



December 1, 2010

Robert Doty, Manager – Peninsula Rail Program  
California High Speed Rail Authority  
925 L Street, 1425  
Sacramento, CA 95814

Re: California High-Speed Train San Francisco to San Jose Section Environmental  
Impact Report/Statement - Additional San Francisco High-Speed Rail  
Alternatives

Dear Mr. Doty,

This letter is a follow up to our letter dated September 28, 2010. In that letter, the San Francisco Stakeholders Technical Working Group (SFSTWG) expressed the City and County of San Francisco's strong support for high speed rail and its concern that your environmental document will need strengthening to avoid running afoul of compliance with the National Environmental Policy Act (NEPA) requirement to develop and assess reasonable alternatives that meet the purpose and need for agency action. Our concerns arose because the Preliminary Alternatives Analysis Report included only one alternative in San Francisco for effecting a grade separation at 16<sup>th</sup> Street when we believe that other viable alternatives exist. Furthermore, the alternative proposed by the CHSRA is inconsistent with local land use and circulation plans and will serve to isolate an important redevelopment area in San Francisco. In that letter, the SFSTWG offered five additional alternatives for the 16<sup>th</sup> Street crossing that better meet San Francisco's interests in that area.

Since then, the SFSTWG and its consultants have continued to define, refine, and analyze the alternatives and have reached consensus on three alternatives that merit inclusion in the CHSRA environmental documents. These alternatives, described below, were discussed at length with your staff at a meeting held on October 27, 2010. In order to strengthen the high-speed rail environmental document and adequately address San Francisco concerns, we request that these three alternatives be assessed at the same level of detail as the single alternative now included in the Preliminary Alternatives Analysis Report and that they be included in the draft environmental impact report and statement (EIR/S).

The three alternatives are:

### **Option 1**

A set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the Transbay Transit Center (TTC), while the other stays at-grade on the current Caltrain alignment as currently proposed. Once the tracks on the Caltrain alignment reach the north portal of Tunnel 1, the tracks would be depressed and go into an underground alignment directly under the existing alignment, and cross below 16th Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and ultimately come back up to grade prior to entering the rail yard at 4th and King Streets. To accommodate this option, the Division Street sewer outfall would be removed and its flows accommodated by increasing the size of a planned storm water outfall tunnel from 18 feet in diameter to 28. The proposed new 28-foot sewer tunnel is expected to be constructed by 2018.

Should there be insufficient space to accommodate the train box between columns supporting the I-280 freeway, a variation on Option 1 is included as Option 4c, and would replace the freeway north of Tunnel 1 with an at-grade parkway over the underground tracks. The parkway would continue to 7th and/or 4th and King Streets. The removal would commence far enough south of Tunnel 1 to effect a smooth transition to the new parkway.

### **Option 2**

A set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the TTC, while the other stays at-grade on the current Caltrain alignment as currently proposed. Once the tracks on the Caltrain alignment reach the south portal of Tunnel 1, just north of the 22nd Street Caltrain station, the tracks would be depressed and go into an underground alignment directly under the existing alignment, and cross below 16th Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and ultimately come back up to grade to the 4th and King rail yard. As in option 1, the Division Street sewer outfall would be removed and the planned storm water outfall tunnel would be increased in size from 18 feet in diameter to 28 feet to accommodate the flows.

### **Option 4C**

This option was developed during the review meetings with the SFSTWG and added to the list of options near the end of the study. Under this option, a set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the TTC, while the other stays at-grade on the current Caltrain alignment (similar to Options 1 and 2) as currently proposed to a point north of Mariposa Street. I-280 would be removed and reconstructed as a parkway from 18th Street north. South of 18th Street, the freeway would be maintained in its current configuration. Mariposa Street would remain below the freeway and the ramps would remain open, and 18th Street would remain above the freeway and the ramps would be closed.

A two-track tunnel box would be constructed under the vacated I-280 right-of-way with a four- to six-lane parkway above and continue to the 4th and King Station along the

Caltrain right-of-way. Signalized intersections along the parkway would be provided at 16th Street Irwin Street, Mission Bay Drive, and Berry Street, and regularly-spaced signalized or stop controlled intersections would align with the Showplace Street grid. The parkway would connect to 7th and King Streets via two surface roads of two lanes each alongside the northwestern and southern boundaries of the rail yard. The parkway would have one-way frontage roads on either side, except the east side of the block from Berry to Mission Bay Blvd, which would instead have a park. A schematic plan of the parkway is included in Appendix C along with the plan and profile of the rail alignment.

The attached report, "Caltrain/ High Speed Rail Alignment Alternatives Within San Francisco", together with Appendices A through G, describe in detail all the alternatives considered and provide line-and-grade drawings, cross sections, analysis and evaluation methodology, and results.

As we move forward, the SFSTWG will continue to review and refine the alternatives and provide any updates or revisions to the CHSRA as they become available. We look forward to continuing cooperative discussions with your staff on this and other issues, such as the Caltrain Bayshore station, subject of our letter dated November 17, 2010, during the next few weeks.

Respectfully,

SAN FRANCISCO STAKEHOLDERS TECHNICAL WORKING GROUP

By:

A handwritten signature in black ink, appearing to read "L. Saage". The signature is stylized with a large initial "L" and a long horizontal stroke.

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# Caltrain/High Speed Rail Alignment Alternatives within San Francisco



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Appendix A: CHSRA Plans, Profiles, and Original Evaluation Matrix Materials for the Study Area

Appendix B: Evaluation Matrix of CHSRA Selected Alternative with Comments by SFTWG

Appendix C: SFTWG Alternative Alignment Options Plan/Profile Drawings

Appendix D: SFTWG Alternative Alignment Options Conceptual Cross-Sections

Appendix E: Appendix L (Cost Estimates) of the CHSRA Supplemental Alternatives Analysis Document

Appendix F: Evaluation Matrices for SFTWG Alternative Alignment Options

Appendix G: Cost Estimates for SFTWG Alternative Alignment Options

## Introduction

### Purpose

The purpose of this analysis is to develop and compare alternative alignments to the Base Alternative proposed for the City and County of San Francisco by the California High Speed Rail Authority (CHSRA) Preliminary and Supplemental Alternatives Analysis documents.

### Regional Context

The City and County of San Francisco strongly support high speed rail and welcome it to San Francisco. To that end, the design and construction of the \$4 billion Transbay Transit Center (TTC) and Downtown Rail Extension (DTX) are underway, and will serve as the San Francisco terminus for the California High-Speed Rail.

However, during the course of reviewing the Alternatives Analysis and conceptual design of the high speed rail alignment, the San Francisco Stakeholders Technical Working Group (SFTWG) became concerned that the environmental documents were not in compliance with the National Environmental Policy Act (NEPA) requirement to develop and assess all feasible and reasonable alternatives that meet the purpose and need for agency action. The Preliminary Alternatives Analysis Report includes only one alternative in San Francisco when the SFTWG believes that other viable alternatives exist. Specifically, San Francisco was extremely concerned that the only option proposed within the Preliminary Alternatives Analysis requires depressing 16<sup>th</sup> Street, 7<sup>th</sup> Street and Mission Bay Drive. Depressing these roadways is inconsistent with local land use and circulation plans and serves to isolate an important redevelopment area in San Francisco.

### Description of Tasks Performed

InfraConsult LLC was retained by the San Francisco County Transportation Authority (SFCTA) to develop alternative Caltrain/high speed rail alignments between the Bayshore Station and the rail termini at 4th/King and the Transbay Terminal Center (TTC), assess the alternatives utilizing the CHSRA impact analysis criteria, refine conceptual-level plan/profiles and/or cross sections, develop preliminary cost estimates, and identify a maximum of three additional alternative alignments/concepts to recommend for further study within the CHSRA environmental documents. This analysis also involved providing comments on the CHSRA selected alignments, preliminary alternatives analysis, and plan/profiles. The information developed during this analysis supports the SFTWG's request to CHSRA to strengthen the environmental documents by assessing additional alignment alternatives at the same level of detail as the single alignment.

Information is attached to this report in the following Appendices:

- Appendix A: CHSRA plans, profiles, and original Evaluation Matrix materials for the study area.
- Appendix B: Evaluation Matrix of CHSRA selected alternative with comments by SFTWG.
- Appendix C: SFTWG Alternative Alignment Options plan/profile drawings.
- Appendix D: SFTWG Alternative Alignment Options conceptual cross-sections.
- Appendix E: Appendix L (Cost Estimates) of the CHSRA Supplemental Alternatives Analysis Document.
- Appendix F: Evaluation Matrices for SFTWG alternative alignment options.
- Appendix G: Cost Estimates for SFTWG alternative alignment options.



## California High Speed Rail Project

### Description

The CHSRA<sup>1</sup> is developing an intercity, high-speed service on more than 800 miles of tracks throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The system is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, which will include contemporary safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour over a fully grade-separated, dedicated track alignment. In the section between San Francisco and San Jose, trains will not exceed the design speed of 125 mph and operate in a shared use corridor with Caltrain.

The San Francisco to San Jose Section study area includes portions of San Francisco, San Mateo, and Santa Clara counties and the Caltrain corridor which extends approximately 48 miles between the TTC in San Francisco and San Jose Diridon Caltrain station. The railroad passes through 14 cities on the San Francisco Peninsula. The Caltrain corridor is primarily double track with some segments consisting of 3, 4, or more tracks, and includes 23 Caltrain stations within the study area. Caltrain operates regional passenger rail service in the corridor and Union Pacific operates local freight service. Though many crossings have been grade-separated, there are 47 at-grade railroad crossing locations remaining within the study area.

The CHSRA's objectives for the proposed High Speed Rail (HSR) system are:

- Provide intercity travel capacity to supplement critically over-used interstate highways and commercial airports.
- Meet future intercity travel demand that will be unmet by present transportation systems and increase capacity for intercity mobility.
- Maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways.
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent and reliable high-speed travel.
- Provide a sustainable reduction in travel time between major urban centers.
- Increase the efficiency of the intercity transportation system.
- Maximize the use of existing transportation corridors and rights-of-way, to the extent feasible.
- Develop a practical and economically viable transportation system that can be implemented in phases by 2020 and generate revenues in excess of operations and maintenance costs.

When developing and selecting the proposed HSR alignment alternatives, CHSRA utilized a Context Sensitive Solution (CSS) approach, as described in the alternatives analysis documents. CSS is a process that involves interested parties in arriving at design solutions for public works projects, such as transportation improvements, that are sensitive to community concerns while also supportive of the objectives of the project. CSS goals specific to the San Francisco to San Jose Section are:

- Ensure that community input is heard and considered during project planning and design;

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<sup>1</sup> This description is sourced from the CHSRA Preliminary Alternatives Analysis (San Francisco to San Jose) document published in April 2010 and the Supplemental Alternatives Analysis (San Francisco to San Jose) document published in August 2010.

- Assist cities and communities to define community-based measures of success and ensure that the project evaluation criteria reflect the goals of stakeholder interests, as well as project goals;
- Facilitate inclusive community engagement that focuses on creative solutions at the corridor and local community levels for alignment and station planning and design; and
- Support a corridor-wide advisory group that can represent community consensus on a preferred feasible and achievable project.

### Description of Proposed Alignment within San Francisco

The portion of the San Francisco to San Jose corridor that is the focus of this report extends from just north of the Bayshore Caltrain Station in Brisbane, California, north to the two HSR / Caltrain stations in San Francisco: the Transbay Terminal Center and the 4<sup>th</sup> and King Caltrain Station. It is within the City and County of San Francisco. The proposed CHSRA alignment generally follows the Caltrain alignment from the Bayshore Caltrain Station to the 4<sup>th</sup> and King Caltrain Station, at which point it continues to the TTC in an underground tunnel.

The base alignment proposed by CHSRA is identified as Option A in the Preliminary and Supplemental Alternatives Analysis for Segments 0A and 1 (this is called the CHSRA Base Alternative). Segment 0A is approximately 2.2 miles from just north of Mission Bay Drive (referred to in the CHSRA's document as Common Street) to the Transbay Terminal (TTC) and to the 4<sup>th</sup> and King stations. Both stations will serve both Caltrain and HSR trains. Segment 1 has seven sub-segments between Mission Bay Drive and the Bayshore station just south of the City and County of San Francisco in the City of Brisbane. The seven sub-segments are numbers 1A through 1G and have a total length of approximately 4.7 miles.

The selected alternative base alignment descriptions for Segments 0A and 1 from the Preliminary and Supplemental Alternatives Analysis report are as follows:

- Subsection 0- Option 0(a)A: HSR and Caltrain to both TTC and 4<sup>th</sup> and King – This option assumes that tracks will be added in an alignment under Townsend and Second Streets to reach a station in the basement of the new TTC. This option assumes the TTC provides 4 tracks for HSR (2 center platforms) and 2 tracks for Caltrain (1 center platform). The 4<sup>th</sup> and King station would be reconfigured at-grade to provide longer platforms required by HSR. The assumed station layout at 4<sup>th</sup> and King provides 4 tracks for HSR (2 center platforms) and 5 tracks for Caltrain (2 center platforms and one side platform for special ballpark service).
- Subsection 1- In this area of hilly terrain, a combined At Grade and Covered Trench/Tunnel option is recommended to be carried forward into further engineering and environmental analysis. This option includes a new 2-track tunnel parallel to existing 2-track Caltrain tunnels 1-4 made necessary by the hills and steep terrain along this alignment. Caltrain and freight would continue to use the existing Caltrain tracks. The new 2-track Covered Trench/Tunnel would begin as a shallow tunnel under 7<sup>th</sup> Street and continue as a deeper tunnel under Pennsylvania Avenue. The existing railroad leads to the Port of San Francisco and Hunters Point would continue to be served by the existing Caltrain alignment.

Plan/profiles from the CHSRA documents for these segments are attached in Appendix A.

### Summary Comparison of Design Options

Tables 4-3 and 4-4 in the Preliminary Alternatives Analysis document illustrate the evaluation measures applied to the two subsections. The relevant information from these tables was reproduced to focus on the selected alternative described above and was used as a comparison with the SFTWG's alternative alignment options. It is included in Appendix A. The SFTWG also identified several statements within the

Summary Comparison tables with which they disagree. Comments related to these statements are included within the tables in Appendix B in italics.

### Identification of Issues and Constraints

The SFTWG identified several concerns with the CHSRA Base Alignment selected in the Preliminary and Supplemental Alternatives Analysis reports. Primarily, the design of grade separations at 7<sup>th</sup> and 16<sup>th</sup> Streets and Mission Bay Drive, including the acquisition of neighboring properties, limited access to neighboring properties, and the potential impacts on the neighborhood character and mobility, prompted the initiation of this study. Additional concerns with the design were a lack of consistency with other planning efforts, as well as a lack of information included within the Alternatives Analysis Evaluation tables regarding locations of potential impacts. Refer to Appendix B for the Evaluation Matrix of the CHSRA alternative with comments from SFTWG in italics.

### Community Context

Mission Bay is the City's newest community. Already substantially underway, at full build-out it will include thousands of new residents and jobs, a University of California (UCSF) campus and medical center, and will represent billions of dollars of public and private investment. The adopted Mission Bay Redevelopment Plan is a result of hundreds of public meetings, building on decades of planning for the redevelopment of the area. Similarly, after a decade of planning, the City adopted new plans for the Showplace Square, Potrero Hill and Central Waterfront areas as part of the Eastern Neighborhoods effort. These plans laid out a framework, based on careful community input, for substantial intensification in this section of the City. Over time, these industrial areas will become dense, mixed-use districts with new residents, workers, students and visitors, supported by robust pedestrian, bicycle, transit and vehicular connections. The Mission Bay and Eastern Neighborhoods planning efforts included significant environmental analysis to determine what transportation and utility infrastructure is necessary to adequately serve these growing areas. Maintaining and enhancing the 16<sup>th</sup> Street, 7<sup>th</sup> Street, and Mission Bay Drive connections are essential to supporting the growth of these neighborhoods.

16<sup>th</sup> Street and 7<sup>th</sup> Street are already major neighborhood arterials supporting the entire northeast quadrant of the City; Mission Bay Drive will be a critical connection once Mission Bay is fully built out. These roads provide key linkages for pedestrians, bicyclists, buses, freight, and autos. Because of the existing at-grade Caltrain tracks, they provide the only such connections between Mission Bay, Showplace Square, Potrero Hill, and the Central Waterfront. The City has made tremendous investments, including the creation of the new Mission Bay Drive (Common Street) crossing of the existing tracks, to connect these neighborhoods.

### Neighborhood Character and Connectivity

The existing at-grade rail tracks and I-280 currently physically divide the Mission Bay, Showplace Square, and Potrero Hill neighborhoods from other parts of the City. A primary tenet of all of the plans adopted for these areas is to improve their connections with the larger city to help improve quality of life, economic vitality and access to services and amenities. Significant public investment has already been made to overcome these barriers, such as improving both the 16<sup>th</sup> Street and Mission Bay Drive crossings (the improvements to the latter cost almost \$20 million alone). However, the CHSRA proposals for 16<sup>th</sup> Street, 7<sup>th</sup> Street, and Mission Bay Drive will instead reduce the quality of the connections between these neighborhoods by creating greater visual physical barriers. In addition, the number of actual connections with the surrounding grid system will be reduced under CHSRA's proposals.

### **Pedestrian and Bicycle Connections and Safety**

The proposed designs for the 16<sup>th</sup> and 7<sup>th</sup> Streets and Mission Bay Drive underpasses create relatively long tunnels and depressed areas that will create an unsafe and unpleasant environment for pedestrians and bicyclists. These tunnels and depressed areas will force pedestrians and bicyclists to traverse relatively long stretches of road with no or very little, visual or physical connection to adjacent properties. Pedestrians are greatly sensitive to walking environments and to grade changes. A wealth of local and international experience has proven that pedestrians avoid the use of bridges or tunnels. Pedestrians rightly avoid such infrastructure not just because of the physical inconvenience of grade changes, but because of the unpleasant experience and the unavoidable fact that these facilities attract undesirable activity and create significant personal safety threats. While there might technically be a pedestrian connection via a bridge or tunnel, the neighborhoods would be effectively completely severed, which will substantially affect pedestrian mobility. Any adequate proposal needs to result in safe, direct, well ventilated and pleasing pedestrian and bicycle access, with minimal grade change, since the City places significant priority on pedestrian and bicycle movements. Additionally, 16<sup>th</sup> Street is a designated bicycle route that will have bike lanes installed.

### **Property Access and Acquisition**

The proposed underpasses would significantly limit or remove access to certain properties around the intersection of 7<sup>th</sup> and 16<sup>th</sup> Streets, requiring the potential acquisition of those properties and almost certainly rendering significant swaths of them degraded in use and value, if not simply undevelopable. On both sides of 16<sup>th</sup> Street just west of 7<sup>th</sup> Street sit two major under-developed pieces of property that are key to the revitalization of the Showplace Square and Potrero Hill areas, representing the potential for several hundred housing units on each parcel, in addition to ground floor retail and community uses to activate and support the neighborhood. On the Mission Bay side, 1700 Owens, at the corner of 16<sup>th</sup> Street, 7<sup>th</sup> Street, and Owens Street was just completed in 2007. It was recently assessed at more than \$65 million in value. However, that building stands to lose much of its retail frontage and access along 16<sup>th</sup> Street under the proposed alternative, including 16<sup>th</sup> Street access to the emergency road and loading area located behind this building. In addition, the proposed Mission Bay Drive realignment would require the acquisition of large pieces of public and private property on both sides of the rail line.

### **Quality of Transit Service**

16<sup>th</sup> Street is the designated corridor for the extension of the 22-Fillmore trolley coach line, which will be the transit connection between Mission Bay and the developing lower 16<sup>th</sup> Street area, BART and the Mission District. Depressing 16<sup>th</sup> Street will negatively impact transit service in two ways. First, it will eliminate the possibility of stops along the depressed roadway, which will distort ideal stop spacing, as well as preclude one or more important stops at key intersections. Secondly, creating a major vertical grade change in a tunnel structure will increase dewirements (where the trolley poles lose contact with the overhead wires). These in turn can create delays of anywhere from two minutes to several hours, compromising the reliability of the service on the entire line. Also at the Mission Bay Drive crossing, MUNI will run the 12-line motor coach route between the western edge of Mission Bay and Showplace Square and Potrero Hill neighborhoods. While the concern with dewirements are not an issue with motor coach service, the problems of stop locations and stop spacing with a depressed roadway would also be present here.

### **Compatibility with Adopted and Local and Regional Plans**

Significant amendments will be required to numerous adopted planning documents to address the inconsistencies that would result with implementation of the proposed CHSRA roadway changes. For instance, the adopted environmental documents, circulation and transportation plans recently adopted for these districts depends on and assumes not just maintenance of these roads at grade but their

enhancement. 7<sup>th</sup> Street is under the jurisdiction of the Port of San Francisco and subject to the State of California Burton Act. A passenger rail road may not be a compatible use with the Burton Act.

## Alternative Alignments within San Francisco

### Alternative Alignment Development Methodology

Rather than simply disagreeing with the conclusions reached in the CHSRA's alternatives study, the SFTWG set forth on a path to reach consensus on an alignment within the San Francisco segment. They identified several objectives that an alternative alignment should meet:

- Maintain 16<sup>th</sup> Street, 7<sup>th</sup> Street, and Mission Bay Drive at-grade;
- Better promote sustainability;
- Be consistent with local land use and circulation plans; and
- Avoid the adverse impacts associated with the single current alternative.

Several alternatives were identified during SFTWG working sessions and further developed by InfraConsult. Alternatives considered different horizontal alignments, vertical profiles, typical cross-sections, and construction technologies, with the goal of avoiding the adverse impacts associated with the CHSRA base alternative.

Five alternatives were initially identified. Once they were defined, plan, profiles, and cross sections were created. A letter was sent to CHSRA in late September 2010 forwarding the materials developed, describing the alternatives and requesting a meeting to discuss them. During October, InfraConsult analyzed the alternatives utilizing the CHSRA's evaluation measures and cost estimate methodology, and developed summary matrices. On October 27, 2010, at a SFTWG meeting, the alternatives identified as lowest performing were eliminated, and the top three alignment alternatives were selected to present to CHSRA representatives at a November 3, 2010 meeting.

### Alternative Alignment Descriptions

The alternatives described below and depicted in the attached drawings and cross sections in Appendices C and D, respectively, maintain 16<sup>th</sup> Street, 7<sup>th</sup> Street, and Mission Bay Drive at-grade, better promote sustainability, are consistent with local land use and circulation plans, and avoid the adverse impacts associated with the single current alternative. These alternatives all call for providing two tracks to the Transbay Transit Center via tunnel and two tracks to the Caltrain station at 4<sup>th</sup> and King Streets in San Francisco and are labeled as options and described below:

#### Option 1

A set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the TTC, while the other stays at-grade on the current Caltrain alignment as currently proposed. Once the tracks on the Caltrain alignment reach the north portal of Tunnel 1, the tracks would be depressed and go into an underground alignment directly under the existing alignment, and cross below 16<sup>th</sup> Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and ultimately come back up to grade prior to entering the rail yard at 4<sup>th</sup> and King Streets. To accommodate this option, the Division Street sewer outfall would be removed and its flows accommodated by increasing the size of a planned storm water outfall tunnel from 18 feet in diameter to 28. The proposed new 28-foot sewer tunnel is expected to be constructed by 2018.

Should there be insufficient space to accommodate the train box between columns supporting the I-280 freeway, a variation on Option 1 is included as Option 4c, and would replace the freeway north of Tunnel 1 with an at-grade parkway over the underground tracks. The parkway would continue to 7<sup>th</sup> and/or 4<sup>th</sup> and King Streets. The removal would commence far enough south of Tunnel 1 to effect a smooth transition to the new parkway.

### Option 2

A set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the TTC, while the other stays at-grade on the current Caltrain alignment as currently proposed. Once the tracks on the Caltrain alignment reach the south portal of Tunnel 1, just north of the 22nd Street Caltrain station, the tracks would be depressed and go into an underground alignment directly under the existing alignment, and cross below 16<sup>th</sup> Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and ultimately come back up to grade to the 4<sup>th</sup> and King rail yard. As in option 1, the Division Street sewer outfall would be removed and the planned storm water outfall tunnel would be increased in size from 18 feet in diameter to 28 feet to accommodate the flows.

### Option 3

A set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the Transbay Transit Center, while the other stays at-grade on the current Caltrain alignment as currently proposed. Once the tracks on the Caltrain alignment reach the south portal of Tunnel 1, just north of the 22<sup>nd</sup> Street Caltrain station, the tracks would be depressed and go into an underground alignment, veering in a north-westerly direction to an alignment parallel to the current alignment but outside of the footprint of the I-280 Freeway, and cross below 16<sup>th</sup> Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and return to grade to the 4<sup>th</sup> and King Streets rail yard. As in option 1, the Division Street sewer outfall would be removed and the planned storm water outfall tunnel would be increased in size from 18 feet in diameter to 28 feet to accommodate the flows.

This option avoids any potential insurmountable conflicts with the I-280 foundation system that may arise during detailed analysis. This option would require that the tracks destined for the TTC, currently planned to follow an underground alignment under Pennsylvania Avenue, be relocated westward to Mississippi Avenue so that the tracks going to 4<sup>th</sup> and King can be located below Pennsylvania Avenue.

### Option 4

Under this option, both sets of track would remain in a parallel at-grade alignment to a point north of Cesar Chavez Street. I-280 would be removed from Cesar Chavez north. The short section of I-280 between Cesar Chavez Street and the crossing over the Caltrain tracks near Evans Street would be reconstructed so that I-280 would touch down at Cesar Chavez Street without constructing pilings in the Caltrain right of way. A four-track tunnel box would be constructed under the vacated I-280 right-of-way with a four-lane parkway above utilizing existing grade separations. Signalized intersections along the boulevard would be provided at 22<sup>nd</sup> Street and 16<sup>th</sup> Street. North of 16<sup>th</sup> Street, the parkway would have regularly-spaced signalized intersections to align with the Showplace Street grid. The parkway would connect to 4<sup>th</sup> and King Streets. The Division Street sewer outfall would be removed and the planned storm water outfall tunnel would be increased in size from 18 feet in diameter to 28 feet to accommodate the flows.

### Option 4A

The four-track tunnel would cross below 16<sup>th</sup> Street and Mission Bay Drive, and above the proposed storm water outfall tunnel and proceed to a below-grade station and rail yard at 4<sup>th</sup> and King Streets.

### **Option 4B**

Alternatively, one set of tracks could return to grade after crossing the outfall to an at-grade station and yard at 4<sup>th</sup> and King Streets.

### **Option 4C**

This option was developed during the review meetings with the SFTWG and added to the list of options near the end of the study. Under this option, a set of tracks enters a tunnel just north of the San Mateo-San Francisco county line and continues to the TTC, while the other stays at-grade on the current Caltrain alignment (similar to Options 1 and 2) as currently proposed to a point north of Mariposa Street. I-280 would be removed and reconstructed as a parkway from 18<sup>th</sup> Street north. South of 18<sup>th</sup> Street, the freeway would be maintained in its current configuration. Mariposa Street would remain below the freeway and the ramps would remain open, and 18<sup>th</sup> Street would remain above the freeway and the ramps would be closed.

A two-track tunnel box would be constructed under the vacated I-280 right-of-way with a four- to six-lane parkway above and continue to the 4<sup>th</sup> and King Station along the Caltrain right-of-way. Signalized intersections along the parkway would be provided at 16<sup>th</sup> Street Irwin Street, Mission Bay Drive, and Berry Street, and regularly-spaced signalized or stop controlled intersections would align with the Showplace Street grid. The parkway would connect to 7<sup>th</sup> and King Streets via two surface roads of two lanes each alongside the northwestern and southern boundaries of the rail yard. The parkway would have one-way frontage roads on either side, except the east side of the block from Berry to Mission Bay Blvd, which would instead have a park. A schematic plan of the parkway is included in Appendix C along with the plan and profile of the rail alignment.

### **Option 5**

Under this option, the entire four-track alignment within San Francisco County would be underground beginning just north of the county line. A set of tracks would remain underground to the TTC and one set could either remain below grade to an underground station and yard at 4<sup>th</sup> and King Streets or return to grade to an at-grade station at 4<sup>th</sup> and King Streets. Conceivably, this option could be built using a single mega-bore tunnel boring machine thereby reducing right-of-way requirements and potentially reducing cost and construction duration.

## **Analysis Methodology**

### **Alternative Alignment Analysis Methodology**

In order to perform an analysis comparing the SFTWG Options to the Base Alternative proposed for the City and County of San Francisco by the CHSRA Preliminary and Supplemental Alternatives Analysis, the same evaluation measures were utilized to develop a comparison matrix for each Option and by each applicable subsection of the alignments. The matrix included the performance objectives and criteria as well as evaluation measures for land use, constructability, community impacts, environmental resources, and natural environment. Table 1 summarizes the evaluation measures.

The Alternatives Analysis reports compiled by CHSRA did not include detailed technical reports explaining the conclusions reached within the evaluation measures tables, thus, there were several measures for which our analysis of the alternative alignment options was incomplete or imprecise. Specifically, information on the locations of displacements, biologically sensitive habitat areas, cultural resource areas, sensitive receivers, and hazardous materials were not calculated for each Option; rather,

information from the CHSRA analysis was used where the alignments were similar, and no information was provided where the alignments diverge. Additional analysis will need to be performed by CHSRA during the EIR process on the selected alternative alignment Options.

**Table 1: CHSRA Evaluation Measures**

Evaluation Measure		
Measurement	Method	Source
<b>Design Objectives</b>	Maximize ridership / revenue potential	Travel time
		Route length
	Maximize connectivity and accessibility	Intermodal connections
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different options)
		Capital cost, does not include ROW
	Acquisition cost of additional ROW	
<b>Land Use</b>	Development potential for TOD within ½ mile of station location	Development potential for TOD within ½ mile of station location
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents
<b>Constructability</b>	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)
	Disruption to existing railroads	Identify existing freight rail and other rail service connections
	Disruption / relocation of utilities	Identify major utilities requiring relocations
<b>Disruption to Communities</b>	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations
	Properties with access affected	Properties with access affected
	Local traffic effects around stations	Increase in traffic congestion
	Local Traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings
<b>Environmental Resources</b>	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)
	Cultural resources	Number of historic structures within ultimate ROW
		Archeological Sensitivity (identified as present or not)
	Parklands	Acres of parklands within ultimate ROW
Agricultural lands	Acres of farmland	
<b>Environmental Measures</b>	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M), school (S) and park (P) properties within 200' of ultimate ROW
		Vibration: Number of residential (R), institutional (I), medical (M), school (S) and park (P) properties within 200' of ultimate ROW



Evaluation Measure		
Measurement	Method	Source
	Change in visual/scenic resources	Number of residential (R), institutional (I), and park (P) properties immediately adjacent to the ultimate ROW
		Number of scenic roadways that cross the ROW
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW / within ¼ mile of ultimate ROW

### Capital Cost Methodology

In order to do an analysis comparing the SFTWG Options to the Base Alternative proposed for the City and County of San Francisco by the CHSRA Supplemental Alternatives Analysis, the same unit costs (Appendix L – Conceptual Cost Estimates, attached as Appendix E to this document) were used to develop rough order of magnitude (ROM) capital costs for each Option and by each applicable subsection of the alignments.

Appendix L, Conceptual Cost Estimates, prepared by the CHSRA is attached to this report in Appendix E as the basic reference document for the ROM costs estimates. Table 2 shows the basic ROM cost development worksheet that was used for this cost comparison analysis. It should be noted that none of the cost estimates include any right of way costs. For Segment OA, a previous cost estimate had been prepared for this 2.2 mile segment at \$3 billion. This cost estimate for this segment was held constant for the analysis with the exception of “additions” to that segment caused by the changes proposed for each of the SFTWG Options.

**Table 2 - ROM Cost Development Worksheet**

Cost Elements	Unit	2009 \$, Unit Price	Option __, Section __	
			Quantity	\$
Track Section	2 track -In Tunnel/ Subway/Trench	Per mile	\$4,700,160	\$0
	2 track - At-grade	Per mile	\$2,100,224	\$0
	4 track - In Tunnel/ Subway/Trench	Per mile	\$9,400,320	\$0
Earthwork - 2 track	At-grade	Per mile	\$150,000	\$0
	Covered trench/tunnel	Per mile	\$6,000,000	\$0
	Mined tunnel	Per mile	\$15,000,000	\$0
Grade Separations	HSR - 4 lanes under 2 tracks	Each	\$13,284,352	\$0
	HSR - 4 lanes under 4 tracks	Each	\$19,926,528	\$0
Structure, Tunnels, Walls	Twin Single Track Drill&Blast (<6 miles)	Per mile	\$142,731,264	\$0
	Cut/Cover Double Track Tunnel	Per mile	\$131,246,080	\$0
	Double Track TBM (<6 miles)	Per mile	\$106,637,312	\$0
	Four Track Drill&Blast	Per mile	\$293,775,369	\$0
	Four Track Cut/Cover Tunnel	Per mile	\$262,492,160	\$0

Cost Elements		Unit	2009 \$, Unit Price	Option __, Section __	
				Quantity	\$
Underground Stations	Caltrain - Per Platform	Each	\$150,000,000		\$0
	HSR - Per Platform	Each	\$200,000,000		\$0
Underground M&O Facility	Caltrain	Each	\$400,000,000		\$0
I-280	Demolition (200' wide)	LF	\$8,000		\$0
Parkway	4 Lanes with median	LF	\$5,000		\$0
Ramps		Lump Sum	\$150,000,000		\$0
System Elements	Signaling, Communications	Per mile	\$2,718,000	0	\$0
Electrification	Traction Power	Per mile	\$2,655,000	0	\$0
Mech/Electrical	For Tunnels	Per mile	\$11,848,704	0	\$0
Environmental Mitigation	Percent of Hard Costs		3%		\$0
Program Implementation Costs	Percent of Hard Costs + Env Mitigation		25.50%		\$0
Contingencies	Percent of Hard Costs + Env Mitigation		25.00%		\$0
<b>Total Cost</b>					<b>\$0</b>

### Evaluation Matrix Results

For each segment and option, an Evaluation Measure matrix was developed following the methods utilized by CHSRA in the Alternatives Analysis reports. Due to the size of the matrices, the full tables are included in Appendix F to this report. This section discusses some of the notable conclusions identified for the options and segments as well as for the original CHSRA alignment identified in the Preliminary and Supplemental Alternatives Analysis Reports.

### Stormwater

All of the options which propose shallow tunnels between the north portal of Tunnel 1 and the 4<sup>th</sup> and King station must contend with existing and proposed sewer and stormwater drainage tunnels. The PUC has facilities adjacent to the 4<sup>th</sup> and King station which serve the entire City. As such, there are tunnels and pipes that converge on this area from all directions. An existing box culvert on Division Street (crossing 7<sup>th</sup> Street) has a cross section of 10 feet by 40 feet (in all likelihood this structure is larger, as PUC identifies their structures by inside diameters). A future gravity-fed pipe on Berry Street (crossing 7<sup>th</sup> Street) could range in diameter from 12 feet to 24 feet (outside diameter, or OD), and has a set invert due to the need to utilize gravity to move the contents. This pipe is part of the City Stormwater Master Plan and is set to begin construction in 2015. In order to locate the tracks under Mission Bay Drive and 16<sup>th</sup> Street, the Division Street sewer must be removed and the proposed new pipe be enlarged to carry the combined flows. The size of the enlarged pipe has been estimated to be 28 feet (OD) in this study; however, further analysis must be done before finalizing a pipe size.

Because San Francisco is fairly hilly, stormwater management utilizes the natural terrain to disperse water during inclement weather. The City sewers are sized to handle 5-year storms, and anything larger is handled by a combination of City sewers and City streets. Areas below grade can be inundated during

large storms resulting in flooding. New projects are carefully considered by PUC before construction for the risk of flooding. The area to the south of the 4<sup>th</sup> and King station at the intersection of Mission Bay Drive and 7<sup>th</sup> Street, is one such low-lying region, and engineers at PUC have indicated that CHSRA's proposed depression of 16<sup>th</sup> St, 7<sup>th</sup> St, and Mission Bay Drive to accommodate an at-grade rail ROW would increase the risk for flooding in the area to a level that could not be adequately addressed by pumping.

### Traffic

Option 4, in all three variations, must be carefully developed so as to not create more traffic congestion in this neighborhood. Regardless of where the freeway is truncated and the parkway is begun, an intensive planning effort to handle the I-280 traffic must be undertaken during the environmental studies.

### Planning Consistency

The Mission Bay community is a rapidly developing area governed by the adopted Mission Bay Redevelopment Plan. Adjacent communities also have adopted new plans as part of the Eastern Neighborhoods effort. These plans laid out a framework, based on careful community input, for substantial intensification in this section of the City. Over time, these industrial areas will become dense, mixed-use districts with new residents, workers, students and visitors, supported by robust pedestrian, bicycle, transit and vehicular connections.

Mission Bay is currently somewhat cut off from the rest of the City by the visual barricade of I-280. In order to ensure that transit, pedestrians, bicyclists, and drivers all have access to and from this growing area, it is vital that further barriers are not implemented. Locating the rail alignments underground and keeping the streets at grade will allow full circulation, best use of properties, and compliance with the City's plans for the area. At grade intersections will allow full use of the transit and bicycle network, including the future trolley line, and a safe and vibrant pedestrian environment. High-potential and existing high value properties will retain access and street frontage, ensuring maximum development and active storefronts. And finally, an underground rail alignment will avoid unnecessary exceptions and amendments to the recently adopted Redevelopment Plan.

### ROW

The cost for right-of-way is not included in any of the options studied. It is possible that once this cost is accounted for, the additional options brought forth for consideration here may appear even more desirable.

### Cost Estimate Results

For each segment, an estimate was prepared based on the conceptual plans developed for each option. Appendix G presents the applicable worksheet for each segment that was changed compared to the Base Alternative assumed by the CAHSRA. The Options were also separated by "alignments" to 4<sup>th</sup> and King, to the TTC, to 4<sup>th</sup> and King and the TTC, and for the Parkway/Freeway components.

Table 3 presents a summary of the ROM Capital Costs for each Option and for each segment of the Option by the sub alignments discussed previously. Table 4 is a Summary for each Option by Segment along with the total.

Table 3 -ROM Cost Estimate by Segment (millions, \$)

Miles	CHSRA Segments								Total
	0	1A	1B	1C	1D	1E	1F	1G	
2.20	0.28	0.76	0.23	0.91	0.66	0.49	1.40	6.93	
<b>CHSRA Base Alternative</b>									
To 4th/King		\$44	\$17	\$4	\$11	\$8	\$8	\$44	\$136
To TTC		\$70	\$211	\$60	\$257	\$175	\$140	\$383	\$1,296
To 4th/King and TTC	\$3,000								\$3,000
<b>Total</b>	\$3,000	\$114	\$228	\$64	\$268	\$183	\$148	\$427	\$4,432
<b>Option 1</b>									
To 4th/King	\$114	\$70	\$53	\$4	\$11	\$8	\$8	\$44	\$312
To TTC		\$70	\$211	\$60	\$257	\$175	\$140	\$383	\$1,296
To 4th/King and TTC	\$3,000								\$3,000
<b>Total</b>	\$3,114	\$140	\$264	\$64	\$268	\$183	\$148	\$427	\$4,608
<b>Option 2</b>									
To 4th/King	\$114	\$70	\$141	\$4	\$11	\$8	\$8	\$44	\$400
To TTC		\$70	\$211	\$60	\$257	\$175	\$140	\$383	\$1,296
To 4th/King and TTC	\$3,000								\$3,000
<b>Total</b>	\$3,114	\$140	\$352	\$64	\$268	\$183	\$148	\$427	\$4,696
<b>Option 3</b>									
To 4th/King	\$114	\$70	\$151	\$4	\$11	\$8	\$8	\$44	\$410
To TTC	\$100	\$70	\$211	\$60	\$257	\$175	\$140	\$383	\$1,396
To 4th/King and TTC	\$3,000								\$3,000
<b>Total</b>	\$3,214	\$140	\$362	\$64	\$268	\$183	\$148	\$427	\$4,806
<b>Option 4a</b>									
To 4th/King	\$1,996								\$1,996
To TTC									\$0
To 4th/King and TTC	\$3,000	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$4,728
<b>Total</b>	\$4,996	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$6,724
<b>Option 4b</b>									
To 4th/King	\$172								\$172
To TTC									\$0
To 4th/King and TTC	\$3,000	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$4,728
<b>Total</b>	\$3,172	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$4,900
<b>Option 4c</b>									
To 4th/King	\$114	\$70	\$53	\$4	\$11	\$8	\$8	\$44	\$312
To TTC		\$70	\$211	\$60	\$257	\$175	\$140	\$383	\$1,296
Parkway/Freeway	\$62	\$39	\$255						\$356
To 4th/King and TTC	\$3,000								\$3,000
<b>Total</b>	\$3,176	\$179	\$519	\$64	\$268	\$183	\$148	\$427	\$4,964

Miles	CHSRA Segments								Total
	0	1A	1B	1C	1D	1E	1F	1G	
Miles	2.20	0.28	0.76	0.23	0.91	0.66	0.49	1.40	6.93
<b>Option 5</b>									
To 4th/King	\$1,938								\$1,938
To TTC									\$0
To 4th/King and TTC	\$3,000	\$184	\$732	\$151	\$598	\$434	\$322	\$920	\$6,341
<b>Total</b>	<b>\$4,938</b>	<b>\$184</b>	<b>\$732</b>	<b>\$151</b>	<b>\$598</b>	<b>\$434</b>	<b>\$322</b>	<b>\$920</b>	<b>\$8,279</b>

Table 4 -ROM Cost Estimate Summary (millions, \$)

Miles	CHSRA Segments								Total
	0	1A	1B	1C	1D	1E	1F	1G	
Miles	2.20	0.28	0.76	0.23	0.91	0.66	0.49	1.40	6.93
<b>CHSRA Base Alternative</b>	\$3,000	\$114	\$228	\$64	\$268	\$183	\$148	\$427	\$4,432
<b>Option 1</b>	\$3,114	\$140	\$264	\$64	\$268	\$183	\$148	\$427	\$4,608
<b>Option 2</b>	\$3,114	\$140	\$352	\$64	\$268	\$183	\$148	\$427	\$4,696
<b>Option 3</b>	\$3,214	\$140	\$362	\$64	\$268	\$183	\$148	\$427	\$4,806
<b>Option 4a</b>	\$4,996	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$6,724
<b>Option 4b</b>	\$3,172	\$168	\$684	\$417	\$66	\$163	\$10	\$220	\$4,900
<b>Option 4c</b>	\$3,176	\$179	\$519	\$64	\$268	\$183	\$148	\$427	\$4,966
<b>Option 5</b>	\$4,938	\$184	\$732	\$151	\$598	\$434	\$322	\$920	\$8,279

### Screening of Options

The SFTWG met on October 27, 2010 to review the screening matrices and cost estimates. Based on the information presented as well as discussions held during the meeting, the group reached consensus to eliminate Options 3, 4a, 4b, and 5. Options 1, 2, and the newly created 4c, were agreed upon to be further developed and forwarded to CHSRA for inclusion in the Environmental Impact Report.

### Eliminated Options

Option 3 was eliminated because moving both tunnels west one block and ensuring both were underground created additional property takes at the Tunnel 1 north portal at the transition to Pennsylvania Avenue. While this alternative met the study purpose, it did not add value.

Options 4a and 4b were eliminated because while rebuilding the freeway as a parkway met the study purpose in that it eliminated the barriers between neighborhoods, it was determined that changing the southern terminus of the new parkway to just south of 16<sup>th</sup> Street could meet the study purpose with fewer impacts to the surrounding neighborhoods.

Option 5, the fully underground mega-bore tunnel, was eliminated because although it met the study goals and objectives, it resulted in significant engineering constraints at the southern portal, requiring property acquisition on a large scale. It also would require large amounts of grouting.

### Options Continued for Further Study

Options 1 and 2 are similar in that a tunnel is utilized to avoid depressing Mission Bay Drive, 7<sup>th</sup> Street, and 16<sup>th</sup> Street. Option 1 is a shorter tunnel with steeper grades (however, remaining within the CHSRA Design Standards), and Option 2 is a slightly longer tunnel with a more gradual incline. Both leave the alignment south of Tunnel 1 as per the CHSRA design. Both options were suggested for further analysis by CHSRA.

Option 4c was developed during the study process, when it became apparent that an alternative to locating the tracks under the freeway and between the support columns would be necessary in the event that the as-built plans for the freeway were inaccurate. This option would replace the freeway north of 16<sup>th</sup> Street with a multiple lane parkway on top of the underground tracks in a box.

### Conclusions

The conclusion of this analysis is that the three options (Option 1, 2, and 4c) are the most reasonable and feasible alternatives and therefore should be included in the CHSRA Alternatives Analysis study.

Significant areas that need further exploration for these three options as well as the current CHSRA alignment include the proposed storm water overflow tunnel under Division Street, the potential removal/replacement of the current Division Street sewer, and the flood risk areas in the low-lying Mission district. Additional study is also needed on the traffic impacts associated with replacing the freeway north of 16<sup>th</sup> Street.