages, SEM mining in rock will be less risky than in soil.

The concept developed for a three-track layout on the DTX project, shown in Figure 7-4, involving twin bore TBM mining (red circles) with the center SEM mined (green stippled area), is a reasonable starting point for conceptual level planning on PAX and was used as a reference frame for the PAX twin bore track crossover sections. This approach was assumed in our cost estimate and schedule.

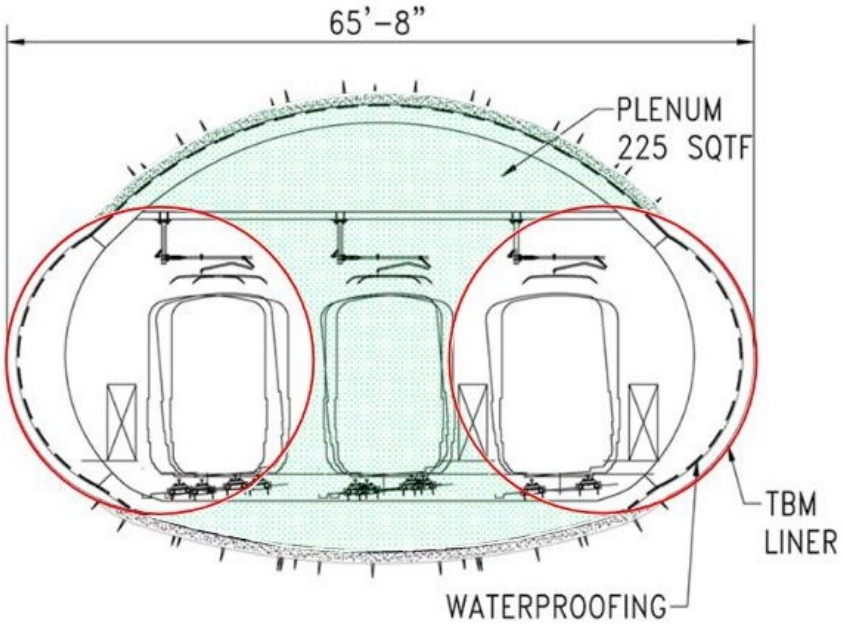


Figure 7-4, Example of SEM Mining of Center Area between Two Running Tunnels to Create Space for a Track Crossover Section (TJPA, 2017)

An example of a track crossover section being constructed in a tunnel is shown in Figure 7-5. This one is from Central Subway in San Francisco.

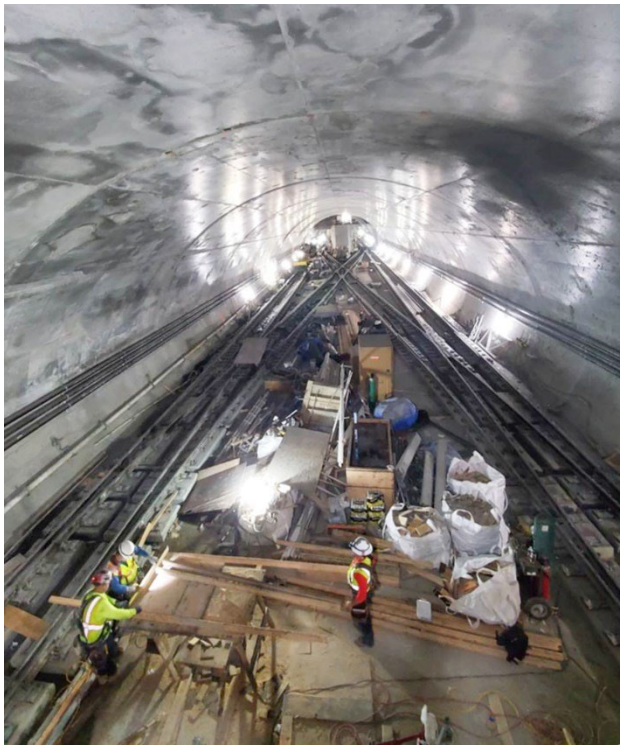


Figure 7-5. Example of a Track Crossover Section under Construction in Central Subway, San Francisco (SFMTA, 2016)

7.1.4 Portals

At the south end of all alignment alternatives, a new portal is required where the tunnel (or tunnels) will daylight to ground surface and will be constructed either into either rock or soil slopes, except for the Alternative C northbound track, which lacks a bored tunnel. At the north end of all alignments, the TBM will "break-in" through a headwall in a launch box constructed for PAX. A specially designed bulkhead with seals will be placed on the headwall where the TBM will break-in to prevent water and soil flowing around the cutterhead and into the trench.

For the south end of all alignments, a vertical headwall that is part of the portal structure will be constructed by excavating the sloped ground to develop the size, geometry, and orientation for the tunnel to daylight and allow for tracks to be installed at the proper grade at ground surface. At the north end of all alignments, the tunnel portal is assumed to be temporary to facilitate tunnel mining and the final PAX structure will consist of a reinforced concrete box constructed between the portal and the stub tunnel constructed by DTX.

Before any portal excavation is performed, it is typical for support to be installed around the portal to ensure the ground remains intact around the opening. Support types can vary depending on ground type and anticipated behavior but may consist of soil nails, shotcrete, or piles and lagging for deep slope cuts. Dewatering may be required. Rock bolts and shotcrete are typically used when portals are driven into rock.

After the ground has been properly supported and the slope cut back for the desired portal, the TBM can be driven out through the portal headwall, commonly termed the TBM "hole-through" or "break-out." Portals are typically finished by forming and placing a cast-in-place concrete headwall around the opening as the permanent works. Figure 7-6 shows examples of a single-track portal (left) and a multitrack tunnel (right). Both tunnels were excavated by means other than a TBM but are intended to show the general appearance of portal structures.

Figure 7-6. Examples of Single and Multitrack Portals

7.1.5 Ventilation and Emergency Egress Shafts

The location and purpose of ventilation and emergency egress structures, hereafter called "the ventilation shafts" for simplicity, are discussed in Section 5.1. These structures are constructed as shafts from the ground surface down. The locations of the ventilation shafts are dependent on finding suitable property to construct it and maintain its permanent presence as a Caltrain-owned facility.

The inverts of the ventilation shafts can be connected to the tunnel, or tunnels, by either a direct connection if it straddles the tunnel, or by a short connecting tunnel called an adit. An adit is necessary where it is not possible for the tunnel alignment to be positioned immediately adjacent to the selected locations and positions of the ventilation shafts.

Ventilation structures constructed in soil will first have a soil support system installed, which if below the water table must be impermeable, such as a slurry diaphragm wall or secant wall. From the invert of the structure, a mined break-in to the tunnel will be constructed where the structure is adjacent to the tunnel. If a connecting adit is necessary between ventilation shaft and tunnel, the adit can be mined from the bottom of the ventilation shaft using the SEM methods described previously. Depending on ground conditions, ground improvement such as jet grouting may be required prior to shaft or adit construction.

Ventilation structures constructed in rock would require an excavated cut and rock support system such as bolting and shotcrete that is installed as the shaft is excavated downward.

The work sequence that follows will involve the installation of permanent structural elements consisting of cast-in-place concrete and steel, followed by mechanical, electrical, and control systems. Finishing architectural work will follow.

7.1.6 Building Protection and Ground Instrumentation Monitoring

Considering the depth of excavations, the extent and type of tunneling technique used, the type of ground present, the presence of groundwater, and the proximity of buildings and buried utilities, a comprehensive building protection plan is envisioned. The program will consist of the following major elements:

- Settlement predictions should be made to calculate anticipated ground movement caused by excavations and tunneling.
- Available documentation on the foundations and construction for all existing buildings and utilities within the footprint of anticipated ground movement should be collected and evaluated. Records of existing utility and building construction should be collected and evaluated.
- A Building and Utility Protection Plan should be developed. A typical plan would categorize existing structures by how they must be addressed with the new PAX construction. For example, structures most prone to damage would be identified in a most severe category requiring advance protection measures, a second less severe category might identify measures to be adopted in the event excessive settlement is observed, and a least severe category might not require any advance action.
- A preconstruction survey that includes video and descriptive documentation of existing buildings and utilities prior to the start of construction should be made.

- A geotechnical and structural instrumentation and monitoring program should be developed and implemented for deep cuts, over TBM mined tunnels, near portals and shafts, and over SEM mined excavation. The program would identify the types, locations, and depths of various types of ground monitoring installation across the project. The frequency of readings and reporting structure would be identified. Threshold limits of allowable ground movement would be determined, and the response actions and responsible parties for taking action would be clearly delineated. Actions could include protective measures to the structure, modifying the construction means and methods, or stopping construction altogether until a solution can be determined.
- A settlement mitigation program such as a compensation grout program should be developed. Compensation grout pipes can be installed and pregrouted to precondition the ground between project excavations and structures expected to be affected by construction. These pipes can then be used in tandem with an instrumentation and monitoring program to inject grout at targeted locations to mitigate observed settlement.
- Postconstruction surveys should be made on certain structures after construction for use in comparison against the preconstruction surveys to document if damage might have been caused by construction activities.

These steps would collectively constitute a reasonable and industry-accepted approach to prevent PAX construction work from causing damage to nearby buildings and utilities.

7.1.7 Staging Areas and Site Access

This project is in an urban setting, so the availability of large areas available to stage construction equipment and materials is limited. Potential available staging areas along the project corridor were studied for the purpose of feasibility assessment.

Tunnel excavation operations require a large staging area for the launch pit or shaft; water treatment; power supply; segment storage; a spoils treatment, classification, and storage area; temporary facilities to service equipment and maintain an inventory of spare parts and materials used during construction; and other site facilities such as field offices. Because of the urban setting, limited equipment and materials would be stored at the launch portal. Tunnel lining segments would be stacked to optimize storage space. Tunnel muck is typically preclassified and/or tested in an expedited manner to avoid the operation becoming "muckbound." Assuming sufficient trucking capacity is maintained to limit the size of the portal-area muck stockpile, and assuming a minimum one-week supply of lining segments will be stored on site to avoid potential delay to the tunneling operation, 2 acres are adequate for staging an EPB TBM mining operation. This is based on stacking twin bore precast concrete segments in units of one complete ring of precast concrete segments. Each ring supports approximately 5 feet of tunnel. The area preliminarily identified to support TBM launch, either from the north or from the south end for the long tunnel alignments, is approximately 2 acres.

7.2 Construction Sequence and Constructability Issues for Each Alternative

This subsection describes the general work sequence for each of the alternative alignments and highlights the major constructability issues. The purpose is to provide the reader with an understanding of the construction workflow that has been assumed to prepare a project cost estimate and schedule, and

demonstrate that based on the facts known or assumed that the alternative is feasible and can be constructed. Significant shortcomings in current knowledge of site conditions or other unknowns that could impact then feasibility of alternatives are identified. Figures of each alignment are included in Section 2.0 (Figure 2-1 to Figure 2-5).

7.2.1 Alternative A1

The work sequence assumes a single 42-foot-diameter TBM is launched from the north end of the alignment to mine a single bore, 1.5-mile-long tunnel that will house both northbound and southbound tracks (Figure 2-1). The PAX contractor will assemble the TBM and trailing gear within the DTX-constructed U-wall. A launch from the south end is also possible. The first activity of the PAX tunnel contractor will be to mobilize to a staging area at the north end of the alignment and begin preparatory activities such as bringing power to the site if that has not already been done; and establishing the ability to hoist equipment, materials, and tunnel spoils from grade into the bottom of the U-wall. The design, procurement, fabrication, and delivery of the TBM, which takes 12–18 months (depending on a number of factors including size), would commence immediately upon authorization.

Details of the work a PAX contractor will be required to perform to fully develop the bottom working area of the U-wall trench and TBM launch pit have not yet been fully developed. An example of a TBM prepared for launch through a headwall is shown in Figure 7-7.

Figure 7-7. Example of a TBM Set Up and Ready to Excavate into a Headwall (46-foot-diameter TBM, Waterview, NZ)

Coordination with the DTX/PAX interface was conducted to optimize the interface on a preliminary basis. Existing Caltrain tracks at the surface are within the footprint of the proposed U-wall box and TBM launch area, as are the proposed DTX tracks. As currently proposed, this interface includes a four-track configuration south of Fourth and Townsend Street that would accommodate PAX construction concurrently with revenue service in a completed DTX system. This interface concept is shown in Figure 7-8 and will enable a PAX TBM launch box for launching a TBM southward or receiving a northbound TBM, to be constructed adjacent to rather than underneath in-service rail lines. The stub track to the

railyard shown in in Figure 7-8 is illustrative only and is intended to show that it is feasible for PAX to connect to a subsurface railyard.

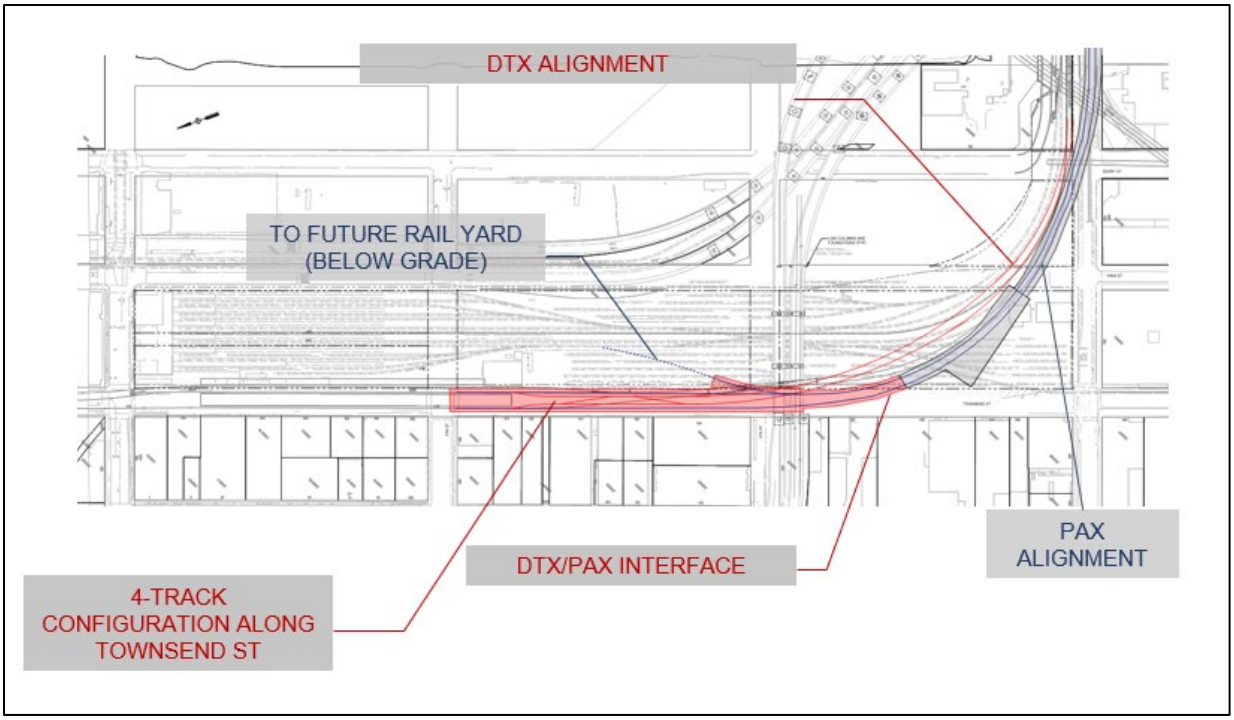


Figure 7-8. PAX TBM Launch Chamber near Interface with DTX (gray area), Showing Interference with Existing Caltrain Tracks (blue)

The TBM launch headwall will be prepared as described in Section 7.1.4 to allow the TBM to penetrate, or break-in through the headwall and begin mining down 7th Street through the improved ground. Precast concrete segments will be continuously installed behind the TBM for the entire tunnel length beginning at the headwall, as described in Section 7.1.1. The TBM will continue down 7th Street and make the turn to the right to excavate south underneath Pennsylvania Avenue. The tunnel will slope downward at 2% to pass beneath existing large utilities, gain ground cover over the tunnel, and pass through more favorable geologic units for tunneling.

The TBM will pass under the SFPUC's Division Street sewer, a four-compartment concrete box sewer on piles, and beneath the future planned SFPUC Folsom Sewer Tunnel. These utilities are shown in the red stippled areas in Figure 7-9. This area will need to be further investigated in detail to be sure there is adequate clearance between the top of the tunnel and the bottom of the existing piles, to ascertain whether preinstalled ground improvement is required, and to develop a program to instrument and monitor ground and utility movement during excavation to ensure the integrity of this structure.

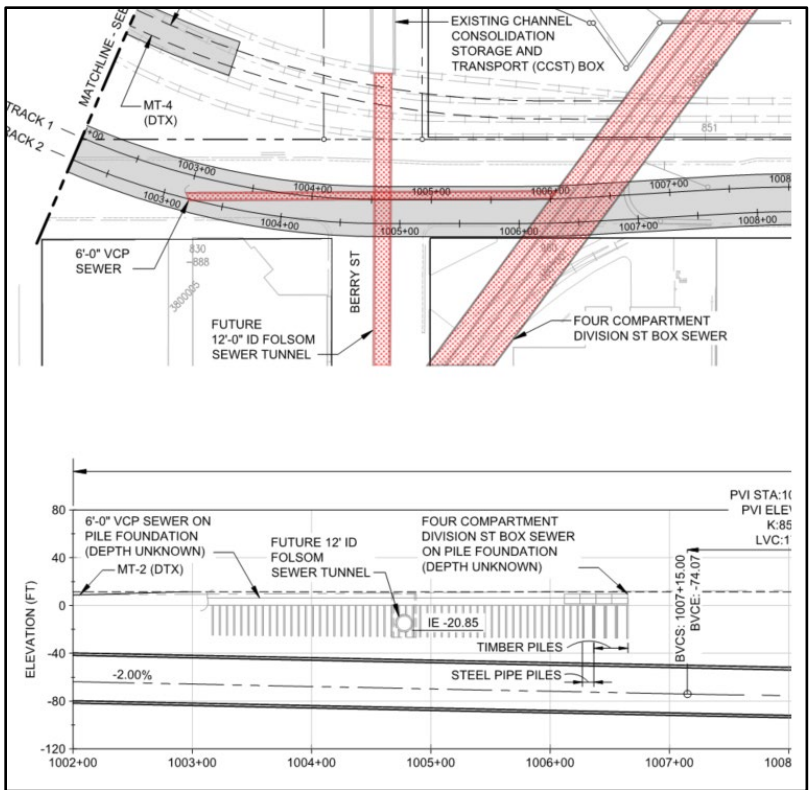


Figure 7-9. Area Where PAX Alignment (gray) Crosses Existing Division Street Box Sewer (red) and Future Folsom Street Sewer (red)

The tunnel will be excavated through a mix of soil and weak rock. The most difficult formation to excavate through in terms of risk of ground loss, ground settlement, or an uncontrolled blowout to the surface is the Young Bay Mud (YBM). Starting from the launch pit, the tunnel vertical profile is kept below this formation, yet it persists just above the tunnel crown where it still poses a risk. Further studies will be required to predict the extent of YBM more scientifically along the alignment and to develop measures that will be required to ensure TBM mining does not cause ground settlements in this weak formation. Figure 7-10 depicts the occurrence of the YBM relative to the tunnel at the north end of the alignment.

Rock is anticipated to be encountered at approximately Station 1019 (Hubbell Street), with either a mixed face of soil and rock or a full face of rock persisting to Station 1032 (17th Street), as shown in Figure 7-11. Thereafter and southward to the tunnel termination the tunnel is expected to be in rock.

From its low point at elevation -95 feet near Station 1026 (16th Street), the tunnel climbs southward to its terminus, first at a 1% grade then steepening to 2%.

Another area of note is from Station 1059 to Station 1073, beneath Pennsylvania Avenue. The ground cover over the tunnel decreases to about one tunnel diameter or less in this stretch. Further, there are areas of soil or fill above the top of rock contact, which is located at an uncertain depth. This is shown in Figure 7-12. Further exploration will be required to determine what, if any, special measures may be required in this area such as ground improvement in advance of tunnel excavation.

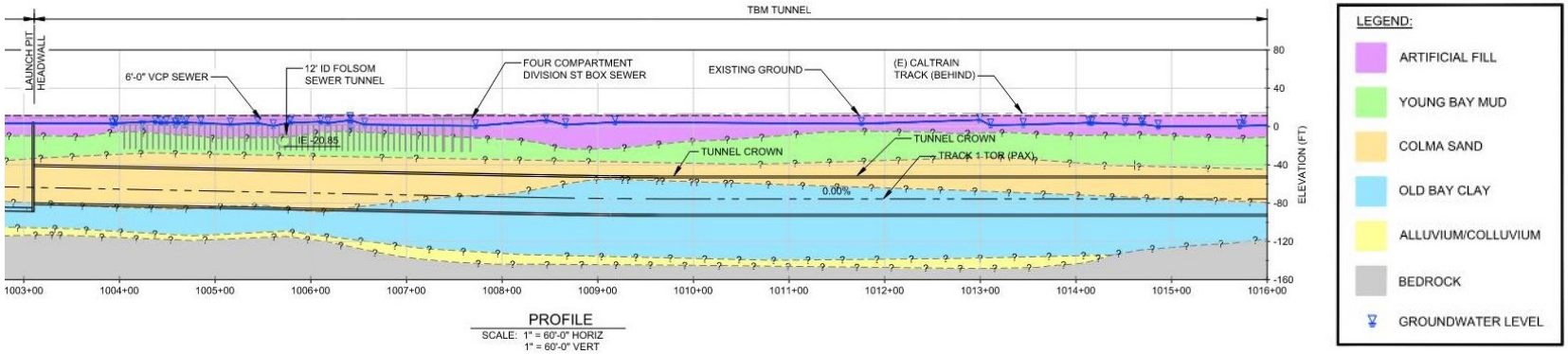


Figure 7-10. Geologic Profile Showing Soil Units Relative to PAX Profile at North End of Tunnel (refer to legend, right)

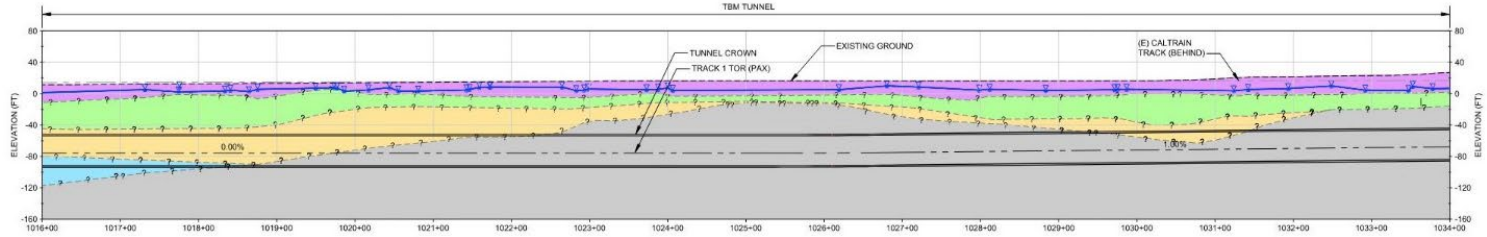


Figure 7-11. Area of PAX Alignment Where Mixed Soil/Rock Conditions are Anticipated to Occur (refer to legend, above)

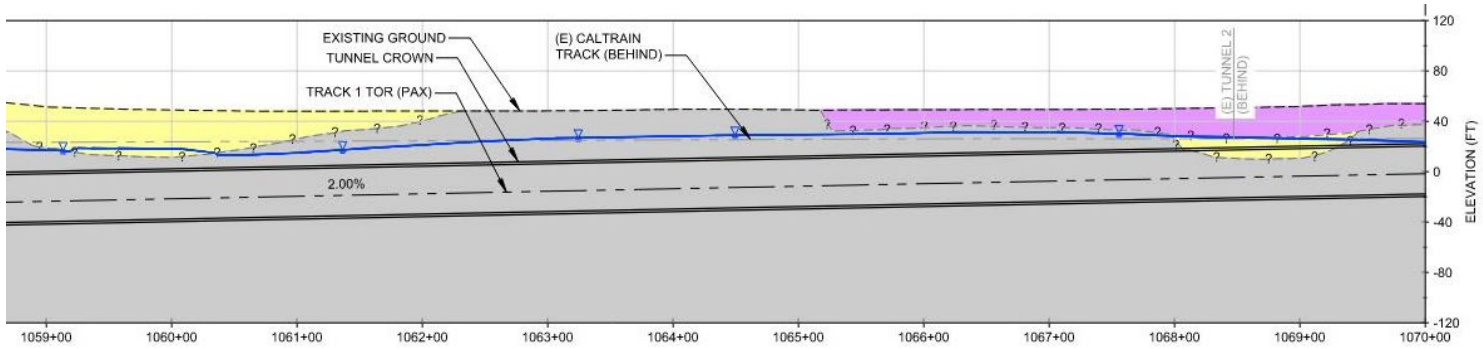


Figure 7-12. Area of PAX Alignment with Low Ground Cover (refer to legend, above)

The southern breakout area in the portal at Station 1079+00 will be prepared by installing a retaining wall and headwall next to the existing tunnel portal. The TBM will break-out through this headwall to complete the tunnel drive. A conceptual sketch of where the portal and ventilation structure will be located on an oblique view 3D rendering is shown in Figure 7-13. The area in the Caltrain ROW from Stations 1079 to 1084 will be graded and leveled to prepare for track installation and a tie-in to the existing Caltrain tracks.

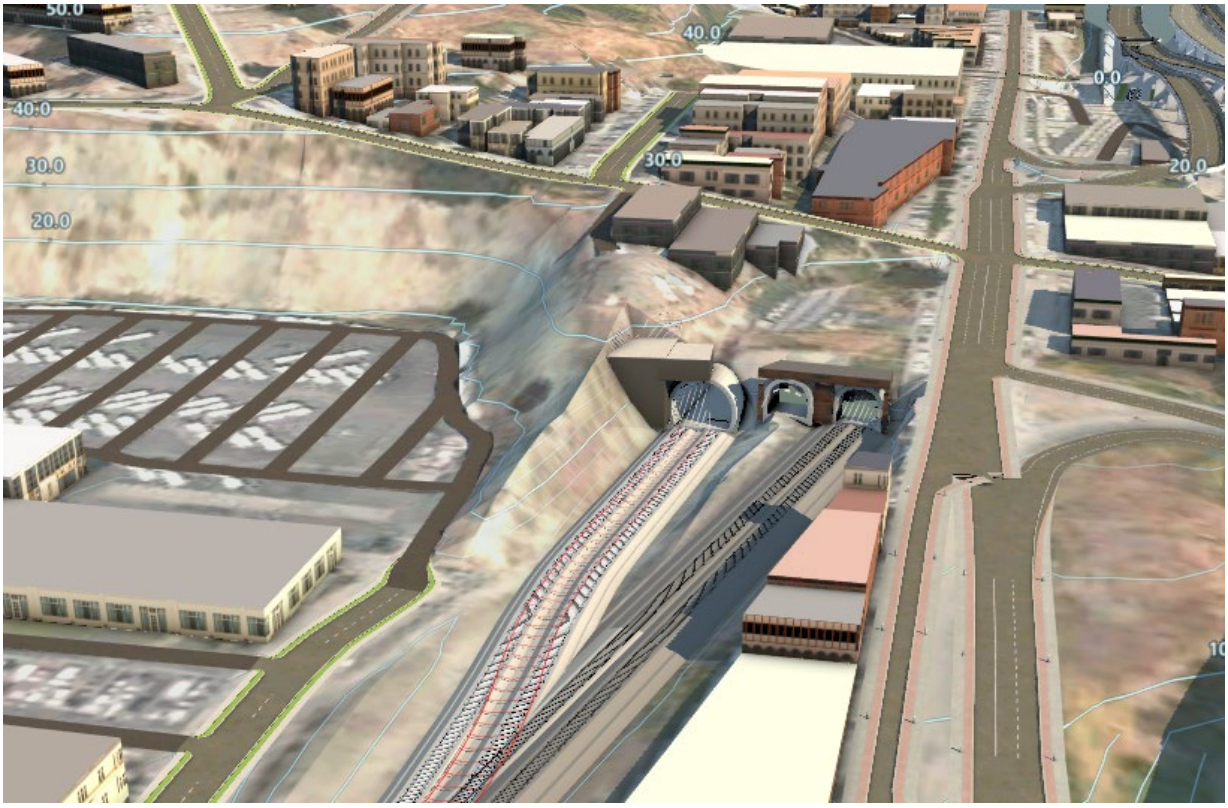


Figure 7-13. South Portal Area for the Alternative A1 Alignment, Showing Potential New Portal Area, Conceptual Footprint of a Ventilation Structure, and Track Tie-in to Existing Caltrain Rail

Four ventilation shafts/structures are proposed for Alternative A1, as shown in Section 5.1. They are located at Stations 1000, 1025, 1043, and 1078 at the south portal. The structure at Station 1043 will likely require a connecting adit. The construction considerations for these structures are described in Section 7.1.5.

Two 600-foot-long track crossovers are proposed, one from Stations 1014 to 1020 and the other from Stations 1038 to 1044. As discussed in Section 7.1.3, the trackwork for the crossovers will be constructed within the confines of the lined single bore tunnel.

The tunnel will be completed with a deck slab constructed of precast concrete or cast-in-place concrete that will provide a platform for trackwork. A divider wall may be installed between the two tracks depending on the ventilation and fire/life safety (FLS) design. The cost estimate assumes a divider wall at all locations except the crossovers. A drainage, sump, and pumping system to handle any water infiltration will be installed. Control, electrical, and mechanical systems will complete the works in the tunnel. Figure 7-14 depicts and assumed cross section of the single bore tunnel.

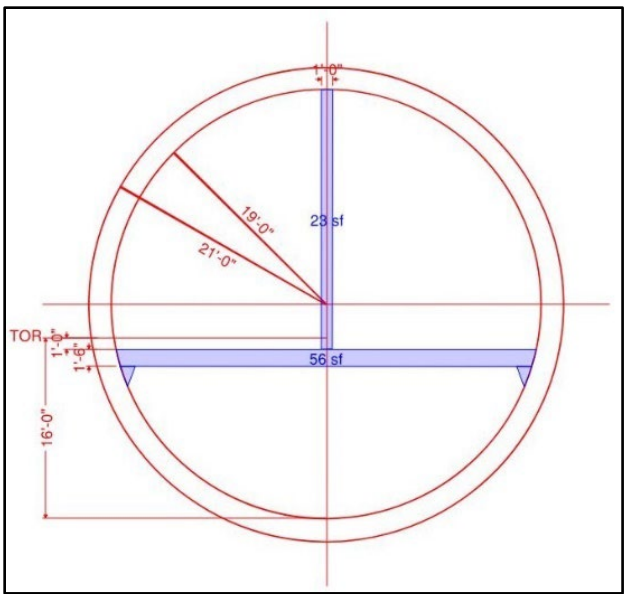


Figure 7-14. Simplified Cross Section of a Single Bore Tunnel Showing Dimensions Assumed for Cost Estimating in this Study

Alternative A1 cannot make use of the existing 22nd Street Station. Station alternatives within the PAX project limits include a new underground station in Pennsylvania Avenue between 22nd Street and 23rd Street. Traditional methods for station construction are to construct a cut-and-cover structure for the length of the station. The soil support system can be constructed and decked over to allow limited traffic flow and shafts to access the station work area below. An alternative is to construct the station platforms within the lined TBM tunnel, which may reduce the footprint of headhouse shafts that provide access to platform level. This alternative may require a larger diameter bore to accommodate platform and access sizing. Further study or discussion of station options is outside the scope of this study.

7.2.2 Alternative A2

The work sequence assumes two 26-foot OD TBMs are used to excavate the 1.5-mile-long twin tunnels that will have one track each as shown in Figure 2-2. The TBMs will be launched from the north end of the alignment by assembling the TBMs and trailing gear within the DTX constructed U-wall. A different configuration of the headwall is required for two TBMs than for the single bore as shown in Figure 7-14. A launch from the south end is also possible. This option will require the same 2-acre work area for servicing the tunnel excavation. Of note, it is less expensive to conduct work from a portal than to conduct work from a launch box because a significant amount of construction-related hoisting is avoided. The savings would be on the order of 5–10% of the cost for tunnel excavation.

Early activities of the PAX tunnel contractor after mobilization at a staging area are similar to those described for the single bore in Section 7.2.1. The discussion in that section on the coordination required for the U-wall and launch pit in terms of the split of work between DTX and PAX is also applicable to Alternative A2.

As with Alternative A1, existing Caltrain tracks at the surface and the future subsurface DTX tracks are within the footprint of the proposed U-wall box and TBM launch area. A solution similar to that shown in Figure 7-8 will be needed to allow Caltrain operations to proceed during construction of PAX.

It is generally preferred to have a one-tunnel diameter separation between two adjacent tunnels. In the northern section of Alignment A2 this is not possible in all locations because of the narrow width of public right-of-way between the existing I-280 deep foundations on the east side of 7th Street and the private property boundary on the west side. This is clearly shown in Figure 7-15, where the distance between tunnels is indicated to be less than 5 feet.

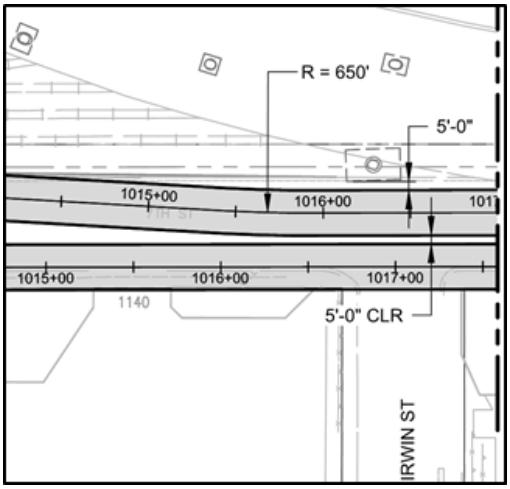


Figure 7-15. Area on 7th Street Where the Two Twin Bore Tunnels are Indicated to be within 5 Feet of Each Other

To assess the feasibility of placing two TBM mined tunnels this close together, an evaluation was performed as part of this study on the "pillar width," or separation distance between the two tunnels as measured at tunnel springline. This evaluation is based on two-dimensional numerical analyses using finite difference software FLAC (Itasca, 2016). A critical cross section at Station 1015+00 was selected for the analyses and represents the anticipated worst-case condition over the tunnel reach with respect to ground conditions and where the narrowest pillar will be formed. Ground cover above the tunnel crown is approximately 60 feet.

The evaluation focused on the following design considerations: (1) ground movement and surface settlement; (2) segmental lining performance in terms of deformation and structural demands compared to capacity; and (3) stresses and strains in the pillar. Four different pillar widths were evaluated: 5, 13, 20, and 26 feet. The results indicate that ground movement and surface settlement will not be significantly affected by the changes of pillar width, though generally the deformations increase as the pillar width decreases. Similarly, displacements and structural demands of segmental linings for both tunnels appear not to be affected significantly by the changes of pillar width. However, the stability and behavior of the ground that forms the pillar between the two parallel tunnels is predicted to be affected significantly by pillar width, especially when the pillar is narrowed to less than one times the tunnel diameter. The evaluation showed that a minimum pillar width of 13 feet is judged as acceptable where the soil making up the pillar is not improved. Ground improvement to enhance strength and stiffness of soil within the zone of the pillar will be required to further reduce the pillar width down to 5 feet or less.

As a result of the evaluation, cost estimates for this alternative assume significant ground improvement will be required along 1,300 feet of the tunnel alignment. This ground improvement can be accomplished using several methods, but a likely choice will be jet grouting. Jet grouting involves the use of drill rigs working from the surface that inject, or "jet," a cement and water mix into the soil from a rotating steel drill at very high pressures to mix and strengthen the soil and create a column of grouted soil. Jet grouted soil columns are overlapped and would cover a zone about 26 feet wide and 40 feet deep and centered between the two tunnels. This will provide an improved soil mass to tunnel through that reduces risk of ground loss and settlement. This process will also create a grouted soil mass between the tunnels to serve as "grout pillars" to stabilize the ground.

Figure 7-16 is a photo from LA Metro's Purple Line Extension in Los Angeles showing an example of jet grouting at the surface. As can be seen, in this case the grouting work is performed on the right side, with vehicle travel lanes established on the left side. The PAX grouting will require various degrees of street closures depending on how the work is staged and the designated work hour restrictions. At least half of the jet grouting work will need to be performed using low-headroom equipment because of the I-280 viaduct over the east half of the improvement area.

Figure 7-16. Example of Footprint Required for Jet Grout Operations from Surface and Associated Traffic Control (LA Metro Purple Line)

As with Alternative A1, A2 will be excavated through a mix of soil and weak rock. The primary difference is that the invert of the A2 alignment bottoms at elevation -80 feet, 15 feet shallower than Alternative A1, and there is always at least one tunnel diameter of ground cover over both tunnels except for the first 400 feet at the northern end of the alignment. The vertical grades for Alternative A2 are similar to those for Alternative A1.

The southern break-out area for the two tunnels will be at a portal area that will be similar to that described for Alternative A1, with the exception that two TBMs will break-out here with an approximate 20-foot separation distance. This will result in a wider twin portal/headwall structure than that for Alternative A1, with the new northbound tunnel being situated 10 feet or less from the existing abandoned Caltrain Tunnel 2.

Four ventilation shafts/structures are proposed for Alternative A2, as shown in Section 5.1. They are located at Stations 1002, 1027, 1044, and 1078 at the south portal. The southbound tunnel runs through the middle of the footprint of the ventilation shaft at Station 1027 (Mississippi Street), which straddles the northbound track. This is shown in Figure 7-17 (the vent shaft location is approximated for illustration purposes only). The structure can either be built prior to TBM excavation with the TBM being "walked through" the ventilation structure opening, or be constructed following the TBM passing through this area. The ventilation shaft at Station 1044 will require a 73-foot-long connecting adit, and the shaft is shown as being constructed in 19th Street. The construction considerations for these structures are described in Section 7.1.5.

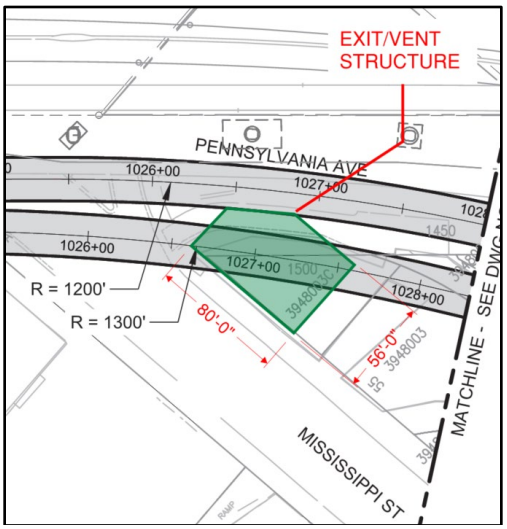


Figure 7-17. One of the Proposed Exit/Vent Shaft Locations for Alternative A2

A single 300-foot-long track crossover is proposed from Stations 1039 to 1042. As discussed in Section 7.1.3, the trackwork for the crossovers will require SEM mining between the two tunnels to create an open space for the entire length of the crossover where the track layout can be installed.

A total of five cross-passage connections are estimated to be required along Alignment A2. One of them will be provided at the ventilation shaft structure at Station 1027, which has a footprint filling the separation area between the two bores. The other four will require SEM mining, as described in Section 7.1.3.

The tunnel will be completed with a bottom slab that may be constructed of precast concrete or cast-in-place concrete that will provide a platform for ties and trackwork to be installed. A drainage, sump, and pumping system to handle any water infiltration will be installed. Control, electrical, and mechanical systems will complete the works in the tunnel. Figure 7-18 depicts an assumed cross section of one of the twin bore tunnels.

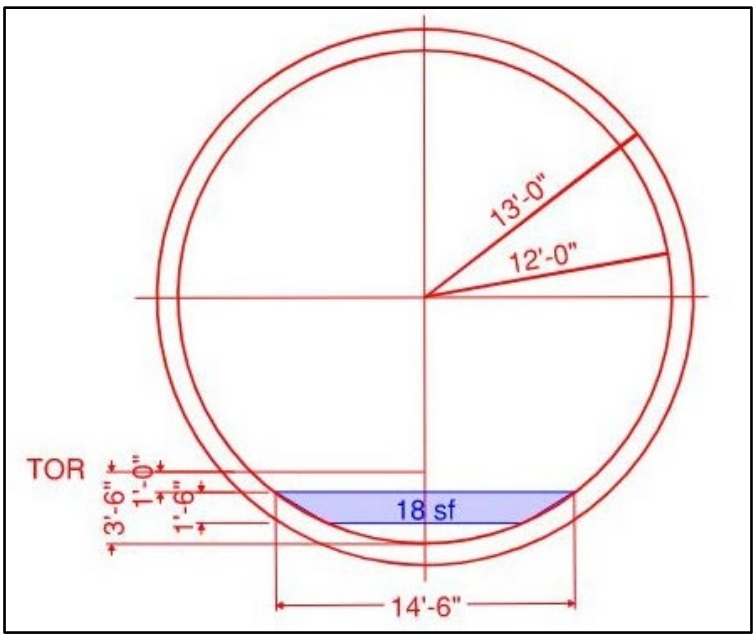


Figure 7-18. Simplified Cross Section of a Tunnel for the Twin Bore Option (Alternative A2) Showing Dimensions Assumed for Cost Estimating in this Study

7.2.3 Alternative B1

This alternative envisions a single bore TBM tunnel terminating at Station 1048 between 19th and 20th Streets. From this point the tunnel bifurcates into two SEM mined tunnels that curve in horizontally to connect to the existing Caltrain line (Figure 2-3). The description of construction issues between the DTX headwall and Station 1048 is essentially the same as previously described for Alternative A1 in Section 7.2.1, and is not repeated in this section. It is noteworthy, however, that there is less than one tunnel diameter of ground cover for the first 400 feet at the northern end of the alignment, as well as between Station 1020 and Station 1038 under 7th Street and Pennsylvania Avenue. Ground improvement may be required in this zone. As depicted in Figure 7-19 below, this section focuses on the construction issues from the TBM termination point at its southerly end (red in the figure), the SEM mining (blue), and the connection of the new northbound track into the existing Caltrain live tunnel that contains the existing northbound track (green).

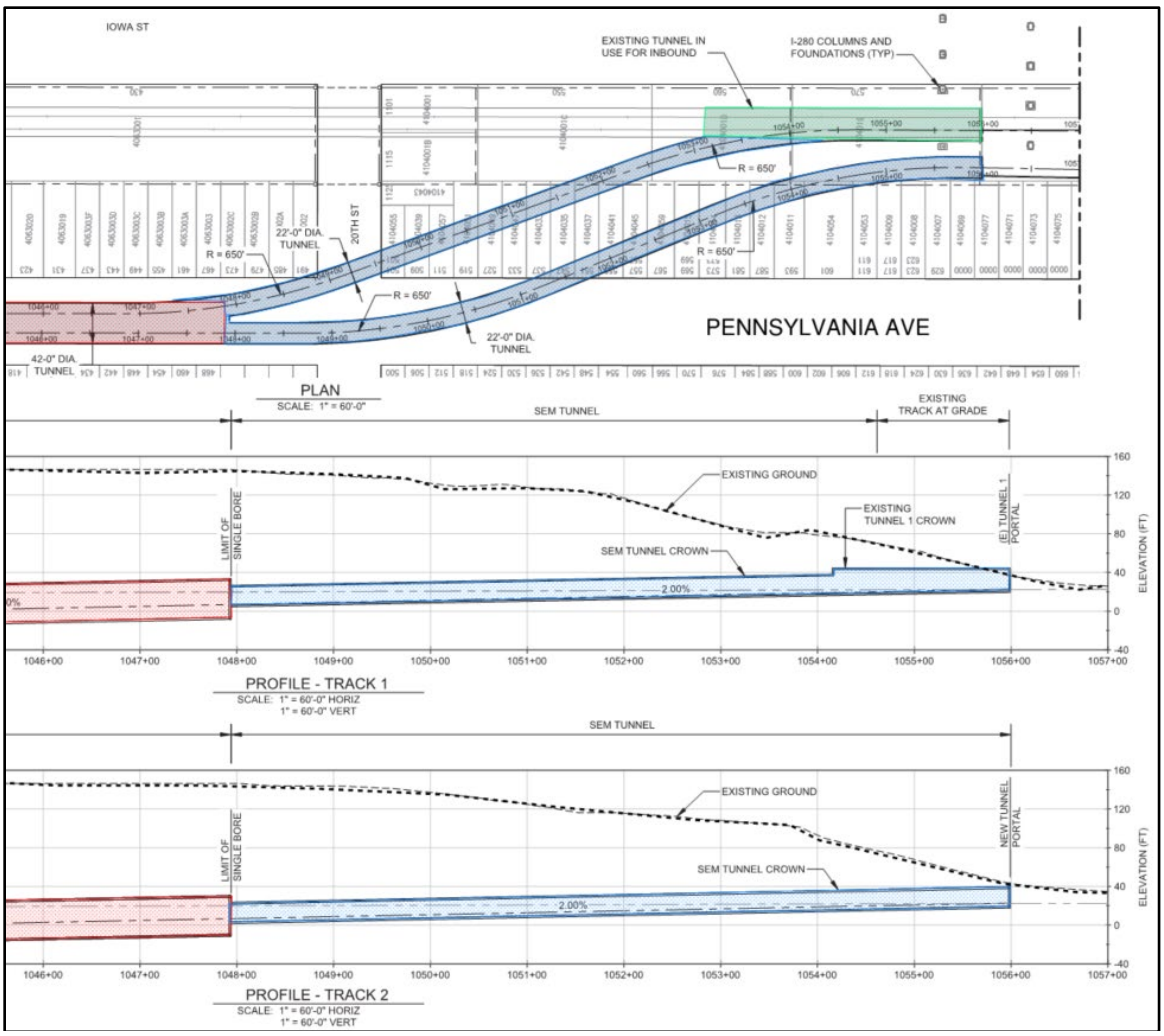


Figure 7-19. Plan and Profile of the SEM-mined Connections from the South End of a Single Bore Tunnel to existing Caltrain Tracks for Alternative B1

Starting from the end of TBM mining, the work sequence to complete the branch tunnels by SEM methods to connect to the existing Caltrain tracks will be as follows (a 3D rendering of the two SEM tunnels is shown in Figure 7-20):

1. The TBM will be stripped of all mechanical, electrical, and structural equipment within the TBM shield and removed from the tunnel. The TBM cutterhead will either have to be collapsible, or will be cut into pieces and removed after the ground in front of the TBM, assumed to be weak rock, is improved and stabilized.
2. Break-out areas will be prepared ahead of time at the existing Caltrain side. This work will be adjacent to live rail, so work will have to be conducted at nights and on weekends to avoid service disruption. Work space here is very limited. For the northbound tunnel, the connection is a break-out to the existing Caltrain Tunnel No. 1 north of 22nd Street Station. The break-out area will be prepared by presupporting the intersection of the two tunnels with spiling and rock bolts. An SEM alcove may be excavated from the existing tunnel side to push the TBM break-in area further away from live rail operations.

3. For the southbound track, a headwall (retaining wall) will be constructed adjacent and just west of the existing Tunnel No. 1 south portal. A new portal for the southbound track will be prepared with spiling and rock bolting. A short distance of tunnel may be driven to create a receiving chamber for the SEM-mined southbound tunnel.
4. Two SEM tunnels will be driven from the TBM tunnel toward the existing Caltrain tunnel (green area in Figure 7-19). At this time, it is understood that there is not likely to be a sufficiently sized staging area between 20th Street and 23rd Street, along the Caltrain ROW, to support SEM operations from south to north (toward the TBM tunnel). For the northbound track, the logistics of mining the SEM tunnel from the active Caltrain Tunnel to the TBM tunnel under live track conditions have significant cost and schedule implications. For these reasons, the assumption is that both SEM tunnels will be driven from the TBM bored tunnel, supported from the work staging area at the north end of PAX.
5. The SEM mining will proceed as described in Section 7.1.1.2. Both tunnels are believed to be entirely in weak rock, based on the desktop study performed. However, both tunnels have minimal rock cover and further explorations will be required to fully characterize the ground along these two alignments. For the purposes of this study, the SEM tunnels were considered to require a pipe canopy presupport system installed in advance of tunnel excavation.
6. The two SEM tunnels will break out through the previously described portals at the existing Caltrain side.
7. A final lining system consisting of cast-in place concrete will be installed. It will be placed inside the TBM shield to join up with the precast segments in the TBM mined tunnel. A waterproof system will be required behind the final lining and inside the initial ground support.
8. The final stage will be installation of track and systems and a tie-in to the existing Caltrain system. See Figure 7-20 for a visualization of this.

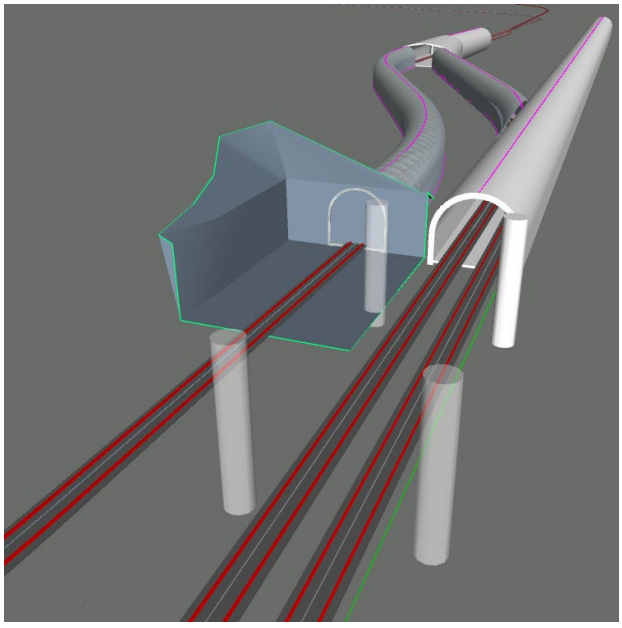


Figure 7-20. 3D Rendering of the Tunnel Connections from TBM Bored Tunnel (upper left) to Existing Caltrain Tracks/Tunnel (right)

South of the tunnel portals and connection to the existing Caltrain track, there will be work required at 22nd Street Station. A new southbound track will be installed at-grade from the new southbound tunnel portal, through the 22nd Street Station area, and through a rehabilitated existing Tunnel 2 that has been abandoned for a number of years. This will require construction of a new retaining wall along the property boundary on the west edge of the station to create the at-grade space necessary to run the new southbound track outboard (west) of the existing I-280 piles. The new northbound track will be rerouted to the existing southbound track and pass through 22nd Street Station and the live Caltrain tunnel (Tunnel No. 2). This concept is shown in Figure 7-21. The new retaining wall is shown in blue, the new southbound tack is orange, and the northbound track is green. Conversion of the 22nd Street station platform and access to a center platform layout will be required to accommodate the new alignments, costs for which are included in the study cost estimate.

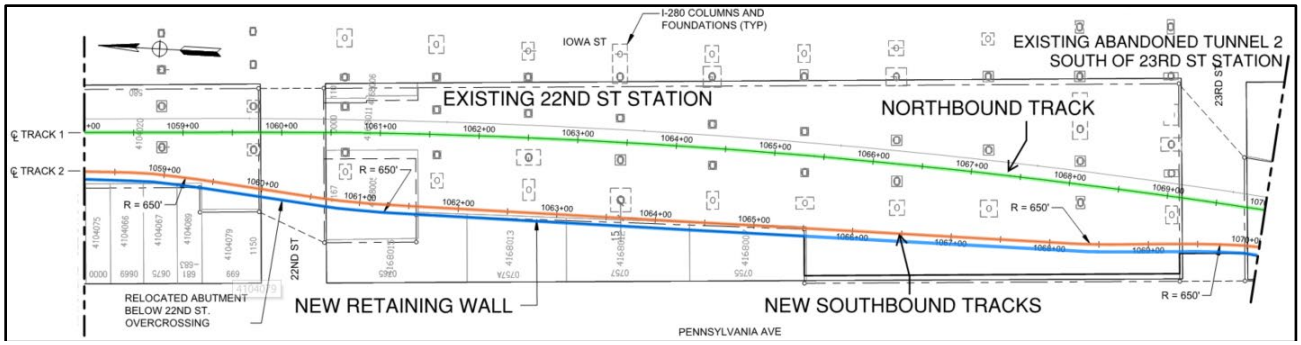


Figure 7-21. Improvements Necessary at 22nd Street Station for Alternatives B1 and B2

The condition of Abandoned Tunnel 2 is uncertain. For the purposes of this study and preparing a cost estimate, it was assumed that the scope of upgrade previously performed on the live Caltrain tunnels would suffice for Abandoned Tunnel 2 (south of 23rd Street). Generally, this work included the application of shotcrete (sprayed concrete) lining over the existing brick linings and a seismic upgrade. The seismic upgrades would include contact grouting, installation of shotcrete, installation of rock anchors, restoration of missing drainage gutters and installation of sump pumps.

South of the Abandoned Tunnel 2 portal and north of Cesar Chavez, the new southbound track will be tied into the existing southbound track at the existing grade.

North of the SEM tie-in to the existing Caltrain tracks, the number and locations of cross passages, ventilations shafts, and track crossovers are the same as Alternative A1.

7.2.4 Alternative B2

A twin bore variant of Alternative B1 was developed that envisions excavating with two TBMs the entire way into the existing Caltrain ROW north of the 22nd Street Station (Figure 2-4). This will eliminate most of the SEM mining required from the termination point of TBM mining (Station 1048) in Alternative B1. This concept is shown in Figure 7-22, with the twin TBM drives shown in red, a SEM mined receiving alcove on the northbound line in blue, and the existing live Caltrain Tunnel No. 1 in green.

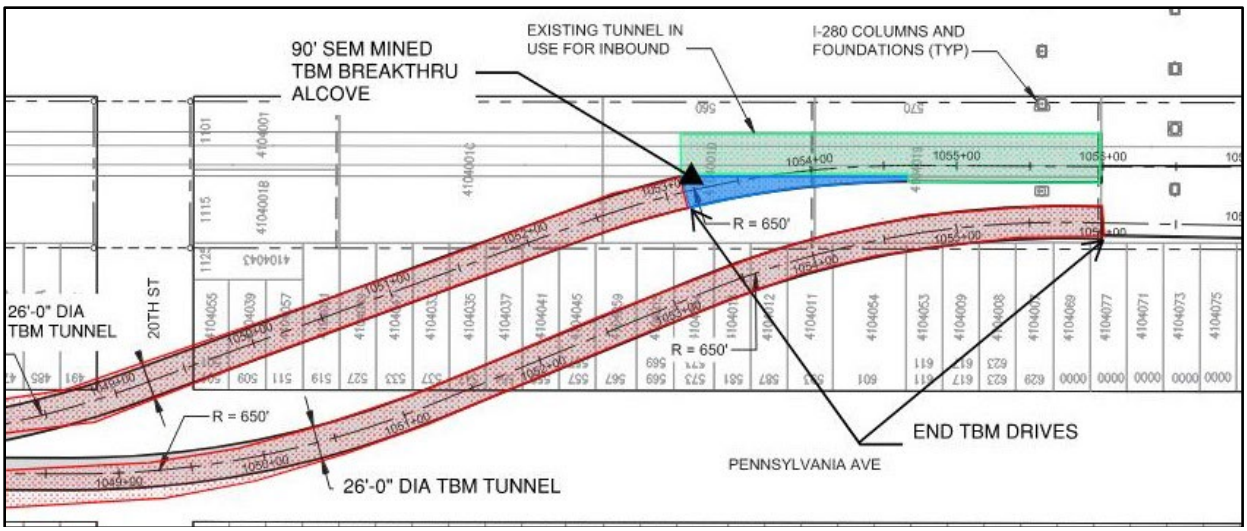


Figure 7-22. Plan and Profile of the Twin TBM Bored Tunnel Connections to Existing Caltrain Tracks for Alternative B2

Considering the limited working area in the Caltrain ROW, active passenger rail operations in Tunnel No. 1 and poor access, construction logistics will be challenging to remove the two TBMs while minimizing disruption to active rail service. The TBMs could be disassembled and removed at the north end, from where they were launched.

All other construction considerations north of 20th Street are as described for Alternative A2, the twin bore concept. All other construction considerations south of the twin bore connection to the existing Caltrain line are as described for Alternative B1, including 22nd Street Station modifications, a new retaining wall between 22nd Street and 23rd Street, and the rehabilitation of Abandoned Tunnel 2.

7.2.5 Alternative C

Alternative C includes a cut-and-cover tunnel and U-wall at the north end of the project that snakes from the DTX boundary through the existing I-280 piles, tying into the existing Caltrain northbound tracks on the north side of the existing Caltrain Tunnel #1 portal between Mariposa Street and 16th Street. The southbound tracks would be installed in a 26-foot-diameter TBM bored tunnel aligned along 7th Street and then Pennsylvania Avenue, which then connects to the existing southbound Caltrain track at a portal just north of the 22nd Street Station. The TBM bored tunnel is essentially the same southbound alignment as Alternative B2 (Figure 2-5).

This alternative solves the problem of the space restriction for two 26-foot-diameter bored tunnels in 7th Street that is described for Alternative A2, while making use of the existing 22nd Street Station. The construction considerations of the TBM bored tunnel are the same as those for the southbound tunnel in Alternative B2, with the exception that the concerns associated with the close separation between two tunnels under 7th Street are eliminated. The discussion of this alternative will therefore focus on the northbound track cut-and-cover tunnel/U-wall section. The general methodology for construction of the cut-and-cover tunnel is as previously described. The groundwater table cannot be lowered during construction using dewatering, so the cut-and-cover construction must prevent water inflows into the

excavation. In addition to an impermeable slurry wall or secant pile wall system, the invert of the excavation must be jet grouted.

Beginning at the DTX U-wall trench, the cut-and-cover tunnel alignment has potentially more severe conflicts with the existing Caltrain tracks that head south from the railyard. This conflict on other alternatives is limited to the U-wall area as all tunnels are bored beneath the tracks. The cut-and-cover tunnel through this area will require temporary shutdown and relocation until decked over and the tracks can be restored.

Figure 7-23 shows the constraints described in this paragraph. The cut-and-cover tunnel will impact surface tracks that will access the railyards once the DTX alignment is operational and will require a shutdown of Berry Street, shown in green. Alternate access is available via King Street. The tunnel will cross SFPUC's Consolidated Transport/Storage Box Sewer (brown), a large concrete structure below grade in Berry Street that conflicts with the proposed alignment. The tunnel also conflicts with the four-compartment Division Street Box Sewer (brown; crossing the PAX alignment at an angle). Neither of these structures can be relocated. The new DTX U-wall will require a special design to excavate and build the PAX tunnel under these structures so that the tracks can be installed at the desired elevation. The design will need to be sufficiently robust to avoid settlement and damage to the existing structures. Complicating matters is the presence of fill and Young Bay Mud in this area, both of which can exacerbate ground settlement if not adequately addressed. A little further south along the alignment at Station 1012, an existing column support for I-280 stands directly in the proposed alignment (yellow) and will require relocation. Rerouting the rail alignment around the column is not feasible.

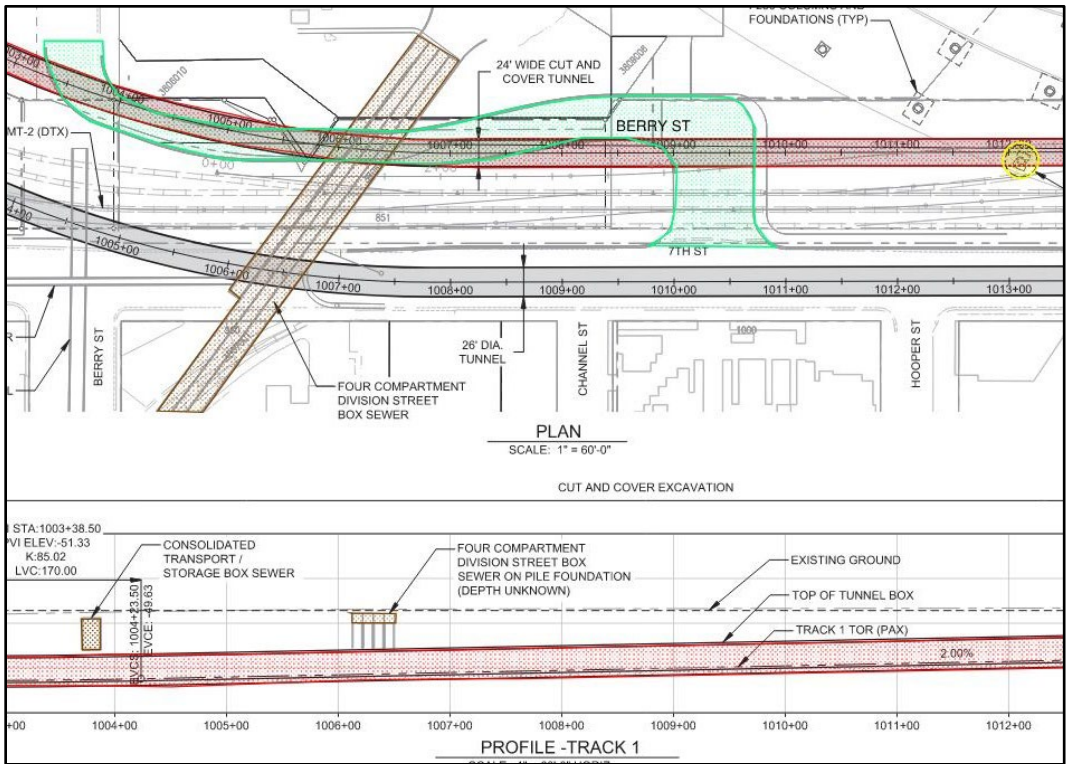


Figure 7-23. Interference Issues Pertaining to the Cut-and-Cover Section for Alternative C PAX Alignment (red). Division Street Box Sewer (brown), Berry Street (green), and Relocation of Existing I-280 column (yellow).

The cut-and-cover trench will be as deep as 70 feet below ground surface with the ground supported by slurry walls. The tunnel climbs at a 2% grade to Station 1026, where it daylights and transitions to a U-wall trench that can be constructed with secant piles or slurry wall. Between 16th Street and Mariposa Street (Stations 1030 to 1035), there are at least three I-280 columns that will require relocation, as shown in yellow in Figure 7-24. Details of column relocation, including additional column relocation that could facilitate simplified cut-and-cover structures, can be studied during future phases. The new northbound track reaches the existing grade at Station 1037 just north of the existing Caltrain tunnel (blue), where new track is tied into existing. The Caltrain tracks must be removed first to install the U-wall, and there is no room to construct a shoofly to maintain service. Technical details for this option will need to be refined in future studies.

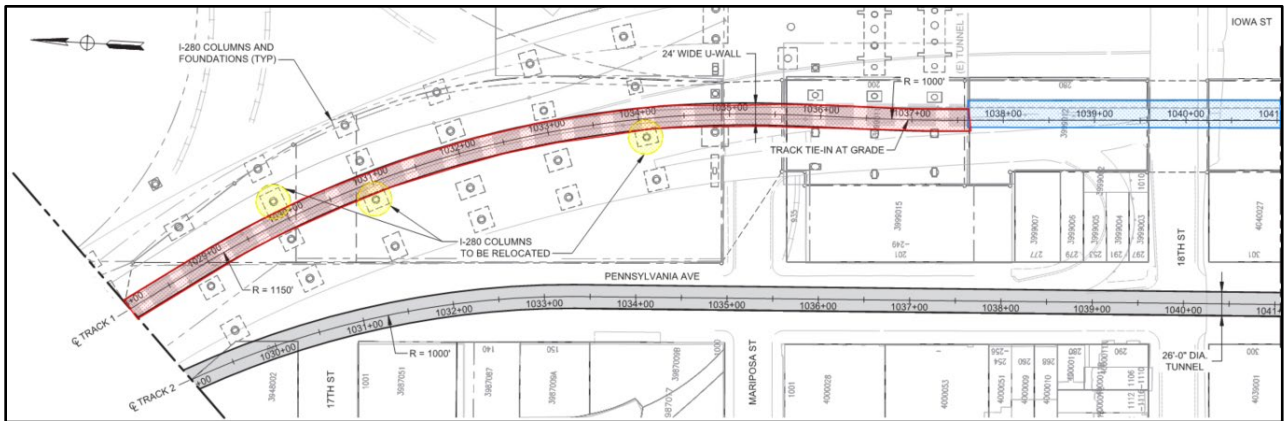


Figure 7-24. Interference and Connection Details in the 17th Street and Mariposa Street Area of Alternative C. New Cut-and-Cover Tunnel (red), TBM Bored Tunnel (gray), Relocated I-280 Columns (yellow), and Existing Caltrain Tunnel No. 1.

Cut-and-cover construction will also impact the two at-grade intersections during construction, requiring full or sequenced partial street closures to complete the cut-and-cover tunnel across the intersections. Excavation methods that would enable an undercrossing should be investigated during the next phase of work to minimize disruption to surface traffic.

8.0 Existing Utilities

8.1 Methodology

As part of the evaluation of existing conditions along the different alignment alternatives, major utilities were identified in order to assess the potential impacts to construction and operations of the PAX project. The evaluation of existing utilities and potential conflicts will allow for identification and resolution of these issues in the following phases of design and development of alternatives.

A desktop study was completed for locating the utilities along the PAX corridor. No field investigations were performed for this phase of the project. They will be conducted in the preliminary engineering/environmental phase of the project. The locations of existing utilities were determined by reviewing several resources. Utility mapping was requested from the following utility owners: San Francisco Public Works (SFPW), San Francisco Public Utilities Commission (SFPUC), San Francisco Department of Technology (DT), PG&E, AT&T, Comcast, and Peninsula Corridor Joint Powers Board (PCJPB). PG&E provided maps for gas and electric distribution and transmission lines. SFPUC and SFPW provided combined sewer, separated storm drain, and separated sanitary sewer system maps including as-builts and record drawings for adjacent projects. The sewer depths were provided by SFPW in record drawings, and general assumptions were made for depths of all other utilities that could not be confirmed by record drawings. Verification of assumed depths will also be conducted in the preliminary engineering/environmental phase. SFPW also provided potable and high-pressure water system maps. AT&T, Comcast, and DT provided communication line maps for fiber optic and copper wire infrastructure for aerial and underground facilities.

The existing utility mapping was overlayed with topographic information collected from third-party sources. Field visits and Google street views were utilized to reconcile mapping from the third-party sources. By overlaying this information in both plan and profile with the proposed alignment alternatives, possible locations of utility conflicts and relocations were determined. No topographic surveys were performed as part of this scope of work. Topographic survey to document all existing conditions, not only utilities, should be performed as the first task of the next phase of this project.

The identified utility map and conflicts along the proposed alignments are presented in Appendix F.

8.2 Findings

The utility desktop study identified various utilities along the alignments that will need to be verified and investigated in future phases of the project to determine if there are any conflicts with the proposed project corridor. The following utility locations, sizes, and depth will need to be verified:

- **6th and Townsend:** The existing 6-foot-diameter and 10-foot by 7-foot box sanitary sewers will need to be verified. TJPA plans to relocate the sewer as part of the DTX project to a location in the vicinity of the Folsom Area Stormwater Improvement Project tunnel.
- **King Street:** A electrical distribution line running along King Street has been identified, and depths and sizes will need to be verified in future phases. The electrical lines intersect the various proposed alignments at this location.

- **Intersection of Berry Street and Alternative C Easterly Alignment:** A 4-foot sanitary sewer along the northeast portion of Berry Street has been identified crossing the Alternative C alignment. The location and depth of this sanitary sewer will need to be verified.
- **Folsom Area Stormwater Improvement Project:** This is a proposed project that is a part of the San Francisco Public Utilities Commission's (SFPUC) flood resilience efforts under the Sewer System Improvement Program (SSIP). The current proposed crossing location is at Berry Street and 7th Street. In the vicinity of the PAX alignments, the tunnel is 15 feet outside diameter, with an approximate invert elevation of -35 feet (Datum: NAVD88). The low-lying Inner Mission neighborhood surrounding 17th, 18th, and Folsom Streets has been historically subject to flooding during moderate to heavy storms. The impact of this planned tunnel on PAX tunneling is that it drives the PAX tunnel deeper.
- **Division Street Sewer Crossings at 7th Street and Berry Street:** The Division Street Box Sewer serves as the main sewer that currently drains the Folsom area in the Mission neighborhood of San Francisco. The sewer runs from the intersection of Harrison Street and Treat Avenue to the Channel Pump Station and Outfall located adjacent to 7th Street. The sewer was designed and constructed in four different phases from 1908 to 1968. The sewer consists of independent compartments, or box structures, that convey combined sanitary and stormwater flows. The number of boxes vary from two to four along the sewer length. The Division Street Box Sewer will cross above the proposed alignments between the intersection of Berry Street/Channel Street and 7th Street as shown in Figure 7-23. Near Berry Street, the Division Street Box Sewer consists of four individual boxes that measure approximately 8'3" by 9'6". The three boxes on the south side of the sewer are supported on wooden pile foundations and were designed in 1906. The box on the north side is supported on steel pipe piles and was designed in 1968. The depth of the box sanitary sewer and piles will need to be verified in future investigations.
- **7th Street:** A box sanitary sewer sized at 3' by 4'6" runs along 7th Street in the PAX corridor. The box sewer may be supported on piles in this location. Future phases shall investigate if this box sewer is supported on piles and determine the type, depth, and location of these piles.
- **16th Street:** A number of utilities have been identified as crossing the proposed PAX corridor at 16th Street. The depths and locations of utilities along 16th Street as they cross the easterly alignment of Alternative C will need to be verified. The utilities at this location have been identified as ones that may need to be relocated if Alternative C is selected for construction.
- **Mariposa Street:** A number of utilities have been identified as crossing the proposed easterly alignment of Alternative C. The depths and locations of utilities along Mariposa Street as they cross the easterly alignment of Alternative C will need to be verified. The utilities at this location have been identified as ones that may need to be relocated if Alternative C is selected for construction.
- **36-inch Sanitary Sewer:** The physical location of a 36-inch-diameter sanitary sewer near the location of the southern portal for Tunnel 1 will need to be verified. This sanitary sewer may conflict with the proposed Alternative B1 and B2 construction.
- **Between 22nd and 23rd Street:** The depth of utilities along the proposed retaining wall for Alternatives B and C will need to be verified.

- **Pennsylvania Avenue and 23rd Street:** An existing 24-inch sanitary sewer pipe has been identified running along Pennsylvania Avenue. The location and depth of this pipe will need to be verified.

8.3 Anticipated Significant Relocations

During construction of the tunnel, shafts, and ventilation structures, utilities located within the project alignment would be relocated as necessary to facilitate construction. These relocations would occur during early construction in advance of other construction activities associated with the PAX project at any given location.

As the design of the project advances, the relevant utility owners will be identified, and designs for utility relocations would be developed using information from the facility owners, including determinations for the entity that will be responsible for undertaking the relocations and how the costs of the relocations will be allocated. Construction activities, including relocation of utilities, would be coordinated by a designated Utility Coordinator with the various utility companies and agencies to avoid or minimize service disruptions during construction, thus resulting in minimum impact to the public.

The utility desktop study concluded that utility relocations for Alternative C may need to occur where Track 1 (eastern track) crosses 16th Street and Mariposa Street. At 16th Street, the tunnel crown of this alignment may intercept existing utilities identified as an 8-inch sanitary sewer, 30-inch natural gas line, communication lines, varying sizes of electrical distribution, and a 16-inch water main. At Mariposa Street, the U-wall construction for the easterly track beginning at Station 1025+50 to approximately Station 1038+00 may conflict with electrical transmission and distribution of various sizes, communication lines, 16-inch auxiliary water supply system, and a pair of 16-inch water mains. The location and depths of these utilities will need to be verified in future phases, and the utilities may need to be relocated during construction.

9.0 Right-of-Way and Property Issues

The Preliminary Right-of-Way Acquisition Assessment is intended to identify properties that are potentially impacted by the Pennsylvania Avenue Tunnel Extension Project (PAX) and to develop an initial high-level cost estimate for the ROW program. This assessment is included as Appendix G. The primary purpose of the ROW Assessment is to evaluate the right-of-way (ROW) impacts for alternative alignments and to compare relative ROW impacts between alternatives for cost, risk, and schedule.

9.1 Alignment Alternatives Considered

ROW impacts and costs have been identified for three separate alignment alternatives. The alternatives considered are as follows:

- A1/A2: Long Alignment – Single Bore/Twin Bore Tunnels
- B1/B2: Mid-Length Alignment – Single Bore/Twin Bore + SEM Tunnels
- C: Short Alignment – Split Tunnels

The ROW impacts for each of these alignments are detailed in the ROW Plan. The purpose of the plan is to identify property impacts for each alternative and quantify costs and other impacts for each alternative.

9.2 Property Identification

Potentially impacted properties were identified for each alternative. Parcels were included if any portion of a parcel is expected to be impacted by the surface or subsurface permanent structure from a given alternative. This report does not include potential impacts from surface settlement outside the plan limits of the permanent project structures.

9.3 Property Valuation

Taxable property values for parcel and structures were provided by the San Francisco Assessor Office. These tax values were escalated based on the last date of sale to bring expected property values to a consistent current value. Escalation values are based on Federal Reserve published data shown in Figure 9-1. Price indexes are published for both single-family residential properties and condominiums.

Figure 9-1. Federal Reserve Property Price Index for Condominiums (source: Federal Reserve Bank, St. Louis)

9.4 Property Impacts

Property impacts are divided into properties that will potentially require full property acquisition and those requiring permanent subsurface easements without impacts at the parcel surface.

ROW impacts for properties requiring permanent subsurface easements are evaluated based on several criteria including potential future development use of the parcel, depth of subsurface impact, and the value of existing structures. The cost of ROW impacts is based on the current estimated property value and the following criteria.

Property Acquisition

- **Commercial properties:** Estimated value has been escalated from County Assessor's Records. If development entitlements have been obtained since the last property sale, 15% of entitled value increase will be added to the property value.
- **Residential properties:** Estimated value has been escalated from the County Assessor's Records. In addition to fair market property value, there are additional potential relocation assistance costs in the event either residential or nonresidential displacements occur. This category can include "consequential displacements." A consequential displacement is displacement of "a person, business, farm, or nonprofit organization from the unacquired remaining property as a direct result of acquisition for the proposed project" (Caltrans Right of Way Manual Chapter 10.011.03.07).[2] Temporary displacements may also be eligible for relocation assistance.

Subsurface Easements

[2] See also 49 CFR Part 24 (Uniform Act.) California Government Code 7260, et seq. and California Code of Regulations, Title 25, Division 1, Chapter 6.

- **20–40 foot tunnel cover**
  - **Residential:** 50% of impacted property value
  - **Commercial:** 50% of value of current plus 10% of potential future development value.

  This impact value is intended to account for both the cost of sub-surface easements and settlement mitigations for structures where required.
- **40+ foot tunnel cover**
  - **Residential:** 20% of impacted property value.
  - **Commercial:** 20% of impacted structure plus 5% of potential future development value.

  The reduced impact costs for properties where the tunnel is further below ground surface is due to several factors:
    - Reduced potential for ground-borne vibrations.
    - Generally better ground conditions at deeper tunnel sections will produce smaller surface impacts.
    - Reduced settlement mitigation requirement.
    - Minimal impact to future development on the property.

Partial Easements at Large Parcels

- **Residential and Commercial:** 10% of impacted property value.

Several large parcels are impacted over a small percentage of the overall parcel area. In these cases, a reduced easement impact was assumed.

9.5 Construction Staging Areas

Potential staging areas are on parcels owned by Caltrain, Caltrans, or the City and County of San Francisco. The PAX contractor may choose to lease privately owned parcels in the project area to facilitate construction of the project. Several viable parcels were identified in the vicinity of Pennsylvania Avenue and Cesar Chavez Street. Based on recent sales, tax records and appreciation, the estimated market value of these parcels is between $4 million and $5 million per acre. Based on a lease term of seven years and industry experience with similar construction staging leases, the total lease cost is expected to be 66% of the market value. This cost includes required site improvements and restoration at the end of the lease. This also assumes 7 acres of construction staging will be required at the high end of the property value range. The cost estimate for construction staging is summarized in Table 9-1 below.

Table 9-1. Construction Staging Area Cost Estimate

Total Acres for Construction Staging	Total Property Market Value	Term of Lease (in Years)	Total Leasing Cost of Construction Staging
7.0	$35,000,000	7	$23,000,000

9.6 Summary of Alternative Impacts

The ROW impact estimates are summarized in Table 9-2 below. Note that these estimates do not include the estimated costs for leasing of construction staging areas included in Section 9.5.

Table 9-2. Summary of ROW Impacts

Alternative	Total ROW Impact
A1: Single Bore TBM	$ 70,000,000
A2: Dual Bore TBM	$150,000,000
B1: Single Bore TBM	$ 30,000,000
B2: Dual Bore TBM	$100,000,000
C1	$ 25,000,000
Note: ROW impact estimates are considered preliminary.	

10.0 Project Risks

Evaluation of project risk is important for the comparison of alternative alignments and development of risk response and mitigation strategies early in the project development process. A robust risk management program is also important so that the risk processes assist with informed decision-making and procurement strategy, follow-on tasks, future provision of cost and schedule contingency, as well as gaining federal funding. Two risk workshops were held in the fall of 2020 and the spring of 2021, during which the project team and the Technical Advisor Group discussed and evaluated a number of risks related to the PAX project. One additional risk workshop, reviewed proposed controls/mitigations for risks, was held in May of 2021.

10.1 Approach

1. **Risk Identification:** Risk identification involves members of the project team who participate in the characterization of the project and are able to identify risks to the project via a collaborative brainstorming process. Risk statements are then captured on a Risk Register, assigned an identification number, and categorized by discipline.
2. **Risk Register:** Capturing risks in a Risk Register provides a basis for further action to reduce the potential loss, or at least recognition that some project elements will not be known until they occur. Identifying these elements provides a means for analyzing the impact of these risk elements and preparing the risk response strategies to address project losses. Another benefit is to focus the project development on the most significant potential risk events and the risk response strategies to minimize their potential impacts. A systematic means of capturing these risks is through the use of a Risk Register.
3. **Workshop Process:** The Project Risk Register was developed with initial input from members of the project team and updated during a risk workshop in September 2020. The Risk Register was subsequently updated following completion of the Alternatives Analysis period. The Risk Register was again reviewed at an ensuing workshop in March 2021, at which project team members and the Technical Advisory Group (TAG) reviewed the risks previously identified on the Risk Register and evaluated the cost impact, schedule impact, and probability of occurrence for each risk.
4. **Risk Scoring:** Project risks were identified, evaluated, and scored for each alignment alternative. Risks on the Risk Register were scored so that their significance can be prioritized and tracked by the project team. Risks were measured or assessed as to:
    - Potential (and most likely) cost impact (C): Scored 1 to 5.
    - Potential (and most likely) schedule delay (T): Scored 1 to 5.
    - Probability of occurrence (P): Scored 1 to 5.
    - The total score will be arrived at through averaging the cost and schedule impact scores and multiplied by the probability score: (C+T) / 2 x P = Total Score.
    - As an example:
        - (C) Cost Impact = 1
        - (T) Time impact = 4

- (P) Probability = 5
- Score = 1 + 4 = 5; / 2 = 2.5; x 5 = 12.5 or a "High Risk"

Table 10-1 below represents the matrix used to score and rank risks on the Risk Register:

Table 10-1. Risk Scoring Matrix

Score	Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)	Risk Score (Average of Cost and Schedule Impact X Probability)
(C) Cost	< $2M	$2–5M	$5–10M	$10–50M	> $50M	High > 10
(T) Time	< 1 Month	1–3 Months	3–6 Months	6–12 Months	>12 Months	Med 3–10
(P) Probability	< 10%	10–50%	50–70%	70–90%	>90%	Low <3

5. **Risk Response:** Risk response planning includes mitigations through avoidance, transfer to the party best equipped to manage, and attempts to control the likelihood and/or magnitude of the consequences. However, some risks are unavoidable and must be accepted and addressed through the issuance of insurance, or consumption of planned cost contingency or schedule float when appropriate. As a next step, project risk responses should be developed for each risk on the Risk Register. Risk response planning should identify the response approach, an action, an appropriate "owner" of the response, and a due date for implementation.

10.2 Findings

1. The compiled Risk Register is included in this report as Appendix H. A total of 47 risks have been identified for the project.
2. Major risks identified in the Risk Registry include risks in the following areas:
   a. Settlement from tunneling operations;
   b. Impacts to existing utilities;
   c. Impacts to rail operations during construction;
   d. Coordination with the DTX and Railyards projects;
   e. Impacts to infrastructure including the I-280 viaduct and existing Caltrain tunnels;
   f. Responsibility for ownership/operations; and
   g. Project funding.
3. Table 10-2 shows risks receiving a high score in one or more of the alignment alternatives. Based on the risk scoring matrix (Table 10-1), Alignment Alternative C had the largest quantity of "high" scored risks with 11; Alignment Alternatives A1, A2, and B2 each had 9 "high" scored risks, and Alignment Alternative B1 had 8 "high" scored risks. Note that the number of "high" scored risks alone does not present the full picture of the risk assessment that was performed and must be reviewed along with Figure 10-1, which provides a summary of the quantities of "high," "medium," and "low" scored risks across each alignment alternative.

Table 10-2. "High" Scored Risks by Alignment Alternative

ID	Risk Description	A1	A2	B1	B2	C
1	Mixed-face (rock and soil) mining causes ground loss	✓		✓		
3	Liquefaction during earthquake requires repairs to the permanent structure					✓
7	Less than favorable ground conditions at south portal require additional support	✓				
8	Specialized work limits bidders and increases costs beyond established budget	✓		✓		✓
9	Limited staging areas increase general condition costs of contractor					✓
10	Limited work windows negatively impact contractor production rates					✓
11	General utility impacts from settlement necessitate unplanned repair and restoration	✓	✓	✓	✓	
12	Phasing of project into separate packages increases schedule					✓
16	Caltrans freeway bridge piers impact TBM operation		✓		✓	✓
18	DTX tie-in impacts system operations	✓	✓	✓	✓	✓
19	Railyards development timing impacts PAX schedule	✓	✓	✓	✓	✓
24	Relocation of 22nd Street Station increases project cost—federal process may require justification	✓	✓			
27	Limited public right-of-way on 7th Street increases right-of-way costs		✓		✓	
29	Development of property at 17th and Pennsylvania drives up acquisition costs or leads to late redesign		✓		✓	
32	Curves and grades increase maintenance and may drive up future operational costs			✓	✓	
39	Construction dust and air pollution lead to potential fines and or additional mitigations					✓
43	Political support is insufficient, requiring additional studies or analysis					✓
44	Sufficient construction funding does not become available	✓	✓	✓	✓	✓
45	Responsibility for ownership/operations cannot be determined	✓	✓	✓	✓	
	Total	**9**	**9**	**8**	**9**	**11**

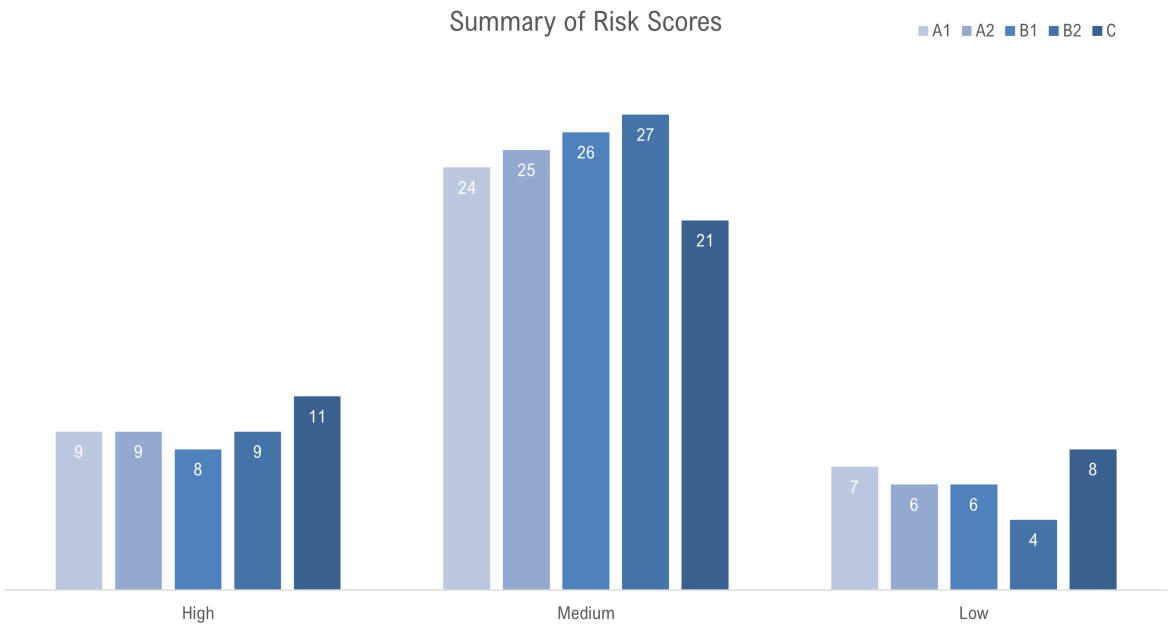


Figure 10-1. Summary of Risk Scores by Alignment Alternative

11.0 Project Schedule and Costs

11.1 Approach

Conceptual project cost estimates and schedules were prepared using pricing data from recent detailed production-based cost estimates for similar work and adjusted as needed for quantities and special conditions unique to the PAX alignments. An example of special conditions is the low operating headroom under the I-280 viaduct that will require specialized construction equipment. For some project components such as internally braced excavations, concrete structures, and the I-280 column retrofits, detailed takeoffs were performed and priced. Specialty construction items such as slurry wall construction and ground improvement were estimated based on anticipated quantities and recent subcontract quotes adjusted for the constrained site conditions. For other complex work with unknown scope, such as the Folsom Street Sewer protection in place for Alternative C, budgetary cost and schedule numbers were used.

Design and construction criteria were established based on available information, and associated risk was priced directly into the work when it was deemed to have a high probability of occurring. An example of this is the need for ground improvement between twin bores for the indicated configurations of Alternatives A2 and B2.

Estimates were prepared using current costs, escalated to the mid-point of construction, and rounded up to the nearest $10 million. Escalation was informed by producer price indices data for the past 3 years obtained from the U.S. Bureau of Labor Statistics website (http://data.bls.gov/cgi-bin/srgate) for a weighted "basket of goods" comprising labor, materials, and equipment. Escalation for the basket of goods amounts to 3.1% per year.

The COVID-19 pandemic has created significant uncertainty in the markets. The same basket of goods evaluated each year for 2018, 2019, and 2020 resulted in annual escalation rates of 4.6%, -0.6%, and 4.8%, respectively. Looking forward, continued volatility is likely as the manufacturing and shipping industries reopen plants and gear up for as-yet uncertain post-pandemic production rates, while financial markets face concerns with increased inflation. Such volatility should continue to be expected for the short term. We considered a long-term average escalation rate of 5% over the life of the project as appropriate, to be consistent with TJPA's approach and to be conservative in the current inflationary environment.

"Soft costs" such as design, project management, construction management, and owner administration were estimated based on historical soft costs from other similar transportation projects and a publication by the Transportation Research Board's Transit Cooperative Research Program (TCRP) Report 138: *Estimating Soft Costs for Major Public Transportation Fixed Guideway Projects* (TRP, 2010). A 20% contingency for soft costs was applied. A range of soft costs was determined for each alternative, with the low end assuming a three-year period for preconstruction activities and a 4-year period for the high end. Soft costs including contingency vary from $197 million for a 3-year preconstruction period to $310 million for a 4-year preconstruction period, or approximately 19% to 30% of an average construction cost for the alternatives. Since the level of effort associated with soft costs is not expected to vary significantly between the construction alternatives, $310 million was used for all alternatives.

An additional 50% allowance was included for project contingency on construction costs and is an appropriate amount to carry at this conceptual stage of project definition. Summarized cost and schedule durations are presented in Table 11-1 and Table 11-2. A detailed project schedule and cost estimate for each alternative are provided in Appendix I and Appendix J, respectively.

11.2 Cost

The cost range between project alternatives is also relatively narrow: Alternative C at $2,010 million has an 18% lower cost than the highest cost of $2,450 million for Alternative A2. The lowest estimated cost among alternatives A1, A2, B1, and B2 is B1 at 13% below the most expensive estimated alternative (A2). This low cost spread between alternatives indicates that selection of the preferred alternative will not be significantly influenced by cost. The cost of the station configuration and components that is associated with each alternative (as shown in Table 11-1 below) and the risk profiles for each alternative will likely be the overriding criteria in determining the preferred alternative. It should be noted that the cost ranges for the alternatives do not address station design and construction, which are outside the scope of this study. New trackwork where required in the 22nd Street Station area is included in the proposed cost.

Table 11-1. Cost of Station Configuration and Components by Alternative

Component	(millions)				
	A1	A2	B1	B2	C1
Construction Costs[1]	**$730**	**$780**	**$710**	**$700**	**$690**
Construction Midpoint[2]	10.1 years	10.2 years	10.3 years	10.1 years	9.5 years
Escalated Construction Costs[3]	**$1,200**	**$1,290**	**$1,180**	**$1,150**	**$1,100**
ROW[1]	$90	$170	$50	$120	$40
ROW Acquisition Midpoint	3.1 years	3.1 years	3.1 years	3.1 years	3.1 years
Escalated ROW Costs[3]	**$110**	**$200**	**$60**	**$140**	**$50**
Soft Costs[4]	**$310**	**$310**	**$310**	**$310**	**$310**
Contingency	**$600**	**$650**	**$590**	**$580**	**$550**
Escalated ROW Costs, Soft Costs, and Contingency	**$1,020**	**$1,160**	**$960**	**$1,030**	**$910**
Total Project Cost	**$2,220**	**$2,450**	**$2,140**	**$2,180**	**$2,010**
Total Project Duration	**13.3 years**	**13.5 years**	**13.6 years**	**13.2 years**	**11.9 years**

[1]Q4 2021 Cost Basis

[2]Based on construction schedule prepared on 2/24/2022

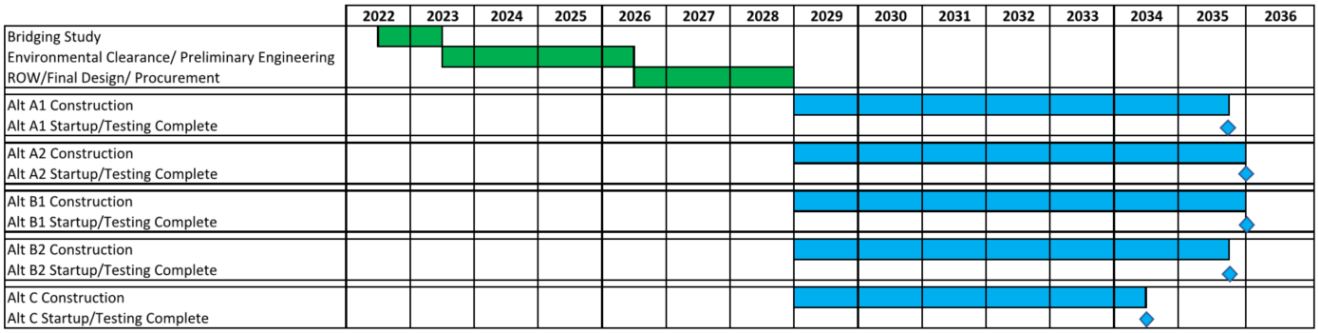
[3]Escalation carried at 5% PA

[4]Including $2M Bridging Study

11.3 Schedule

Project schedules based on major construction activities were prepared for each alternative, allowing for a 78-month period for CEQA clearance, real estate procurement, preliminary and final design, and construction contract procurement. It should be noted that no contingency has been applied to the project alternatives schedules on the basis that schedule risk will be addressed during subsequent project definition. Project schedules for the alternatives are summarized in Table 11-2 below.

Table 11-2. Project Schedule Summaries for Alternatives



The alternatives have an estimated duration of 11.9 to 13.6 years, which is inclusive of the remaining project development activities and construction. This relatively narrow range between alternatives indicates that selection of the preferred alternative will not be significantly influenced by schedule.

12.0 Environmental, Cultural, and Historic Studies

12.1 Findings of Studies Completed

12.1.1 Traffic

An initial traffic impact study (Appendix K) was undertaken that evaluated the delay that could be caused by excavation haul traffic on various intersections associated with the construction of the PAX project. The study modeled roadway traffic volume growth between the years 2015 and 2035 to assess future intersection changes and traffic volumes in a no-build scenario (without the project). In the analysis of the five alternative alignments, the traffic analysis also considered options for north and south tunnel bore starts to assess potential effects on traffic delays during construction/excavation.

Under existing conditions and under a no-build scenario level of service (LOS),[3] degradation (meaning significant increases in traffic delays) was notable both during AM and PM peak hours for nearly all intersections in the study area. Under the project, the only alternatives that would result in notable impacts on LOS during AM peak hours would be Alternatives A1 and A2, where Pennsylvania Avenue / Cesar Chavez Street / northbound I-280 off-ramp would be degraded from LOS E to LOS F during the construction phase. The only alternatives that would result in notable impacts on LOS during PM peak hours would be Alternatives A1, A2, B1, and B2, where both 7th Street / Brannan Street and 7th Street / 16th Street intersections would be degraded from LOS D to LOS E during project construction. All scenarios and alternatives significantly impact traffic operations except Alternative C. At least one intersection is impacted in every scenario, and Alternative A1/A2 impacts two intersections. The analysis of Alternative C showed that the study intersections could handle the additional estimated 13 trucks per hour.

The study also evaluated benefits associated with the operation of the PAX project. Under existing conditions, Caltrain crosses 16th Street and Mission Bay Drive east of 7th Street at surface or at-grade crossings. Additional delays due to the interruption of the signal cycle occur at these times for track clearance at the intersection. In future year 2035, 24 trains per hour (12 in each direction) are anticipated to be in operation, which would be associated with increases in congestion. Under a (2035) post-build scenario, traffic delays would be significantly reduced compared to no-build delays during both weekday AM and PM peak hours for the 7th Street / Mission Bay Drive and 7th Street / 16th Street intersections (from LOS F/E to LOS D/C).

12.1.2 Air Quality

The assessment of potential air quality constraints was based on a qualitative evaluation of the potential impacts on nearby receptors that could result from the project. Air quality does not affect individuals or groups within the population in the same way, and some groups are more sensitive to adverse health effects caused by exposure to air pollutants than others. Population subgroups more sensitive to the health effects of air pollutants include the elderly and children, such as those with higher rates of respiratory disease (e.g., asthma and chronic obstructive pulmonary disease), or land uses such as schools, children's

[3] Additional evaluation of traffic impacts including evaluation of project-generated vehicle miles traveled would be undertaken during subsequent environmental analysis of the PAX project.

daycare centers, hospitals, and nursing and convalescent homes, which support population groups with increased susceptibility to respiratory distress.

The potential impacts for construction activities that would be associated with each of the project alternatives are described below. Regarding operations, each of the alternatives would result in the relocation of train operations belowground and the associated removal of at-grade rail crossings at busy roadways. The project would generally result in a beneficial impact associated with long-term localized reduction in vehicle exhaust emissions along the PAX corridor because of the reduction in vehicle congestion that currently exists along adjacent streets during train crossings. In addition, although not directly related to the PAX project, Caltrain is purchasing 19 new high-performance seven-car electric train sets to replace the current diesel locomotive trains.[4] Caltrain will electrify the corridor from San Francisco's 4th and King Caltrain Station down through San Jose. Passenger service of the new electric trains is expected to begin in 2022. One of the primary purposes of Caltrain electrification is to improve regional air quality and lower greenhouse gas emissions. Electric train service would result in decreased diesel particulate emissions within the project corridor relative to existing conditions regardless of which alternative is selected. Because the operational beneficial impacts would be the same regardless of alternative, operational impacts are not discussed below for each of the alternatives.

12.1.2.1 Alternative A1

Emissions associated with tunneling would be vented to the atmosphere from either the north or south entry tunnel, three ventilation shafts along the alignment, and the south exit tunnel and ventilation shaft. These five locations represent the project's aboveground tunneling-related emissions sources, although the total emissions from the south exit tunnel and ventilation shaft would be substantially less than from the other four locations since tunnel excavation would proceed from the north. In addition to tunneling, this alternative would involve the most off-haul trips of excavated material because of the large dimensions of the single tunnel. Haul trucks would access the north entry tunnel to off-haul excavated tunnel materials.

Sensitive receptors in the vicinity of these five emission generation locations include:

- Crescent Cove apartments at Berry Street.
- A residential building at King and 7th within 150 feet and 200 feet, respectively, of the north entry tunnel and the northern-most ventilation shaft.
- Apartments approximately 100 feet from the 16th Street ventilation shaft site at 1050 17th Street.
- Single-family homes immediately adjacent to the 19th Street ventilation shaft site, and residences at 270 feet north of the southern exit tunnel and ventilation shaft. These residences would be exposed to elevated concentrations of toxic air contaminants for the duration of tunneling activities, which could pose a health risk to these neighborhoods.

[4] Obtained from Caltrain Modernization Program Overview and Electric Trains web pages at https://calmod.org/ and https://calmod.org/electric-trains/.

12.1.2.2 Alternative A2

Based on the combined volume of the twin tunnels under Alternative A2 relative to the volume of the single tunnel for Alternative A1, and the general assumption that excavation of a certain volume of material generates a certain mass of toxic air contaminants, this alternative would result in the generation of approximately 23% fewer toxic air contaminant emissions associated with tunneling and material hauling compared to Alternative A1. The TBMs for this alternative could be launched from the north or the south. It is presumed that most emissions associated with tunneling would be vented to the atmosphere from the north or the south entry tunnel, depending on the location of the entry tunnel, as well as from the same ventilation shaft sites discussed under Alternative A1. Haul trucks would also access the north or south entry tunnel to off-haul excavated tunnel materials. The same residential uses discussed under Alternative A1 would be affected by this alternative, potentially resulting in a health risk to these neighborhoods. Exposure concentrations in the vicinity of these residences would be elevated for the duration of tunneling activities.

12.1.2.3 Alternative B1

Based on the volume of the tunnel under Alternative B1 relative to the volume of the tunnel for Alternative A1, and the general assumption that excavation of a certain volume of material generates a certain mass of toxic air contaminants, there would be generation of approximately 30% fewer toxic air contaminants from tunneling and hauling under this shorter alternative compared to Alternative A1. Emissions associated with tunneling would be vented to the atmosphere from the north entry tunnel as well as from three ventilation shaft sites. The northern two ventilation shaft sites would be at the same locations as described for Alternative 1 and therefore would expose the same residences to pollutants; however, under this alternative there would be no 19th Street ventilation shaft, and the southern-most ventilation shaft would be under the southbound lanes of Interstate 280, just north of 22nd Street. This southern ventilation shaft site is approximately 50 feet from residences along Pennsylvania Avenue. Haul trucks would access the north entry tunnel to off-haul excavated tunnel materials. Exposure to concentrations in the vicinity of these residences would be elevated for the duration of tunneling activities.

12.1.2.4 Alternative B2

Based on the dimensions of the twin tunnels under Alternative B2 relative to the volume of the single tunnel for Alternative A1, and the general assumption that excavation of a certain volume of material generates a certain mass of toxic air contaminants, there would be approximately 54% fewer toxic air contaminants from tunneling and hauling under this alternative compared to Alternative A1. Emissions associated with tunneling would be vented to the atmosphere from the north entry tunnel as well as from the same three northern ventilation shaft sites as described for Alternative A1. These three ventilation shaft sites would expose the same residences to pollutants as identified for Alternative A1. Haul trucks would access the north entry tunnel to off-haul excavated tunnel materials. Exposure to concentrations in the vicinity of these residences would be elevated for the duration of tunneling activities.

12.1.2.5 Alternative C

It is presumed that emissions associated with tunneling would be vented to the atmosphere from the north entry tunnel as well as from approximately the same three northern ventilation shaft sites as described for Alternative A1. These three ventilation shaft sites would expose the same residences to pollutants as identified for Alternative A1. Haul trucks would access the entry tunnel to off-haul excavated tunnel materials. Exposure to concentrations in the vicinity of these residences would be elevated for the duration of tunnel-boring activities. However, emissions associated with cut-and-cover techniques under Alternative C would be released to the atmosphere where they are generated along the alignment. This would result in lower emission concentrations at the north entry tunnel and ventilation shaft sites compared to the two southern ventilation shaft sites, as well as lower emission concentrations at any one location along the cut-and-cover alignment compared to at the north entry tunnel and ventilation shaft sites under the other alternatives since cut-and-cover work would proceed in open-air conditions at a linear pace along the alignment. Such release along the alignment would thus have the effect of diluting pollutants emitted to the atmosphere at any single location along the length of the cut-and-cover alignment as opposed to emitting more concentrated emissions at the discrete ventilation point locations (i.e., at the north entry tunnel as well as the three northern ventilation shaft sites).

12.1.3 Noise and Vibration

The assessment of potential constraints associated with noise and vibration was based on a qualitative evaluation of the potential impacts on nearby noise and vibration receptors that could result from the project. The evaluation of construction impacts reflected consideration of the duration of construction, type of construction (e.g., pile driving), and proximity of construction and staging areas to sensitive receptors such as residences as well as to each other. The evaluation of operational impacts considered the proposed depth of tunnels and proximity of these tunnels to sensitive receptors.

Some land uses are considered more sensitive to ambient noise levels than others because of the amount of noise exposure (in terms of both the duration of exposure and insulation from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, and auditoriums generally are more sensitive to noise and vibration than are commercial and industrial land uses. Residential uses exist at the northern end of the project alignment as close as 150 feet.

The designation of vibration-sensitive land uses depends not only on the type of activities commonly associated with a given land use, but also considers nearby structures that could be damaged by vibration-inducing activities. More than a dozen historic architectural resources are located within or adjacent to the project corridor (refer to Section 12.1.5). High-sensitivity uses also include land uses where vibrations would interfere with interior operations and include hospitals, research operations, television and recording studios, and concert halls.

12.1.3.1 Alternative A1

Construction Noise

Although this alternative would have the longest tunnel, it would be excavated using a TBM as opposed to cut-and-cover techniques; as such, only the tunnel portals and ventilation shaft portals would experience at-grade construction noise. Therefore, construction noise impacts would be focused at the two tunnel portal ends and, to a much lesser degree, the three ventilation shaft portals. Excavation portals under this alternative would be more than 150 feet from the closest noise-sensitive receptors at the northern portal, while residences located north of 25th Street would be within 270 feet of the southern portal. However, existing ambient noise levels at these receptors are already high because of the presence of the I-280 ramp flyovers, so the increase in noise over ambient conditions would not be expected to be substantial. This alternative would have the greatest number of trucks being loaded to off-haul excavated materials from the portals, which would have a moderate impact on noise levels along roadways used to access the freeway.

Construction Vibration

Depending on the method employed, support of excavation for the cut-and-cover structure at the DTX/PAX interface and TBM operations could have vibration impacts depending on depth of tunnel, underlying soil types, and overlying land uses such as residences or biotech facilities with vibration-sensitive equipment (e.g., MRI or electron microscopy). However, the distance of tunnel portals from the nearest structure is likely sufficient to avoid building damage or sensitive equipment impacts.

Operational Noise

Overall, Alternative A1 would result in beneficial operational noise impacts within the project corridor as a result of at-grade rail operations being relocated within a new tunnel and the removal of at-grade crossings at Mission Bay Drive and 16th Street, which generate noise during train crossings from warning bells and required horn blasts. The four ventilation shafts would represent potential new noise sources that would have to be evaluated with respect to Federal Transit Administration criteria for each location established in its *Transit Noise and Vibration Impact Assessment Manual* (FTA, 2018).

Operational Vibration

The realignment of rail tracks from at-grade to underground would result in vibrations from rail operations being generated in new locations. The Alternative A1 tunnel would relocate existing rail operations to locations directly beneath six existing residential uses at Pennsylvania Avenue and 25th Street, as well as under Pennsylvania Avenue where residential uses exist on both sides of the street from Mariposa Street to 22nd Street. The FTA would likely require a quantitative analysis of the potential vibration-related operational impacts associated with the selected alternative. Typically, the heavier the transit structure, the lower the vibration levels. The vibration levels from a cut-and-cover concrete double-box subway can be assumed to be lower than the vibration from a lightweight concrete-lined bored tunnel (FTA, 2018). As tunneling generates greater operational vibration than a cut-and-cover concrete double-box subway, Alternative A1, like all tunneled alternatives, would generate more operational vibration than Alternative C.

12.1.3.2 Alternative A2

Construction Noise

This alternative would likely have the longest duration of construction and noise impacts associated with the use of TBMs. This alternative would have a reduced number of trucks being loaded to off-haul excavated materials from the portals compared to Alternative A1 because of the reduction in excavated material. Excavation portals under this alternative would be at the same locations as Alternative A1 and would result in the same impacts on noise sensitive receptors. Consequently, other than a slightly reduced construction duration, the construction noise impacts associated with Alternative A2 would be the same as Alternative A1.

Construction Vibration

Depending on the method employed, support of excavation for the cut-and-cover structure at the DTX/PAX interface and TBM operations could have vibration impacts depending on depth of tunnel, underlying soil types, and overlying land uses such as residences or biotech facilities with vibration-sensitive equipment (e.g., MRI or electron microscopy). However, the distance of tunnel portals from the nearest structure is likely sufficient to avoid building damage or sensitive-equipment impacts. Consequently, other than a slightly reduced construction duration, the construction vibration impacts associated with Alternative A2 would be the same as Alternative A1.

Operational Noise

Operational noise impacts associated with Alternative A2 would generally be beneficial and would be the same as described for Alternative A1.

Operational Vibration

The realignment of rail tracks from at grade to underground would result in vibrations from rail operations being generated in new locations. The proposed tunnel would relocate existing rail operations to locations directly beneath six existing residential uses at Pennsylvania Avenue and 25th Street, as well as under Pennsylvania Avenue where residential uses exist on both sides of the street from Mariposa Street to 22nd Street. The western bore would be directly beneath existing residential uses on the west site of 7th Street between Hubbell Street and 16th Street and at the corners of 17th Street and Pennsylvania Avenue. The FTA would likely require a quantitative analysis of the potential vibration-related operational impacts associated with the preferred alternative. The potential for operational vibration impacts associated with Alternative A2 would be greater than for Alternative A1 because of the western tunnel bore locating railroad operations directly below more residential uses. As tunneling generates greater operational vibration than a cut-and-cover concrete double-box subway, Alternative A2, like all tunneled alternatives, would generate more operational vibration than Alternative C.

12.1.3.3 Alternative B1

Construction Noise

Although SEM work would involve excavators, the work would be conducted within a tunnel such that only the spur tunnel portals would experience at-grade construction noise. This alternative would likely have a shorter duration of construction and associated noise impacts because of the reduced tunnel lengths compared to Alternatives A1 and A2 and would have a reduced number of trucks being loaded to off-haul excavated materials from the portals because of the reduction in excavated material. The northern excavation portal under this alternative is at the same location as for Alternatives A1 and A2 and so is at the same distance to noise-sensitive receptors. The southern portal at 22nd Street has residential uses nearby. Consequently, because of reduced duration of construction and reduced truck trips compared to Alternatives A1 and A2, Alternative B1 would have a reduced potential for construction-related noise impacts.

Construction Vibration

Depending on the method employed, support of excavation for the cut-and-cover structure at the DTX/PAX interface and TBM operations could have vibration impacts depending on depth of tunnel, underlying soil types, and overlying land uses such as residences or facilities with vibration-sensitive equipment. However, the distance of tunnel portals from the nearest structure is likely sufficient to avoid building damage impacts. Consequently, other than a slightly reduced construction duration, the construction vibration impacts associated with Alternative B1 would be similar but slightly reduced in comparison to Alternatives A1 and A2.

Operational Noise

Operational noise impacts associated with Alternative B1 would generally be beneficial and would be similar to those of Alternatives A1 and A2.

Operational Vibration

The realignment of rail tracks from at-grade to underground would result in vibrations from rail operations being generated in new locations. The proposed tunnel would relocate existing rail operations to locations directly beneath 18 existing residential uses on the 500 block of Pennsylvania Avenue at 20th Street, as well as under Pennsylvania Avenue where residential uses exist on both sides of the street from Mariposa Street to 20th Street. The FTA would likely require a quantitative analysis of the potential vibration-related operational impacts associated with the preferred alternative. The potential for operational vibration impacts associated with Alternative B1 would be greater than for Alternatives A1 and A2, because of the tunnel bore locating railroad operations directly below more residential uses. Like Alternatives A1 and A2, Alternative B1 would have the potential for greater operational vibration generation than Alternative C because a bored tunnel generates more vibration a than cut-and-cover concrete double-box subway.

12.1.3.4 Alternative B2

Construction Noise

Although SEM work would involve excavators, construction of this alternative would primarily be conducted within a tunnel such that only the spur tunnel portals would experience at-grade construction noise. This alternative would likely have a shorter duration of construction and associated noise impacts because of the reduced tunnel lengths compared to Alternatives A1, A2, and B1 and would have a reduced number of trucks being loaded to off-haul excavated materials from the portals because of the reduction in excavated material. The northern excavation portal under this alternative is at the same location as for Alternatives A1, A2, and B1, so is at the same distance from noise sensitive receptors. The southern portal at 22nd Street has residential uses nearby. Consequently, because of reduced duration of construction and reduced truck trips compared to Alternatives A1, A2, and B1, Alternative B2 would have a reduced potential for construction-related noise impacts.

Construction Vibration

Depending on the method employed, support of excavation for the cut-and-cover structure at the DTX/PAX interface and TBM operations could have vibration impacts depending on depth of tunnel, underlying soil types, and overlying land uses such as residences or facilities with vibration-sensitive equipment. However, the distance of tunnel portals from the nearest structure is likely sufficient to avoid building damage impacts. Consequently, other than a slightly reduced construction duration, the construction vibration impacts associated with Alternative B2 would be similar but reduced in comparison to Alternatives A1, A2, and B1.

Operational Noise

Operational noise impacts associated with Alternative B2 would generally be beneficial and would be the similar to those of Alternatives A1, A2, and B1.

Operational Vibration

The potential for operational vibration impacts associated with Alternative B2 would be similar to Alternative B1, and greater than Alternatives A1 and A2, because of the tunnel bore locating railroad operations directly below more residential uses. Like Alternatives A1, A2, and B1, Alternative B2 would have the potential for greater operational vibration generation than Alternative C because a bored tunnel generates more vibration than a cut-and-cover concrete double-box subway.

12.1.3.5 Alternative C

Construction Noise

Cut-and-cover work would result in exposed at-grade excavation not associated with other alternatives that would occur over the length of the northbound (easterly) box from the DTX/PAX interface to the northern portal of Tunnel 1. TBM operations in the westerly tunnel would only generate noise at the portals' locations where soil and muck are removed.

This alternative would likely have a shorter duration of construction and associated noise impacts because of the reduced tunnel lengths compared to Alternatives A1 and A2. It would be similar to Alternatives B1 and B2 in that it would have a reduced number of trucks being loaded to off-haul excavated materials from the portals because of the reduction in excavated material compared to Alternatives A1, A2, and B2. The northern excavation portal under this alternative is at the same location as Alternatives A1, A2, B1, and B2, so is at the same distance from noise-sensitive receptors. The southern portal at 22nd Street has residential uses nearby. However, because of the requirements for cut-and-cover work along 7th Street, Alternative C would have the greatest potential for construction-related noise impacts.

Construction Vibration

Depending on the method employed, support of excavation for the cut-and-cover structure at the DTX/PAX interface and TBM operations could have vibration impacts depending on depth of tunnel, underlying soil types, and overlying land uses such as residences or facilities with vibration-sensitive equipment. However, the distance of tunnel portals from the nearest structure is likely sufficient to avoid building damage impacts. Consequently, the construction vibration impacts associated with Alternative C would be similar to all other alternatives unless sheet piles are required for shoring of the cut-and-cover trench.

Operational Noise

Overall, the proposed Alternative Alignment C would result in beneficial operational noise impacts within the alignment study area resulting from at-grade rail operations being relocated to within the proposed tunnel and from the removal of at-grade crossings at Mission Bay Drive and 16th Street with their associated warning bells and required horn blasts. The three ventilation shafts would represent potential new noise sources that would have to be evaluated with respect to FTA criteria for each location established in the *Transit Noise and Vibration Impact Assessment Manual* (FTA, 2018). Consequently, the operational noise impacts associated with Alternative C would generally be beneficial and would be the similar to those of the other alternatives.

Operational Vibration

The potential for operational vibration impacts associated with Alternative C would be similar to but greater than Alternatives A1 and A2 because of the tunnel bore locating railroad operations directly below more residential uses but less than those of Alternatives B1 and B2 as a result of reduced tunneling. In addition, the cut-and-cover concrete box subway proposed for the easterly tunnel under Alternative C could reduce vibration impacts along this route compared to the other alternatives.

12.1.4 Archaeological Resources

The evaluation of archaeological resources was based on a qualitative assessment of potentially adverse effects or significant impacts on archaeological resources that qualify for listing on the California Register of Historical Resources (California Register) or the National Register of Historic Places (National Register), or soils and landforms that may contain archaeological resources potentially eligible for either register. The evaluation considers factors such as sensitivity of landform for buried archaeological

resources, and the potential for construction activities to affect archaeological resources potentially eligible for either the California Register or the National Register.

No archaeological resources have been previously identified within the corridor or buffer area. The geotechnical report prepared for the PAX project (MJ/Slate, 2022b) identified that bedrock is located at the surface in the middle and southern end of the alignment. In these areas, there is a very low potential for archaeological resources on the surface and no potential for buried archaeological resources. Soils are present at the northern and south-central portion of the alignment. In these areas, soil stratigraphy can be generalized as artificial fill at the top 0 to 20 feet, which overlies Young Bay Mud that varies in thickness from 20 to up to 100 feet in depth. The layers below the Young Bay Mud vary throughout the alignment, but generally, below the Young Bay Mud is Colma Sand, Old Bay Clay, Alluvium/Colluvium, and then bedrock.

Artificial fill is sensitive for historical-era archaeological resources associated with early San Francisco settlement and development. Following the 1906 earthquake and fire, mass grading and landfill occurred throughout all affected areas of the City, with the goal to remove and dispose of rubble so that reconstruction could begin. Rubble from former structures was off-hauled or incorporated into underlying soils to create a new surface for redevelopment. These soils may also contain redeposited prehistoric material, which would have been disturbed as the reclamation of the San Francisco Bay occurred and during the post–Great Fire reconstruction. Younger Bay Mud and underlying soils have sensitivity for prehistoric archaeological resources (Meyer and Brandy, 2019). In general, this sensitivity is highest in Young Bay Mud and decreases with the age of soils.

The northern end of the alignment, in Mission Bay, was increasingly underwater between 8,000 and 2,000 years before present because of sea level rise (Meyer and Brandy, 2019). While the submerged areas were not accessible during this time period, the margin where the land and water met may have been a location of heightened prehistoric activity because of the important food and materials present along the shoreline. The northern portion of the alignment was within the tidal marsh of Mission Bay until the 1860s, when land reclamation efforts began. Before land reclamation efforts began, historical maps do not depict any maritime features, such as wharves or piers, within the northern portion of the alignment, and the water was very shallow, likely precluding maritime activities except possibly fishing camps.

The exact depth of previous disturbance of the soils along the proposed alignments is unknown. It is likely that in some areas previous construction has disturbed existing soils; however, the exact depth and extent of this disturbance are unknown.

12.1.4.1 Alternative A1

This alternative would require extensive soil disturbance. The total volume of soil disturbed would be the highest for all of the alignments; therefore, this alternative would have the highest potential to impact cultural resources. This alternative would require tunneling through Young Bay Mud soils at the northern end of the project corridor. These soils are considered moderately sensitive for prehistoric archaeological resources. Artificial fill at the northern end of the project corridor may also be sensitive for historical-era archaeological resources (Meyer and Brandy, 2019).

12.1.4.2 Alternative A2

This alternative would require a reduced amount of soil disturbance in comparison to Alternative A1, but because of the length of the proposed tunnel, still has a high potential to impact cultural resources. Alternative A2 would have similar but slightly reduced impacts in comparison to Alternative A1.

12.1.4.3 Alternative B1

This alternative would result in less soil disturbance than Alternatives A1 and A2 because of reduced tunnel length. Alternative B1 would have similar but slightly reduced impacts in comparison to Alternatives A1 and A2.

12.1.4.4 Alternative B2

This alternative would include slightly less soil disturbance than Alternative B1 and would have similar but slightly reduced impacts on archaeological resources.

12.1.4.5 Alternative C

This alternative would include a similar volume of soil disturbance as Alternatives B1 and B2. However, it would be excavated using a TBM and cut-and-cover techniques. Cut-and-cover work would result in exposed at-grade excavation. Cut-and-cover methods disturb a large amount of soil and would be used for Alternative C in a location that has moderate to high sensitivity for archaeological resources. Similar to other alternatives, Alternative C would require construction within Young Bay Mud soils that are moderately sensitive for prehistoric archaeological resources. Artificial fill at the northern end of the project corridor may also be sensitive for historical-era archaeological resources. Therefore, this alternative would have the highest potential to impact archaeological resources.

12.1.5 Cultural and Historic Resources

The evaluation of historic architectural resources was based on a qualitative assessment that considered potentially adverse impacts on resources that qualify for listing on the California Register and/or the National Register or on a property regulated by the U.S. Department of Transportation (DOT) under Section 4(f) of the Department of Transportation Act. Under Section 4(f),[5] a historic site must be of

[5] Resources regulated under Section 4(f) also include public parks and recreation lands (Figure 2). There are several parks located within or close to the project corridor including the Tunnel Top Community park located at the southern end of the project corridor. Although it is not anticipated that any parks would be directly impacted by the PAX project, these resources could be indirectly impacted during project construction as a result of construction noise, emissions, and traffic. Potential impacts on and appropriate mitigation for these resources would be evaluated in detail at the next stage of environmental review.

national, state, or local significance and be listed on or eligible for listing on the National Register under Criteria[6] A, B, and/or C.

More than a dozen historic architectural resources are located within or adjacent to the project corridor as follows:

- Historic resources located within the project corridor:
  - Bridges and Tunnels Historic District (eligible for listing on the National Register and California Register under Criteria A/1 and considered a Section 4(f) historic site; see description below)
  - 700–768 7th Street, Baker and Hamilton Building (San Francisco Landmark No. 193)
  - 600 Townsend Street, Charles Harley Co. (eligible for listing on the National Register as an individual resource under Criterion C and considered a Section 4(f) historic site)
- 300 Pennsylvania Avenue, Captain Adams House (included in the 1968 *Here Today* architectural survey [Olmsted and Watkins], which is an adopted local register)
  - 301 Pennsylvania Avenue, Richards House (eligible for listing on the California Register as an individual resource under Criteria 1 and 3)[7]
  - 331 Pennsylvania Avenue, Union Iron Works/Bethlehem Steel Co. Hospital (eligible for listing on the California Register as an individual resource under Criteria 1 and 3)[8]

[6] National Register Criteria consider the quality of significance in American history, architecture, archeology, engineering, and culture that is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- Criterion A. That are associated with events that have made a significant contribution to the broad patterns of our history;
- Criterion B. That are associated with the lives of persons significant in our past; and
- Criterion C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

[7] Documentation regarding the historic status of 301 Pennsylvania Avenue on file at the San Francisco Planning Department is inconsistent. When it was evaluated in 2008 as part of the Showplace Square Historic Resource Survey, it was recommended as eligible for listing on the California Register as an individual resource under Criteria 1 and 3. However, at the same time it was assigned a California Historical Resource Status Code of 3S, which means that it "appears eligible for the National Register as an individual property through survey evaluation." In order to determine if this property is in fact eligible for listing on the National Register and therefore a Section 4(f) historic site, confirmation should be requested from planning staff. See San Francisco Planning Department, *Showplace Square Historic Resource Survey Map,* accessed March 17, 2021, https://sfplanning.org/resource/showplace-square-historic-resource-survey-map.

[8] Documentation regarding the historic status of 331 Pennsylvania Avenue on file at the San Francisco Planning Department is inconsistent. When it was evaluated in 2008 as part of the Showplace Square Historic Resource Survey, it was recommended as eligible for listing on the California Register as an individual resource under Criteria 1 and 3. However, at the same time it was assigned a California Historical Resource Status Code of 3S, which means that it "appears eligible for the National Register as an individual property through survey evaluation." In order to

- 367 Pennsylvania Avenue (included in the 1968 *Here Today* architectural survey, which is an adopted local register)
- 400 Pennsylvania Avenue (included in the 1968 *Here Today* architectural survey, which is an adopted local register)

- Historic resources located within 200 feet of the project corridor:
  - Dogpatch Historic District (designated as a historic district under Article 10 of the Planning Code, which is an adopted local register)
  - Bluxome Townsend Warehouse Historic District (eligible for listing on the California Register under Criteria 1 and 3)
  - 135 Mississippi Street, Berger & Carter Co. (eligible for listing on the California Register as an individual resource under Criterion 3)
  - 199 Mississippi Street, Potrero Exchange Hotel (eligible for listing on the California Register as an individual resource under Criterion 3)
  - 1200 17th Street (only the brick building on 17th Street is eligible for listing on the California Register as an individual resource under Criterion 1)

12.1.5.1 Bridges and Tunnels Historic District

The discontiguous Bridges and Tunnels Historic District is located entirely within the project corridor. The district is composed of four contributing structures: two brick and concrete tunnels and two steel bridges, all of which were constructed between 1904 and 1907. These structures are known as Tunnel No. 1 (a 1,817-foot-long single tunnel that extends from milepost 1.33 to milepost 1.67), Tunnel No. 2 (a 1,086-foot-long double tunnel whose western portal has been partially infilled with brick and that extends from milepost 1.93 to milepost 2.14), 22nd Street Bridge (near milepost 1.70), and 23rd Street Bridge (near milepost 1.85).[9]

The district was identified in 2001 as part of the Planning Department's Central Waterfront Survey and determined to be eligible for listing on the National Register under Criterion A because of its association with the development of the Central Waterfront, an area characterized by its mixed industrial and residential uses. As such, it is considered a Section 4(f) historic site. A period of significance was not identified; however, it can logically be presumed to be 1904–07, which corresponds to the construction of the bridges and tunnels. The structures were found to retain a high degree of integrity. Additionally, the tunnels and bridges were determined to be individually eligible for listing on the California Register;

determine if this property is in fact eligible for listing on the National Register and therefore a Section 4(f) historic site, confirmation should be requested from planning staff. See San Francisco Planning Department, *Showplace Square Historic Resource Survey Map,* accessed March 17, 2021, https://sfplanning.org/resource/showplace-square-historic-resource-survey-map.

[9] San Francisco Planning Department, State of California Department of Parks and Recreation (DPR) Series 523 Form-sets for the Bayshore Cutoff Tunnels No. 1 and 2 (P-38-004820), 22nd Street Bridge (P-38-004498), 23rd Street Bridge (P-38-004756), July 20, 2001.

because eligibility for listing under specific criterion/criteria was not specified, they are presumed to be individually eligible for listing under California Register Criterion 1 (events).[10]

12.1.5.2 Alternative A1

Construction

This alternative has the potential to result in direct and indirect construction impacts to the discontiguous Bridges and Tunnels Historic District. Alternative A1 would overlap with the boundaries of the district in one location: at the south end of Alternative A1 just south of 25th Street. Additionally, this alternative has the potential to result in new and/or increased vibration impacts to the aboveground historic resources located within the project corridor.

Operation

Alternative A1 includes excavation directly below Pennsylvania Avenue. This alternative would move the existing Caltrain alignment closer to a number of historic resources within the project corridor, particularly those located on Pennsylvania Avenue. This could result in new and/or increased operational vibration impacts to historic resources that are currently not impacted by Caltrain operations.

12.1.5.3 Alternative A2

Construction

Similar to Alternative A1, this alternative has the potential to result in direct and indirect construction impacts to the discontiguous Bridges and Tunnels Historic District and could have similar new and/or increased vibration impacts to the aboveground historic resources located within the project corridor.

Operation

Operational historic property impacts associated with Alternative A2 would be similar to those associated with Alternative A1.

12.1.5.4 Alternative B1

Construction

Similar to Alternatives A1 and A2, Alternative B1 could result in direct and indirect construction impacts to the discontiguous Bridges and Tunnels Historic District and could have similar new and/or increased vibration impacts to the aboveground historic resources located within the project corridor.

[10] Ibid.

Operation

Operational historic property impacts associated with Alternative B1 would be similar to those associated with Alternatives A1 and A2.

12.1.5.5 Alternative B2

Construction

Similar to Alternatives A1, A2, and B1, Alternative B2 could result in direct and indirect construction impacts to the discontiguous Bridges and Tunnels Historic District and could have similar new and/or increased vibration impacts to the aboveground historic resources located within the project corridor.

Operation

Operational noise impacts associated with Alternative B2 would be similar to those associated with Alternatives A1, A2, and B1.

12.1.5.6 Alternative C

Construction

Similar to all other alternatives, Alternative C could result in direct and indirect construction impacts to the discontiguous Bridges and Tunnels Historic District. Alignment C would overlap with the boundaries of the district in two locations: at the north end of Tunnel No. 1 (near Mariposa Street) and at 22nd Street (the location of the 22nd Street Bridge, which would not be impacted by the project). Additionally, this alternative also has the potential to result in new and/or increased vibration impacts to the aboveground historic resources located within the project corridor.

Operation

Operational noise impacts associated with Alternative C would be similar to those associated with Alternatives A1, A2, B1, and B2.

12.2 Hazards and Hazardous Materials

The preliminary assessment of impacts associated with the presence of hazards[11] was based on a qualitative evaluation of the potential risks posed by the presence of former and existing hazardous sites in the project corridor. A potential impact would occur if a known hazardous site or contaminated soil or groundwater was encountered during construction, thereby exposing workers, general public, or the environment to hazardous materials. For discussion of potential impacts associated with unknown hazards associated with contaminated soil and groundwater, refer to the hydrology and geotechnical reports prepared for the PAX project (MJ/Slate, 2022a,b). This analysis considers construction impacts only;

[11] This analysis focuses on potential impacts associated with hazardous sites. Impacts associated with the use of hazardous materials during construction would likely be common to all alternatives and so are not discussed in this report but would be addressed in subsequent environmental review.

once constructed, the project would not affect or be affected by hazardous sites, and therefore operational impacts[12] are not discussed here.

The presence and potential release of hazardous materials and contaminants in subsurface soil and/or groundwater may affect the indoor or outdoor air, or air within a trench used by construction workers. Additionally, workers may be directly exposed to groundwater while performing activities in subsurface trenches or to contaminants in the subsurface soil and/or groundwater via incidental ingestion, dermal contact, and inhalation of vapor and dust particles.

The types of hazardous materials sites located in the project corridor consist of Leaking Underground Storage Tank (LUST) Cleanup Sites, various DTSC Cleanup Sites, and Cleanup Program Sites.[13] While closed sites would not likely pose a potential risk during construction, there are three open sites within the project corridor that could pose a risk during construction.

- ***Mission Bay – Mission Bay Redevelopment Area (Cleanup Program Site)*. Cleanup Status: Open – Site Assessment as of May 14, 2009**. Environmental investigations conducted at the site indicate that the principal chemicals present are petroleum hydrocarbons associated with the former bulk petroleum operations. In 1999, a Risk Management Plan (Environ, 1999) was approved by the Regional Water Quality Control Board (RWQCB). In 2000, a covenant and environmental restriction ("deed restriction") was executed for this property. Any construction activities within the boundaries of this property would require approval from the RWQCB prior to commencement (Catellus, 2000). Construction activities along the northern portions of all alignment alternatives (i.e., along the northern extent of Pennsylvania Avenue, 7th Street, and Townsend Street) would occur in proximity to this site and may encounter contaminated soil or groundwater, or may be planned within the boundaries of the existing covenant.
- ***Former Chevron Bulk Terminal (LUST Cleanup Site)***. **Cleanup Status: Open – Remediation as of June 30, 2017.** This site is the location of a former Standard Oil Company of California bulk storage and distribution facility, which was in operation from the late 1800s until 1974. The facility occupied an area bordered by 8th, Irwin, 7th, and Hubbell Streets. Multiple site investigations indicate the presence of petroleum hydrocarbons in the soil and groundwater at this site. Results of groundwater investigation conducted at the site also indicate the presence of light non-aqueous phase liquid (LNAPL; e.g., petroleum product floating on groundwater). Soil vapor investigations detected total petroleum hydrocarbons as gasoline (TPH-G) exceeding the residential and industrial shallow soil gas ESLs in three of six soil vapor probes (ARCADIS, 2014). Construction activities along the northern portions of all alignments (i.e., along 7th and

[12] This analysis assumes that any potential soil or groundwater contamination identified prior to construction would be avoided or mitigated, so as to not expose construction workers, the public, or the environment to any hazardous materials. Although, as discussed under construction impacts, there is a potential for the volatilization of contaminants in subsurface soil and/or groundwater, which could seep into air within the project tunnel during operation. However, it is assumed that vapor intrusion into the tunnel would be prevented through standard tunnel construction measures that would seal the tunnel from groundwater inflow.

[13] For location and additional details of specific sites, see Appendix L, the Pennsylvania Avenue Extension Study Environmental Constraints Analysis (ESA/MJ, 2022).

Townsend Streets) would occur in proximity to this site and may encounter contaminated soil or groundwater.

- ***Infoimage, Inc. (DTSC Evaluation Site)*. DTSC Status: Inactive – Needs Evaluation as of December 1, 1992**. In 1992, lead and total petroleum hydrocarbons (TPH) were detected in soils within the fill materials at this site. Groundwater and surface water are indicated as possible pathways of contamination. In 1995, remediation was proposed, but it is unclear if any remediation was implemented; DTSC does not have a copy of a report confirming that remediation was implemented. In 1999, the site was reported to have been paved over. As of 1999, the site is in use as a storage rental facility. Further evaluation was recommended to determine if any remediation was implemented and whether additional work is needed (DTSC, 1999).

In addition, the Caltrain Yard is listed by the EPA as a small-quantity generator of hazardous waste and is on EPA databases. Contaminated soil cleanup has occurred at this site (TJPA Transbay Transit Center Supplemental EIS/EIR, 2015).

12.2.1 Alternative A1

The Cleanup Program and LUST Cleanup Sites at the northern portion of Alternative A1 could impact construction activities as a result of potential soil and groundwater contamination. The DTSC Evaluation Site, near the intersection of Pennsylvania Avenue and 23rd Street, could also impact the construction of this alternative, as site records indicate the potential for soil and groundwater contamination. As the contamination at this site is unconfirmed, further investigation is recommended prior to excavation to accurately characterize the contamination at this site.

Additionally, as discussed above, there are 12 LUST Cleanup Sites located within the proposed route of this alignment, all of which are now closed. The records for these sites have been reviewed to determine if there is any indication that residual contamination is present and might be encountered during construction. Based on the review, records indicate that encountering any residual contamination from any of these closed sites is considered unlikely.

12.2.2 Alternative A2

Impacts associated with this alignment would be similar to those associated with Alternative A1.

12.2.3 Alternative B1

Although Alternative B1 is shorter than the previous two alignments, it could still be impacted by the presence of the Cleanup Program and LUST Cleanup Sites at the northern portion of this alignment described under Alternative A1. However, as this alignment would terminate north of the DTSC Evaluation Site, between 20th and 22nd Streets, it is unlikely to be affected by any potential contamination associated with this site. Similar to Alternative A1, the 12 LUST Cleanup Sites that were identified have been closed and would not result in any impacts associated with this alignment.

12.2.4 Alternative B2

Impacts associated with this alternative would be similar to those associated with Alternative B1.

12.2.5 Alternative C

Impacts associated with this alternative would be similar to those associated with Alternatives B1 and B2. As with Alignments B1 and B2, because this alignment terminates north of the DTSC Evaluation Site, it is unlikely to be affected by any potential contamination associated with this site.

12.3 Environmental Justice

The evaluation of potential impacts associated with environmental justice considered whether project construction could have environmental impacts such as air pollution, noise, or risk of hazardous materials releases that would be experienced disproportionately by environmental justice populations. Because of the localized nature of the potential environmental impacts of the project, geographies within 0.25 mile of the potential project alignments were screened to identify potential environmental justice populations.[14]

During project operation, impacts on environmental justice populations would be beneficial and these populations would experience greater benefits than surrounding communities through improved local conditions such as reduction in ambient noise, congestion, and air emissions from idling vehicles. Project operation would be expected to result in a long-term localized reduction in vehicle exhaust emissions along the project alignment because of the reduction in vehicle congestion that currently exists along adjacent streets during train crossings. The project would result in beneficial operational noise impacts because of at-grade rail operations being relocated to within the proposed tunnel and the removal of at-grade crossings. Therefore, project operation is likely to result in beneficial impacts for surrounding communities with regard to air quality, noise, and hazardous materials and is not likely to result in any adverse impacts that could be disproportionately high or adverse for environmental justice populations. Because the operational beneficial impacts would be similar regardless of alternative, operational impacts are not discussed below for each of the alternatives. Environmental justice related to the 22nd Street Station will be addressed in the environmental document.

12.3.1 Alignment A1

Alignment A1 would include construction activities near several minority and low-income communities. Additionally, construction along the entire alignment would occur within and near census tracts with a high level of existing pollution burden with regard to diesel, traffic, cleanup sites, hazardous waste generators and facilities, and impaired water bodies. Project construction would result in short-term emissions of diesel particulate matter and other toxic air contaminants. This alternative would result in the most off-haul trips of excavated materials because of the dimensions of the tunnel and, therefore, the greatest impact to air quality. Under this alternative, sensitive receptors are located within 200 feet of the project alignment and would be exposed to elevated concentrations of toxic air contaminants during tunneling, which would pose a health risk to nearby communities. Because this alignment is located near low-income communities and communities with a high level of diesel pollution burden, construction of the proposed project has the potential to temporarily exacerbate high existing levels of diesel pollution burden.

[14] For additional details of environmental justice populations, see Appendix L, the Pennsylvania Avenue Extension Study Environmental Constraints Analysis (ESA/MJ, 2022).

As described in Section 12.2.1, LUST Cleanup Sites near the northern portion of the alignment and the DTSC Evaluation Site near the intersection of Pennsylvania Avenue and 23rd Street could result in soil and groundwater contamination, which could impact indoor or outdoor air quality. Because of the high existing level of groundwater threats, impaired water bodies, and hazardous waste generators and facilities in census tracts near this alignment, project construction has the potential to exacerbate existing pollution burden within the study area.

Under this alternative, construction noise impacts would be focused at the two tunnel portal ends. Because of high levels of existing ambient noise, the increase in noise levels is not expected to be significant. However, depending on the ultimate increase in noise levels at these locations and the proximity to low-income census tracts, noise impacts from construction of this alternative have the potential to temporarily impact nearby minority and low-income populations.

Along the project alignment, three of the census tracts are considered to be minority and/or low-income populations. Noise impacts from project construction have the potential to be disproportionately high and adverse for these populations as compared to other census tracts along the project alignment. Additionally, the potential for soil and groundwater contamination would be concentrated at the northern portion of the alignment, and this proximity could potentially result in a disproportionately high and adverse impact to an environmental justice population. Air quality impacts would occur along the alignment near all census tracts considered in this analysis. More detailed analysis of air quality impacts will be needed to identify whether any would be disproportionately high and adverse for the minority and low-income populations identified in this analysis as compared to the other census tracts along the alignment. Portions of the alignment—including portions of each of the minority and low-income census tracts identified—are located within the APEZ and would require special consideration to determine whether the project's activities would add a substantial amount of emissions to areas already adversely affected by poor air quality.

12.3.2 Alignment A2

Construction of Alignment A2 would occur in the same area as Alignment A1 and would result in impacts to the same census tracts. Construction would be expected to result in approximately 23% fewer air emissions, similar noise impacts, and similar impacts with regard to hazardous materials as compared to Alignment A1. Therefore, impacts to environmental justice populations would likely be similar, but slightly reduced, as compared to Alignment A1.

12.3.3 Alignment B1

Construction of Alignment B1 would occur in the same area as Alignment A1 and would result in impacts to the same census tracts. Construction would be expected to result in 30% fewer air emissions. Additionally, there would be no 19th Street ventilation shaft and the southernmost ventilation shaft would be under southbound I-280. Therefore, air quality impacts could be slightly reduced under this alternative as compared to Alignment A1. Additionally, this alignment would be expected to result in slightly reduced noise impacts, and similar impacts with regard to hazardous materials as compared to Alignment A1. Therefore, impacts to environmental justice populations would likely be similar, but slightly reduced, as compared to Alignment A1.

12.3.4 Alignment B2

Construction of Alignment B2 would occur in the same area as Alignment A1 and would result in impacts to the same census tracts. Construction would be expected to result in approximately 54% fewer air emissions, similar noise impacts, and similar impacts with regard to hazardous materials as compared to Alignment A1. Therefore, impacts to environmental justice populations would likely be similar, but slightly reduced, as compared to Alignment A1.

12.3.5 Alignment C

Construction of Alignment C would occur in the same area as Alignment A1 and would result in impacts to the same census tracts. Alternative C would result in lower emission concentrations near the north entry tunnel and ventilation shaft sites compared to emissions at the other ventilation shaft sites. This may result in reduced air quality impacts as compared to the other alternatives. This alignment would be expected to have similar impacts with regard to hazardous materials as compared to Alignment A1. Alignment C would have the greatest potential for noise impacts. Therefore, impacts to environmental justice populations would likely be similar, but with slightly higher potential for noise impacts, as compared to Alignment A1.

12.4 Major Issues

The implementation of the PAX project would require major construction in a densely populated area of San Francisco. The construction and operation of the PAX project would likely result in some adverse effects on a range of resources. In general, these effects would be temporally limited to project construction, spatially limited to the project corridor, and could be mitigated with the implementation of a variety of measures. During operation, the project would provide a range of project benefits for the local community and adverse effects would be expected to be minimal.

With respect to each of the five alternatives, as all the alignments would be located within the same project corridor there would not be any substantial differences in project construction impacts between the alignments. The longer alignments (A1 and A2) would likely result in slightly more impacts because of the overall longer length of these alignments compared to the mid-length alignments (B1 and B2). Alternative C, which involves a shorter alignment and the use of cut-and-cover construction techniques, would result in the greatest construction impacts compared to the long and mid-length alignments as it would result in additional impacts on air quality and noise as a result of open construction as opposed to tunneling.

With respect to operation, there would be very few adverse effects associated with the project. Impacts on historic properties and residences associated with vibration could occur under any one of the alternatives, and would need to be evaluated further in subsequent environmental review. Generally, most project operational impacts would be beneficial. In operation the longer alternatives would offer greater environmental benefits as a result of the extended undergrounding of the existing Caltrain alignment compared to the three shorter alternatives.

12.5 Approval and Next Steps

The analysis of environmental constraints for the PAX project is intended to inform decision makers about the various resource considerations that should be taken into account as part of the project planning process. Project impacts and benefits would be evaluated in detail at the next stage of project environmental review, and the preliminary evaluation of environmental constraints will likely be used to focus the scope for future state and federal environmental review of the project pursuant to the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), respectively.

Mitigation measures that could be implemented to reduce and/or eliminate potential impacts on environmental resources are outlined in the PAX Environmental Constraints Analysis (ESA/MJ, 2022; Appendix L). These measures would be further developed during subsequent environmental review. As part of that subsequent review, guidance and regulations of a range of federal, state, and local agencies would be considered and implemented/complied with as appropriate.

13.0 Permitting

Construction of the PAX project would require completion of consultations with and issuance of authorizations and permits from various agencies with authority over the project. Preliminary review of the PAX project indicates that several consultations, authorizations, and permits may be required. Additional consultations, authorizations, and permits may be identified upon completion of CEQA and NEPA reviews.

13.1 Encroachment Permits

Construction and operation of the project would take place within Caltrans right-of-way associated with I-280. A **Caltrans Encroachment Permit** would be required to accommodate the project.

13.2 Air Quality Permits

Project construction would generate emissions from construction equipment and dust. Additionally, naturally occurring asbestos (NOA) and hazardous levels of toxic substances may be present in project area soils, which may pose an air quality or health risk if disturbed during construction. The project may require issuance of an **Authorization to Construct** or other applicable air quality permits from the Bay Area Air Quality Management District (BAAQMD).

13.3 Water Quality and Discharge Permits

Construction of the PAX project would require compliance with the National Pollutant Discharge Elimination System (NPDES) program, and the project would be required to comply with and append the **NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities** (Order No. 2009-0009-DWQ and as amended by Orders 2010-0014-DWQ and 2012-0006-DWQ, or as updated at the time of project construction) as administered by the San Francisco Bay Regional Water Quality Control Board (RWQCB).

Coverage under the NPDES Construction General Permit is not required for projects in areas of San Francisco that drain to the combined sewer system. Projects in these areas must comply with the City of San Francisco's Construction Site Runoff Control Program and obtain a **Construction Site Runoff Control Permit** from the SFPUC prior to construction.

Although cursory review of the project area has not identified jurisdictional waters of the United States and State, and the need for associated permits is considered unlikely, if jurisdictional waters are present, then the project may require acquisition of permits as follows:

- Nationwide 404 permit pursuant to the federal Clean Water Act (CWA)
- 401 Clean Water Quality Certification pursuant to the federal CWA
- Waste discharge requirements pursuant to the California CWA

Construction of the project could encounter groundwater during construction, which would require dewatering. If dewatering is required during project construction, a **Batch Discharge Permit from the**

San Francisco Department of Public Works would be required for dewatering effluent discharge to the City of San Francisco's combined sewer system.

If dewatering would be required for operation of the project, then is it expected that permanent dewatering effluent would be discharged to the combined sewer system, and an **Industrial User Permit** would be required from the San Francisco Public Utilities Commission.

13.4 Noise Permits

Nighttime construction may be required for the project. Per Article 29 Section 2908 of the San Francisco Police Code, construction activities in the public right-of-way that exceed the ambient noise level by 5 dBA is prohibited without a **Night Noise Permit** from the San Francisco Public Works Department.

13.5 Cultural Resources Consultations

There are known historic resources in the project vicinity, and there is potential for buried prehistoric and historical-era cultural resources in the project corridor. As the project could affect historic resources, **consultation with the State Historic Preservation Office (SHPO)** pursuant to Section 106 of the National Historic Preservation Act, as Amended (NHPA) would be required to obtain concurrence on the effect finding.

14.0 Recommendations for Further Technical Studies

14.1 General

The objective of future phases of PAX studies will be to narrow the alignment alternatives and ultimately select a single alignment to design and construct. To this end, preliminary engineering and the environmental review process are expected to proceed concurrently to further define the scope of the project and obtain environmental clearance through the NEPA/CEQA process. To accomplish this, further technical studies will be required. The purpose of this section is to discuss a preliminary basis for the scope of such studies.

14.2 Environmental

As stated in Section 12.5, project impacts and benefits would be evaluated in detail during the project environmental review, and the preliminary evaluation of environmental constraints will likely be used to focus the scope for future state and federal environmental review of the project pursuant to the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), respectively.

Mitigation measures that could be implemented to reduce and/or eliminate potential impacts on environmental resources are outlined in the PAX Environmental Constraints Report (Appendix L). These measures would be further developed during subsequent environmental review. As part of that subsequent review guidance and regulations of a range of federal, state, and local agencies would be considered and implemented/complied with as appropriate.

14.3 Traffic

As construction configuration and methods are studied further, specific impacts related to ground treatment that include mid-alignment work activities and tunnel muck disposal at all possible disposal sites should be assessed. Updates to rail operations parameters should also be made if any changes arise after the conclusion of this phase of study.

In future stages of the project, the traffic impact analysis of the muck hauling should be reevaluated related to likely hauling hours and possible hauling restrictions. At the time this report it was assumed that muck would be removed evenly over a 24-hour period, including during the peak commute hours. A number of factors including landfill hours, cost, available staging, preclassification of excavation spoils, and community impacts could factor into muck hauling.

In addition, as stated in Section 12.1.1, evaluation of traffic impacts including evaluation of project-generated vehicle miles traveled would be undertaken during subsequent environmental analysis of the PAX project.

14.4 Geotechnical

Investigations will include a robust geotechnical exploration program that will be accomplished by truck-mounted drill rigs drilling bores several inches in diameter to below planned tunnel depth to obtain soil, rock, and groundwater samples. Data to be obtained for the DTX project may be relevant and

incorporated into the PAX exploration program. As stated in Section 6.1, given the dense urban corridor and challenging geologic conditions anticipated along the PAX project corridor, it is anticipated that significant additional subsurface investigations will be needed to better characterize geotechnical conditions and to assist in evaluating the tunneling methods discussed in this report. As is normal practice, the results and interpretations of these investigations should be used to develop design parameters, model anticipated settlement due to project excavations, confirm selected or allowed excavation and support methods, select ground improvements and other mitigations, and set baselines for contract bidding. In the case of a twin bore alignment being selected, geotechnical investigation results should be used to select the pillar width between the bored tunnels, and the anticipated scope and location of ground improvement. The same should be performed for areas of low cover over the single bore tunnel.

14.5 Tunneling

As mentioned in the prior section, mitigations for anticipated ground movements will be refined with regard to buildings, utilities, and other structures that could be impacted by tunneling operations. The determination and preliminary design of feasible ground support methods will progress so that community impacts can be determined for the CEQA process and accurate cost and schedules can be developed. Preliminary lining design is needed to confirm outside diameter of bored tunnels. Portal designs are needed to support selected excavation configurations. Spaceproofing of the underground works will involve sufficient preliminary design to ensure the dynamic envelope of trains, rail systems, emergency egress, ventilation, and all electrical and mechanical systems fits within tunnels, cross passages, adits, and shafts. Stability analysis should be undertaken where there is potential to affect major structures such as those owned by Caltrans and Caltrain. Requirements for performance-based and specification-based means and methods will need to be selected and prepared for inclusion in the contract documents.

14.6 Existing Utilities and Infrastructure

Major existing known utilities should be investigated further, either in partnership with the SFPUC's planned projects or as separate investigations. Contingency design and planning should be included in all alternatives selected for further study because of unknowns. Potholing to verify as-built utility locations should be implemented as part of the detailed design process for PAX.

It will be critical to improve the accuracy of pile depth, location, and pile types used in construction of SFPUC's Division Street Sewer, the 7th Street Sewer, and the location of the future Folsom Street Sewer tunnel. All of these utilities impact the depth and location of the PAX tunnel, which will need to clear below pile tips to avoid TBM mining problems. Similarly, the I-280 deep foundation elements must be further defined near the tunnel alignments for the same reasons.

14.7 Rail/Systems

Requirements for rail design parameters must be developed in partnership with Caltrain and CHSRA. Egress and ventilation design should be progressed with the involvement of the operators. Sequencing and scheduling of PAX interfaces where the project will tie-in to existing rail alignments will be important inputs for narrowing and selection of alignments.

14.8 ROW/Property

Further analysis of right-of-way is needed, including additional sources for property value estimates. These would include comparable market sales, broker input and listing data, and appraisals or other estimates if they have been completed. Additional overall factors that will contribute to relevant ROW estimating should ultimately address issues such as potentially hazardous waste, severance damages, loss of business goodwill, relocation assistance, risk assessment and contingencies, etc. Categories such as these can be analyzed as the preliminary studies continue. In addition, projects in the pipeline with the City of San Francisco should be included in the ROW analysis.

14.9 Risk

The risk matrix should be updated as a part of the decision-making process during the next phase of work.

15.0 Conclusion

Three viable PAX alternative alignments have been developed, two of which have sub-options for a total of five alternative configurations, as follows:

- **Alternative A1/A2: Long Alignment** that bypasses the existing 22nd Street Station. Alternative A1 as a single large (42-foot outside diameter) 1.5-mile-long TBM bored tunnel with both northbound and southbound tracks in a single tunnel. Alternative A2 is two smaller (26-foot outside diameter) 1.5-mile-long TBM bored tunnels, each with a single track. This alternative likely results in the decommissioning of the existing 22nd Street Station.
- **Alternative B1/B2: Mid-Length Alignment** connecting tunnels from DTX to just north of the existing 22nd Street Station, which would be modified for continued use. Alternative B1 is a single large (42-foot outside diameter) 0.9-mile-long TBM bored tunnel with both northbound and southbound tracks in a single tunnel. Alternative B2 is two smaller (26-foot outside diameter) 0.9-mile long TBM bored tunnels each with a single track. Both B1 and B2 have short SEM sections, 600 feet to 700 feet long, connecting TBM bored tunnel to existing track. This alternative allows use of the existing 22nd Street Station, with modifications.
- **Alternative C: Short Alignment – Split Tunnels** is a hybrid with the northbound track in a new cut-and-cover tunnel under I-280 and a single smaller (26-foot outside diameter) 1.0-mile-long TBM bored tunnel containing the southbound track. The concept allows continued use of the existing 22nd Street Station, with modifications.

The alternatives were scored using an evaluation framework of 23 criteria grouped into five separate categories that were selected to provide a broad spectrum analysis of program, environmental, community, and engineering factors. The results were as shown in Table 15-1, with the higher number reflecting a more favorable rating:

Table 15-1. Preliminary Evaluation Score Results for Alternatives

Alternative	A1	A2	B1	B2	C
Overall Weighted Score	2.2	2.1	2.1	2.1	1.9

The results show relatively equivalent scoring across all alternatives, with Alternative A edging slightly ahead and Alternative C behind the others. Alternative C offers some advantages, such as the lowest construction cost and the ability to use the existing 22nd Street Station. However, this study revealed that Alternative C has shortcomings (including construction risks associated with the northbound track cut-and-cover section, as well as significant impacts to Caltrain operations during construction) when compared to the other alternatives. Alternative C scored lowest for meeting project goals, construction, and environmental impacts. It is noted that Alternatives B1 and B2 offer the PAX alignment similar overall benefits as Alternative C with respect to making use of the existing 22nd Street Station.

In considering the Alternative A Alignments and the Alternative B Alignments, it is evident that the overall scoring is nearly equal, with the single bore tunnels scoring slightly higher than, or the same as, their twin bore counterparts. The further studies recommended in this report will provide guidance as to the best path forward with respect to selecting single versus twin bore. Consideration should be given in

future phases to whether both single and twin bore tunnels can be offered as options for bidding tunnel contractors or design-build teams. The advantage in this regard, assuming all other factors are equal, is to let the marketplace determine the least expensive, least risky, and most constructible alternative. Including the twin bore configuration is likely to enlarge the pool of potential qualified bidders, thereby increasing competition for the project. The design and location of a station within the PAX footprint, and the selected project delivery methods, will be important factors in making this decision.

The primary driver here will be the decision-making process of determining the need for and the location of a future station along or near the PAX alignment. A decision to make use of the existing 22nd Street Station effectively eliminates the A Alignments unless a new subsurface station is planned, and the project would then determine whether B1, B2, or C is the most viable alternative. Alternatively, if it is decided that the existing 22nd Street Station can be replaced, then all alternatives are open to selection. In reviewing the Evaluation Framework Scoring, it is evident that the A Alignment Alternatives offer greater benefits for achieving project goals (including street connectivity, seismic performance, rail operations, and surface safety) than do the B or C Alternatives. Further, construction criteria scoring (which includes constructability, geologic profile, disruption to existing rail operations, and access/laydown) favors the A Alignments over the B Alignments.

In summary, the recommendation for the next phase is to include a focus on consideration of a rail station in or near the PAX alignment, as this is most likely the single greatest factor impacting PAX alignment selection.

Section 14.0 of this report summarizes recommendations for further studies. As outlined below, there are critical aspects of the PAX project that stand out as a higher level of priority requiring study early in the next phase, as their outcome has a significant impact on viability of the alternatives.

1. The DTX/PAX/Railyards interface needs to be further advanced and a sequencing/phasing plan developed that will allow DTX to be brought on line for revenue service while PAX design and construction proceed concurrently.
2. The twin bore arrangement for Alternatives A2 and B2 should be studied further in the 7th Street area where the two tunnels pinch together because of the I-280 foundation elements and privately held land. The feasibility of twin bore tunneling in this area was confirmed in this study; however, it was determined that ground modification, which carries significant cost and surface impacts, is expected to be necessary. The extent of ground modification and impacts at the surface on 7th Street should be further studied to fully understand cost, schedule, and community/traffic impacts.
3. The single bore tunnel for Alternative A1 under Pennsylvania Avenue and the single bore tunnel for Alternative B1 under 7th Street and Pennsylvania Avenue have an area of low ground cover. As with the closely spaced twin bore tunnels, ground modification may be required in Pennsylvania Avenue, which would have surface impacts. The need for and potential extent of this work should be evaluated further.
4. A concerted effort should be made to further map existing utilities and infrastructure early in the next phase, particularly those that have significant impacts on the alignment selection and locations. High priority should be placed on determining accurate as-built locations of the I-280 foundations and the SFPUC Division Street Sewer and planned Folsom Street Sewer tunnel.

These structures will have significant impacts on both vertical and horizontal alignments. Coordination with DTX is also recommended for proposed utility relocations along 6th Street as these relocations may impact the PAX alignment and other SFPUC sewer improvements along Berry Street (including the Folsom Sewer tunnel).

5. Conceptual engineering performed in this study for the existing 22nd Street Station area for Alternatives B1, B2, and C is very preliminary in nature. If it is decided to proceed with retaining use of the existing 22nd Street Station, the concept for the following project elements needs to be advanced:
    a. Modifications to the existing station;
    b. Mining approach from the end of TBM bored tunnels into the existing track and existing Caltrain Tunnel 1 located north of the station;
    c. The interference between existing I-280 foundations and preferred new rail alignment just north of the station and south of Tunnel 1;
    d. Modifications to the existing 22nd Street bridge overpasses;
    e. Retaining wall on the west side of the station and ROW issues in this area;
    f. Condition of the existing abandoned Tunnel 2 and work required to reuse this tunnel; and
    g. Caltrain and blended service operational requirements for this area such as the need for track to allow through trains to bypass trains stopped at the station. Additionally, further collaboration with Caltrain with regard to construction phasing is important to confirming viability of the alternatives, especially Alternative C, which would require a significant interruption to Caltrain service during construction.
6. Conceptual engineering was not performed in this study for a potential new subsurface station, mid-alignment for Alternative A1/A2. Future phases of work will need to examine this design concept and impact to PAX design, construction, and operations.

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San Francisco
County Transportation
Authority

1455 Market Street, 22ND Floor, San Francisco, California 94103 415-522-4800 info@sfcta.org www.sfcta.org

Memorandum

AGENDA ITEM 8

DATE: June 23, 2021

TO: Transportation Authority Board

FROM: Maria Lombardo – Chief Deputy Director

SUBJECT: 07/12/22 Board Meeting: Accept the Pennsylvania Avenue Extension Project Initiation Report

RECOMMENDATION ☐ Information ☐ Action

Accept the Pennsylvania Avenue Extension (PAX) Project Initiation Report.

SUMMARY

The PAX project will grade-separate existing Caltrain passenger rail operations from local vehicular and pedestrian traffic patterns between the Mission Bay and Potrero Hill neighborhoods. When completed, PAX will replace existing at-grade Caltrain crossings at Mission Bay Drive and 16th Street with a rail tunnel, as recommended in the 2018 Railyard Alignment and Benefits (RAB) Study prepared by the San Francisco Planning Department. The proposed project will serve Caltrain and future California High-Speed Rail (CHSR) operations, connecting to the Downtown Rail Extension (DTX) near the future 4th and Townsend Station. We have completed the PAX Project Initiation Study (the Study), which developed and evaluated a range of conceptual alignment alternatives for the project. These alternatives reflect different tunnel configurations and construction methods, with varying implications for existing and potential future station locations along the alignment. Based on a preliminary evaluation of constructability, cost, schedule, risk, environmental considerations, and benefits, the PAX Project Initiation Report identifies three broad alternatives to be further refined and evaluated through the next phase of planning, design, and public outreach, prior to advancing the project into the environmental review phase.

- ☐ Fund Allocation
- ☐ Fund Programming
- ☐ Policy/Legislation
- ☒ Plan/Study
- ☐ Capital Project Oversight/Delivery
- ☐ Budget/Finance
- ☐ Contract/Agreement
- ☐ Other: _____

BACKGROUND

In 2018, the San Francisco Planning Department, in partnership with the Transportation Authority and other partner agencies, concluded the RAB Study. The RAB Study assessed options for the alignment of the Caltrain corridor through San Francisco and identified the City's preferred alignment as a tunnel beneath 7th Street and Pennsylvania Avenue, which would connect directly to the DTX and extend the below-grade rail alignment southward. The Transportation Authority Board endorsed this alignment in September 2018 through approval of Resolution 19-12.

The PAX project will connect to the DTX's southern limits adjacent to the existing Caltrain railyard at 4th and King streets and will continue south beneath 7th Street and Pennsylvania Avenue. The southern limit of PAX will vary depending on the eventual selected alternative.

The primary purpose of the PAX project is to eliminate existing at-grade rail crossings at Mission Bay Drive and 16th Street. PAX will serve Caltrain and CHSR trains traveling between the Peninsula and Salesforce Transit Center. In the future, Caltrain and the California High-Speed Rail Authority (CHSRA) plan to operate up to a combined 12 trains per peak hour per direction, for a bi-directional total of 24 train movements per peak hour in the corridor.

This volume of train movement and interruption to traffic flow will result in unacceptable impacts to transit and other surface modes. Placing rail in a tunnel beneath 16th Street and Mission Bay Drive will improve safety, support the speed and reliability of bus transit on the 16th Street corridor, and expand street grid connectivity between the Mission Bay/Dogpatch and neighborhoods to the west and northwest.

In November 2019, the Transportation Authority Board appropriated $1.6 million in Prop K sales tax funds for the PAX Project Initiation Study. In June 2020, the Board approved the award of a consulting contract to McMillen Jacobs Associates to undertake the Study's technical work program.

DISCUSSION

The purpose of the Study was to identify viable rail alignment alternatives to advance into the subsequent phases of planning and environmental review.

Study Approach and Activities. Transportation Authority staff conducted the study with the consultant team and with the support and input of project partners. We have undertaken technical engagement with Caltrain, CHSRA, the Transbay Joint Powers Authority (TJPA), Caltrans, multiple City departments, and other partners. Study activities included:

- *Alternatives development and evaluation* – identification of potential PAX alternatives, screening assessment, and concept design and evaluation for promising options;
- *Initial technical studies* – development of a range of studies and analyses to understand the project corridor and support evaluation, including initial

environmental studies, desktop-level geotechnical assessment, traffic analysis, and risk assessment, among others;

- *PAX interfaces and related projects* – design and planning for interfaces of the PAX project with the DTX, 4th and King Railyard, and station planning;
- *Cost and schedule* – development of planning-level estimates of capital cost and implementation schedule; and
- *Initial public outreach* – preliminary engagement with stakeholders and the public, through coordination with broader public outreach undertaken for related studies.

The PAX Project Initiation Report documents Study activities, presents the evaluation of alternatives, and makes recommendations regarding subsequent phases of project development.

Alternatives Development and Evaluation. The Study developed a range of alternatives within the broad alignment of 7th Street and Pennsylvania Avenue, as established by the RAB Study. The Study's range of alternatives reflect differing approaches to alignment length, tunnel methodology, and impacts on existing infrastructure and corridor operations. Some alternatives allow for the preservation of the existing 22nd Street Caltrain Station, whereas others would require a replacement station to be constructed.

The Study developed a technical evaluation process to screen and evaluate the alternatives through design development, technical analysis, risk assessment, cost estimation, partner input, public engagement, and a third-party peer review. The Project Initiation Report identifies three broad alternatives as shown below. A map of the study area and drawings of each of the alternatives are included in Attachment 2.

A. Long Alternative – Alternative A would provide a tunneled rail alignment from DTX to a point immediately north of Cesar Chavez Street. This alternative requires replacement of the existing 22nd Street Caltrain Station.

B. Mid-Length Alternative – Alternative B would provide a tunneled rail alignment from DTX to a point immediately north of the 22nd Street Station. This alternative would require some modifications to the existing 22nd Street Station, as well as a more complex interface with existing Caltrain tunnels.

C. Short Alternative – Alternative C is a "split-tunnel" configuration, with southbound and northbound tunnels separated, with the northbound tunnel within the existing Caltrain right-of-way, and an interface point north of the 22nd Street Station. This alternative would have a more significant impact on Caltrain operations during construction.

The Study evaluated these alternatives across several criteria guided by project goals. Alternative A (long tunnel) would result in the greatest improvement to rail operations and

would minimize certain construction impacts; however, it would require decommissioning the 22nd Street Station and has the greatest estimated capital cost among the studied alternatives. Alternative B (mid-length tunnel) offers the opportunity to avoid a need to replace the 22nd Street Station, but it has a more complex and potentially risky interface with existing infrastructure. Alternative C (short tunnel) allows the existing 22nd Street Caltrain Station to remain with minimal modifications, and it is the least-cost alternative; however, it would have the greatest construction impacts, including to existing rail operations.

Initial Technical Studies. The Study developed various preliminary technical studies to support the evaluation of alternatives and understanding of project impacts and challenges. These studies included: desktop studies for geotechnical engineering and hydrology; a traffic impact study to consider the construction phase and operational phase; initial analysis of environmental benefits and constraints; and development of a preliminary risk assessment and risk register. Notable project delivery risks include tunneling construction and ground settlement; utility conflicts and relocations; impacts to rail operations during construction; and interfaces with DTX and Caltrain railyards.

PAX Interfaces and Related Projects. The Study effort included intensive design coordination and engagement with related projects. In particular, the interface between PAX, DTX, and the Caltrain Railyard represents a critical location for managing the development of multiple infrastructure projects over time. The Study identified a feasible option for this interface point, which is informing the DTX preliminary design process and is providing input to ongoing planning for the Railyard. Future phases of PAX work will continue to carefully consider this interface, in collaboration with TJPA, Caltrain, CHSRA, and other partners.

The PAX Study was developed in parallel to the San Francisco Planning Department's Southeast Rail Station Study (SERSS), which considered potential future station locations along the PAX alignment. The next phase of PAX work will incorporate the SERSS work to date, in order to incorporate station design and cost considerations into the further refinement and evaluation of PAX alternatives.

Cost and Schedule. The Study developed planning-level capital cost estimates and schedules for the three PAX alternatives. The estimated capital cost of these alternatives is approximately $2.0-2.5 billion, excluding potential costs to replace the 22nd Street Station. With respect to schedule, advancing the project through further planning, environmental review, design, procurement, and construction is expected to take a minimum of approximately 12-15 years. Progression through these phases on such a timeline is subject to available funding. The next phase of PAX work will include an effort to refine or modify alternatives, with an eye to opportunities to reduce cost.

Initial Public Outreach. The Project Initiation Study was primarily a technical effort, in order to define an initial range of project alternatives and explore constraints and interfaces with related projects. In Fall 2021, the Study Team participated in public outreach sessions in

coordination with the City and Caltrain, to share information on PAX, SERSS, and Caltrain's nearer-term planning for access to the 22nd Street Station. Key areas of interest for the public with respect to PAX include implementation timeframe, coordination with related projects, the opportunity to better connect neighborhoods, and the management of construction phase impacts. The next phase of PAX planning will incorporate more extensive public outreach and stakeholder engagement.

Next Steps. To follow the Project Initiation Study and to continue to develop the PAX projects, we recommend undertaking a Pre-Environmental Study, working closely with Caltrain and other project partners. The purpose of the Pre-Environmental Study will be to prepare for the environmental review, in particular by identifying 1-2 most viable alternatives and developing the organizational and technical approach to the environmental phase. Key activities for the Pre-Environmental Study are anticipated to include:

- Development of a refined understanding of the comparison of alternatives, through additional analysis of constructability, interfaces, and rail operations;
- Assessment of opportunities to materially reduce cost and risk, including through consideration alternative technical concepts;
- Integration of design and cost considerations for replacement of 22nd Street Station, to the extent required;
- Preparation of a strategy for the environmental phase, including consideration of state and federal requirements, technical approach, and multi-agency governance;
- Further technical and design coordination with the Railyard and DTX; and
- Project-specific public outreach and stakeholder engagement.

We are currently developing the scope of work for the Pre-Environmental Study phase. We plan to bring forward a Prop K appropriation request for the Pre-Environmental Study to the Transportation Authority Board in the fall.

FINANCIAL IMPACT

The recommended action would have no impact on the adopted Fiscal Year 2022/23 budget.

CAC POSITION

The Community Advisory Committee was briefed on this item at its June 22, 2022, meeting and unanimously adopted a motion of support for the staff recommendation.

SUPPLEMENTAL MATERIALS

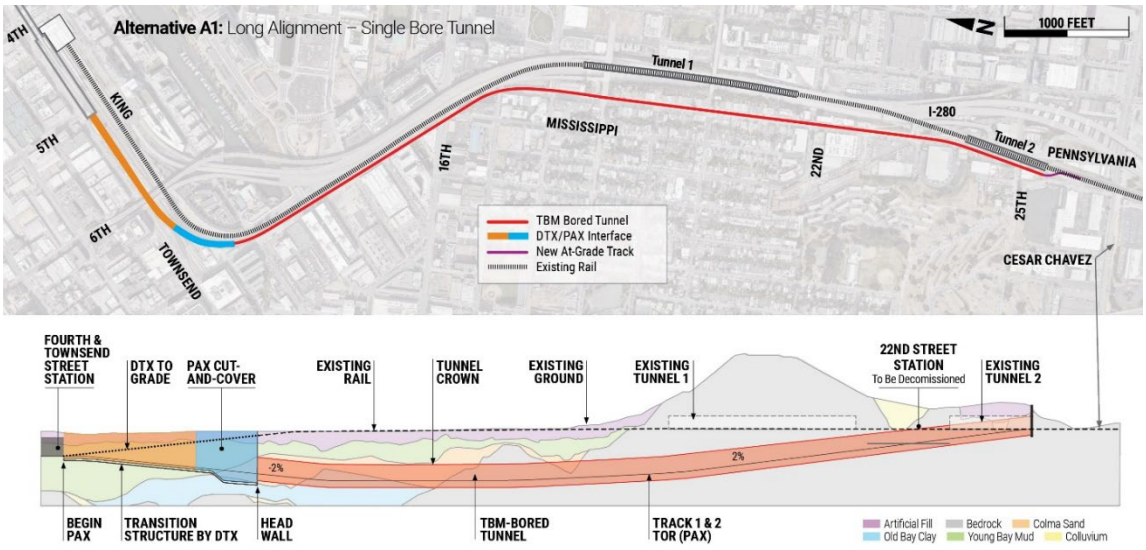
- Attachment 1: PAX Project Initiation Report – Draft [Attached to Resolution]
- Attachment 2: Project Area Map and Alternatives

ATTACHMENT – PAX PROJECT AREA MAP AND ALTERNATIVES

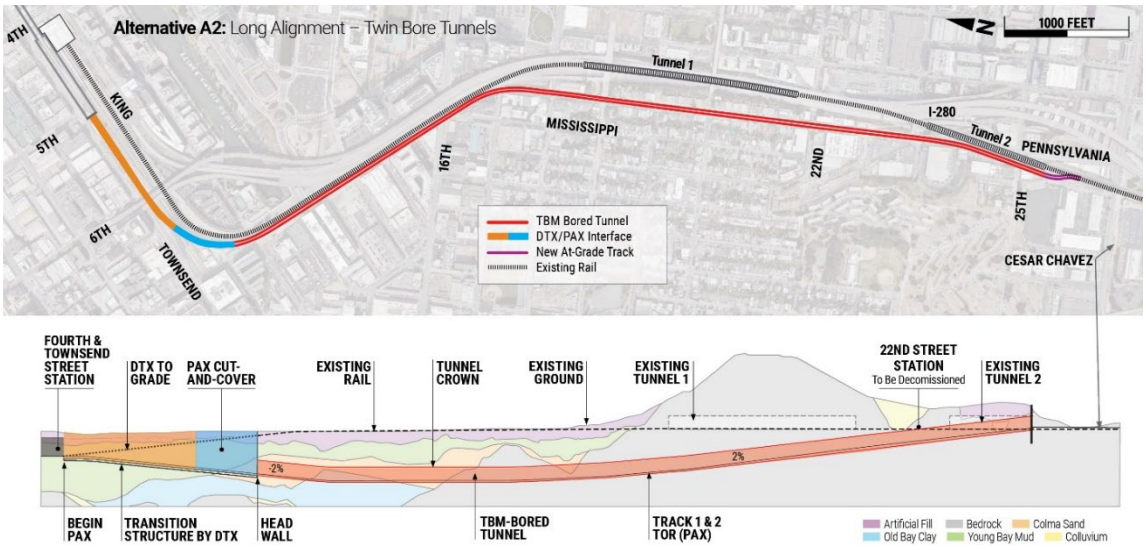
Project Area

ATTACHMENT – PAX PROJECT AREA MAP AND ALTERNATIVES

Alternative A1 – Plan and Profile

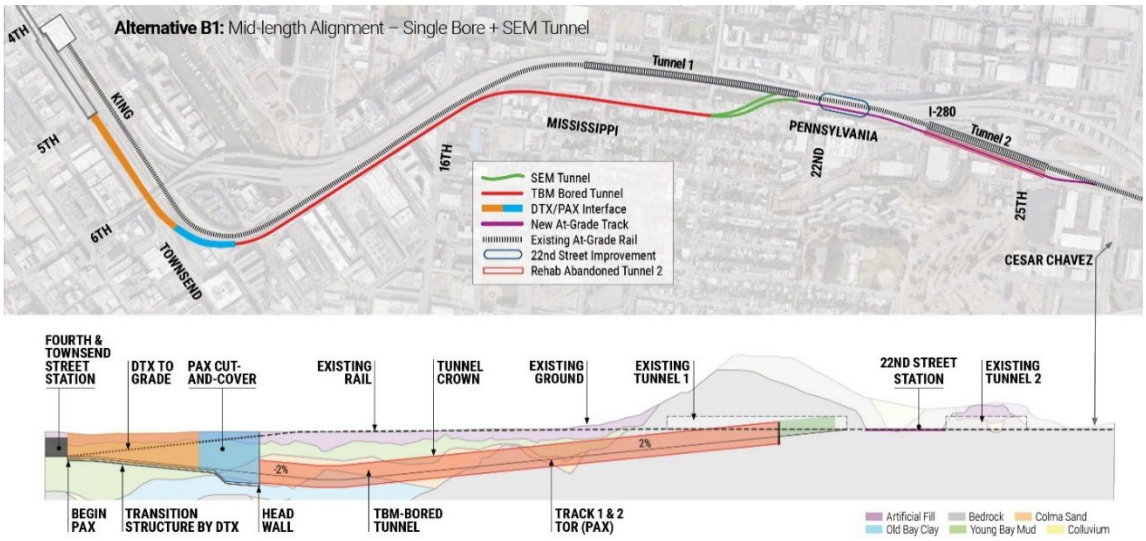


Alternative A2 – Plan and Profile

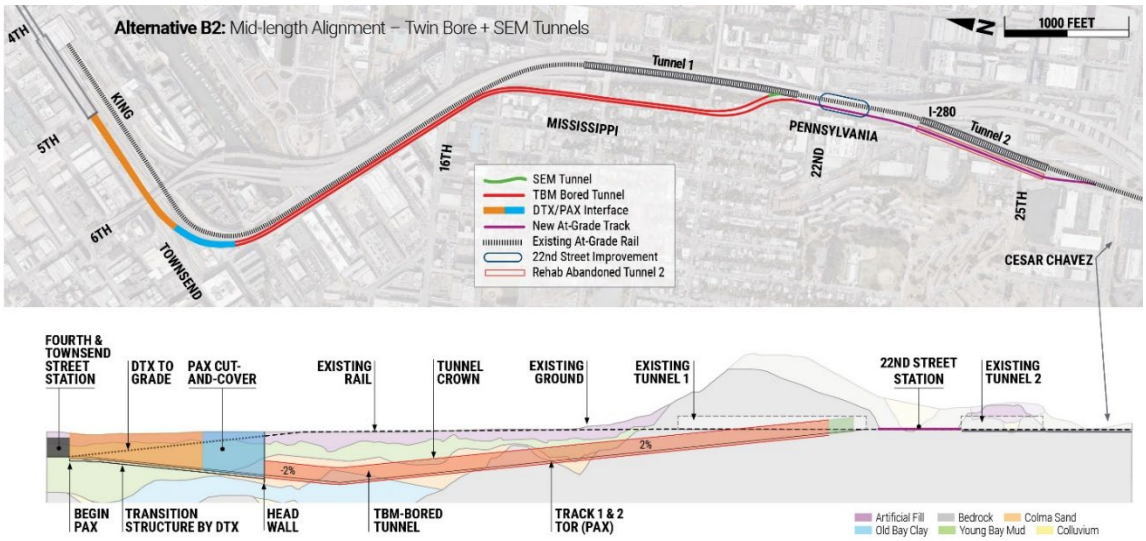


ATTACHMENT – PAX PROJECT AREA MAP AND ALTERNATIVES

Alternative B1 – Plan and Profile



Alternative B2 – Plan and Profile



ATTACHMENT – PAX PROJECT AREA MAP AND ALTERNATIVES

Alternative C – Plan and Profile