ROAD REPAIR AND ACCOUNTABILITY ACT OF 2017
PROJECT BASELINE AGREEMENT

Posey Tube and Webster Tube Ventilation Upgrade (04-2Y780)

Resolution SHOPP-P-2526-02B
(to be completed by CTC)

1. FUNDING PROGRAM

- ☐ Active Transportation Program
- ☐ Local Partnership Program (Competitive)
- ☐ Solutions for Congested Corridors Program
- ☑ State Highway Operation and Protection Program
- ☐ Trade Corridor Enhancement Program

2. PARTIES AND DATE

2.1 This Project Baseline Agreement (Agreement) effective on October 16, 2025 (will be completed by CTC), is made by and between the California Transportation Commission (Commission), the California Department of Transportation (Caltrans), the Project Applicant, Caltrans, and the Implementing Agency, Caltrans, sometimes collectively referred to as the "Parties".

3. RECITAL

3.1 Whereas at its 3/22/2024 meeting the Commission approved the State Highway Operation and Protection Program and included in this program of projects the Posey Tube and Webster Tube Ventilation Upgrade (04-2Y780), the parties are entering into this Project Baseline Agreement to document the project cost, schedule, scope and benefits, as detailed on the Project Programming Request Form attached hereto as ***Exhibit A***, the Project Report attached hereto as ***Exhibit B***, the Performance Metrics Form, if applicable, attached hereto as ***Exhibit C***, as the baseline for project monitoring by the Commission.

3.2 The undersigned Project Applicant certifies that the funding sources cited are committed and expected to be available; the estimated costs represent full project funding; and the scope and description of benefits is the best estimate possible.

4. GENERAL PROVISIONS

The Project Applicant, Implementing Agency, and Caltrans agree to abide by the following provisions:

4.1 To meet the requirements of the Road Repair and Accountability Act of 2017 (Senate Bill [SB] 1, Chapter 5, Statutes of 2017) which provides the first significant, stable, and on-going increase in state transportation funding in more than two decades.

4.2 To adhere, as applicable, to the provisions of the Commission:

- ☐ Resolution _____, "Adoption of Program of Projects for the Active Transportation Program", dated _____
- ☐ Resolution _____, "Adoption of Program of Projects for the Local Partnership Program", dated _____
- ☐ Resolution _____, "Adoption of Program of Projects for the Solutions for Congested Corridors Program", dated _____
- ■ Resolution G-24-34, "Adoption of Program of Projects for the State Highway Operation and Protection Program", dated 3/22/2024
- ☐ Resolution _____, "Adoption of Program of Projects for the Trade Corridor Enhancement Program", dated _____

4.3 All signatories agree to adhere to the Commission's Guidelines. Any conflict between the programs will be resolved at the discretion of the Commission.

4.4 All signatories agree to adhere to the Commission's SB 1 Accountability and Transparency Guidelines and policies, and program and project amendment processes.

4.5 Caltrans agrees to secure funds for any additional costs of the project.

4.6 Caltrans agrees to report to Caltrans on a quarterly basis; on the progress made toward the implementation of the project, including scope, cost, schedule, and anticipated benefits/performance metric outcomes.

4.7 Caltrans agrees to prepare program progress reports on a on a semi-annual basis and include information appropriate to assess the current state of the overall program and the current status of each project identified in the program report.

4.8 Caltrans agrees to submit a timely Completion Report and Final Delivery Report as specified in the Commission's SB 1 Accountability and Transparency Guidelines.

4.9 Caltrans agrees to submit a timely Project Performance Analysis as specified in the Commission's SB 1 Accountability and Transparency Guidelines.

4.10 All signatories agree to maintain and make available to the Commission and/or its designated representative, all work related documents, including without limitation engineering, financial and other data, and methodologies and assumptions used in the determination of project benefits and performance metric outcomes during the course of the project, and retain those records for six years from the date of the final closeout of the project. Financial records will be maintained in accordance with Generally Accepted Accounting Principles.

4.11 The Inspector General of the Independent Office of Audits and Investigations has the right to audit the project records, including technical and financial data, of the Department of Transportation, the Project Applicant, the Implementing Agency, and any consultant or sub-consultants at any time during the course of the project and for six years from the date of the final closeout of the project, therefore all project records shall be maintained and made available at the time of request. Audits will be conducted in accordance with Generally Accepted Government Auditing Standards.

5. SPECIFIC PROVISIONS AND CONDITIONS

5.1 Project Schedule and Cost
See Project Programming Request Form, attached as Exhibit A.

5.2 Project Scope
See Project Report or equivalent, attached as Exhibit B. At a minimum, the attachment shall include the cover page, evidence of approval, executive summary, and a link to or electronic copy of the full document.

5.3 Performance Metrics
See Performance Metrics Form, if applicable, attached as Exhibit C.

5.4 Additional Provisions and Conditions *(Please attach an additional page if additional space is needed.)*

Attachments:

Exhibit A: Project Programming Request Form
Exhibit B: Project Report
Exhibit C: Performance Metrics Form *(if applicable)*

SIGNATURE PAGE
TO
PROJECT BASELINE AGREEMENT

Project Name: **Posey Tube and Webster Tube Ventilation Upgrade (04-2Y780)**

Resolution: SHOPP-P-2425-02B

(to be completed by CTC)

Hung Nguyen — 7/11/2025

Hung Nguyen
Date

Project Manager
Project Applicant

David Ambuehl — 08/21/2025
David Ambuehl (Aug 21, 2025 14:48:18 PDT)

David Ambuehl
Date

Acting District Director
California Department of Transportation

Dina El-Tawansy — 09/22/2025
Dina El-Tawansy (Sep 22, 2025 13:01:52 PDT)

Dina El-Tawansy
Date

Director
California Department of Transportation

Paul Golaszewski for — 10/31/2025

Tanisha Taylor
Date

Executive Director
California Transportation Commission

Baseline agreement information was extracted from Caltrans' project data systems. Project description, funding and performance measures are from CTIPS. Project delivery milestones are from PRSM. All information is current and accurate.

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

BASELINE AGREEMENT

Date:	08/29/25 04:14:57 PM

District	EA	Project ID	PPNO	Project Manager
04	2Y780	0423000158	2919C	NGUYEN, HUNG T

County	Route	Begin Postmile	End Postmile	Implementing Agency	
ALA	260	R 1.1	R 1.8	PA&ED	Caltrans
				PS&E	Caltrans
				Right of Way	Caltrans
				Construction	Caltrans

Project Nickname

Posey Tube and Webster Tube Ventilation Upgrade (04-2Y780)

Location/Description

In the cities of Alameda and Oakland, at the Posey Tube No. 33-0106R (PM R1.1R/R1.8R) and Webster Tube No. 33-0106L (PM R1.1L/R1.9L). Improve ventilation by installing jet fans.

Legislative Districts

Assembly:	18	Senate:	09	Congressional:	13

PERFORMANCE MEASURES

	Primary Asset	Good	Fair	Poor	New	Total	Units
Existing Condition	Bridge Health	0.0	666509.0	0.0		666509	Square feet of bridge deck
Programmed Condition	Bridge Health	0.0	666509.0	0.0	0.0	666509	Square feet of bridge deck

Project Milestone	Actual	Planned
Project Approval and Environmental Document Milestone	04/24/25	
Right of Way Certification Milestone		05/22/26
Ready to List for Advertisement Milestone		05/29/26
Begin Construction Milestone (Approve Contract)		12/09/26

FUNDING (Allocated amounts are shaded)

Component	Fiscal Year	SHOPP					Total
PA&ED	22/23	3,748					3,748
PS&E	25/26	8,706					8,706
RW Support	25/26	25					25
Const Support	25/26	9,191					9,191
RW Capital	25/26	11					11
Const Capital	25/26	37,348					37,348
Total		59,029					59,029

State of California
DEPARTMENT OF TRANSPORTATION

California State Transportation Agency

Memorandum

To: RICH STONE
SHOPP
HQ Financial Programming

Date: September 9, 2025

File: 04-2Y780
0423000158
04-ALA-260 RI.10/I.80

From: Hung Nguyen, PE
Project Manager
District 4

Subject: **PROJECT STATUS UPDATE**

This memorandum is written to accompany the Baseline Agreement for the referenced project.

The Project was programmed into the 2022 SHOPP Program for FY 25/26 RTL delivery. Since the Project Report was prepared, the schedule has been revised to reflect the current design progress. In addition, right of way capital listed in the project report is $50K. The initial programed amount was $11k. District will request for additional right of way capital funds via G12 if expenditures are expected to exceed $11k.

The CTIPS programmed amount for construction capital is $37,348k. However, the current cost estimate as shown in the project report is $36,902K. In addition, the project post miles as shown in the Asset Management Tool contain suffixes that are not shown in the other data sources. This is due to the AM Tool using updated post mile formatting. However, the project location itself is consistent between sources.

Milestone	PR Schedule	Current Schedule
M200	4/23/2025	4/24/2025
R/W Cert M410	1/28/2026	5/22/26
RTL M460	2/28/2026	5/29/26
Approve Contract M500	11/30/2026	12/09/26

Project Report

For Project Approval

On Route 260 in Alameda and Oakland in Alameda County, Posey/Webster Tubes (Br. No. 33-0106R, Br. No. 33-0106L)

Between PM R1.1

And PM R1.8

I have reviewed the right of way information contained in this report and the Right of Way Data Sheet attached hereto and find the data to be complete, current, and accurate:

Julie McDaniel, Deputy District Director,
Right of Way and Land Surveys

APPROVAL RECOMMENDED:

Hung Nguyen, Project Manager

Morteza Azimi

Morteza Azimi, Office Chief
Design Alameda

PROJECT APPROVED:

Wajahat

Wajahat Nyaz
Deputy District Director, Design

04/23/2025
Date

Vicinity Map

Posey/Webster Tubes (Br#33-0106R, Br#33-0106L) on State Route 260 in Cities of Oakland and Alameda in Alameda County

This Project Report has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data on which the recommendations, conclusions, and decisions are based.

William Fong 2/21/2025

REGISTERED CIVIL ENGINEER *DATE*

WILLIAM FONG

Table of Contents

List of Tables

1. INTRODUCTION

Project Description:

The project proposes to upgrade both the Posey Tunnel and the Webster Tunnel (also referred to as the Posey/Webster Tubes (Br#33-0106R, Br#33-0106L) in the cities of Oakland and Alameda in Alameda County and bring them into compliance with the life-safety goals of National Fire Protection Association (NFPA) 502, Standard for Road Tunnels and Limited Access Highways (see Attachment A for a location map). The primary focus of the upgrade is to improve the emergency ventilation systems. The improvements will add ceiling jet fans near the entry portal of the Webster Tube on State Route (SR) 260 and reconfigure the existing ventilation systems in both the Posey Tube and the Webster Tube from transverse ventilation systems to longitudinal ventilation systems to meet the life-safety goals of the project. These ventilation enhancements will primarily address fire mitigation for heavy goods vehicle fires by improving smoke management for egress and enhancing firefighting operational response. In addition, the project will add deluge sprinkler systems to both tubes. The design of the ventilation systems will not impact the design of the deluge systems. Table 1-1 summarizes the key information for the project.

Table 1-1: Key Project Information

Project Limits	Ala - 260 – PM R1.1/R1.8	
Number of Alternatives	Two (One Build Alternative and the No-Build Alternative)	
	Current Cost Estimate	**Escalated Cost Estimate**
Capital Outlay Support	21,670,000	21,670,000
Capital Outlay Construction	30,363,500	36,902,376
Capital Outlay Right-of-Way	50,000	50,000
Funding Source	SHOPP Program 201.110	
Funding Year	2025/26	
Type of Facility	Tunnels	
Number of Structures	Two	
SHOPP Project Output	Two Bridges See Section 6 for full list	
Environmental Determination or Document	Categorical Exemption (CEQA) Categorical Exclusion (NEPA)	
Legal Description	Posey/Webster Tubes (Br#33-0106R, Br#33-0106L) on State Route 260 in Cities of Oakland and Alameda in Alameda County	
Project Development Category	4B	

Notes:
Ala = Alameda County
Br. = Bridge
CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act
PM = post mile(s)
SHOPP = State Highway Operation and Protection Program

2. RECOMMENDATION

It is recommended that this Project Report be approved, and that authorization be granted for the preparation of Plans, Specifications and Estimate (PS&E).

3. BACKGROUND

Project History

The Project Initiation Report (PIR) was approved in January 2023. The project was initiated in response to a risk analysis report for the Posey and Webster Tubes as a part of a broader risk analysis of seven Caltrans Road tunnels. (See Attachment B). In accordance with the recommendation in the risk analysis report, the existing ventilation systems and various alternative ventilation systems were analyzed. The analysis evaluated the outcome of hazardous events with potential adverse consequences and the likelihood of hazardous event would occur (risk-consequence x likelihood).

The study considered the probability of fire occurring in one of the tunnels and associated consequences. The fires analyzed were divided into three categories, each assigned a separate hazard score as follows:

- A small fire (e.g., a car fire, 5 Megawatts (MW)), with minimal life-safety hazard or damage potential (hazard score = 10)
- A medium fire (e.g., a bus fire, 20 to 30 MW), with a possible life-safety hazard or damage potential (hazard score = 100)
- A large fire (e.g., a truck fire, 50 to 100 MW), with a significant life-safety hazard or damage potential (hazard score = 1000)

Fire likelihood was based on the traffic traveling through the tunnel (Average Annual Daily Traffic [AADT]), the tunnel length, the types of vehicles (cars, buses, and trucks), and the rate of fires on US highways. The risk score was computed based on the sum (for each category of fire hazard [small, medium, and large]) of the hazard score multiplied by fire likelihood. These results are referred to as the fire risk scores (FRSs).

A FRS was computed for each tunnel and design option as well as for a benchmark tunnel (a 2,560-foot-long tunnel—that is, a half mile-long tunnel assumed to meet NFPA 502, with the same traffic number and profile as the Posey and Webster Tubes). The benchmark tunnel is used to help make a consistent comparison between options. See Attachment B for the complete WSP risk analysis of District 04 road tunnels.

The risk analysis concluded that the Posey and Webster Tubes were the highest risk-priority tunnels in California and recommended ventilation upgrades for both tunnels.

Community Interaction

A Transportation Management Plan Data Sheet has been prepared for the project (see Attachment G). The TMP will outline public outreach to keep the community informed about the project-related lane closures as necessary.

Existing Facility

Posey and Webster Tubes are two parallel tunnels crossing the Oakland Estuary, connecting Oakland and Alameda cities. Traffic in the Webster Tube travels in a westerly direction from entrances at 6th and Webster Streets and 5th St and Broadway in Oakland to Webster Street in Alameda. Traffic in the Posey Tube travels in an easterly direction from Webster Street in Alameda to 6th and Harrison Streets in Oakland. Both tunnels are approximately 3,500 feet long and 32 feet in diameter.

4. PURPOSE AND NEED

Purpose:

The purpose of the project is to improve the performance of the existing smoke ventilation systems for both the Posey Tube and the Webster Tube. The improvements will reconfigure the existing ventilation systems in both tubes and add jet fans at the entry portal to the Webster Tube to provide additional ventilation for improving smoke management for egress and to improve firefighting operational response.

Need:

The need for the project was identified in WSP's risk analysis, which explored the ventilation capacities of the complex tunnels/tubes within California to address the smoke hazard posed from vehicle fires of current commercial vehicles. The risk analysis concluded that the Posey and Webster Tubes were the highest risk-priority tunnels in California and recommended ventilation upgrades.

4A. Problem, Deficiencies, Justification

Neither the Posey Tube nor the Webster Tube follows the life-safety goals of NFPA 502. The project proposes to upgrade the emergency ventilation system in both tunnels to improve smoke management during egress and to improve firefighting operational response. The WSP risk analysis concluded that the Posey and Webster Tubes were the highest-risk priority tunnels in the state and recommended ventilation upgrades.

4B. Regional and System Planning

Corridor Overview

State Route 260 is a principal arterial corridor that serves commuter and commercial traffic between the cities of Alameda and Oakland near I-880 via the Posey/Webster Tube. This route is one of the main connecting routes to Alameda Island and serves as an alternative

route to the San Francisco Bay Oakland International Airport via State Route 61. The route begins at the Webster Street/Atlantic Avenue-Ralph Appezzato Parkway intersection and proceeds north to I-880. Connecting the cities of Alameda and Oakland, SR 260 is primarily a controlled access facility in both the northbound and southbound directions, known as the Posey Tube in the northbound direction and the Webster Tube in the southbound direction. Land use along the route is characterized by retail and commercial development, educational facilities (College of Alameda), apartments, and the Posey and Webster Tubes. The route consists of two segments:

Segment A: Atlantic Ave./Ralph Appezzato Pkwy. in Alameda to the Posey Tube (ALA 0.65 – 1.125)

Segment B: Posey Tube to 7th Ave. and Harrison St in Oakland (ALA 1.125 – 1.924)

Table 4-1: Federal and State of California Planning Characteristics of SR 260 in Alameda County

Functional Classification	Trucking Designations	Speed Information (TSN 2024)	National Highway System (NHS)	Scenic Highway	Interregional Road System (IRRS)
Principal Arterial	65' California Legal Route	From PM R1.1 L/R to 1.5L/R – 45 MPH, From PM 1.51L/R to 1.8L/R – 70 MPH	MAP21 Principal Arterial	No	No

State Planning

SR-260 Transportation Concept Report

The State Route 260 Transportation Concept Report (TCR) (2011) is a long-range planning document that provides highway project recommendations and a conceptional vision for the corridor through the year 2035. Based on the TCR, all planned and programmed projects for the corridor should be completed. Segment A is to maintain the existing 5-lane conventional highway facility and Segment B is to maintain the existing divided four-lane facility.

Regional Planning

The Metropolitan Transportation Commission (MTC) is the State-designated Regional Transportation Planning Agency and the federal-designated Metropolitan Planning Organization for the San Francisco Bay Area. The MTC is responsible for the Regional Transportation Plan (RTP), a long-range (though financially constrained) planning report for the region. Under Senate Bill 375, along with an updated RTP, each region in California is mandated to develop a Sustainable Communities Strategy (SCS) that promotes compact, mixed-use commercial and residential development that is walkable, bikeable, and close to

mass transit, jobs, schools, shopping, parks, recreation, and other amenities to help achieve the greenhouse gas emission reduction target outlined in SB 32.

In partnership with the Regional Planning Agency Association of Bay Area Governments (ABAG), MTC developed Plan Bay Area (PBA) 2050, approved in October 2021. PBA 2050 is comprised of 35 strategies focused on improving housing, economic growth, transportation, and the environment for the Bay Area's nine counties. These strategies serve as a blueprint to inform the nine counties of the Bay Area to plan and create a more resilient and equitable region over the next 30 years and beyond. Each strategy is a public policy or investment to be implemented collaboratively at the city, county, regional, or state level with equity as the priority for execution. An update to PBA 2050, called Plan Bay Area 2050+ is currently underway. This is a limited and focused update to the plan, that will refine select plan strategies using lessons learned from the last three years and will also enable continued progress implementing the strategies of the Plan. This project is a SHOPP project and therefore is included in PBA 2050 in one of the programmatic categories. There are no other non-SHOPP PBA 2050 projects in the vicinity of this project.

Local Planning

The OAAP project proposes to improve access along Interstate 880 (I-880) and in and around the Webster and Posey Tubes (State Route 260 [SR-260] tunnels under the Oakland Estuary [Tubes]) within the approximately 1-mile-long project, I-880 (ALA PM 30.47 to PM 31.61) and SR-260 (ALA PM R0.78 to R1.90). The key modification is that constructing a new horseshoe connector under I-880 at Jackson Street, removing the existing northbound I-880/Broadway off ramp viaduct, widening the northbound I-880/Oak Street off ramp, and enhancing bicycle and pedestrian pathways through the Posey and Webster Tubes. The anticipated begin construction for OAAP is in summer of 2025 and to take approximately 36 months.

The Alameda County Transportation Commission (Alameda CTC) is a joint powers authority that plans, funds, and delivers transportation programs and projects that expand access and improve mobility to foster a vibrant and livable Alameda County. Alameda CTC also serves as the county's congestion management agency. It is governed by 22 elected officials representing all 14 cities in Alameda County. Alameda CTC coordinates countywide transportation planning efforts; programs local, regional, state, and federal funding; and delivers projects and programs including those approved by voters in Alameda County transportation expenditure plans for Measure B, Measure BB, and the Vehicle Registration Fee.

The Alameda Countywide Transportation Plan (CWTP) is a long-range policy document that guides future transportation investments, programs, policies, and advocacy for all of Alameda County through 2050. The CWTP, which is updated approximately every four years, identifies several future trends, issues and challenges for the County including safety and more specifically an increase in the number of collisions on roadways. ACTC is currently developing the next update to this plan and is expected to be completed in 2026. The following projects are listed in the current CWTP.

Table 4-2: Local Projects Listed in the Alameda CWTP in the Vicinity of the EA 04-2Y780 Project Limits

Project	Sponsor Agency	Total Cost (Millions)
04-2W740-Install Permanent Fuel-Cell Power Systems & Modify Existing Circuit Infrastructure (PM 1.1/1.9), Phase 3, 4	Alameda	$8
04-0G360- Oakland/Alameda Access Project (PM R0.78/R1.90), Phase 1	Alameda CTC	$114

Notes:
CWTP = Countywide Transportation Plan
EA = Expenditure Authorization

Future Projects

SHOPP

The State Highway Operation and Protection Program (SHOPP) is the State's "fix-it-first" program that funds the repair, safety improvements, some highway operational improvements, and preservation of the State Highway System.

Table 4-3 below identifies within the vicinity of the project limits.

Table 4-3: Project Included in the SHOPP That Are in the Vicinity of the EA 04-2Y780 Project Limits

Project ID	County /Route	Post Miles	EA	Legal description	Work Description *	SHOPP Program/ Plan	Phase
0421000266	ALA 260	R1.1 / R1.9	2W740	Posey/Webster Tubes (Br 33-0106R, Br 33-0106L) on Route 260, In the cities of Oakland and Alameda, in Alameda County	Install Permanent Fuel-Cell Power Systems and Modify Existing Circuit Infrastructure	SHOPP 2022	1_PostRTL

* Source: Milestone Report 12-19-2024.
Notes:
1_PostRTL = Phase 1, post-Ready to List
Ala = Alameda County
EA = Expenditure Authorization
ID = identification number
SR = State Route

STIP

The California State Transportation Improvement Program (STIP) is the biennial five-year plan adopted by the California Transportation Commission for future allocations of certain state transportation funds for state highway improvements, intercity rail, and regional highway, and transit improvements. There are no projects in the project vicinity included in the STIP.

4C. Traffic

Current and Forecasted Traffic

The Average Daily Traffic (ADT) levels for the count year (2018), construction completion year (2028), and design year (2048) are listed in Table 4-4.

The Traffic Indices (TI) and the Equivalent Single Axle Loads (ESALs) for the 20-year and 40-year forecasts after project completion are also summarized in Table 4-4.

Table 4-4: Current and Forecasted Traffic Data Within the Project Limits

Count Year ADT (2018)	64,800
Construction Year ADT (2028)	71,000
Design Year ADT (2048)	83,000
DHV_2048	6,300
D	55.1%
Truck %	2.40%

TI and ESAL	
20-year TI	12.50
20-year ESAL	17,314,000
40-year TI	14.00
40-year ESAL	37,461,000

Collision Analysis

The Table B reports identified in Table 4.5 and Table 4.6 were generated on 01-10-2025 it depicts collision rates per million vehicle miles from the Traffic Accident Surveillance and Analysis System (TASAS). These tables summarize and compares the actual crash rates to the average rates for similar facilities throughout the State.

The Total crash rates include all reported crashes: Fatal, Injury, and Property Damage.

Table 4-5: ALA SR-260 PM 1.1 to 1.865 – Posey Tube TASAS
Table B Collision Rates (April 1, 2019 – March 31, 2024)

Segment	No. of Collisions					Collision Rate (per million vehicle miles)					
	Total	Fatal	Serious Injury	Other Injury	PDO	Actual			Average		
						F	F+I	Total	F	F+I	Total
ALA SR-260 PM R1.1 to R1.865 (main line)	17	0	0	5	12	0.000	0.09	0.3	0.008	0.37	1.08

Table 4.5 (TASAS Table B Crash Rates (04-01-2019– 03-31-2024)) summarizes and compares the actual crash rates for the segment of ALA SR-260 PM R1.1 to R1.865 – Mainline to the average rates for similar facilities throughout the State. The Total crash rates include all reported crashes: Fatal, Injury, and Property Damage.

Analysis of the TASAS Table B records shows a total of 17 crashes within the segment of ALA SR-260 PM R1.1 to R1.865 – Mainline and study periods summarized above, with a total rate of fatal and injury related crash rate that is below the average crash rate for similar facilities statewide, and a total crash rate that is below the average for similar facilities statewide.

Detailed analysis of the types of reported collisions shows that:
• 4 (23.5%) crashes were sideswipe,
• 8 (47.1%) crashes were rear end,
• 4 (23.5%) crashes were hit object, and
• 1 (5.9%) crash was overturn.

The primary crash factors were:
• 1 (5.9%) Influence of alcohol,
• 1 (5.9%) Follow too close,
• 8 (47.1%) Improper turn,
• 6 (35.3%) Speeding, and
• 1 (5.9%) Other violations.

Table 4-6: ALA SR-260 PM 1.1 to 1.836 – Webster St. Tube
TASAS Table B Collision Rates (April 1, 2019 – March 31, 2024)

Segment	No. of Collisions					Collision Rate (per million vehicle miles)					
	Total	Fatal	Serious Injury	Other Injury	PDO	Actual			Average		
						F	F+I	Total	F	F+I	Total
ALA SR-260 PM R1.1 to R1.865 (main line)	37	1	2	6	28	0.019	0.17	0.7	0.008	0.37	1.08

Table 4.6 (TASAS Table B Crash Rates (04-01-2019– 03-31-2024)) summarizes and compares the actual crash rates for the segment of ALA SR-260 PM R1.1 to R1.836 – Mainline to the average rates for similar facilities throughout the State. The Total crash rates include all reported crashes: Fatal, Injury, and Property Damage.

Analysis of the TASAS Table B records shows a total of 37 crashes within the segment of ALA SR-260 PM R1.1 to R1.836 - Mainline and study periods summarized above, with a total rate of fatal and injury related crash rate that is below the average crash rate for similar facilities statewide, and a total crash rate that is below the average for similar facilities statewide. Detailed analysis of the types of reported collisions shows that:

- 3 (8.1%) crashes were head-on,
- 7 (18.9%) crashes were sideswipe,
- 6 (16.2%) crashes were rear end,
- 2 (5.4%) crashes were broadside,
- 17 (45.9%) crashes were hit object, and
- 2 (5.4%) crashes were other.

The primary crash factors were:

- 6 (16.2%) Influence of alcohol,
- 16 (43.2%) Improper turn,
- 9 (24.3%) Speeding,
- 4 (10.8%) Other violations,
- 1 (2.7%) Unknown and
- 1 (2.7%) Other than driver.

5. ALTERNATIVES

The project has Build Alternative and the No-Build Alternative. The project only has one Build Alternative, which is to reconfigure the existing ventilation systems in both Posey and Webster Tubes.

5A. Viable Alternative

Proposed Engineering Features

The project proposes to upgrade the Posey and Webster Tubes on State Route 260, bringing them into compliance with critical life-safety goals of NFPA 502, Standard for Road Tunnels and Limited Access Highways. The primary focus of upgrades will be improvement in emergency ventilation systems and control of fire size. The improvement includes the addition of 3 ceiling Jet Fans near the entry portal of the Webster Tube and the reconfiguration of existing ventilation systems in both Posey and Webster Tubes to convert from transverse ventilation systems to longitudinal ventilation systems. Each tube's existing ventilation supply duct openings and exhaust duct openings, spanning the approximately 3,500-foot length of the tubes, will be sealed shut to promote longitudinal airflow, to direct smoke away from upstream traffic, and to protect sensitive electrical equipment and conductors in exhaust ducts. Number of affected duct openings is approximately 368 supply and 406 exhaust in the Webster Tube, and 398 supply and 448 exhaust in the Posey Tube. Four large operable tunnel dampers will be installed in tunnel ceilings to extract smoke from specific locations based on the fire's location. The ventilation enhancements are designed to, address the mitigation of heavy goods vehicle (HGV) fires, improve smoke management for egress, and enhance firefighting operational response.

Fixed firefighting systems (deluge sprinkler systems) will be added to the tubes. The deluge systems will consist of approximately 33 fire zones per tube along their full length, each zone spanning approximately 105 feet in length. New water connections to the public utility will be provided on both ends of the Posey Tube to accommodate the increased water demand of the deluge system. The existing water supply to the Webster Tube has been determined to be adequate. Further upgrades are to install linear heat detection (LHD) systems to automatically locate and initiate timely fire response, public address systems (PA) to provide audible directions to egressing motorists along the full length of the tubes, and variable message and lane use signs installed at entry portals of each tube to control traffic. These combined upgrades aim to enhance the effectiveness of the tunnels fire life safety systems and aid firefighting personnel responding to tunnel fires.

Nonstandard Design Features

This Project does not introduce new non-standard features beyond the existing conditions. Lane widths, shoulder widths, horizontal clearances to walls, and vertical clearances for both Webster and Posey tubes remain non-standard. The project does not alter vertical clearance, including any impacts related to the jet fans and ventilation system. To bring these nonstandard features to standard will cost over $3.8 billion and is outside of scope of the project. This assessment was reviewed and concurred with by the HQ Project Delivery Coordinator, Rob Effinger, on January 9, 2025. These non-standard features were also identified under Oakland Alameda Access Project (OAAP), EA 0G360, DSDD, which was approved on September 25, 2020. As a part of OAAP there are improvements to the sidewalk in Webster Tube however, they are insufficient to meet current standards, Construction for OAAP is anticipated to begin in the summer of 2025.

5B. Rejected Alternatives

No-Build Alternative

The No-Build alternative will not upgrade Posey and Webster tubes. By not bringing Posey and Webster tubes into compliance with the life-safety goal of NFPA 502, it will not meet the purpose and need.

6. CONSIDERATIONS REQUIRING DISCUSSIONS

6A. Hazardous Waste

A hazardous materials survey of the Posey and Webster Tubes was conducted in March 2024, did not identify any asbestos-containing material or lead-based paint in the structural components of the tunnels to be disturbed by the proposed ventilation systems upgrade work. Therefore, the project does not have any hazardous waste concerns to be addressed.

6B. Value Analysis

Deputy Directive 92-R1 requires an approved Federal Highway Administration (FHWA) Value Analysis (VA) study be performed on all projects over $50 million ($40 million for bridge projects).

A Value Analysis study will be needed to be performed in a future phase because the total project cost exceeds the $40 million threshold for conducting such a study.

6C. Resource Conservation

Using the existing ventilation system in both tubes will reduce the visual impacts relative to the new equipment that would otherwise be installed in the tubes. Reconfiguration of existing ventilation system from a transverse to a longitudinal ventilation system will improve the system performance significantly and thus likely conserve resources.

6D. Right of Way

- **General** - Estimated cost information is contained in the Right of Way Data Sheet in Attachment E of this report. Additional R/W acquisition will not be required for this project.
- **Railroad** – Railroad involvement will not be required for this project.
- **Utilities** – Verifications of utilities will be required. The need for potholing will be ascertained following the verification process during PS&E phase.

6E. Environmental Compliance

A Water Quality Study was completed, and it is provided as Attachment F.

The project NIS is less than 10,000 square feet (~0.23 acres) with no 404 or 401 permit requirements. The cover of the approved Storm Water Data Report is provided as Attachment N.

Environmental Approvals

The project is Categorically Exempt under Class 1f of the State CEQA Guidelines.

The project is Categorically Excluded under the National Environmental Policy Act (NEPA). See Attachment D.

Highway Planting and Irrigation

Within the project limits, existing vegetation is limited as most of the project will occur within the two tunnels. However, if existing vegetation or irrigation is removed or impacted as part of the construction activities, the removed vegetation and the impacted existing irrigation may need to be replaced. During the Design phase, studies regarding replacement plantings and irrigation repairs will be conducted.

Erosion Control

Disturbed areas will be stabilized by applying permanent erosion control measures such as compost, fiber rolls, hydroseed, or hydro mulch. The locations of erosion control treatment will be developed during the Design phase.

Visual Aesthetics

The completed project is expected to result in minimal visual changes to the corridor. To maintain visual quality during, contractor staging/laydown shall be restricted to areas free of existing vegetation and/or irrigation systems. The project will not significantly alter the visual character of the existing corridor, and no adverse effects are anticipated to Designated Scenic Resources, as defined by CEQA statutes, guidelines, or Caltrans policy.

With the implementation of appropriate Avoidance and Minimization Measures, the project will result in low overall visual impact and no long-term adverse visual effects within the project area. Appropriate context sensitive solutions that complement the aesthetics of the existing corridors will be incorporated into the project design to blend the proposed visual changes with the existing appearance, including textures, colors, and materials. Determination of these aesthetic treatments will be determined in the Design phase.

6F. Air Quality Conformity

Available project information indicates that the project is exempt from air quality conformity per Title 40 Code of Federal Regulations (CFR) § 93.126 (Table 2– Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational, or capacity changes). Therefore, the project does not need an Air Quality Study. A construction GHG emissions analysis has been performed as part of the Project Approval and Environmental Document (PA&ED) phase (see Section 7, Climate Change Considerations).

6G. Title VI Considerations

Caltrans recognizes its leadership role and unique responsibility in State government to eliminate transportation barriers that have divided communities and amplified racial inequities. Caltrans is committed to provide more equitable transportation for all Californians by creating more transparent, inclusive, and ongoing consultation and collaboration processes and engaging with the communities most impacted by structural racism in transportation decision-making, policies, processes, planning, design, and construction. Caltrans is also committed to increase pathways to opportunity for minority-owned and disadvantaged business enterprises and for individuals who face systemic barriers to employment. The goal is to create a more resilient transportation system that distributes the benefits and burdens of the system more equitably to the current and future generations of Californians.

Per Title VI of the Civil Rights Act of 1964 and amendments, the project will not adversely affect low-income, low-mobility, or minority groups. Although there are public transit facilities, ramps/curb ramps, and bus stops within the project limits, the project will not have any significant effects on them. As such, the project will not reduce or limit access to residences or businesses such as shopping areas, schools, hospitals, or recreation areas that are being served through the corridor.

6H. Noise Abatement Decision Report

The project does not involve the vertical or horizontal realignment of any existing roadways or the construction of any new roadways. Also, the project does not involve the construction, removal, or replacement of any sound walls. Thus, the project is a type III project under 23 CFR 772, and no noise study is required.

6I. Life-Cycle Cost Analysis

A Life-Cycle Cost Analysis is not applicable to the project.

6J. Reversible Lanes

This project does not qualify as a capacity-increasing project or a major street or highway realignment project. Thus, reversible lanes have not been considered.

6K. Cultural–Section 106:

Section 106 is a Programmatic Agreement (PA):

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to consider the effects on historic properties of projects they carry out, assist, fund, permit, license, or approve throughout the country. If a federal or federally assisted project has the potential to affect historic properties, a Section 106 review will take place.

Section 106 gives the Advisory Council on Historic Preservation, interested parties, and the public the chance to weigh in on these matters before a final decision is made. This process is an important tool for citizens to lend their voice in protecting and maintaining historic properties in their communities.

Caltrans, pursuant to Section 106 PA Stipulation X.B.1.a/b, has determined a Finding of No Adverse Effect with Standard Conditions-Secretary of the Interior's Standards (FNAE-SC-SOIS) is appropriate for this undertaking. Caltrans completed a Historic Property Survey Report with FNAE-SC-SOIS Report, which was submitted to the Headquarters Cultural Studies Office (CSO) on November 20, 2024. CSO approved the finding on December 5, 2024 (see Attachment M).

7. OTHER CONSIDERATIONS AS APPROPRIATE

Public Hearing Process

A public hearing will not be scheduled because the Environmental Document for the project is a Categorical Exemption (CEQA) / Categorical Exclusion (NEPA), neither of which requires a public hearing. See Attachment D.

Caltrans Equity Statement

State departments of transportation are bound by law to consider the needs of residents with low incomes, communities of color, people with limited English proficiency, seniors, the disabled, and other communities, and individuals when developing transportation plans. Caltrans acknowledges that communities of color and underserved communities have experienced fewer of the benefits and a greater share of the negative impacts associated with the California Transportation System. Some of these disparities reflect a history of transportation decision-making, policy, processes, planning, design, and construction that put-up barriers, divided communities, and amplified racial inequities, particularly in disadvantaged neighborhoods. Caltrans recognizes its leadership role and unique responsibility to eliminate barriers and provide more equitable transportation for all Californians. This understanding is the foundation for intentional decision-making that

recognizes past, stops current, and prevents future harms from its actions. Furthermore, Caltrans is developing public outreach methodologies to increase participation by disadvantaged community members and local community-based organizations to ensure that they have a voice on projects that affect their communities.

A Community Impact Assessment (CIA) was not prepared for the project as it is a CE/CE and apart from road closures and detours (see Traffic Management Plan below for details), there are no aspects of this project which would necessitate a CIA.

Environmental Justice

Information used to identify potential Environmental Justice issues is documented in corridor plans so that transportation projects ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. This approach applies to the scope of the project, from the early stages of transportation planning and investment decision-making through construction, operations, and maintenance. Executive Order 12898, issued in 1994, gave a renewed emphasis on Environmental Justice in minority and low-income populations by giving federal attention to the environmental and human health effects of federal actions on minority and low-income populations, with the goal of achieving environmental protection for all communities. There are three fundamental principles at the core of Environmental Justice:

- To identify and address the disproportionately high and adverse human health and environmental effects on minority and low-income populations, to the greatest extent practicable and permitted by law.

- To ensure full and fair participation by all potentially affected communities in the transportation decision-making process

- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

Although Environmental Justice Communities are located near the project area, they would not be disproportionally affected by this project.

California Climate Change Investment Priority Populations

According to SB 535, disadvantaged communities are disproportionately affected by environmental pollution, low income, high unemployment, low levels of home ownership, high rent burden, sensitive populations, and low levels of educational attainment. In Assembly Bill (AB) 1550, low-income communities are defined as census tracts with median household incomes at or below 80 percent of the statewide median income or with median incomes at or below the threshold designated as low income by the US Department of Housing and Urban Development. Both SB 535 and AB 1550 direct that at least 25 percent of the Greenhouse Gas Reduction Fund should go to projects within or for the benefit of disadvantaged communities and at least an additional 10 percent should go for low-income households or communities.

Although both SB 535 and AB 1550 communities are located near the project area, they would not be disproportionally affected by this project.

Equity Priority Communities

MTC's Equity Priority Communities (EPCs) index is based on eight American Community Survey (ACS) 2014–2018 tract-level variables. The development of MTC's EPCs index was a part of the Equity Framework within the Regional Transportation Plan. The framework includes equity measures to analyze scenarios and define disadvantaged communities. The eight variables include minority populations, low-income areas, less-English-proficient populations, seniors (age 75 and older), zero vehicle households, single-parent households, people with disabilities, and rent-burdened households. EPCs within the Regional Transportation Plan area are rated at high and highest levels of concern, meaning these communities are burdened by multiple socioeconomic factors.

EPCs near the project area are affected during the closures of the tubes.

Cooperative Agreements

There is no need for cooperative agreements or update/modify existing agreements.

Transportation Management Plan

A Transportation Management Plan Data Sheet has been prepared for the project (see Attachment G). There will be significant lane and shoulder closures because of the project, and traffic will be detoured to the South Island during tunnel closures.

Road closures are expected during low demand periods including nighttime and weekends. It is estimated that Webster tube will require approximately 11-20 nights of full closure , including 3 consecutive nights for cutting damper openings, 3 consecutive nights to prepare for and install dampers, and 5 consecutive nights to install jet fans. It is estimated that Posey tube will require approximately 7-12 nights of full closure, including 3 consecutive nights for cutting damper opening and 3 consecutive nights to prepare for and install dampers. These estimates assume that the great majority of work can be done with lane closures at night. More precise requirements for partial and full closures will be determined during design phase. A complete Traffic Management Plan is being developed and will be refined during the design phase. It will include press releases to notify and inform motorists, businesses, community groups, local entities, and emergency services of upcoming closures or detours. Portable changeable message signs (CMS) and CHP COZEEP will be utilized to alleviate and minimize delays for the travelling public. During Posey and Webster Closures coordination with Metropolitan Transportation Commission (MTC) and other appropriate local agencies will be needed for work. See Attachment C.

Stage Construction

Construction staging details will be developed as part of the PS&E process. During damper modifications in the tubes, full closures are required and traffic will be detoured to the South Island during tunnel closures. See Attachment C.

Accommodation of Oversize Loads

Trucks are restricted from transporting hazardous materials/waste through the Posey and Webster Tubes.

Asset Management

Under both federal (Moving Ahead for Progress in the 21st Century Act [MAP-21], Fixing America's Surface Transportation Act [FAST]) and State legislation (SB 486, Chapter 917), Caltrans is required to prepare a robust asset management plan to guide the development of the SHOPP (see Attachment L for details). The nomination of this project in the SHOPP Tool for the 10-year SHOPP Plan and future SHOPP cycle aligns with the Caltrans Asset Management Plan. Table 7-1 lists the performance measures for the project.

Table 7-1: Performance Measures of the Project

Activity Detail	Unit of Measurement	Quantity	Assets in Good Cond.	Assets in Fair Cond.	Assets in Poor Cond.	New Asset Added
Number of bridges	Each	2	—	666,509	—	—
Is any location within the project limits ped. /Bike accessible?	Yes/no	Yes	—	—	—	—
Justification for Complete Streets being not applicable	—	Bridge/ tunnel mechanical / electrical	—	—	—	—

Notes:
— = not applicable Cond. = Condition

Complete Streets

The primary project purpose addresses assets that are outside of the roadbed, and pedestrian and bicycle travel is not affected. Thus, the project will not affect future pedestrian and bicycle facilities. The approved Complete Streets Decision Document (CSDD) from the Project Initiation Document (PID) phase is included in Attachment H and there is no change to the CSDD. Any temporary closures or detours during work still needs to consider the movements of non-motorized road users as reflected in the TMP in Attachment G.

Climate Change Considerations

Greenhouse Gas Emissions

The Environmental Document for the project is a Categorial Exemption under CEQA and a Categorical Exclusion under NEPA. Therefore, the Federal Highway Administration (FHWA) Infrastructure Carbon Estimator (ICE) Tool is not applicable. The GHG emissions analysis estimated that project construction would result in emissions of 412 tons of carbon dioxide (see Attachment I).

Sea Level Rise

The Project is subject to Sea Level Rise (SLR) at 3.28ft and is included in the Caltrans Priority SLR Report. Given the limited scope and budget of this project addressing SLR concerns is not feasible.

Broadband and Advanced Technologies

This project will not have wireless broadband communications capability.

The following items will be not be considered for this project: electromagnetic interference and other radio signal; weather conditions such as rain, snow, high winds, and high humidity; security concerns; firmware issues; and software issues.

ADA Compliance

The Webster Tube bike/pedestrian walkway meets ADA Public Right of Way Accessibility Guidelines (PROWAGs) and Caltrans accessibility standards for slope but requires an exception for width, which is the provision of 60-inch passing spaces on the bike/pedestrian walkway in the Webster Tube. This cannot be achieved due to structural infeasibility. The project makes no permanent changes to the existing walkway and further details can be found in the OAAP where modifications were made.

8. FUNDING, PROGRAMMING, AND ESTIMATE

Funding

This project is funded under SHOPP 201.110, Bridge Preservation Program. The proposed funding fiscal year for this project is 2025/2026. It has been determined that this project is eligible for federal-aid funding from the Infrastructure Investment and Jobs Act (IIJA).

Programming

The following table shows the fund distribution for each phase for each fiscal year.

Table 8-1: Current Estimates

Fund Source	Fiscal Year Estimate								
20.XX.201.110	Current	22/23	23/24	24/25	25/26	26/27	27/28	Future	Total
Component	In thousands of dollars ($1,000)								
PA&ED Support	—	3,748	—	—	—	—	—	—	3,748
PS&E Support	—	—	—	—	8,706	—	—	—	8,706
Right of Way Support	—	—	—	—	25	—	—	—	25
Construction Support	—	—	—	—	9,191	—	—	—	9,191
Right of Way	—	—	—	—	50	—	—	—	50
Construction	—	—	—	—	36,902	—	—	—	36,902
Total	—	3,748	—	—	54,874	—	—	—	58,700

Notes:
— = not applicable
Project Approval and Environmental Document
PS&E = Plans, Specifications, and Estimate

The support cost ratio is $21,670,000/ 36,952,376 = 0.586, or 58.6%.

Estimate

The current capital outlay cost escalated to the mid-point of construction is $36,952,376 which consists of $36,902,376 for the construction capital cost and $50,000 for the right of way capital cost.

For cost details, refer to Attachment J, the 11-page estimate for the Preliminary Cost Estimate for the PA&ED Phase. A 4.89% escalation rate has been applied to the project construction capital.

The component of right of way capital was not escalated in the Right of Way Data Sheet (see Attachment E). The support to capital cost ratio has been calculated to be 58.6%.

9. DELIVERY SCHEDULE

Table 9-1 lists the project milestones, milestone dates, and current milestone designation.

Table 9-1: Project Milestones, Dates, and Designations

Project Milestones		Milestone Date	Milestone Designation
PROGRAM PROJECT	M015	03/22/2023	Actual
BEGIN ENVIRONMENTAL	M020	07/15/2024	Actual
PA&ED	M200	04/2025	Target
PS&E TO DOE	M377	08/2025	Target
DRAFT STRUCTURES PS&E	M378	06/2025	Target
PROJECT PS&E	M380	12/2025	Target
RIGHT OF WAY CERTIFICATION	M410	01/2026	Target

READY TO LIST	M460	02/2026	Target
HEADQUARTERS ADVERTISE	M480	06/2026	Target
AWARD	M495	09/2026	Target
APPROVE CONTRACT	M500	11/2026	Target
CONTRACT ACCEPTANCE	M600	12/2028	Target
END PROJECT EXPENDITURES	M800	12/2029	Target
FINAL PROJECT CLOSEOUT	M900	09/2030	Target

Notes:
DOE = District Office Engineer, N/A = not applicable
Project Approval and Environmental Document
PS&E = Plans, Specifications, and Estimate

10. RISKS

A Risk Register that identifies the potential risks for the development of the project is provided with this report as Attachment K. The risks identified at this phase of the project is based on the information available, and these risks are to be modified or refined in the following phases as information is developed or becomes superseded. The significant risks identified at this phase are as follows:

- The project may conflict with other ongoing projects within the project limits, leading to overlapping work areas or incorrect sequence of work resulting in additional cost and schedule delays.
- Ductile iron pipes are to be installed to draw water service from the nearby EBMUD water mains for the tunnel's fire suppression system. There may be delays due to EBMUD not providing as-built plans due to NDA issues. This issue is beyond the control of the project, leading to potential schedule delays affecting the final design of tunnel fire suppression system. If RTL delays the due date of June 2026, the project will loose the IIJA Funding.

11. EXTERNAL AGENCY COORDINATION

Federal Highway Administration (FHWA): This project is considered to be a delegated project in accordance with the current Stewardship and Oversight Agreement signed between the Federal Highway Administration and Caltrans on May 28, 2015.

State Agency: State Fire Marshall

Local Agency: Coordination with Alameda County Transportation Commission, Cities of Oakland and Alameda is required to ensure that there are no conflicting plans.

12. PROJECT REVIEWS

The project reviews, names of the reviewers, and the dates of the reviews are as follows:

Scoping team field review attendance:

District District Program Advisor:	Byron Lim	Date:01/10/2025
Headquarters Project Delivery Coordinator:	Robert Effinger	Date: 12/19/2024
Project Manager:	Hung Nguyen	Date: 12/15/2024
Environmental:	David Rodriguez	Date: 12/23/2024
Traffic Engineering:	Necko Omar	Date: 01/02/2025
Traffic Operation:	Lore Ahmadi	Date: 12/30/2024
Transportation Planning:	Moran Amber	Date: 12/23/2024
Pedestrian & Bicycle:	Greg Currey	Date: 12/17/2024
Hazardous Waste:	Carlos M. Moral	Date: 12/18/2024

13. PROJECT PERSONNEL

Table 12-1: Project Personnel by Name, Title, Division/Office, and Phone Number

Name	Title	Division/Office	Phone
William Fong	Sr Tr Eng/ Project Engineer	District 04 / Design Alameda	(510) 286-5633
Hassan Nikzad	Sr Transportation Engineer	District 04 / Design Alameda	(510) 715-8210
Hung Nguyen	Project Manager	District 04 / Division of Program/Project Management	(510) 496-9231
Kavya Tanda	Asst Project Engineer	District 04 / Design Alameda	(510) 588-0031
David Rodriguez	Environmental Scientist	District 04 / Environmental Analysis	(510) 506-1461
Orlando Ramirez	Associate Transportation Planner	District 04 / Multimodal System Planning	(510) 926-0733
Carlos E. Ramirez	Structural Engineer	WSP	(916) 752-2304
Lore Ahmadi	Transportation Engineer	District 04 / Highway Operations	(510) 421-9729
Claudia Fang	Branch Chief	District 04 / Traffic Signing	(510) 421-7367

14. ATTACHMENTS (Number of Pages)

A. Location Map, Title Sheet and Layout Sheets (6)
B. WSP Caltrans Road Tunnel Risk Report (64)
C. Detour Plans (2)
D. CEQA Exemption / NEPA Categorical Exclusion (13)
E. Right of Way of Data Sheet (8)
F. Water Quality Study (4)
G. Transportation Management Plan (TMP) Data Sheet (2)
H. Complete Streets Decision Document (3)
I. Climate Change Analysis Report (2)
J. Preliminary Cost Estimate (11)
K. Risk Register (4)
L. Performance Asset Management (1)
M. Section 106 Memo (4)
N. Storm Water Data Report (7)

ATTACHMENT A
Location Map

Location Map

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	260	R0.8/R2.0		

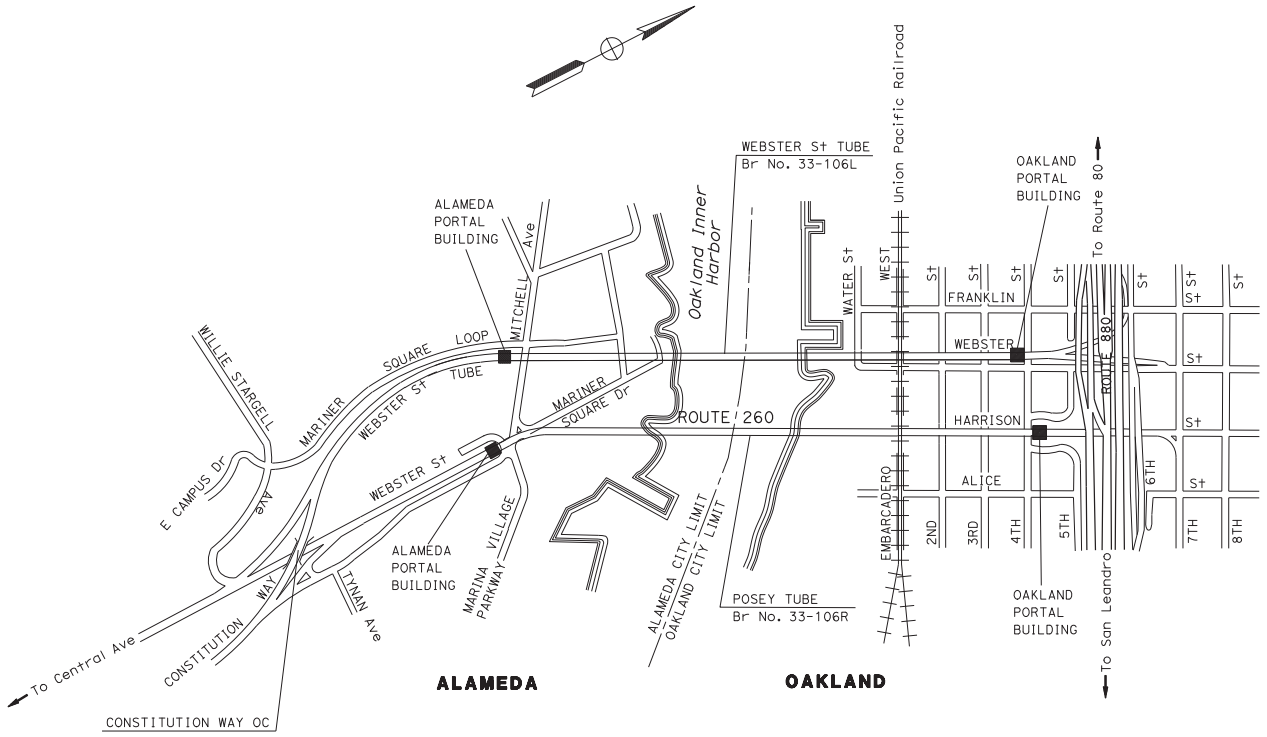
STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN ALAMEDA COUNTY
IN ALAMEDA AND OAKLAND
AT POSEY TUBE AND WEBSTER STREET TUBE



NO SCALE

CONTRACT No.	04-2Y780
PROJECT ID	0423000158

PROJECT MANAGER

DESIGN MANAGER
WILLIAM FONG

LAST REVISION
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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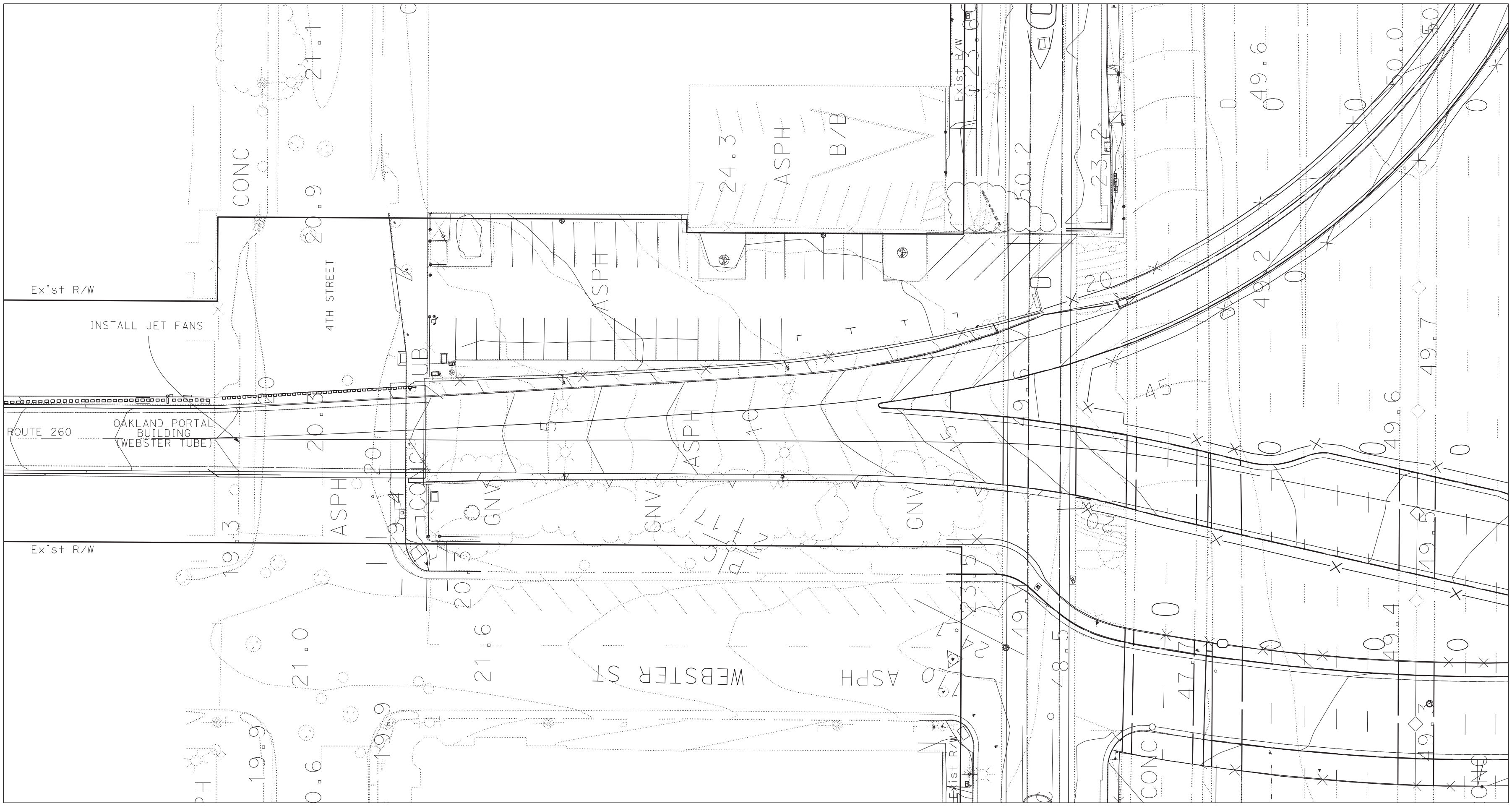

PRELIMINARY PLANS
SUBJECT TO CHANGE

PRELIMINARY LAYOUT SHEET 1

SCALE: 1" = 20'

REVISED BY	DATE REVISED
CALCULATED-DESIGNED BY	CHECKED BY
FUNCTIONAL SUPERVISOR	WILLIAM FONG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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UNIT 0725
PROJECT NUMBER & PHASE 0423000158

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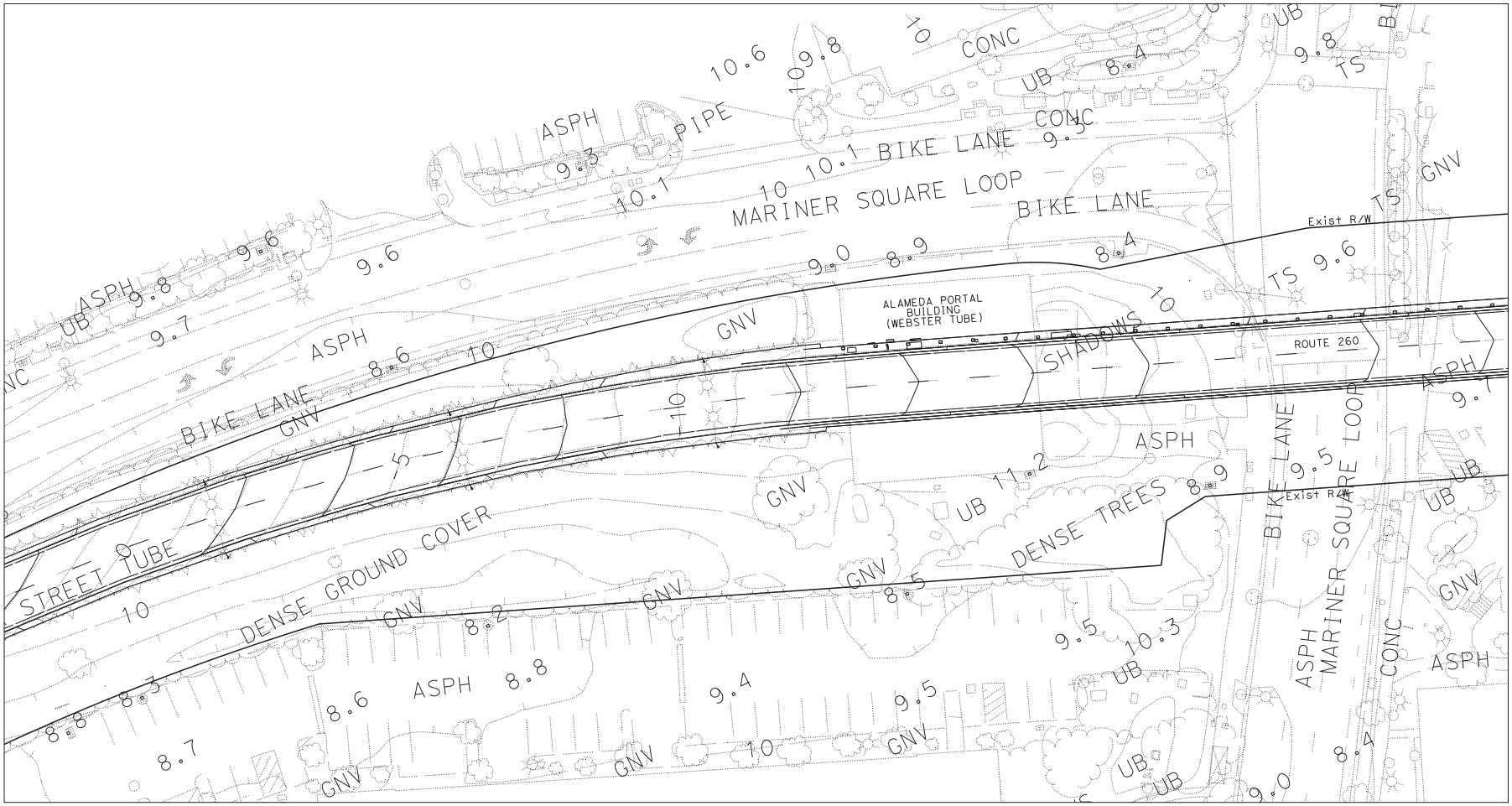

PRELIMINARY PLANS
SUBJECT TO CHANGE

PRELIMINARY LAYOUT SHEET 2

SCALE: 1" = 20'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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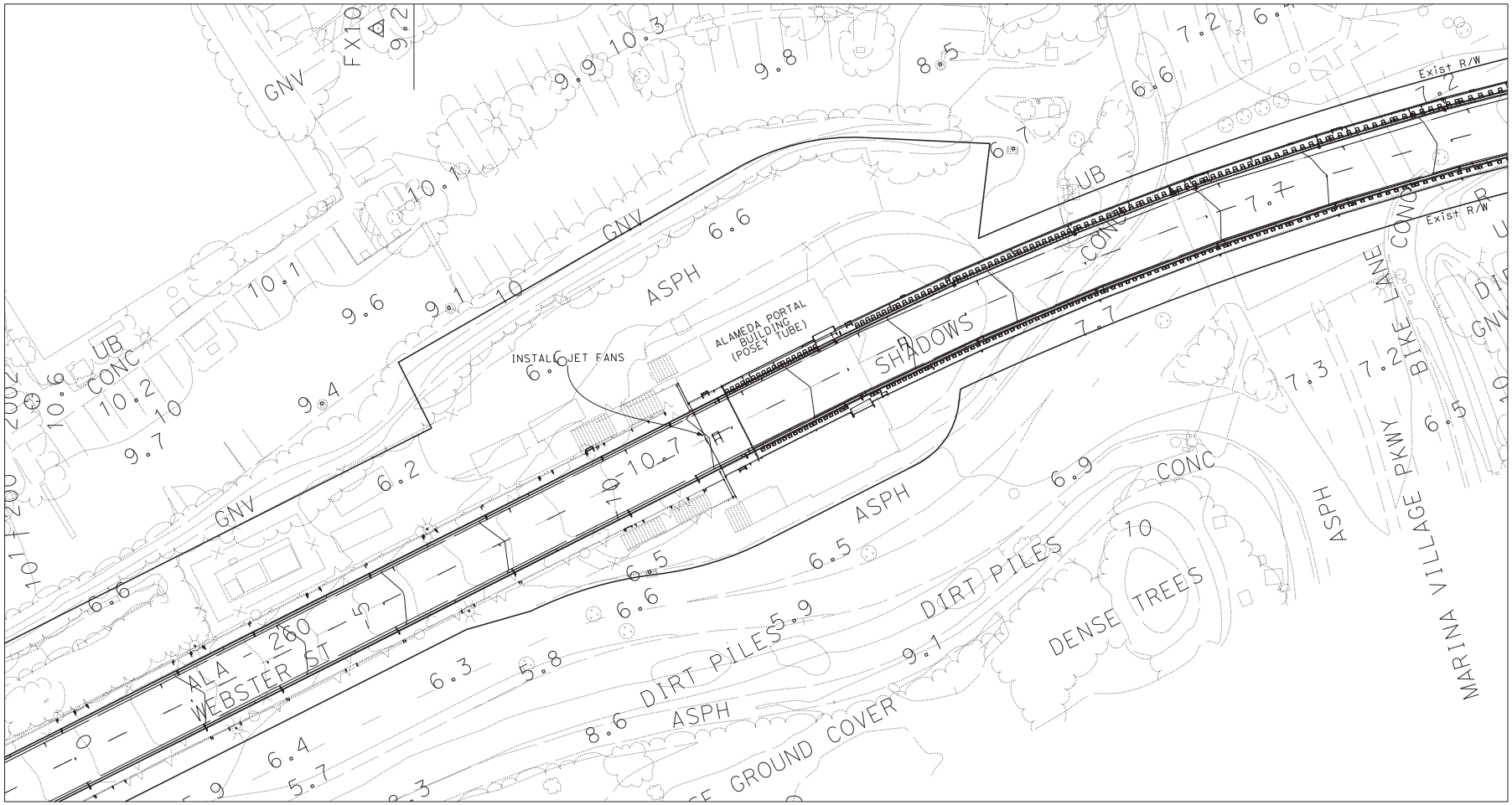

PRELIMINARY PLANS
SUBJECT TO CHANGE

PRELIMINARY LAYOUT SHEET 3

SCALE: 1" = 20'

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Caltrans	WILLIAM FONG	CHECKED BY	DATE REVISED

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UNIT 0725

PROJECT NUMBER & PHASE 0423000158

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY		REVISED BY			
Caltrans	WILLIAM FONG	CHECKED BY		DATE REVISED			

BORDER LAST REVISED 7/2/2010

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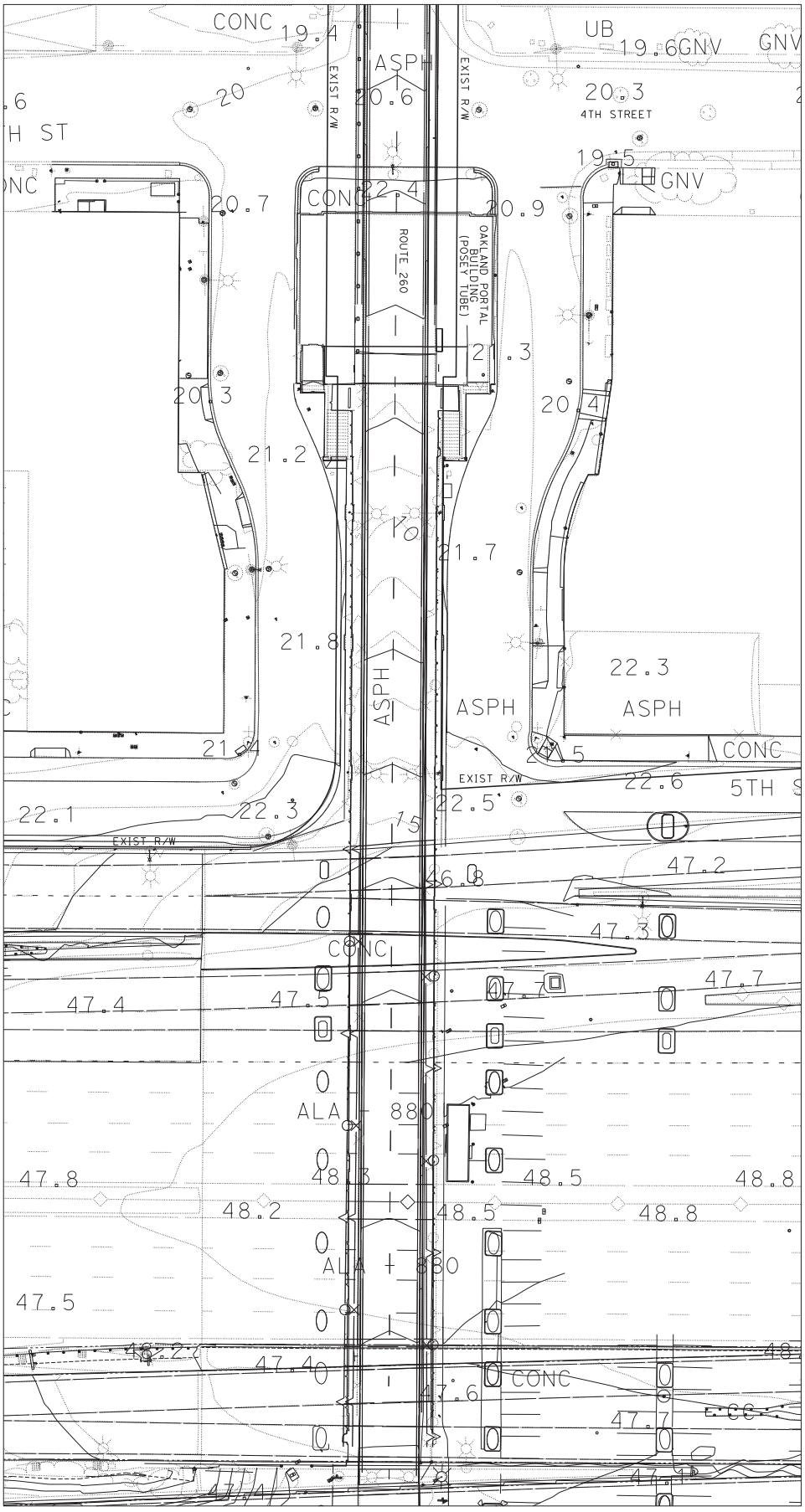
UNIT 0725

PROJECT NUMBER & PHASE

0423000158



PRELIMINARY PLANS
SUBJECT TO CHANGE

PRELIMINARY LAYOUT SHEET 4

SCALE: 1" = 20'

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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STATE OF CALIFORNIA
No.
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

LAST REVISION	DATE PLOTTED => 31-OCT-2023
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ATTACHMENT B
WSP Caltrans Road Tunnel Risk Report

Risk Assessment of Caltrans Road Tunnels

Statewide Risk Assessment Report

Submitted to:
California Department of Transportation (Caltrans)

Prepared for:

Prepared by:

2150 River Plaza Dr #400
Sacramento, CA 95833

FINAL

December 27, 2021

Contents

Executive Summary

The scope the work described herein was to conduct a risk analysis on seven Caltrans road tunnels (per the list provided below – total number of unique tunnel bores is 10) in order to quantify the overall fire-life safety risk for each tunnel and to prioritize improvement options. The risk analysis was conducted in a manner to facilitate relative comparisons of risk level between different tunnels and the various improvement options. A prioritization exercise was then conducted to assist Caltrans in identifying those tunnels that are at a higher risk level and to rank improvement options on a cost-benefit scale.

The tunnels included in this assessment are as follows:

1. Tunnel # 33 0106L and 33 0106R: Webster Street-Posey Tube Tunnel (referred to herein as Posey-Webster)
2. Tunnel # 35 0246F: W92-S280 Connector UC (referred to herein as 92-280)
3. Tunnel # 01 0049: Randolph Collier Tunnel
4. Tunnel # 28 0015, 28 0015L, and 28 0015R: Caldecott Tunnel Bores 1-3
5. Tunnel # 34 0004: Yerba Buena Crossing Tunnel
6. Tunnel #53 2437G and 53 2441F: E105-N405 (NW Connector) and W105-S405 (SE Connector) Connector Tunnels (LAX connector tunnels)
7. Tunnel # 34 0016: Presidio (MacArthur) Tunnel

Risk is the product of the outcome of an event (hazard) with potential adverse consequences by the chances that the hazardous event occurs (risk = consequence x likelihood). The conditions considered in this study were the likelihood that a fire occurs in a tunnel and the consequences of that occurrence. The fires under consideration were divided into three categories and given a hazard score:

- Small (a car fire, 5 MW), minimal life safety hazard or damage potential, hazard score = 10.
- Medium (a bus fire, 20-30 MW), possible life safety hazard or damage potential, hazard score = 100.
- Large (a truck fire, 50-100 MW), significant life safety hazard or damage potential, hazard score = 1000.

Fire likelihood was based on the traffic travelling through the tunnel (average annual daily traffic), the tunnel length, the types of vehicles (cars, buses, trucks) and the rate of fires occurring on US highways. The risk score was computed based on the sum (for each fire hazard; small, medium, large) of the hazard score multiplied by fire likelihood. This is referred to as the fire risk score (FRS). An FRS is computed for each tunnel and design option, as well as a benchmark tunnel (a 2560 ft. long tunnel – half a mile long – assumed to meet NFPA 502, with the same traffic number and profile as the Posey-Webster Tunnels). The benchmark tunnel is used to help make a consistent comparison between options.

A summary of the tunnels and recommendations is provided in Table 1.

Table 1: Summary of key risks and mitigations

Tunnel and FRS / benchmark (before and after mitigation)	Key systems to mitigate risks / recommendations	Order-of-magnitude cost of recommendations	Priority (current risk rank)
Posey-Webster FRS_{before} = 11.6 FRS_{after} = 5.3	Mode-based operation (run fans remotely from a monitored control room interface, modes to use ventilation in most effective way based on fire location, plus backup fire detection and automatic response) – improved smoke management for egress and fire fighting, improved operational response. Fixed fire fighting system (FFFS) – improve structural resilience, improve ventilation performance.	$16.9M (both bores) (maintenance $7.4M)	High (1)
Caldecott Bore 3 FRS_{before} = 10.3 FRS_{after} = 1.0	Saccardo nozzle utilizing reversed exhaust fans [18] – improved smoke management for egress and fire fighting. FFFS – improve structural resilience, improve ventilation performance.	$19.1M (maintenance $5.0M)	High (2)
Caldecott Bore 1 and 2 FRS_{before} = 10.0 FRS_{after} = 1.1	Saccardo nozzle – improved smoke management for egress and fire fighting. FFFS – improve structural resilience, improve ventilation performance.	$67.1M (both bores) (maintenance $13.4M)	High (3)
Presidio (MacArthur) FRS_{before} = 7.4 FRS_{after} = 0.8	Jet fans and FFFS – the jet fans are intended principally for fire fighting, given the bidirectional traffic situation. The FFFS is intended to help mitigate life safety risks in bidirectional traffic.	$32.5M (maintenance $5.9M)	Medium (4)
W105-S405 FRS_{before} = 4.1 FRS_{after} = 0.7	Jet fans to get to 100 MW design fire + passive fire protection evaluation This is a major interchange tunnel where a fire and structural damage could have very disruptive consequences; review possible impacts of a major fire on the structure (if there were major impacts, passive fire protection might be needed – it is considered unlikely though and thus not included in cost estimates).	$9.2M (maintenance $1.2M)	Medium (5)

Tunnel and FRS / benchmark (before and after mitigation)	Key systems to mitigate risks / recommendations	Order-of-magnitude cost of recommendations	Priority (current risk rank)
E105-N405 FRS_{before} = 2.1 FRS_{after} = 0.4	Jet fans to get to 100 MW design fire + passive fire protection evaluation This is a major interchange tunnel where a fire and structural damage could have very disruptive consequences; review possible impacts of a major fire on the structure (if there were major impacts, passive fire protection might be needed – it is considered unlikely though and thus not included in cost estimates).	$9.2M (maintenance $1.2M)	Medium (6)
Randolph-Collier FRS_{before} = 1.8 FRS_{after} = 1.6	Implement an automatic response (maintain ventilation as-is, add linear heat detector and traffic stops at portals – response to stop traffic, start ventilation, to be automatic on heat detection).	$1.1M (maintenance $0.3M)	Low (7)
YBI – lower FRS_{before} = 1.5 FRS_{after} = 0.3	NFPA 502 compliance (note that this option should undergo some further validation analysis to check the performance of the current systems and optimize extent of upgrades needed). Jet fans are recommended given the length and AADT. Note that this scheme will need a substantial amount of validation due to the tight space available. FFFS – improve structural resilience, improve ventilation/egress. Structural – Protect the structure (deck above). Note that this scheme will need a substantial amount of validation due to the tight space available.	$24.0M (maintenance $5.9M)	Low (8)
92-280 FRS_{before} = 0.6 FRS_{after} = 0.2	Mode-based operation – improved operational response plus upgrade exhaust.	$2.0M (maintenance $0.4M)	Low (9)
YBI – upper FRS_{before} = 0.5 FRS_{after} = 0.5	Retain existing operations, consider via a study whether there is any structural vulnerability, but otherwise, the short length means that traffic control and a standpipe are the only main features needed here per NFPA 502.	$0M (maintenance $0M)	Low (10)

1 Introduction

The scope of this work was to conduct risk analysis on Caltrans road tunnels (per the list provided below) to quantify the overall fire-life safety risk for each tunnel and to identify and to prioritize improvement options. The risk analysis allows a comparison among the different tunnels in the network and the risk level at each location. A prioritization exercise was then conducted to assist Caltrans in identifying those tunnels that are at a higher risk level and to rank improvement options on a cost-benefit scale. The tunnels included in this assessment are as follows:

1. Tunnel # 33 0106L and 33 0106R: Webster Street-Posey Tube Tunnel (referred to herein as Posey-Webster)
2. Tunnel # 35 0246F: W92-S280 Connector UC (referred to herein as 92-280)
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7. Tunnel # 34 0016: Presidio Tunnel (also known as the MacArthur Tunnel)

The outline of the report is as follows:

- Section 2 provides a description of the characteristics of each of the tunnels.
- Section 3 summarizes the risk assessment methodology.
- Sections 4 through 11 provide the risk analysis results for the tunnels.
- Section 12 summarizes the overall results, compares the improvement options, and provides recommendations.

1.1 Abbreviations

AADT	Average annual daily traffic
BC	Benefit – cost ratio
CFD	Computational fluid dynamics
DOT	Department of Transport
FFFS	Fixed fire fighting system
FHS	Fire hazard score
FHT	Fire hazard type
FRS	Fire risk score
NFPA	National Fire Protection Association
SES	Subway Environment Simulation

2 Tunnel Characteristics

2.1 Posey-Webster Tunnels

The Posey and Webster Street Tubes are two parallel underwater tunnels connecting the cities of Oakland and Alameda. The Posey tube is 3570 ft long and the Webster tube is 3350 ft long. Both tubes operate with unidirectional traffic. For the Posey tube, the traffic direction is from west (Alameda) to east (Oakland) and for the Webster tube, traffic direction is from east (Oakland) to west (Alameda) [1].

The cross-section in each of the tubes is similar. A cross-section of the Posey tube is provided in Figure 1.

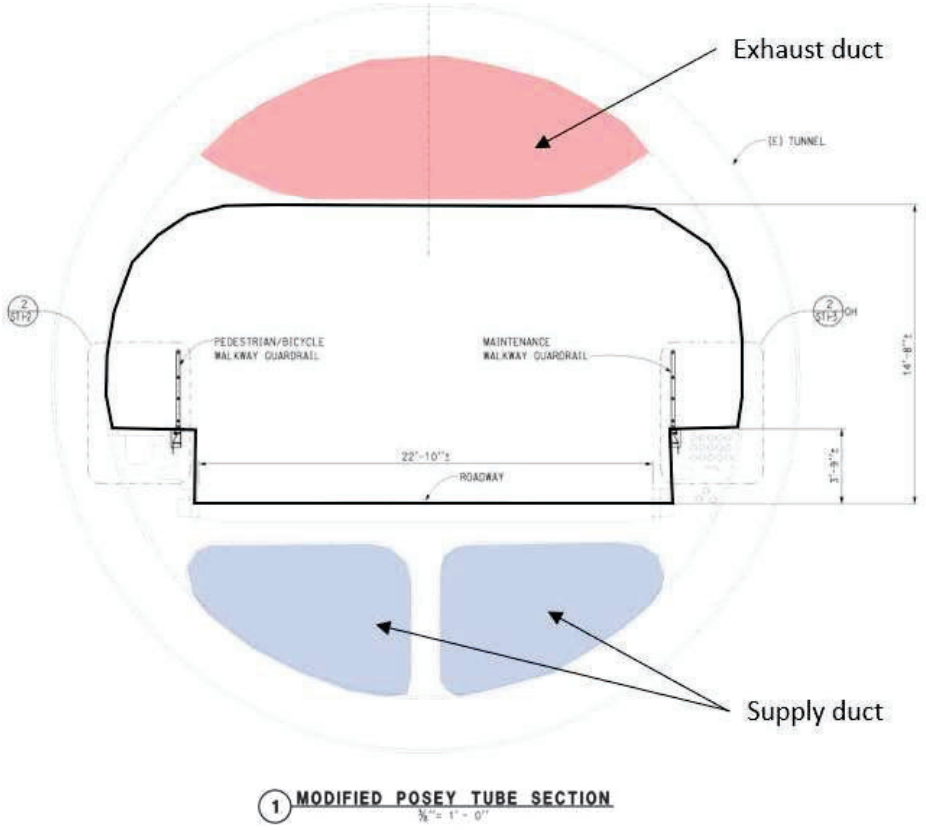

Figure 1: Tunnel cross section

The average annual daily traffic (AADT) for the Posey-Webster Tunnels (both bores) is 64,600 and the traffic mix is comprised of 97.6% cars and 2.4% trucks. Data are not available on specific breakdown of vehicles, such as buses or medium trucks [1]. It is assumed that the 97.6% cars figure is made up of 87.6% cars and 10% vehicles that are medium size vehicles like large vans or buses. The tunnel is provided with a transverse ventilation system. Several assessments have been conducted and are used (qualitatively) to inform the risk analysis presented herein [2] [3].

2.2 92-280 Tunnel

The two-lane South Connector Undercrossing is a 900 ft long unidirectional (southbound) connection ramp located at the junction of State Route 92 and Interstate 280 (the 92-280 tunnel). A satellite view of the tunnel in relation to the surrounding interchange and the tunnel layout, showing the entrance and exit, are presented in Figure 2 and Figure 3, respectively. The cross-section is uniform throughout the length of the tunnel and is shown in Figure 4. A longitudinal section, including tunnel gradient and showing the ventilation structures, is provided in Figure 5. The main geometric features of the tunnel are also summarized in Table 2.

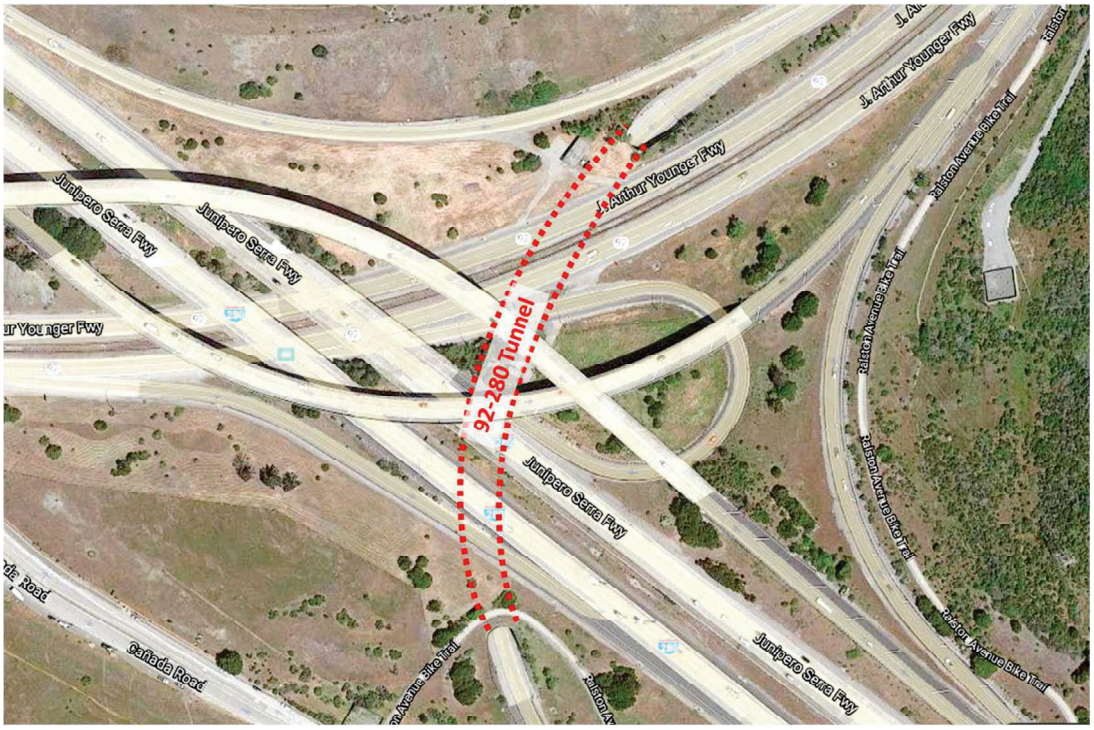

Figure 2: Satellite view of the 92-280 Tunnel (source: Google Maps)

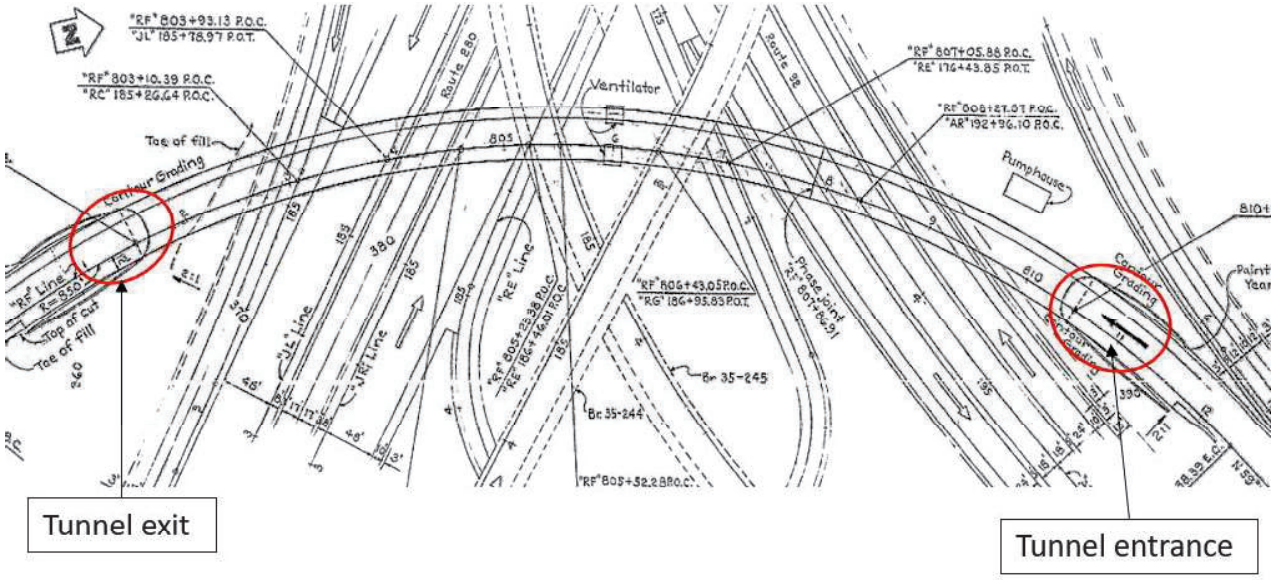

Figure 3: Tunnel layout

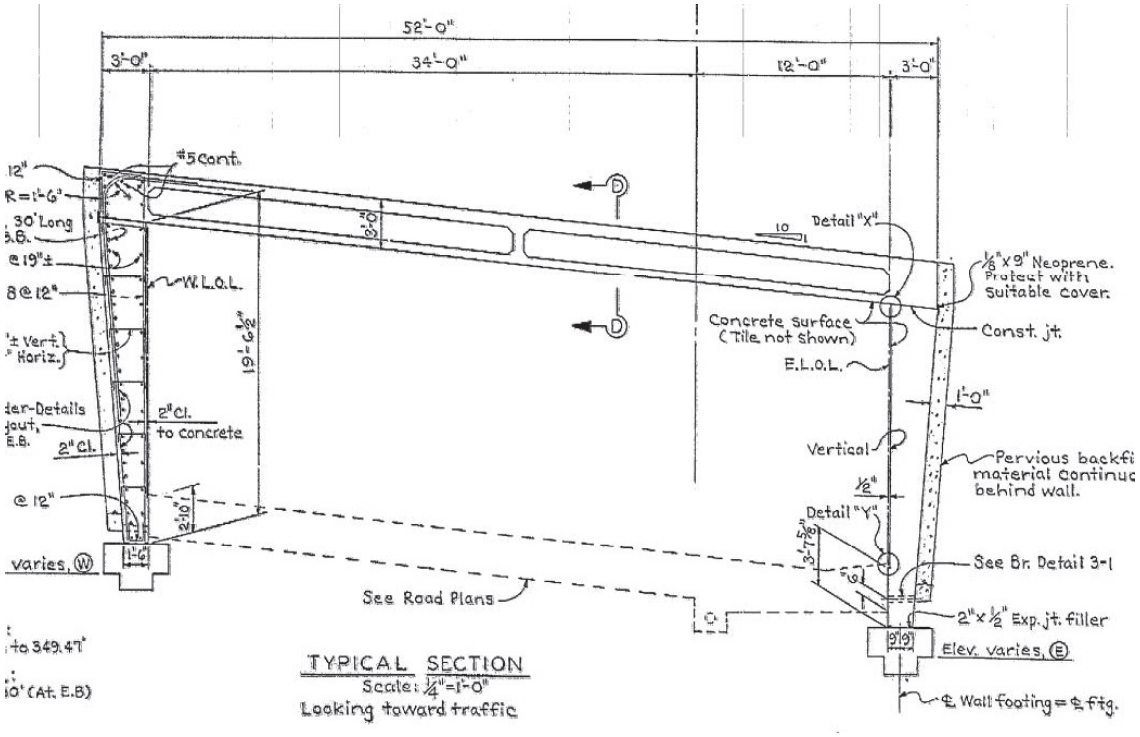

Figure 4: Tunnel cross section

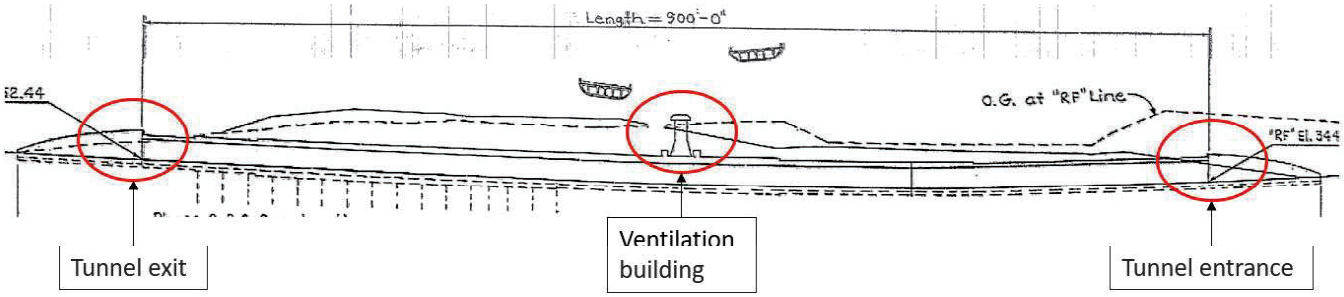

Figure 5: 90-280 longitudinal profile

Table 2: Geometric features of the 92-280 Tunnel

	Length	Area	Perimeter
92-280 Tunnel	900 ft	736 ft^2 (68.4 m^2)	125 ft (38.2 m)

AADT for the tunnel is 48,000 with 1% trucks and an assumed breakdown between cars and medium size vehicles of 87% and 12%, respectively [4].

The ventilation system in the tunnel consists of two industrial type fans housed in vent structures (ventilators) located directly above the roadway, near the mid-point between the portals. The system was designed only to manage vehicular CO emissions, supplying the tunnel with fresh air through the hoods above the tunnel (see mushroom-like structures shown in Figure 5 and Figure 6). Each fan is provided with a backdraft damper connected to openings in the tunnel ceiling, directly below the fan. The distance between the two ventilation shaft openings is 25 ft and the geometric configuration of both shafts is the same. The combined ventilation shaft opening size is 330 ft^2. A preliminary field assessment determined that these fans only operate in supply mode and are not of a type that would comply with NFPA 502 design requirements for emergency ventilation. An assessment has been conducted

on the tunnel ventilation system's ability to manage smoke, and this was used to inform the risk analysis presented herein [4].

Figure 6: 92-280 Tunnel (South Connector Undercrossing) ventilators

2.3 Randolph Collier Tunnel

Randolph Collier Tunnel (RCT) is an 1886 ft long bi-directional traffic tunnel with two lanes (each 13 ft wide) and was built in 1962. RCT has a semi-transverse ventilation system with an overhead duct (128 ft^2 cross sectional area), two 5 ft diameter exhaust fans located at the north portal, not temperature-rated, and driven by 25 hp motors. Tunnel grade is 3% (elevation rise towards the south portal) and the nearest fire stations are 8 and 25 miles away from the north and south portals, respectively. The annual average daily traffic through the tunnel is 4700 cars (3901 cars, 47 buses, and 752 trucks) [5].

Figure 7: RCT north portal

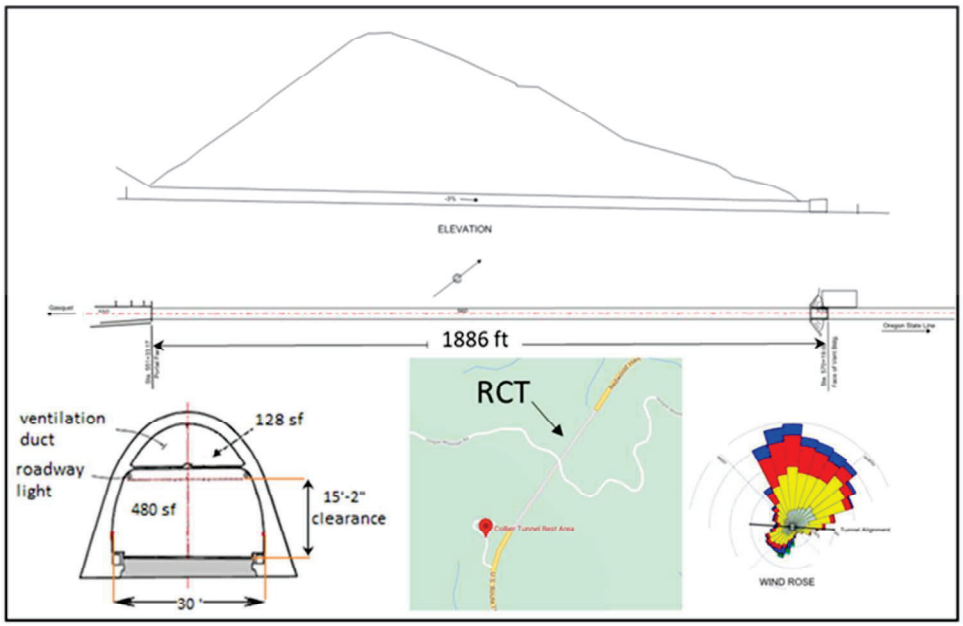

Figure 8: RCT profile and location

2.4 Caldecott Tunnel, Bores 1 and 2

This four-bore tunnel is located on the border of Alameda and Contra Costa counties on State Highway 24, in the Berkeley hills. The brief description that follows pertains to Bores 1 and 2, which were opened in 1937.

Each of the Caldecott bores 1 and 2 carry two lanes of eastbound traffic, over a length of 3610 ft and a nearly constant grade of about 4.0% from west to east. Each bore has a uniform cross section of 410 ft^2 (38.1 m^2). The tunnel location is shown in Figure 9. A longitudinal section, including tunnel gradient is provided in Figure 10.

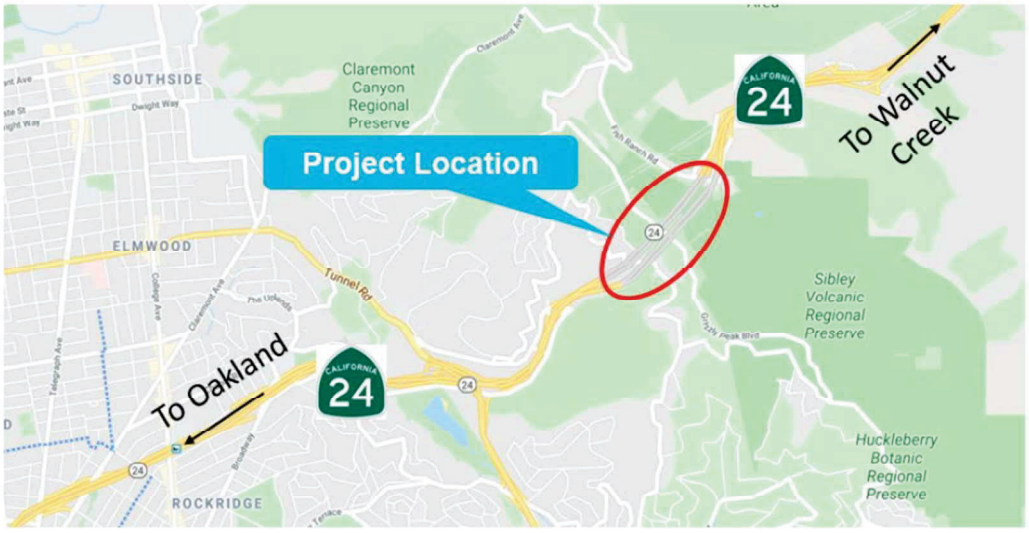

Figure 9: Caldecott tunnel location

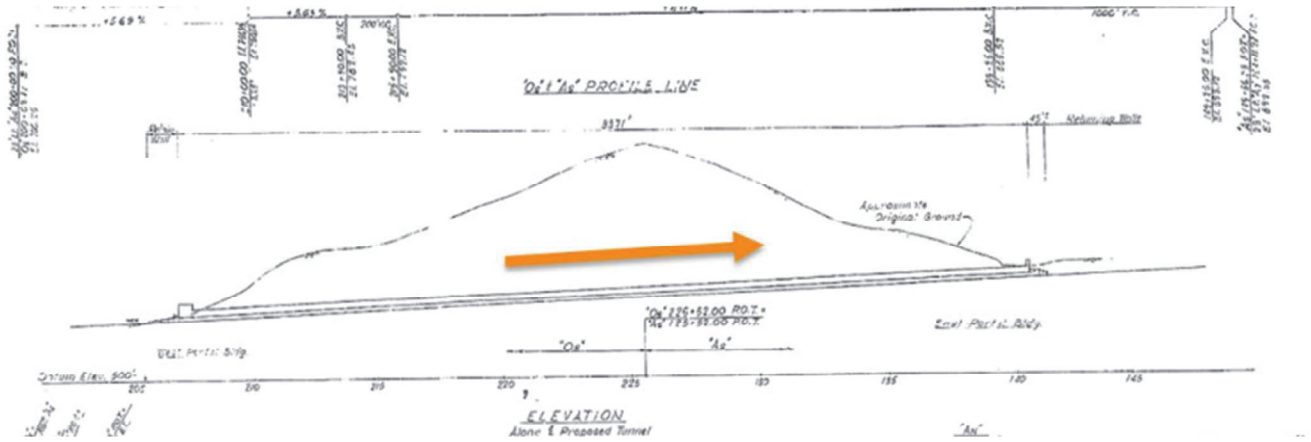

Figure 10: Caldecott bores 1 and 2 longitudinal profile

The average annual daily traffic for the Caldecott tunnel is 89,413 (in each bore, 178,286 vehicles per day in each direction) and the traffic mix is comprised of 97.7% cars and 0.5% trucks [6]. Bores 1 and 2 are provided with a fully transverse ventilation system, with exhaust and fresh air shafts above the roadway. The exhaust air plenum is located above the roadway and the supply plenum is above the exhaust plenum. A bulkhead near the midpoint of each bore separates the plenums into two independent systems, connected only to the fans at the closest portal. Supply air is introduced into tunnels through openings along the tunnel wall just above the roadway surface. Air is exhausted through ceiling openings along the tunnel's length.

There are three cross-passages between Bores 1 and 2. These cross-passages are not accessible to motorists and are intended for maintenance access only.

The risk analysis presented herein is based on the Phase 2 assessment of April 2021 [7].

2.5 Caldecott Tunnel, Bore 3

Bore 3 of the Caldecott tunnel is 3371 ft long and was completed in 1964. It carries two lanes of traffic in the westbound direction. Traffic enters the east portal at a downhill 4% grade and exits the west portal at a downhill grade of 5.7%. The tunnel has a uniform cross-section of about 620 ft^2 (57.6 m^2). Bore 3 relative placement within the four tunnel bores is indicated in Figure 11. A longitudinal section of bore 3, including its gradient is provided in Figure 12.

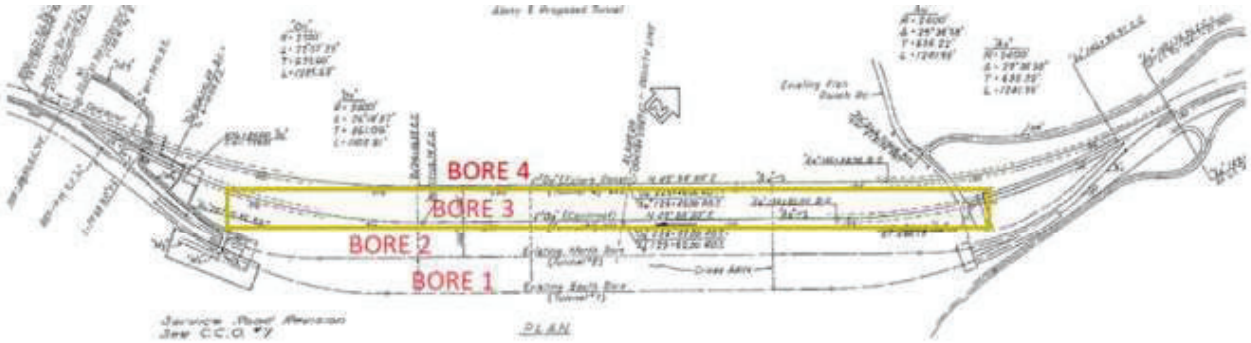

Figure 11: Caldecott tunnel site plan, showing location of bore 3 within the tunnel

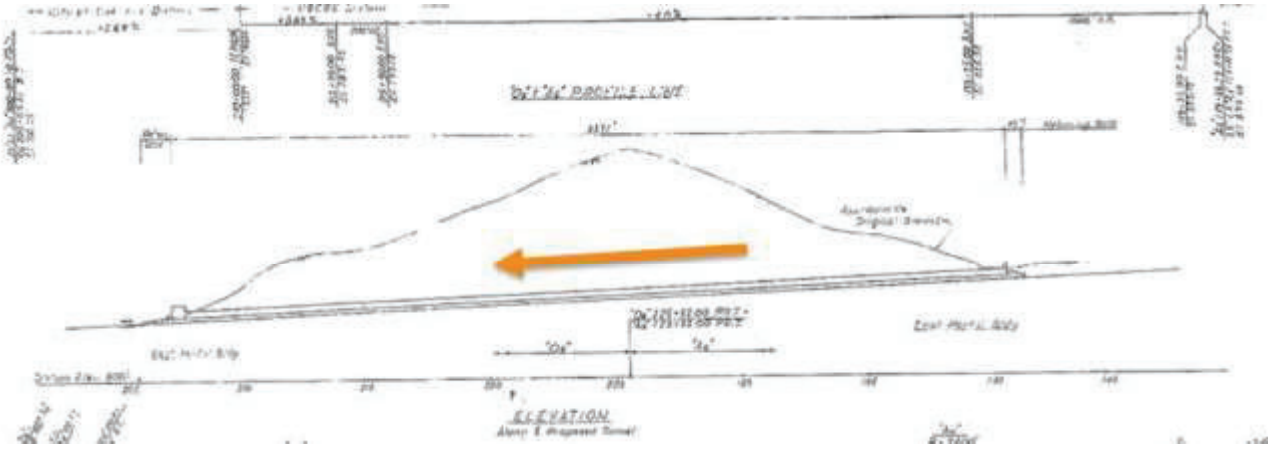

Figure 12: Caldecott bore 3 longitudinal profile

Similar to bores 1 and 2, the average annual daily traffic for bore 3 of the Caldecott tunnel is 89,413 and the traffic mix is comprised of 97.7% cars and 0.5% trucks.

To provide mechanical ventilation to the tunnel, four axial fans are located above the west portal. The supply and exhaust air are introduced into the tunnel at the ceiling through port holes along the tunnel length. There is no bulkhead in bore 3.

Seven cross passages connect bore 3 with the recently added bore 4 (completed in 2013). These cross passages are intended to be used by motorists in the event of a fire emergency.

The risk analysis for bore 3 of the Caldecott tunnel is based on the Phase 2 assessment of April 2021 [7].

2.6 Yerba Buena Island Tunnels

The Yerba Buena Tunnel (also called Yerba Buena Island Tunnel, YBI) is a double-deck highway tunnel on the Interstate 80 (I-80) and carries five lanes of traffic on each of upper (westbound) and lower (eastbound) decks. Average annual daily traffic (AADT) for the tunnel is 96,452 (assumed equal for upper and lower decks) with an average daily truck traffic (ADTT) of 1060 trucks (1.1% of the AADT) [*https://pems.dot.ca.gov*]. It is assumed in this document that the breakdown between cars, medium size vehicles and large trucks is 89.45%, 10% and 0.55%, respectively [8]. No mechanical ventilation system is currently present in the tunnel decks and ventilation of traffic pollutants relies on air movement caused by wind and moving traffic. To improve natural ventilation of the longer lower deck, several vents have been placed under the sidewalk of the upper deck [8]. This creates a risk of smoke circulation from the lower deck to the upper deck. Both decks are equipped with fire hydrants located at portals and in addition, the lower deck is equipped with an automatic, single zone, sprinkler system.

Figure 13: YBI Tunnel location

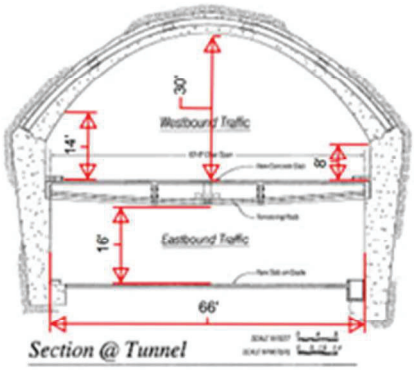

Figure 14: YBI cross section [8]

Table 3: Geometric features of the YBI tunnels

	YBI Tunnel, lower deck	YBI Tunnel, upper deck
Length	940 ft (286.5 m)	540 ft (164.6 m)
width	66 ft (20.1 m)	66 ft (20.1 m)
Height	16 ft (4.9 m)	Min: 14 ft (4.2 m), Max:30 ft (9.1 m)
Area	1122 ft^2 (104.3 m^2)	1639 ft^2 (152.3 m^2)
Perimeter	168 ft (51.2 m)	171 ft (52.1 m)

2.7 LA Connector Tunnels

LAX Connector Tunnels (105-405 highways) refer Tunnel # 53 2437G and 53 2441F: E105-N405 (NW Connector) and W105-S405 (SE Connector) Connector Tunnels. Location, cross section, and longitudinal profiles of these tunnels are shown in Figure 15, Figure 16 and Figure 17. NW and SE connector tunnels are 1350 ft and 1781 ft long, respectively, and have AADT (2014) of 11,119 and 16,714, respectively. Traffic percentage distribution for both tunnels is 95% cars/SUV, 1% buses, and 4% trucks. Analysis of the possible ventilation improvements has been reported (space proofing only) [9].

Figure 15: Location of LAX connector tunnels

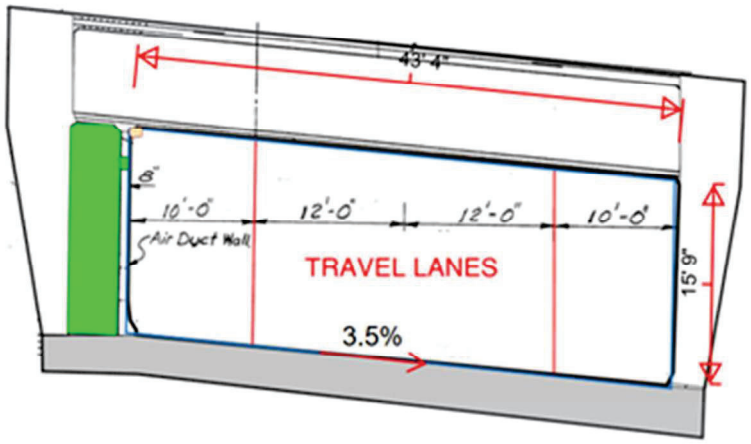

Figure 16: LAX connector tunnel cross section

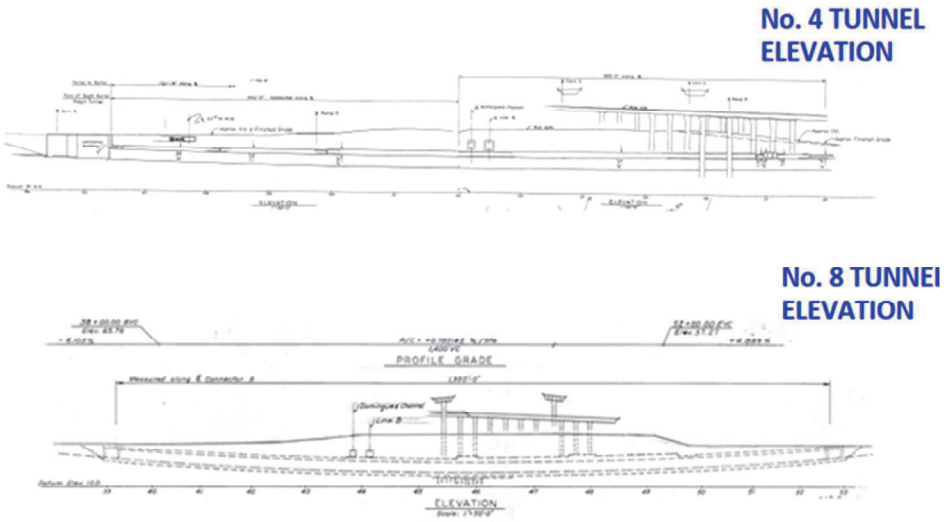

Figure 17: Longitudinal profiles of LAX connector tunnels

2.8 Presidio Tunnel

The four-lane Presidio Tunnel (also called MacArthur Tunnel) is a 1300 ft long bidirectional tunnel running along Veterans Boulevard in the Presidio Park area of San Francisco. Satellite views of the tunnel showing the entrance and exit, are presented in Figure 18 and Figure 19. The main geometric features of the tunnel are summarized in Table 4.

Figure 18: Presidio Tunnel south portal (source: Google Maps)

Figure 19: Presidio Tunnel north portal (source: Google Maps)

Table 4: Geometric features of the Presidio Tunnel

	Length	Approximate area	Approximate perimeter
Presidio Tunnel	1300 ft (396.2 m)	1117 ft^2 (103.8 m^2)	132 ft (40.2 m)

AADT for the tunnel is 64,000 with an average daily truck traffic (ADTT) of 1280 trucks (2% of the AADT) [10]. It is assumed in this document that the breakdown between cars and medium size vehicles is 88% and 10%, respectively.

There is no mechanical ventilation system currently in the tunnel. Natural ventilation is provided through a 24 ft. by 24 ft. shaft located midway between portals (see Figure 20). An assessment has been conducted on the tunnel ventilation system's ability to manage smoke, and this is used to inform the risk analysis presented herein [11].

Figure 20: Presidio Tunnel ventilation shaft

3 Risk Assessment Method

This section outlines the risk assessment method. The risk assessment is based on a semi-quantitative methodology. Separate reports are referenced for each tunnel which use analysis to characterize the system (Subway Environment Simulation / one dimensional analysis, computational fluid dynamics or both) and/or judgement based performance appraisal based on experience. Separate reports (refer Section 13) provide documentation of analysis. There are several documents that informed the development of the risk assessment, including MIL Standard 882 [12].

3.1 Methodology

Risk is calculated as the product of the likelihood and consequence of a hazard. The methodology adopted for the Caltrans risk assessment uses a scoring system to enable many risk assessments to be undertaken and the outcomes to be compared using a standardized approach. The following mathematical representation is used to calculate the fire risk score (FRS) for a fire hazard type (FHT):

$$FRS = hazard\ consequence \times\ likelihood = \sum_{j=1}^{m} FHS_{j,1} P_j.$$

There are three FHTs defined. These include "low", "medium" and "high" to account for different hazards that might be experienced in a segment. Each FHT is assigned a fire hazard score (FHS) that provides an indication of the hazard before and after mitigations are considered. The mitigations might include a smoke management system, evacuation provisions or some other means of reducing the consequences of the hazard. A lower FHS means a lower level of risk expressed as a FRS.

The likelihood (P_j) of the FHT is calculated based on the details of the segment being investigated. The FHS for each FHT is then defined as:

$$FHS_{j,1} = \frac{FHS_{j,0}}{100 \sum_{i=1}^{n} W_i} \sum_{i=1}^{n} (100 - S_{ij} \alpha_i \beta_i) W_i,$$

where,

$FHS_{j,1}$	Fire hazard score for FHS_j after a score is applied for the provisions incorporated (mitigated hazard)
$FHS_{j,0}$	Fire hazard score for FHS_j before the scoring is applied (unmitigated hazard)
S_{ij}	Score for how a provision defined by score table i reduces the hazard for FHS_j (value between 0 and 100) – refer Appendix A for details
α_i	Operational factor applied to score value applied from score table i (value between 0 and 1) – refer Section 0 for details
β_i	Condition factor applied to score value applied from score table i (value between 0 and 1) – refer Section 0 for details
W_i	Weighting factor applied to score value applied from score table i (value greater than 0)
n	Total number of score tables used (integer greater than 0)
m	Total number of FHTs considered (integer greater than 0 and less than or equal to 3 for this assessment – low, medium, and high hazards)

Figure 21 provides aa flow chart of the risk assessment calculation procedure. The result of the risk assessment is a comparison of the FRS and order of magnitude costs for each option considered. This enables a cost-benefit comparison of different options compared to the current condition.

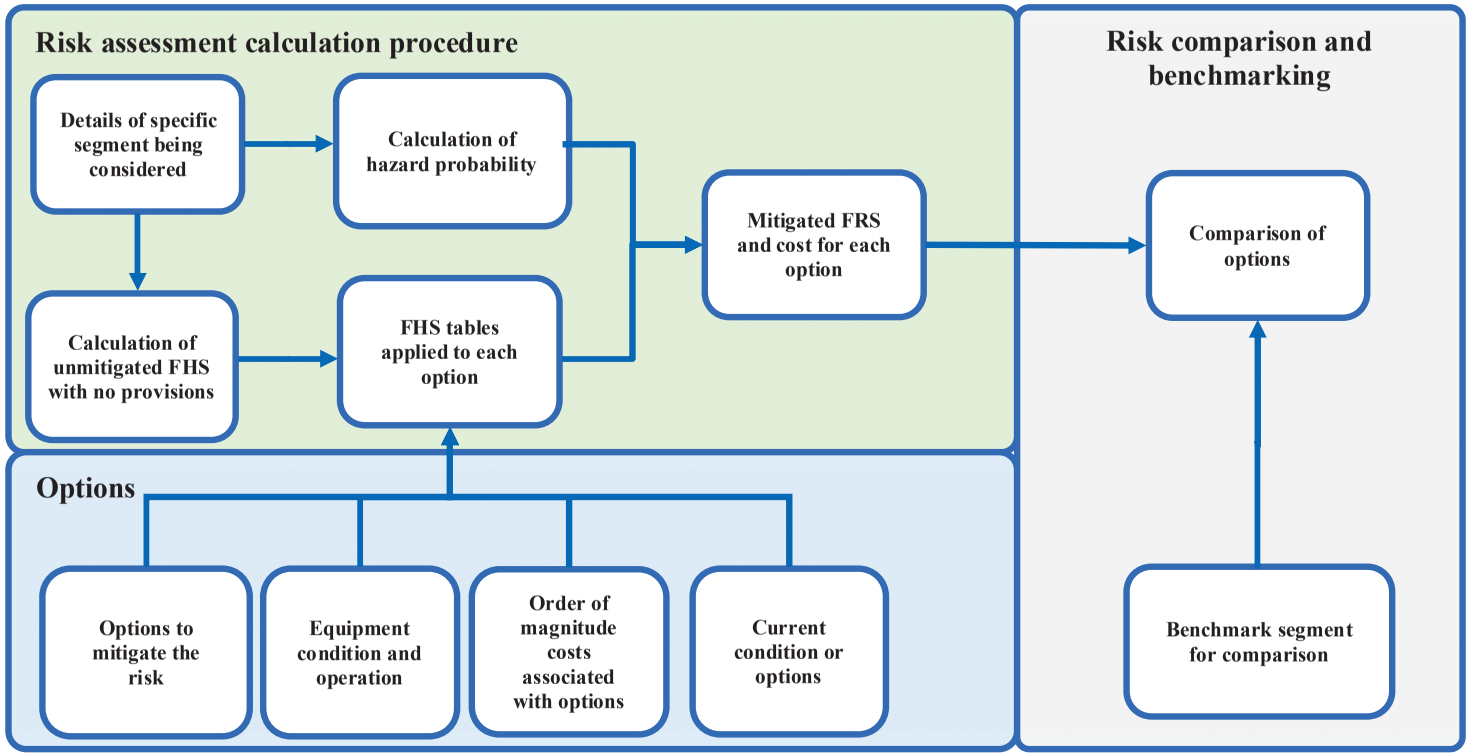

Figure 21: Risk assessment methodology details

The outcome of the assessment is an FRS for each option and cost for each option. A benefit to cost ratio for each option is computed as follows:

BC = [current condition FRS – design option FRS] / [design option cost – current condition cost].

The option with the largest value of BC is the most cost effective (i.e., greatest risk reduction for least cost). The BC is computed using the capital cost of the provision and does not include maintenance or operations costs.

3.2 Fire Frequency

Fire frequency in a tunnel is a function of the traffic mix (types of vehicles) and number of vehicles per day. The National Fire Protection Association (NFPA) publishes data on fire frequency on highways in the United States based on vehicle types, and location of the fire (highway, rural, urban, etc.) [13]. The US Department of Transport (DOT) publishes the number of vehicle miles traveled each year based on types of vehicles and type of road [14]. The two data sets were used to compute the probable rate of fires for a US highway. Table 5 provides the data (calculation reference PWT-13-5).

Table 5: Data on fire frequency from NFPA and DOT data

Fire severity, vehicle type	Cases of fire per 10^8 vehicle km	Case of fire per 10^8 vehicle miles	Remarks
Low, car	0.734	1.182	Refer calculation PWT-13-5
Medium, bus	0.816	1.313	
High, truck	1.245	2.004	

The data in Table 5 are used to compute rates of fires for the risk analysis herein. The actual rate of fires depends on the individual tunnel and the types of vehicles using that tunnel. An example computation follows:

Average annual daily traffic (AADT) = 64,600

Length of tunnel (ft) = 3,360

100 million vehicle miles per year = 64,600 * 3,360/5,280 * 365 / 100,000,000 = 0.15 * 10^8 veh. miles

87.6% cars

Number of car fires per year = (1.182 * 10^{-8}) * (0.15 * 10^8) * 0.876 = 0.155 car fires per year

3.3 Common Inputs

Table 6 provides inputs for the risk assessment that are common across all the tunnels. Inputs for the benchmark tunnel are also provided. See also Appendix A provides additional notes on the risk assessment method.

Table 6: Common inputs for the risk assessment

Parameter	Value (and units)	Comments	Source
Operating Parameters			
Hours of operation per day	24 hr/day	Tunnel shutdowns are rare	Assumed
Design period of interest	30 years	Same for all tunnels	Assumed
Unmitigated Fire Hazard Score			
Starting hazard score, low	10 /fire	Least potential for harm if unmitigated	Engineering judgement
Starting hazard score, medium	100 /fire	Order of magnitude higher harm potential compared to low fire	Engineering judgement

Parameter	Value (and units)	Comments	Source
Starting hazard score, high	1000 /fire	Highest fire has 100 times more harm potential than the low fire	Engineering judgement
Timeframe for Economic Considerations			
Condition decay half life	N/A	Assumed that equipment is well maintained and thus kept in good repair	Assumption
Discount factor	0.02	2% average yearly discount rate, considered reasonable for comparison purposes	Engineering judgement
Benchmark Tunnel			
Length	2640 ft	Nominal for benchmark purposes	
Vehicles per day	57,600	Nominal for benchmark purposes	
NFPA 502 compliant	Yes	Appropriate as benchmark condition	
Traffic mix	87.6% cars 10% medium 2.4% high	Assumption	

3.4 Mitigation Measures

Mitigation measures are considered for each of the tunnels and are described in detail in the respective reports (see Section 13). The measures considered ranged from updating emergency response plans and operational capacity, to repairing ventilation, installing new ventilation systems, or adding a fixed fire fighting system. Measures to protect the structure were also considered. Note that the depth of investigation of each measure is varied and once a preferred option is identified, further in-depth validation studies will be needed to confirm the feasibility of the option.

3.5 Risk Decision Framework

Ideally all tunnels would meet NFPA 502 [15], however, because this is an existing system that is not always possible. NFPA 502 recognizes this situation in Section 1.4:

> *1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.*
>
> *1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.*
>
> *1.4.2 In those cases where the AHJ determines that the existing situation presents an unacceptable degree of risk, the AHJ shall be permitted to apply retroactively any portions of this standard deemed appropriate.*
>
> *1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the AHJ and only where the determined level of life safety and fire protection provisions required is approved.*

The standard asks for existing tunnels to comply, but it allows for flexibility and local judgement when dealing with existing tunnels.

The methodology used in this study allows for a cost/benefit comparison to help select the most cost-effective option. This implies a level of risk acceptance because the most cost-effective option may not have the lowest risk.

Risk acceptance is necessary in any transportation infrastructure, for instance, the American Public Transport Association (APTA) recognizes that risk acceptance is necessary when applying risk assessments to existing systems [16]: *APTA believes that passenger railroads must recognize that a fundamental feature of this approach is that some residual risk must be accepted.*

Risk acceptance is a subjective process and there is no specific level of risk that is identically acceptable to all stakeholders. The "as low as reasonably practical" (ALARP) concept applied to fire-life safety risk assessment is a key consideration to risk-based decision making. Per the UK HSE [17] the demonstration "*that risks have been reduced ALARP involves an assessment of the risk to be avoided, of the sacrifice (in money, time and trouble) involved in taking measures to avoid that risk, and a comparison of the two*."

The following process was used to differentiate options:

1. **Assessment of the risk to be avoided:** this is accomplished via the fire risk score (FRS) relative to the benchmark tunnel (tunnel half a mile long, compliant with NFPA 502, traffic profile similar to the Posey-Webster tunnels with 2400 vehicles per hour). This allows different tunnels to be compared to one another on a consistent basis, and for the highest risk tunnels to be identified, and for the residual risk level for a given option to be identified.
2. **Consideration of the reasonableness of the residual risk level:** this is accomplished by computing an FRS for a design option for the tunnel under consideration that would comply with NFPA 502. The NFPA 502 compliant tunnel is assumed to have an FFFS, structural fire protection, and effective ventilation such that all LOW, MEDIUM, and HIGH category fires are managed (score of 95 out of 100). **A rule of thumb is used to identify a reasonable option as one that reaches an FRS to within a factor of 5 of the NFPA 502 compliant solution.**
3. **Assessment of the sacrifice in taking measures to avoid the risk:** the benefit to cost score (BC) gives a measure of which options provide the most risk reduction for the least cost. An option need not have the best BC score, but when situations arise where two options are close together, or there are limited funds available for implementation, then the BC value can be used to differentiate or justify an option that does not meet the criterion of step 2. A higher value of BC means an option is more cost effective.
4. **Alternatives:** When conducting risk analysis, it is important to look at alternative schemes. This practice can help to identify if one of the alternative schemes is likely to be viable on the basis of cost, practicality, or effectiveness. The goal with this step is to make sure the scheme ultimately proposed passes a "commonsense" check.

4 Posey-Webster Tunnels

Table 7 provides the risk results for the Posey-Webster tunnels. In general, Posey-Webster is ranked highest risk of the tunnels evaluated in terms of the FLS hazard.

Options for improving the current condition in the tunnel included [2], [3]:

- Mode-based operation (run fans remotely from a monitored control room interface, modes to use ventilation in most effective way based on fire location, plus backup fire detection and automatic response) of fans (option 3).
- Upgrade ventilation 1 (increase fan capacity) (option 4).
- Jet fans at the entry portal (option 5).
- Convert the supply duct to exhaust (option 6).
- Mode based operation + FFFS (option 7).
- Mode-based operation + board (fire board to protect structure) (option 8).

As shown in Table 7, the most cost-effective option is to adopt a mode-based operation (BC = 2.26), but the risk relative to an NFPA 502 compliant option is high ($FRS/FRS_{NFPA502}$ = 14.31).

Upgrading the ventilation (option number 4) is not considered a good option due to the large cost for providing the increased fan capacity. The second-best option regarding cost-effectiveness is the installation of four jet fans at each entry portal. This option also reduces the risk level to near five times the NFPA 502 level, which, as previously stated, is assumed to be a good measure of an acceptable option. Application of fire board (option 8) provides some risk reduction, but the residual risk remains at more than five times the NFPA 502 level.

This tunnel runs under water and so there is a potential for higher consequence resulting from structural damage caused by a fire. Adding an FFFS (option 7) reduces the risk level from the current condition for this situation. It is almost as effective as upgrading ventilation and still a viable option with respect to cost effectiveness.

In summary the following can be stated:

1. **Assessment of the risk to be avoided:** The Posey-Webster tunnels have the highest risk due to the length of the tunnels and traffic volume, and hence an increased fire likelihood. The FRS relative to an NFPA 502 compliant tunnel is high. This risk ranking makes these tunnels highest priority for upgrades.
2. **Consideration of the reasonableness of the residual risk level:** The installation of jet fans at the portals (option 5) can reduce the FRS to a value near 5 times the NFPA 502 compliant option.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** The installation of jet fans at the portals (option 5) ranks second out of all the options based on BC score, emphasizing its cost effectiveness.
4. **Alternatives:** Cost wise, installation of an FFFS with mode-based operation (option 7) is comparable to installing jet fans at the entry portal and it deserves further consideration since it can provide structural protection, improved ventilation performance and faster post-incident recovery. Option 7 (install FFFS) is noted to have an increased maintenance cost due to inclusion of the FFFS. However, the benefits noted should be considered as potential offsets to the increased maintenance.

Based on the analysis, option 7 is recommended for implementation consideration to improve the current condition in the tunnel.

Table 7: Risk results for the Posey-Webster tunnels (PWT-13-21)

Tunnel	**Posey-Webster**		**Notes**					
Annual average daily traffic (AADT)	32300							
Tunnel length (m | ft)	1024	3360						
Number of bores | Cost safety factor	2	2						
	Likelihood	Probability	One fire every 11 years					
5 MW	0.85	90%	% chance of occuring in 30 years					
20 MW	0.11	26%						
100 MW	0.04	10%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	11.59	1	16.24					
2. NFPA 502 compliant	0.71	44	1.00	69.18	17.10	86.27	0.31	4
3. Mode-based operation	10.21	4	14.31	1.22	0.35	1.57	2.26	1
4. Upgrade ventilation	5.35	12	7.50	131.50	14.94	146.44	0.09	6
5. Jet fans at entry portal	3.85	19	5.39	20.62	2.52	23.14	0.75	2
6. Convert supply duct to exhaust	10.60	2	14.85	57.04	6.60	63.64	0.03	7
7. Mode based operation + FFFS	5.29	13	7.41	16.85	7.35	24.20	0.75	3
8. Mode based operation + board	9.62	6	13.48	34.04	7.70	41.75	0.12	5
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	1	16.24					
5. Jet fans at entry portal	5	19	5.39	20.62	2.52	23.14	0.75	2
7. Mode based operation + FFFS	7	13	7.41	16.85	7.35	24.20	0.75	3

5 92-280 Tunnels

The risk results for the 92-280 tunnel are shown in Table 8. The risk level associated with this tunnel is low because of its short length and relatively low traffic volumes.

Options for improving the current condition in the tunnel include [4]:

- Mode-based operation of fans (option 3).
- Upgrade ventilation 1 + mode based operation (upgrade to 200 KCFM per fan) (option 4).
- Upgrade ventilation 2 + mode based operation (upgrade to 300 KCFM per fan) (option 5).
- Mode based operation + FFFS (option 6).
- Mode-based operation + board (fire board to protect structure) (option 7).

The most cost-effective option is to implement a mode-based operation of the fans (option 3) by remote control via SCADA. Upgrading the ventilation system (and also including SCADA control - a measure that would be undertaken in any of the fan upgrades) (option number 4) is the second-best option for cost-effectiveness, while also reducing the residual risk level to nearly 5.15 times the NFPA 502 level (versus 8.30 for option 3).

Application of fire board (option 7) provides some risk reduction, but it is not cost effective. Since this is not a subaqueous tunnel, the risk of structural damage is not as critical as the situation with the Posey-Webster tunnel. Similarly, installing an FFFS (option 6) reduces the risk level, but it is not a cost-effective option relative to other options.

In summary the following can be stated:

1. **Assessment of the risk to be avoided:** The 92-280 tunnels rank lower than the Posey-Webster tunnels since these tunnels are very short (900 ft.) with a lower AADT. This risk ranking makes this tunnel a lower priority for upgrades.
2. **Consideration of the reasonableness of the residual risk level:** Increasing ventilation capacity (option 4) will get the solution to within a factor of five times the NFPA 502 compliant solution.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** Increasing fan capacity and including mode-based operations, ranks 2 and 3 (depending on amount of fan capacity increase) out of all the options for BC score, suggesting a relatively good cost effectiveness. The only option ranking better is mode-based operation (option 3).
4. **Alternatives:** The global risk level for the 92-280 tunnel is very low. As such, the most critical improvements for fire safety would include providing fire detection, traffic control and a ventilation response (as per option 3 or 4). Other improvements, such as increasing fan capacity, are helpful but not immediately critical relative to the other tunnels being assessed.

Based on the analysis, option 4 (improves response and smoke management, and reduces risk, for a relatively small investment) is recommended for implementation consideration to improve the current condition in the tunnel.

Table 8: Risk results for the 92-280 tunnels (PWT-13-21)

Tunnel	**92-280**		**Notes**					
Annual average daily traffic (AADT)	12000							
Tunnel length (m | ft)	274	899						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 111.7 years					
5 MW	0.85	20%	% chance of occuring in 30 years					
20 MW	0.13	3%						
100 MW	0.02	0%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	0.63	49	13.85					
2. NFPA 502 compliant	0.05	68	1.00	17.76	3.61	21.37	0.03	6
3. Mode-based operation	0.38	53	8.30	1.08	0.33	1.41	0.23	1
4. Upgrade ventilation 1	0.23	61	5.15	2.00	0.44	2.44	0.20	2
5. Upgrade ventilation 2	0.17	63	3.80	3.18	0.57	3.75	0.14	4
6. Mode based operation + FFFS	0.17	64	3.65	3.17	1.27	4.44	0.15	3
7. Mode based operation + board	0.35	56	7.70	5.47	1.32	6.79	0.05	5
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	49	13.85					
4. Upgrade ventilation 1	4	61	5.15	2.00	0.44	2.44	0.20	2
4. Upgrade ventilation 1	4	61	5.15	2.00	0.44	2.44	0.20	2

6 Randolph Collier Tunnel

Table 9 provides risk results for the Randolph Collier tunnel. The results show a relatively low risk level. This result is expected given the low AADT.

Options for improving the current condition in the tunnel included [5]:

- Maintain the existing TVS and add LHDs and traffic stops at the portals (implement an automatic response – mode-based operation – response to stop traffic and start ventilation to be automatic on heat detection) (option 3).
- Remove the plenum slab and add LHDs and traffic stops at the portals (option 4).
- SPE upgrade 1 (install a single point extract system to handle a 10 MW fire) (option 5).
- SPE upgrade 2 (install a single point extract system to handle a 50 MW fire) (option 6).
- SPE upgrade 3 (install a single point extract system to handle a 100 MW fire) (option 7).

The most cost-effective scheme is to maintain the current fans and add linear heat detectors and traffic stops at both entry portals (option 3), but the risk relative to an NFPA 502 compliant scheme is still high ($FRS/FRS_{NFPA502}$ = 12.44). Removing the plenum while maintaining the existing fans, and adding LHDs and traffic stops (option 4) is the second-best scheme for cost-effectiveness, but the reduction in residual risk level it provides is not very significant ($FRS/FRS_{NFPA502}$ from 13.77 to 10.65). The options involving the installation of a single point extract system fared better. In particular, option 7 (installation of a single point extract system to handle a 100 MW fire), was able to bring the risk level to less than 5 times that of the NFPA compliant option ($FRS/FRS_{NFPA502}$ = 2.75).

In summary the following can be stated:

1. **Assessment of the risk to be avoided:** Compared to the rest of the tunnels in this assessment the Randolph Collier tunnel ranks low in terms of risk levels due to its relatively short length and low AADT.
2. **Consideration of the reasonableness of the residual risk level:** Installing a single point extract system able to manage a 100 MW fire will get the residual risk to about a factor of three times from the NFPA 502 compliant solution.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** Installing a single point extract system (option 7) ranks number 3 for the BC score, making this option somewhat cost effective (however, note that the cost is much greater, by around $20M, than the option ranking number 2 – option 4).
4. **Alternatives:** The overall risk level is low relative to other tunnels in the network, and this is a rural tunnel. Thus, upgrades to the ventilation system should be kept as simple as possible with minimal maintenance and operational complexity. Thus, although mode-based operation will not bring the system in compliance with NFPA 502, it is a good alternative given the tunnel configuration and location (option 3).

Based on the analysis, option 3 is recommended for implementation consideration to improve the current condition in the tunnel.

Table 9: Risk results for the Randolph Collier tunnel (PWT-13-21)

Tunnel	**Randolph Collier**		**Notes**					
Annual average daily traffic (AADT)	4700							
Tunnel length (m | ft)	575	1886						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 130.9 years					
5 MW	0.78	16%	% chance of occuring in 30 years					
20 MW	0.11	2%						
100 MW	0.11	2%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	1.79	29	13.77					
2. NFPA 502 Compliant	0.13	66	1.00	26.68	5.92	32.60	0.06	3
3. Maintain existing system (LHDs, traffic stop)	1.62	30	12.44	1.12	0.34	1.46	0.15	1
4. Remove plenum slab (LHDs, traffic stop)	1.38	34	10.65	4.72	0.74	5.46	0.09	2
5. SPE Upgrade 1	1.38	34	10.65	20.66	2.53	23.19	0.02	6
6. SPE Upgrade 2	1.11	38	8.52	23.32	2.82	26.14	0.03	5
7. SPE Upgrade 3	0.36	55	2.75	25.20	3.03	28.23	0.06	4
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	29	13.77					
7. SPE Upgrade 3	7	55	2.75	25.20	3.03	28.23	0.06	4
3. Maintain existing system (LHDs, traffic stop)	3	30	12.44	1.12	0.34	1.46	0.15	1

7 Caldecott Tunnel, Bores 1 and 2

Table 10 shows risk results for the Caldecott tunnel, bores 1 and 2. Although Caldecott bores 1 and 2 have lengths and traffic frequency comparable to that of Posey-Webster, a much lower percentage of trucks travel through Caldecott than through Posey-Webster (0.5% versus 2.4%), which results in a lower relative risk for the Caldecott Tunnel and indicates the strong dependence of tunnel risk scores on the traffic composition.

Options for improving the current condition in the tunnel included [7]:

- Installation of a Saccardo nozzle (option 3).
- Installation of a Saccardo nozzle + FFFS (option 4).
- Installation of jet fans (option 5).
- Installation of jet fans + FFFS (option 6).

The most cost-effective scheme was to use a Saccardo nozzle + FFFS (option 4). The use of the jet fan + FFFS alternative (option 6) resulted in the same reduction of the risk score, although at a higher cost than the Saccardo nozzle. Without inclusion of the FFFS, both options were not as cost effective.

In summary the following can be stated (options 4 and 6 are preferred):

1. **Assessment of the risk to be avoided:** The Caldecott Tunnel is one of the higher risk tunnels due to the length and large traffic volumes.
2. **Consideration of the reasonableness of the residual risk level:** The installation of a Saccardo nozzle + FFFS brings the fire risk score down to 1.57 times the NFPA 502 compliant option.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** Installing a Saccardo nozzle + FFFS, ranks 1 for BC score, suggesting a relatively good cost effectiveness. The extra expense needed to achieve full NFPA 502 compliance is around $25M.
4. **Alternatives:** The risk level at the Caldecott Tunnel is one of the higher levels due to the length and large traffic volumes. Both options that performed well included the FFFS, which is warranted given the higher risk levels. Option 6 (jet fans + FFFS) is more expensive than the nozzle but with similar performance levels. Final choice of which option is preferred could come down to constructability and whether issues arise in concept design that make one option preferred over another.

Based on the analysis, the recommended solution for this tunnel is the installation of a Saccardo nozzle + FFFS (option 4).

Table 10: Risk results for the Caldecott Tunnel, bore 1 and 2 (PWT-13-21)

Tunnel	**Caldecott Bores 1&2**		**Notes**					
Annual average daily traffic (AADT)	89413							
Tunnel length (m | ft)	1102	3613						
Number of bores | Cost safety factor	2	2						
	Likelihood	Probability	One fire every 3.8 years					
5 MW	0.97	100%	% chance of occuring in 30 years					
20 MW	0.02	15%						
100 MW	0.01	7%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	9.99	5	14.11					
2. NFPA 502 Compliant	0.71	45	1.00	83.60	19.39	102.99	0.22	3
3. Saccardo Nozzle	5.58	10	7.88	50.34	5.85	56.19	0.18	4
4. Saccardo Nozzle + FFFS	1.11	36	1.57	67.15	13.38	80.53	0.26	1
5. Jet Fans	5.58	10	7.88	62.70	7.23	69.93	0.14	5
6. Jet Fans + FFFS	1.11	36	1.57	79.51	14.76	94.27	0.22	2
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	5	14.11					
6. Jet Fans + FFFS	6	36	1.57	79.51	14.76	94.27	0.22	2
4. Saccardo Nozzle + FFFS	4	36	1.57	67.15	13.38	80.53	0.26	1

8 Caldecott Tunnel, Bore 3

Table 11 shows risk results for the Caldecott Tunnel, bore 3. The overall risk level is similar to Caldecott Tunnel, bores 1 and 2.

Option for improving the current condition in the tunnel included [7]:

- Installation of jet fans to manage a 10 MW fire (option 3).
- Installation of jet fans to manage a 50 MW fire (option 4).
- Installation of jet fans + FFFS (option 5).
- Transverse ventilation with dampers (option 6).
- Installation of a Saccardo nozzle (option 7).
- Installation of a Saccardo nozzle + FFFS (option 8).
- Installation of a Saccardo nozzle via reversing exhaust fans and check valves (option 9).
- Installation of a Saccardo nozzle via reversing exhaust fans and check valves + FFFS (option 10).

Note that options 9 and 10 rely on an innovative scheme that retains existing fans and reverses the axial exhaust fans. Check valves are used in the exhaust duct (to prevent supplied air from going out the exhaust ports) and a connection from the exhaust plenum to the supply plenum is needed (via an operable damper). The nozzle installation in the tunnel is similar to options 7 and 8. Performance of the scheme has been assumed to be the same as options 7 and 8 for options 9 and 10, respectively. It is strongly recommended that further CFD analysis be conducted to test that this innovative concept can work [18].

The most cost-effective scheme was the use of the Saccardo nozzle with FFFS (option 10) with a good reduction of risk score and a similar residual risk such that the scheme is similar in residual risk to the NFPA 502 compliant scheme. It is noted that this concept needs further verification.

An alternative scheme could be option 8, which uses a Saccardo nozzle and FFFS, but would rely on changing out fans rather than just reversing existing exhaust fans. Performance of this option is similar to option 10 but at reduced cost.

In summary the following can be stated (option 10 is preferred):

1. **Assessment of the risk to be avoided:** The risk level at the Caldecott Tunnel is one of the higher levels due to the length and large traffic volumes.
2. **Consideration of the reasonableness of the residual risk level:** The installation of a Saccardo nozzle + FFFS brings the fire risk score down to 1.57 times the NFPA 502 compliant option.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** Installing a Saccardo nozzle + FFFS, ranks 2 for BC score, suggesting a relatively good cost effectiveness. The extra expense needed to achieve full NFPA 502 compliance is around $30M.
4. **Alternatives:** The risk level at the Caldecott Tunnel is one of the higher levels due to the length and large traffic volumes. Saccardo nozzle options all performed well (options 8 and 10), with good cost effectiveness. Both options that performed well included the FFFS, which is warranted given the higher risk levels in this tunnel. Option 5 (jet fans + FFFS) is slightly more expensive than the nozzle but with similar performance levels. Final choice of which option is preferred could come down to constructability and whether issues arise in concept design that make one option preferred over another.

Based on the analysis, the recommended solution for this tunnel is the installation of a Saccardo nozzle + FFFS using the scheme that operates axial exhaust fans in reverse (option 10).

Table 11: Risk results for the Caldecott tunnel, Bore 3 (PWT-13-21)

Tunnel	**Caldecott Bore 3**		**Notes**					
Annual average daily traffic (AADT)	89413							
Tunnel length (m | ft)	1028	3371						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 4.1 years					
5 MW	0.97	100%	% chance of occuring in 30 years					
20 MW	0.02	14%						
100 MW	0.01	6%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	10.31	3	15.61					
2. NFPA 502 Compliant	0.66	48	1.00	49.49	10.45	59.93	0.19	8
3. Jet Fans 1 (10 MW)	5.89	8	8.92	11.40	1.49	12.89	0.39	3
4. Jet Fans 2 (50 MW)	5.05	16	7.65	25.08	3.02	28.10	0.21	7
5. Jet Fans + FFFS (100 MW)	1.04	39	1.57	32.86	6.53	39.39	0.28	5
6. Transverse Ventilation with Dampers	5.89	8	8.92	29.98	3.57	33.55	0.15	9
7. Saccardo Nozzle	5.10	14	7.72	22.28	2.71	24.99	0.23	6
8. Saccardo Nozzle + FFFS	1.04	39	1.57	30.12	6.22	36.34	0.31	4
9. Saccardo Nozzle Alt A	5.10	14	7.72	11.28	1.48	12.76	0.46	2
10. Saccardo Nozzle Alt A + FFFS	1.04	39	1.57	19.12	4.99	24.11	0.48	1
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	3	15.61					
8. Saccardo Nozzle + FFFS	8	39	1.57	30.12	6.22	36.34	0.31	4
10. Saccardo Nozzle Alt A + FFFS	10	39	1.57	19.12	4.99	24.11	0.48	1

9 Yerba Buena Island Tunnels

Table 12 provides risk results for the YBI's upper deck tunnel. Results show the lowest risk among all tunnels studied in this report. This is driven by the significantly shorter length and large cross-sectional area. The option for improving the current condition considered is installation of jet fans (option 3), which can reduce the current risk factor to 2.28 ($FRS/FRS_{NFPA502} = 2.28$) with an expense of $9.80M.

In summary the following can be stated:

1. **Assessment of the risk to be avoided:** The risk level of the current condition is less than 5 times the NFPA 502 compliant level ($FRS/FRS_{NFPA502} = 3.0$), meaning the risk to be avoided here is quite low to begin with.
2. **Consideration of the reasonableness of the residual risk level:** Mechanical ventilation via jet fans or bringing the tunnel to NFPA 502 compliance can reduce the risk levels, but given that the risk level is already low, there is not a great benefit to further reduction in the risk.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** The risk level of the current condition does not warrant the investment, as can be seen from the very low BC values.
4. **Alternatives:** One item for consideration is the structural integrity under fire, given the importance of this tunnel for the roadway network. Protection of the structure might be warranted. Adding mechanical ventilation to the upper deck is not recommended given the short length and high ceiling.

Based on the analysis, keeping the current condition is preferred (option 1).

Table 13 provides risk results for the YBI's lower deck tunnel. Result shows the third lowest risk among all tunnels studied in this report. This is driven by the short length and large cross-sectional area for this tunnel. A sprinkler system is provided. Its effect is computed in these calculations through improved structural fire rating performance. The option for improving the current condition considered is installation of jet fans (option 3), which can reduce the current risk factor to 2.92 ($FRS/FRS_{NFPA502} = 2.92$). Note that the space available for jet fans on the lower deck is minimal and this option would need to go through a lot of validation to determine if enough fans to provide required airflow could be fit into the space available.

In summary the following can be stated:

1. **Assessment of the risk to be avoided:** The risk level of the current condition is low, and only just above the 5 times the NFPA 502 compliant scheme, meaning that the risk to be avoided here is quite low to begin with.
2. **Consideration of the reasonableness of the residual risk level:** Mechanical ventilation via jet fans can reduce the risk level to less than 5 times the NFPA 502 level. The solution could be very difficult to implement due to the lack of clearances for jet fans and wide tunnel cross section.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** The BC values for installing jet fans suggest poor cost effectiveness.
4. **Alternatives:** Given the importance of this tunnel for the roadway network, one item for consideration is the structural integrity under fire. The longer length and lower ceiling height also add to fire-life safety risk here. Given these points, the NFPA 502 compliant option might be worth some consideration as it provides structural protection, smoke management and FFFS.

Based on the analysis, it is recommended to consider the implementation of the NPFA 502 compliant option to improve the current condition in the tunnel. It is noted that this option needs careful validation analysis; more detailed analysis of the current condition and the feasibility of NFPA 502 implementation may show acceptable FLS outcomes with the current configuration.

Table 12: Risk results for the YBI tunnel – upper deck (PWT-13-21)

Tunnel	**YBI - upper**		**Notes**					
Annual average daily traffic (AADT)	96452							
Tunnel length (m | ft)	165	540						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 23.3 years					
5 MW	0.88	68%	% chance of occuring in 30 years					
20 MW	0.11	13%						
100 MW	0.01	1%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	0.50	50	3.00					
2. NFPA 502 Compliant	0.17	65	1.00	17.92	4.04	21.95	0.02	1
3. Jet Fans	0.38	54	2.28	9.78	1.31	11.09	0.01	2
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	50	3.00					
3. Jet Fans	3	54	2.28	9.78	1.31	11.09	0.01	2
1. Current condition	1	50	3.00	0.00			0.00	0

Table 13: Risk results for the YBI tunnel – lower deck

Tunnel	YBI - lower		Notes					
Annual average daily traffic (AADT)	96452							
Tunnel length (m | ft)	287	940						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 13.4 years					
5 MW	0.88	86%	% chance of occuring in 30 years					
20 MW	0.11	22%						
100 MW	0.01	2%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	1.47	32	5.09					
2. NFPA 502 Compliant	0.29	59	1.00	23.99	5.90	29.90	0.05	2
3. Jet Fans	0.84	42	2.92	9.90	1.32	11.22	0.06	1
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	32	5.09					
3. Jet Fans	3	42	2.92	9.90	1.32	11.22	0.06	1
2. NFPA 502 Compliant	2	59	1.00	23.99	5.90	29.90	0.05	2

10 LAX Connector Tunnels

Table 14 provides risk results for the NW LAX Connector Tunnel (E105-N405). According to risk score results, this tunnel ranks 6 out of the 10 tunnel bores. Table 15 provides risk results for the SE LAX Connector Tunnel (W105-S405). According to risk score results, this tunnel ranks 5, one place higher than the NW LAX Connector tunnel.

Options for improving the current condition (in both of the tunnels) included [9]:

- Installation of jet fans to manage a 10 MW fire (option 3).
- Installation of jet fans to manage a 50 MW fire (option 4).
- Installation of jet fans to manage a 100 MW fire (option 5).
- Installation of a Saccardo nozzle to manage a 10 MW fire (option 6).
- Installation of a Saccardo nozzle to manage a 50 MW fire (option 7).
- Installation of a Saccardo nozzle to manage a 100 MW fire (option 8).
- Installation of jet fans to manage a 100 MW fire + passive fire protection (option 9).

The most cost-effective scheme which can lower the current risk factor to less than five times that of an NFPA 502 compliant tunnel is to use jet fans (option 5). The only other ventilation option that can achieve this is option 8, but at additional expense. An option is also considered where passive fire protection is included. This option is incorporated because these underpasses are on a key interchange where an extended outage due to a fire is unlikely to be acceptable. With passive fire protection this scheme (option 9) is still the third most cost effective. An FFFS was not considered for this tunnel because the AADT is relatively low, and it does not have a dedicated operation like the Posey-Webster or Caldecott Tunnels.

In summary the following considerations are made for the NW LAX and SE LAX Connector Tunnels:

1. **Assessment of the risk to be avoided:** The risk level of the current condition is approximately 16 times that of an NFPA 502 compliant scheme ($FRS/FRS_{NFPA502} = 16$).
2. **Consideration of the reasonableness of the residual risk level:** Mechanical ventilation inclusion via jet fans (to manage a 100 MW FHRR, option 5) has an impact on reducing the risk level to within five times an NFPA 502 compliant tunnel.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** The risk level of the current condition is quite low relative to other tunnels, as can be seen from the very low cost effectiveness of the solutions (BC values all $<<1$).
4. **Alternatives:** Although NFPA 502 compliance is more costly, it is a realistic alternative to flag for consideration because it would include designing for structural fire resistance. Adding a passive fire protection board (option 9) is a possible solution.

Based on the analysis, the recommended solution for these tunnels is the installation of jet fans to manage 100 MW fires. During the validation phase, structural fire resistance and configuration should be assessed to determine if there's any fire risk to road infrastructure above the tunnels (considered unlikely, so not included in the cost at present). It has been assumed, at present, that a structural failure in the tunnels due to fire will not likely cause progressive collapse or damage to roads above the tunnels.

Table 14: Risk results for the NW LAX Connector tunnel (PWT-13-21)

Tunnel	E105-N405		Notes					
Annual average daily traffic (AADT)	11119							
Tunnel length (m | ft)	412	1350						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 79.6 years					
5 MW	0.92	29%	% chance of occuring in 30 years					
20 MW	0.01	0%						
100 MW	0.07	2%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	2.06	24	16.12					
2. NFPA 502 Compliant	0.13	67	1.00	19.03	4.35	23.38	0.10	4
3. Jet Fans 1 (10 MW)	1.84	25	14.39	6.76	0.97	7.73	0.03	5
4. Jet Fans 2 (50 MW)	1.82	27	14.20	7.96	1.10	9.06	0.03	6
5. Jet Fans 3 (100 MW)	0.35	57	2.74	9.20	1.24	10.44	0.19	1
6. Nozzle 1 (10 MW)	1.84	25	14.39	7.64	1.07	8.71	0.03	7
7. Nozzle 2 (50 MW)	1.82	27	14.20	10.96	1.44	12.40	0.02	8
8. Nozzle 3 (100 MW)	0.35	57	2.74	12.00	1.56	13.56	0.14	2
9. Jet Fans 3 (100 MW) with fire board	0.22	62	1.74	15.79	2.72	18.51	0.12	3
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	24	16.12					
5. Jet Fans 3 (100 MW)	5	57	2.74	9.20	1.24	10.44	0.19	1
5. Jet Fans 3 (100 MW)	5	57	2.74	9.20	1.24	10.44	0.19	1

Table 15: Risk results for the SE LAX tunnel

Tunnel	W105-S405		Notes					
Annual average daily traffic (AADT)	16714							
Tunnel length (m | ft)	543	1781						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 40.2 years					
5 MW	0.92	50%	% chance of occuring in 30 years					
20 MW	0.01	1%						
100 MW	0.07	5%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	4.10	18	16.18					
2. NFPA 502 Compliant	0.25	60	1.00	22.14	5.27	27.41	0.17	4
3. Jet Fans 1 (10 MW)	3.66	20	14.45	6.76	0.97	7.73	0.06	5
4. Jet Fans 2 (50 MW)	3.61	22	14.26	7.96	1.10	9.06	0.06	6
5. Jet Fans 3 (100 MW)	0.69	46	2.74	9.20	1.24	10.44	0.37	1
6. Nozzle 1 (10 MW)	3.66	20	14.45	7.36	1.04	8.40	0.06	7
7. Nozzle 2 (50 MW)	3.61	22	14.26	9.66	1.29	10.95	0.05	8
8. Nozzle 3 (100 MW)	0.69	46	2.74	11.18	1.46	12.64	0.30	2
9. Jet Fans 3 (100 MW) with fire board	0.44	52	1.74	17.90	3.19	21.09	0.20	3
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	18	16.18					
5. Jet Fans 3 (100 MW)	5	46	2.74	9.20	1.24	10.44	0.37	1
5. Jet Fans 3 (100 MW)	5	46	2.74	9.20	1.24	10.44	0.37	1

11 Presidio (MacArthur) Tunnel

Table 16 provides risk results for the Presidio (MacArthur) tunnel. The results indicate that the Presidio tunnel is second only to the Posey-Webster tunnels in terms of risk. Although this tunnel has a relatively short length, its traffic frequency is the highest in all the tunnels considered (AADT of 64,000).

Options for improving the current condition (in both of the tunnels) included [11]:

- Installation of axial fans and mode-based operation (option 3).
- Installation of jet fans (option 4).
- Installation of axial fans + FFFS (option 5).
- Installation of jet fans + FFFS (option 6).

The most cost-effective of all the improvement options is the installation of jet fans (option 4), with a good residual risk relative to the NFPA 502 compliant option ($FRS/FRS_{NFPA502} = 2.95$). The installation of axial fans and FFFS is the least cost-effective solution, however, the residual risk level relative to the NFPA 502 compliant option is good (3.15). The use of jet fans and FFFS (option number 6) is the second-best scheme for cost-effectiveness, and this scheme achieves the lowest residual risk level ($FRS/FRS_{NFPA502} = 1.63$). Although this option is costlier than the use of jet fans alone, the benefits associated with the use of FFFS, such as reduction of the fire size, bidirectional traffic/egress, and improvement of tenability with FFFS, and better structural fire protection help to make a case for this alternative.

In summary the following considerations are made:

1. **Assessment of the risk to be avoided:** Compared to the rest of the tunnels in this assessment, the Presidio tunnel ranks second in terms of risk because, although the tunnel is relatively short, it has the largest AADT of all the tunnels considered.
2. **Consideration of the reasonableness of the residual risk level:** Option 6 (jet fans + FFFS) brings the fire risk score down to 1.63 times the NFPA 502 compliant solution. Although most of the other options considered also show a risk reduction level below 5 times the NPA 502 compliant option, this alternative offers benefits associated with the use of FFFS, such as reduction of the fire size and better structural fire protection. The bidirectional traffic is also a consideration as the FFFS will help mitigate some risk associated with the fan that people are more likely to be exposed to smoke.
3. **Assessment of the sacrifice in taking measures to avoid the risk:** Installing jet fans + FFFS (option 6), ranks second out of all the options for BC score, suggesting a relatively good cost effectiveness.
4. **Alternatives:** The risk level at the Presidio Tunnel is high because of the significantly large AADT. If an FFFS is not installed, then an alternative is just to include jet fans (option 4). Jet fan operation would need careful consideration due to the bidirectional traffic and it might be the case that jet fans are used only for fire fighting purposes.

Based on the analysis, the recommended solution for this tunnel is the installation of jet fans + FFFS (option 6).

Table 16: Risk results for the Presidio tunnel (PWT-13-21)

Tunnel	Presidio		Notes					
Annual average daily traffic (AADT)	64000							
Tunnel length (m | ft)	396	1300						
Number of bores | Cost safety factor	1	2						
	Likelihood	Probability	One fire every 14.4 years					
5 MW	0.86	83%	% chance of occuring in 30 years					
20 MW	0.11	20%						
100 MW	0.03	7%						
Option	FRS / benchmark	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Combined cost ($M)	BC	BC rank
1. Current condition	7.37	7	15.17					
2. NFPA 502 Compliant	0.49	51	1.00	42.61	8.35	50.95	0.16	3
3. Axial Fans & Mode Based Operation	4.41	17	9.08	47.50	5.53	53.03	0.06	5
4. Jet Fans	1.43	33	2.95	26.48	3.18	29.66	0.22	1
5. Axial Fans + FFFS	1.53	31	3.15	53.55	8.24	61.79	0.11	4
6. Jet Fans + FFFS	0.79	43	1.63	32.53	5.89	38.41	0.20	2
Narrowing options down	Option	Global FRS rank	FRS / FRS (NFPA502)	Cost ($M)	Maintenance cost ($M)	Total cost ($M)	BC	BC rank
1. Current condition	1	7	15.17					
4. Jet Fans	4	33	2.95	26.48	3.18	29.66	0.22	1
6. Jet Fans + FFFS	6	43	1.63	32.53	5.89	38.41	0.20	2

12 Summary and Recommendations

A summary of key data (length, AADT, fire probability) and risk levels for the current condition of all the tunnels is provided in Table 17:

- The column "**FRS/NFPA502**" indicates the risk score relative to the same tunnel if it were to comply with NFPA 502.
- The column "**FRS/b'mark**" indicates the fire risk score relative to a common benchmark tunnel (NFPA 502 compliant tunnel, half a mile long, 2400 vehicles per hour, traffic mix the same as Posey-Webster).
- The risk rank of each tunnel is provided, indicating that Posey-Webster tunnel is the highest risk tunnel at present. Top three tunnels are: Posey-Webster, Caldecott Bores 1&2 and Caldecott Bore 3. The highest ranks indicate those tunnels in need of most urgent attention based on the risk posed.
- Drivers of the risk vary between the tunnels. Posey-Webster is a very long tunnel, with high AADT, a larger proportion of trucks, and systems in need of repair. Caldecott Bores 1&2 are similar in length to the Posey-Webster but with a larger AADT. Caldecott Bore 3 is a long tunnel that runs downhill, with high AADT. In contrast, Randolph Collier is a mid-length tunnel with a low AADT, thus it ranks lower in terms of the risk.
- Note that all costs quoted are rough order of magnitude; a detailed validation study and formal cost estimate is needed for any option herein that is considered seriously for implementation. Maintenance costs were estimated as a percentage of the capital costs.

Table 17: Summary of risk levels – current condition

Tunnel	Length	AADT	Fire probability in 30 yrs - small	Fire probability in 30 yrs - medium	Fire probability in 30 yrs - large	Rank	District, rank	FRS / b'mark	FRS / NFPA502
Posey-Webster	3360	32300	90%	26%	10%	1	4-1	11.6	16.2
Caldecott Bore 3	3371	89413	100%	14%	6%	2	4-2	10.3	15.6
Caldecott Bores 1&2	3613	89413	100%	15%	7%	3	4-3	10.0	14.1
Presidio	1300	64000	83%	20%	7%	4	4-4	7.4	15.2
W105-S405	1781	16714	50%	1%	5%	5	7-1	4.1	16.2
E105-N405	1350	11119	29%	0%	2%	6	7-2	2.1	16.1
Randolph Collier	1886	4700	16%	2%	2%	7	1-1	1.8	13.8
YBI - lower	940	96452	86%	22%	2%	8	4-5	1.5	5.1
92-280	899	12000	20%	3%	0%	9	4-6	0.6	13.8
YBI - upper	540	96452	68%	13%	1%	10	4-7	0.5	3.0

NFPA 502 is the main standard to follow for fire-life safety and if a new tunnel were to be built today, the approach would be to follow NFPA 502. Thus, the starting point for consideration of risk reduction is to consider what is needed to meet NFPA 502. Generally, in all tunnels this was assumed to include ventilation upgrade, structural fire protection and inclusion of an FFFS. There would be other factors around NFPA 502 compliance that would need attention, and in any of the tunnels a detailed validation study would be needed to determine the feasibility of the upgrades noted (structure, ventilation and FFFS). Additionally, other features could need an upgrade too, such as, a fire standpipe, electrical upgrades, emergency response planning, traffic control, etc. **Thus, when looking at the options to meet NFPA 502, the costs need to be interpreted with some caution; the costs are very rough order of magnitude, with a contingency factor (2.0) built in. Moving forward, validation studies on preferred options will help refine this.** Table 18 provides risk numbers for an NFPA 502 compliant scheme for each tunnel:

- Cost to achieve NFPA 502 compliance across all tunnels rounds out to $372.40M; as noted, this number has a factor of 2 contingency applied, which can be reduced as validation studies on preferred options are carried forward. Maintenance costs have a similar contingency applied and are estimated as a percentage of the capital cost.
- NFPA 502 is not compulsory, but it is a recommended point to strive for, noting that some tunnels, because of their short length and low risk, may never be high enough risk relative to others to warrant implementation of the NFPA 502 scheme.

Table 18: Summary of approximate cost and residual risk levels for NFPA 502 compliance across all tunnels

Tunnel	Length	AADT	FRS / b'mark (before)	FRS / b'mark (after)	Cost ($M)	Maintenance ($M)	BC
Posey-Webster	3360	32300	11.6	0.7	69.2	17.1	0.31
Caldecott Bore 3	3371	89413	10.3	0.7	49.5	10.4	0.19
Caldecott Bores 1&2	3613	89413	10.0	0.7	83.6	19.4	0.22
Presidio	1300	64000	7.4	0.5	42.6	8.3	0.16
W105-S405	1781	16714	4.1	0.3	22.1	5.3	0.17
E105-N405	1350	11119	2.1	0.1	19.0	4.4	0.10
Randolph Collier	1886	4700	1.8	0.1	26.7	5.9	0.06
YBI - lower	940	96452	1.5	0.3	24.0	5.9	0.05
92-280	899	12000	0.6	>0.0	17.8	3.6	0.03
YBI - upper	540	96452	0.5	0.2	17.9	4.0	0.02
					372.4	**84.4**	

Consideration of different upgrade options was made for each tunnel, based on identifying which options achieve the best degree of risk reduction. Table 19 provides a summary of the change in risk levels for the recommended options. In all cases there is a large reduction in the FRS and the tunnels move closer to NFPA 502 risk levels (within a factor of five, except for Posey-Webster, which is almost at a factor of five).

Table 19: Summary of recommended options

Tunnel	Recommendations	Length	AADT	FRS / b'mark (before)	FRS / b'mark (after)	FRS / NFPA502	District, rank	Cost ($M)	Maintenance ($M)	BC
Posey-Webster	7. Mode based operation + FFFS	3360	32300	11.6	5.3	7.4	4-1	16.9	7.4	0.75
Caldecott Bore 3	10. Saccardo Nozzle Alt. A + FFFS	3371	89413	10.3	1.0	1.6	4-3	19.1	5.0	0.48
Caldecott Bores 1&2	4. Saccardo Nozzle + FFFS	3613	89413	10.0	1.1	1.6	4-2	67.1	13.4	0.26
Presidio	6. Jet Fans + FFFS	1300	64000	7.4	0.8	1.6	4-4	32.5	5.9	0.20
W105-S405	5. Jet Fans 3 (100 MW)	1781	16714	4.1	0.7	2.7	7-1	9.2	1.2	0.37
E105-N405	5. Jet Fans 3 (100 MW)	1350	11119	2.1	0.4	2.7	7-2	9.2	1.2	0.19
Randolph Collier	3. Maintain existing system (LHDs, traffic stop – automatic on heat signal)	1886	4700	1.8	1.6	12.4	1-1	1.1	0.3	0.15
YBI - lower	2. NFPA 502 Compliant	940	96452	1.5	0.3	1.0	4-6	24.0	5.9	0.05
92-280	4. Upgrade ventilation	899	12000	0.6	0.2	5.1	4-7	2.0	0.4	0.20
YBI - upper	1. Current condition	540	96452	0.5	0.5	3.0	4-5	0.0	0.0	0.00
								181.16	**40.77**	

Table 20: Summary of tunnels, risks, mitigations and recommendations

Tunnel	Key risks	Key systems to mitigate risks / recommendations	Priority (current risk rank)
Posey-Webster	Urban tunnel, high AADT and length, transverse ventilation with low effectiveness for smoke management, sub-aqueous immersed tube tunnel with potential heavy goods vehicle traffic, no intermediate egress.	Mode-based operation (run fans remotely from a monitored control room interface, modes to use ventilation in most effective way based on fire location, plus backup automatic fire detection and response) – improved smoke management for egress and fire fighting, improved operational response. Fixed fire fighting system (FFFS) – improve structural resilience, improve ventilation performance.	High (1)
Caldecott Bore 3	Urban tunnel, high AADT and length, transverse ventilation with low effectiveness for smoke management, with potential heavy goods vehicle traffic.	Saccardo nozzle utilizing reversed exhaust fans [18] – improved smoke management for egress and fire fighting. FFFS – improve structural resilience, improve ventilation performance.	High (2)
Caldecott Bores 1 and 2	Urban tunnel, high AADT and length, transverse ventilation with low effectiveness for smoke management, with potential heavy goods vehicle traffic, no intermediate egress.	Saccardo nozzle – improved smoke management for egress and fire fighting. FFFS – improve structural resilience, improve ventilation performance.	High (3)
Presidio (MacArthur)	Bi-directional tunnel, urban, high AADT, natural ventilation.	Jet fans and FFFS – the jet fans are intended principally for fire fighting, given the bidirectional traffic situation. The FFFS is intended to help mitigate life safety risks in bidirectional traffic.	Medium (4)
W105-S405	Urban tunnel, low ventilation capacity, moderate AADT, tight cross section on a curve.	Jet fans to get to 100 MW design fire This is a major interchange tunnel where a fire and structural damage could have very disruptive consequences, and as such, a review of the possible impacts of a major fire on the structure are recommended; passive fire protection might be needed if the structure and structures above were found to be vulnerable to the effects of fire (it is considered unlikely though and thus not included in cost estimates).	Medium (5)

Tunnel	Key risks	Key systems to mitigate risks / recommendations	Priority (current risk rank)
E105-N405	Urban tunnel, low ventilation capacity, moderate AADT, tight cross section on a curve.	Jet fans to get to 100 MW design fire This is a major interchange tunnel where a fire and structural damage could have very disruptive consequences, and as such, a review of the possible impacts of a major fire on the structure are recommended; passive fire protection might be needed if the structure and structures above were found to be vulnerable to the effects of fire (it is considered unlikely though and thus not included in cost estimates).	Medium (6)
Randolph-Collier	Rural tunnel without automatic systems for fire detection and response (alarms, traffic control, ventilation).	Implement an automatic response (maintain ventilation as-is, add linear heat detector and traffic stops at portals – response to stop traffic, start ventilation, to be automatic on heat detection).	Low (7)
YBI – lower	Urban tunnel, high AADT but relatively short length, no mechanical ventilation, structural risk due to traffic travelling in the upper deck above	NFPA 502 compliance (note that this option should undergo some further validation analysis to check the performance of the current systems and optimize extent of upgrades needed). Jet fans are recommended given the length and AADT. Note that this scheme will need a substantial amount of validation due to the tight space available. FFFS – improve structural resilience, improve ventilation/egress. Structural – Protect the structure (deck above). Note that this scheme will need a substantial amount of validation due to the tight space available.	Low (8)
92-280	Rural tunnel without automatic systems for fire detection and response (alarms, traffic control, ventilation).	Mode-based operation – improved operational response plus upgrade exhaust (200 KCFM option per earlier CFD analysis [4]).	Low (9)
YBI – upper	Urban tunnel, high AADT but relatively short length with high ceiling and no mechanical ventilation.	Retain existing operations, consider via a study whether there is any structural vulnerability, but otherwise, the short length means that traffic control and a standpipe are the only main features needed here per NFPA 502.	Low (10)

13 References

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Appendix A. Risk Method Additional Information

Additional detailed information on the risk analysis methodology is provided herein.

General Information

Item	Value and notes	Source
Consequences (FRS_X)	Based on the fire risk score of option "X" (FRS_X) which is based on the net fire hazard and the fire frequency. The FRS is dimensionless and is measured relative to a benchmark tunnel. Assume that the FRS contains the costs associated with the fire event (implicitly, not via direct computation). The FRS is typically normalized by a benchmark case. See also Section 3.1.	
Cost (C_X)	Based on the capital cost of a given mitigation option "X" and the cost to maintain the piece of equipment. Cost is measured in dollars. Assume that costs associated with the fire event are built into the FRS. Thus, the cost referred to here is the cost associated with the hazard reduction.	
Net benefit	NB = FRS for current condition – FRS for option X	
Net cost	NC = C for option X – C for current condition	
Cost-benefit, or expense incurred per unit reduction of the fire risk score	BC = NB / NC, BC measures the ratio of the units of benefit derived per unit of cost incurred. The larger the value of CB, the better a provision performs relative to the costs incurred. If BC is less than 0, then it means that either the cost of the option is less than the current condition (unlikely), or it means that the FRS for the option is more than the current condition (unlikely since the options are supposed to be improving conditions).	
Capital costs versus maintenance costs	For each option there is a capital expense cost and a maintenance cost. The capital cost is associated with providing the feature including design and construction. The capital cost will vary between different options. The maintenance cost is the annual cost to maintain the infrastructure (not the entire cost, only costs connected to the feature being proposed) and this annual cost is compounded over the design life to a present-day cost. Maintenance costs are computed as a percentage of the capital costs as follows: FFFS = 2% (of capital cost) Ventilation = 0.5% Egress + operations = assume an initial capital cost of $100,000 for NFPA 502 solution, $50,000 for all other options, and then 10% per annum cost Structural fire protection = 1%	
Mitigating features	Fixed fire fighting system, ventilation for egress, ventilation for fire fighting, egress, structural protection. Refer to descriptions below.	
Fixed fire fighting system	Fixed fire fighting systems (FFFS) potentially have a major positive impact on outcomes, and as such the weighting assigned is 0.7. The FFFS is likely to have an impact through prevention of larger fires, and improved ventilation effectiveness. Scores are weighting accordingly.	
Ventilation – egress	Ventilation for occupant egress is based on whether the system can achieve critical velocity (for a longitudinal system) or whether occupants can egress before onset of untenable conditions (for a transverse system). The score is based on the percentage of the tunnel length for which the system achieves the stated goals. The option has a weighting of 1.0 (highest value).	

Item	Value and notes	Source
Ventilation – firefighting	Ventilation for fire fighting is based on limitation of the extent of smoke spread, which ideally is cantered on provision of a smoke free path to the fire. The option has a weighting of 0.1 (lower relative importance since facilitation of conditions for fire fighting depends on many factors beyond just ventilation and a smoke free environment). Costs are not computed for this provision because it is part of the "Ventilation – egress" mitigation measure.	
Egress	The egress risk reduction is included to factor in the potential to enhance occupant egress. This feature would work in conjunction with ventilation and successful implementation would rely on people responding accordingly, and for this reason the provision has a weighting of 0.1 since it does not have such a direct impact. Mitigations are included for items such as extra cross passages, exit directions, and signage.	
Structural protection	This option would reduce consequences for a high fire hazard event, such as a heavy goods vehicle fire. The option is assumed to comprise a protective board. For lower fire heat release rates this option has less impact since the structure inherently can withstand the lower fire heat release rates. The option has a weighting of 0.1 (lower relative importance since events that threaten the structure are rare and even then, the impact on the structure is not necessarily catastrophic).	

Fire hazard score tables are used to quantify the reduction in the unmitigated hazard score associated with a particular provision. The risk assessment allows for up to 10 score tables to be used, but only those tables that are relevant to a specific segment need to be applied in the risk assessment.

A higher score means a greater reduction in the unmitigated hazard and consequently a lower risk. Conversely, a lower score means a lower reduction in the unmitigated hazard. A score of zero means there is no change to the unmitigated risk score.

Five base tables (named Tables A to E in the risk assessment) are predefined and these are shown below. Other tables (named Tables F to J in the risk assessment) could be implemented for an area that has specific hazard reduction provisions that are not covered by the predefined tables. If a table is not relevant for a tunnel, then this is not included in the assessment.

For each table a weighting factor can be applied. The risk assessment is un-weighted if all tables have a weighting of unity. Different weighting factors can be used if a particular provision is deemed to have a greater overall influence on the outcome. For instance, in a tunnel segment the successful operation of the ventilation system may have the greatest potential to mitigate the life safety risk. The default assumption as follows:

- Fixed fire fighting system, Table A, 0.70 weighting.
- Ventilation for egress, Table B, 1.00 weighting.
- Ventilation fire fighting, Table C, 0.10 weighting.
- Operations and egress, Table D, 0.10 weighting.
- Structural protection, Table E, 0.10 weighting.

Table 21: Fixed fire fighting system score table (Table A in risk assessment)

Score	Description
0	No FFFS included 0
50	FFFS included, less than 0.2 gpm/sq ft, 50
80	FFFS included 0.2 gpm/sq ft or more, 80
100 (or 95)	FFFS included 0.2 gpm/sq ft or more and regular drills (95 and 100 are equivalent here – the score of 95 is used to guard against the analysis mathematics given excessively large or small numbers)

Table 22: Smoke management for egress score table (Table B in Risk Assessment)

Score	Description
0 to 100	Smoke management score = 0 Smoke management score = 5 Smoke management score = 10 Smoke management score = 15 Smoke management score = 20 Smoke management score = 25 Smoke management score = 30 Smoke management score = 35 Smoke management score = 40 Smoke management score = 45 Smoke management score = 50 Smoke management score = 55 Smoke management score = 60 Smoke management score = 65 Smoke management score = 70 Smoke management score = 75 Smoke management score = 80 Smoke management score = 85 Smoke management score = 90 Smoke management score = 100
Note	Smoke management scoring is a weighted average score informed by analysis or judgment for a tunnel. When egress analysis is performed in parallel with smoke management, the weighting is based on whether people are exposed to untenable conditions, and the percentage of the population exposed. If egress analysis is not performed in parallel, scoring categories are assigned based on whether the ventilation system can achieve critical velocity. In some cases, engineering judgement based on experience might be used; explanation is provided on a case-by-case basis. When FFFS is installed the score is increased by a factor of 40 (unless better specific information is available) to account for improvement to smoke management due to the FFFS cooling effect benefitting ventilation effectiveness.

Table 23: Smoke management for fire fighting score table (Table C in risk assessment)

Score	Description
0 to 100	Smoke management score = 0 Smoke management score = 5 Smoke management score = 10 Smoke management score = 15 Smoke management score = 20 Smoke management score = 25 Smoke management score = 30 Smoke management score = 35 Smoke management score = 40 Smoke management score = 45 Smoke management score = 50 Smoke management score = 55 Smoke management score = 60 Smoke management score = 65 Smoke management score = 70 Smoke management score = 75 Smoke management score = 80 Smoke management score = 85 Smoke management score = 90 Smoke management score = 100
Note	The score for fire fighting is set based on whether the ventilation system can achieve critical velocity (and the percentage of tunnel length it can achieve it for, at a given FHRR). Where the system cannot achieve critical velocity, a score is assigned based on fire fighters being able to approach from either entry portal (corresponding to a length of tunnel where they can manage conduct operations of around 200 ft.). If the FHRR is 5 MW (low category), then it is assumed fire fighters can conduct operations throughout the tunnel due to their use of protective gear and these categories have a score of 100.

Table 24: Operational response score table (Table D in risk assessment)

Score	Description
0 to 100	Operations and egress score = 0 Operations and egress score = 10 Operations and egress score = 20 Operations and egress score = 30 Operations and egress score = 40 Operations and egress score = 50 Operations and egress score = 60 Operations and egress score = 70 Operations and egress score = 80 Operations and egress score = 90 Operations and egress score = 100
0 to 100	Scores assigned based on amount of effort put into training, automated operation, etc.: Auto operation, manual operation, egress signs, drills, testing (none), 0 Auto operation, manual operation, egress signs, drills, testing (1 of 5), 20 Auto operation, manual operation, egress signs, drills, testing (2 of 5), 40 Auto operation, manual operation, egress signs, drills, testing (3 of 5), 60 Auto operation, manual operation, egress signs, drills, testing (4 of 5), 80 Auto operation, manual operation, egress signs, drills, testing (5 of 5), 100

Table 25: Structural protection score table (Table E in Risk Assessment)

Score	Description
100	Provision mitigates all the risk, or the event is of no consequence
95	Provision mitigates all the risk, or the event is of no consequence
75	Provision mitigates 75% risk, or the event is unlikely to be of major consequence
50	Provision mitigates 50% risk
25	Provision mitigates 25% risk
10	Provision mitigates 10% risk, structure likely to be severely damaged
0	Complete vulnerability to the event

Condition and Operation Factors

Condition (Table 26) and operation (Table 27) score tables are used to weight the FRS based on the condition of the equipment and the likelihood of it being operated correctly during a fire event. This is used to account for the current condition and/or operation and for any improvement in the condition and/or operation with alterations or improvements.

A value of unity has no effect on the risk reduction. That is, the hazard reduction value selected from the FHS tables is directly applied and the full risk reduction is realized. Conversely, a value of zero means that the hazard reduction value selected from the FHS tables is not applied at all and there is no reduction in the hazard due to the condition or operational factor applied. If the condition or operation factor is not relevant for a particular provision, then a value of unity is applied.

Table 26: Condition factor

Score	Description
1.0	Not applicable (e.g., static equipment, structural etc.)
1.0	Equipment in very good condition ("as new") and operating as it should
0.8	Equipment in good condition and mainly operating as it should
0.6	Equipment in average condition and usually operating as it should
0.4	Equipment in poor condition and sometimes operating as it should
0.2	Equipment not working as intended and in poor state of repair
0.0	Operating equipment is likely to increase the fire safety risk

Table 27: Operational factor

Score	Description
1.0	Not applicable (e.g., static equipment, structural etc.)
1.0	Highly likely that equipment will be operated as required during a fire
0.8	Likely that equipment will be operated as required during a fire
0.6	More likely than not that equipment will be operated as required during a fire
0.4	More likely than not that equipment will NOT be operated as required during a fire
0.2	Unlikely that equipment will be operated as required during a fire
0.0	Equipment cannot be operated during a fire

For most of the tunnels the condition and operation factors are assumed to be in good operating condition due to improvements that have been implemented or are currently underway. Values used are noted on a case by case basis.

Note that for all design options a minimum score of 5 is assigned and a maximum of 95. While scores of 0 and 100 are possible, assigning these scores lead to a situation where the numbers can become very small or very large, making the FRS go to values that are artificially inflated or deflated. Assigning scores of 5 and 95 instead can capture the impact of different options but without the numerical value of results varying by factors of 100 or more.

Order of Magnitude Costs

An order of magnitude cost-benefit assessment is undertaken as part of the assessment. For most situations, discrete cost ranges, and in some cases the actual cost, are used to quantify the order of magnitude cost of a particular provision in terms of the capital (Table 28) and maintenance (Table 29) costs. These costs are entered to the risk assessment and the total present value cost is calculated accounting for both the capital and operational cost over a specified time period. The timeframes and discount rates used to calculate the present value cost are provided with the common inputs (refer Section 3.3). Costs are varied on a case by case basis for each tunnel. Tables below summarize the different cost inputs used.

Table 30 provides costs for the FFFS. This cost is arrived at via a nominal cost of $543.50 per lane foot (installed cost, including design fees, overhead, based on a nominal value of $250 per lane foot prior to overheads, etc.). The value used is the same for all the tunnels. Maintenance costs per annum for the FFFS are estimated at 2% of the capital cost. Fire board costs assume a nominal cost of $25 per square foot of coverage, or $58.15 per square foot installed (installed cost, including design fees, overhead, etc.). Maintenance for the board is assumed at 1% of the capital cost for annual maintenance or longer-term inspection efforts. Table 31 provides the cost estimates for structural fire protection board. The area was estimated based on a 12 ft. wide lane, 3 ft. shoulders and 6 ft coverage down each sidewall.

Note that a contingency factor is applied to the final costs; **this factor herein is 2.0 and it was applied on top of the costs quoted in this section quoted for each individual tunnel**. This was done due to the uncertainty at this early stage and the complexity of rehabilitation efforts in tunnels compounding this. This factor can (and should) be refined as validation studies are conducted on preferred options.

Table 28: Capital cost

Cost	Description
$100M $75M $50M $25M $15M $10M $8M $6M $4M $3M $2M $1M $750k $500k $250k $100k $50k $25k $0k	
Custom	Range of cost values used. Discrete values or a custom input is also possible.

Table 29: Maintenance cost assumptions

Item	Description
FFFS	Maintenance costs at 2% capital costs, per annum.
Ventilation	Maintenance costs at 0.5% capital costs, per annum.
Egress	For NFPA 502 compliant case, assume a base cost of $100,000 (for exercise/plan development, for instance). For other cases assume a base cost of $50,000. Maintenance costs per annum are set at 10% of the initial costs.
Structure	Assume fire board cost is 1% capital costs, per annum.

Table 30: FFFS costs

Cost	Description
$7,815,000	Posey-Webster (both bores)
$1,046,000	92-280
$2,193,000	Randolph Collier
$8,404,000	Caldecott bores 1 and 2 (both bores)
$3,920,000	Caldecott bore 3
$2,733,000	YB tunnel, lower
$1,570,000	YB tunnel, upper
$1,570,000	E105-N105 tunnel
$2,071,000	W1045-S405
$3,024,000	Presidio

Table 31: Fire board costs

Cost	Description
$16,412,000	Posey-Webster
$2,196,000	92-280
$4,606,000	Randolph Collier
$17,648,000	Caldecott bores 1 and 2
$8,233,000	Caldecott bore 3
$4,264,000	YB tunnel, lower
$2,449,000	YB tunnel, upper
$3,297,000	E105-N105 tunnel
$4,350,000	W1045-S405
$4,989,000	Presidio

Appendix B. Score Tables for Tunnels

Posey-Webster								
Options	Option 1 Current condition	Option 2 NFPA 502 compliant	Option 3 Mode-based operation	Option 4 Upgrade ventilation	Option 5 Jet fans at entry portal	Option 6 Convert supply duct to exhaust	Option 7 Mode based operation + FFFS	Option 8 Mode based operation + board
Table A	**Fixed Fire Fighting System**							
Condition Factor	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0
Operational Factor	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0
Low Hazard	0	95	0	0	0	0	95	0
Medium Hazard	0	95	0	0	0	0	95	0
High Hazard	0	95	0	0	0	0	95	0
CAPEX [$k]	0	7815	0	0	0	0	7815	0
OPEX [$k p.a]	0	156	0	0	0	0	156	0
Total [$K]	0.00	11316.09	0.00	0.00	0.00	0.00	11316	0.00
Table B	**Smoke Management - Egress**							
Condition Factor	0.8	1.0	0.8	1.0	0.8	0.8	0.8	0.8
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	15	95	45	70	95	40	65	45
Medium Hazard	5	95	15	60	95	10	40	15
High Hazard	5	95	15	60	95	10	40	15
CAPEX [$k]	0	10260	560	65700	10260	28470	560	560
OPEX [$k p.a]	0	51	3	329	51	142	3	3
Total [$K]	0.00	11408.94	622.71	73057.24	11408.94	31658.14	622.71	622.71
Table C	**Smoke Management - Fire Fighting**							
Condition Factor	0.8	1.0	0.8	1.0	0.8	0.8	0.8	0.8
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95
Medium Hazard	5	95	15	60	95	15	40	15
High Hazard	5	95	15	60	95	15	40	15
CAPEX [$k]	0	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**							
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40	40	40
Medium Hazard	20	95	40	40	40	40	40	40
High Hazard	20	95	40	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**							
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	75	95
High Hazard	10	95	10	10	10	10	75	95
CAPEX [$k]	0	16412	0	0	0	0	0	16412
OPEX [$k p.a]	0	164	0	0	0	0	0	164
Total [$K]	0.00	20088.02	0.00	0.00	0.00	0.00	0.00	20088.02

92-280							
Options	Option 1 Current condition	Option 2 NFPA 502 compliant	Option 3 Mode-based operation	Option 4 Upgrade ventilation 1	Option 5 Upgrade ventilation 2	Option 6 Mode based operation + FFFS	Option 7 Mode based operation + board
Table A	**Fixed Fire Fighting System**						
Condition Factor	0.0	1.0	0.0	0.0	0.0	1.0	0.0
Operational Factor	0.0	1.0	0.0	0.0	0.0	1.0	0.0
Low Hazard	0	95	0	0	0	95	0
Medium Hazard	0	95	0	0	0	95	0
High Hazard	0	95	0	0	0	95	0
CAPEX [$k]	0	1046	0	0	0	1046	0
OPEX [$k p.a]	0	21	0	0	0	21	0
Total [$K]	0.00	1513.86	0.00	0.00	0.00	1513.86	0
Table B	**Smoke Management - Egress**						
Condition Factor	0.8	1.0	0.8	1.0	1.0	0.8	0.8
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	85	95	90	90	90	95	90
Medium Hazard	25	95	75	80	90	95	75
High Hazard	5	95	60	75	90	95	60
CAPEX [$k]	0	5540	490	950	1540	490	490
OPEX [$k p.a]	0	28	2	5	8	2	2
Total [$K]	0.00	6160.38	544.87	1056.38	1712.45	544.87	544.87
Table C	**Smoke Management - Fire Fighting**						
Condition Factor	0.8	1.0	0.8	1.0	1.0	0.8	0.8
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95
Medium Hazard	20	95	20	20	20	60	20
High Hazard	20	95	20	20	20	60	20
CAPEX [$k]	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**						
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40	40
Medium Hazard	20	95	40	40	40	40	40
High Hazard	20	95	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**						
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	95
High Hazard	10	95	10	10	10	75	95
CAPEX [$k]	0	2196	0	0	0	0	2196
OPEX [$k p.a]	0	22	0	0	0	0	22
Total [$K]	0.00	2687.37	0.00	0.00	0.00	0.00	2687.37

Randolph Collier							
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Maintain existing system (LHDs, traffic stop)	Option 4 Remove plenum slab (LHDs, traffic stop)	Option 5 SPE Upgrade 1	Option 6 SPE Upgrade 2	Option 7 SPE Upgrade 3
Table A	**Fixed Fire Fighting System**						
Condition Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Operational Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Low Hazard	0	95	0	0	0	0	0
Medium Hazard	0	95	0	0	0	0	0
High Hazard	0	95	0	0	0	0	0
CAPEX [$k]	0	2193	0	0	0	0	0
OPEX [$k p.a]	0	44	0	0	0	0	0
Total [$K]	0.00	3175.91	0.00	0.00	0.00	0.00	0
Table B	**Smoke Management - Egress**						
Condition Factor	0.8	1.0	0.8	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95
Medium Hazard	40	95	50	60	60	95	95
High Hazard	20	95	25	30	30	45	95
CAPEX [$k]	0	6440	510	2310	10280	11610	12550
OPEX [$k p.a]	0	32	3	12	51	58	63
Total [$K]	0.00	7161.17	567.11	2568.68	11431.18	12910.11	13955.38
Table C	**Smoke Management - Fire Fighting**						
Condition Factor	0.8	1.0	0.8	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95
Medium Hazard	95	95	95	95	95	95	95
High Hazard	95	95	95	95	95	95	95
CAPEX [$k]	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**						
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	40	95	40	40	40	40	40
Medium Hazard	40	95	40	40	40	40	40
High Hazard	40	95	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**						
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	75
High Hazard	10	95	10	10	10	10	10
CAPEX [$k]	0	4606	0	0	0	0	0
OPEX [$k p.a]	0	46	0	0	0	0	0
Total [$K]	0.00	5637.80	0.00	0.00	0.00	0.00	0.00

Caldecott Bores 1&2						
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Saccardo Nozzle	Option 4 Saccardo Nozzle + FFFS	Option 5 Jet Fans	Option 6 Jet Fans + FFFS
Table A	**Fixed Fire Fighting System**					
Condition Factor	0.0	1.0	0.0	1.0	0.0	1.0
Operational Factor	0.0	1.0	0.0	1.0	0.0	1.0
Low Hazard	0	95	0	95	0	95
Medium Hazard	0	95	0	95	0	95
High Hazard	0	95	0	95	0	95
CAPEX [$k]	0	8404	0	8404	0	8404
OPEX [$k p.a]	0	168	0	168	0	168
Total [$K]	0.00	12168.16	0.00	12168.16	0.00	12168.16
Table B	**Smoke Management - Egress**					
Condition Factor	0.8	1.0	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0
Low Hazard	50	95	95	95	95	95
Medium Hazard	5	95	95	95	95	95
High Hazard	5	95	5	95	5	95
CAPEX [$k]	0	15650	25120	25120	31300	31300
OPEX [$k p.a]	0	78	126	126	157	157
Total [$K]	0.00	17402.52	27932.99	27932.99	34805.05	34805.05
Table C	**Smoke Management - Fire Fighting**					
Condition Factor	0.8	1.0	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0
Low Hazard	50	95	95	95	95	95
Medium Hazard	5	95	95	95	95	95
High Hazard	5	95	5	95	5	95
CAPEX [$k]	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40
Medium Hazard	20	95	40	40	40	40
High Hazard	20	95	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98
Table E	**Structural Protection**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75
High Hazard	10	95	10	75	10	75
CAPEX [$k]	0	17648	0	0	0	0
OPEX [$k p.a]	0	176	0	0	0	0
Total [$K]	0.00	21600.60	0.00	0.00	0.00	0.00

Caldecott Bore 3										
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Jet Fans 1 (10 MW)	Option 4 Jet Fans 2 (50 MW)	Option 5 Jet Fans + FFFS (100 MW)	Option 6 Transverse Ventilation with Dampers	Option 7 Saccardo Nozzle	Option 8 Saccardo Nozzle + FFFS	Option 9 Saccardo Nozzle Alt A	Option 10 Saccardo Nozzle Alt A + FFFS
Table A	**Fixed Fire Fighting System**									
Condition Factor	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	1.0
Operational Factor	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	1.0
Low Hazard	0	95	0	0	95	0	0	95	0	95
Medium Hazard	0	95	0	0	95	0	0	95	0	95
High Hazard	0	95	0	0	95	0	0	95	0	95
CAPEX [$k]	0	3920	0	0	3920	0	0	3920	0	3920
OPEX [$k p.a]	0	78	0	0	78	0	0	78	0	78
Total [$K]	0.00	5676.57	0.00	0.00	5676.57	0.00	0	5676.57	0.00	5676.57
Table B	**Smoke Management - Egress**									
Condition Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	5	95	95	95	95	95	95	95	95	95
Medium Hazard	5	95	5	95	95	5	95	95	95	95
High Hazard	5	95	5	5	95	5	5	95	5	95
CAPEX [$k]	0	12490	5650	12490	12460	14940	11090	11090	5590	5590
OPEX [$k p.a]	0	62	28	62	62	75	55	55	28	28
Total [$K]	0.00	13888.66	6282.70	13888.66	13855.30	16613.02	12331.88	12331.88	6215.98	6215.98
Table C	**Smoke Management - Fire Fighting**									
Condition Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95	95
Medium Hazard	45	95	45	95	95	45	45	95	45	95
High Hazard	45	95	45	45	95	45	45	95	45	95
CAPEX [$k]	0	0	0	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**									
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40	40	40	40	40
Medium Hazard	20	95	40	40	40	40	40	40	40	40
High Hazard	20	95	40	40	40	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**									
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	75	75	75	75
High Hazard	10	95	10	10	75	10	10	75	10	75
CAPEX [$k]	0	8233	0	0	0	0	0	0	0	0
OPEX [$k p.a]	0	82	0	0	0	0	0	0	0	0
Total [$K]	0.00	10076.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YBI - lower			
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Jet Fans
Table A	**Fixed Fire Fighting System**		
Condition Factor	1.0	1.0	0.0
Operational Factor	1.0	1.0	0.0
Low Hazard	95	95	0
Medium Hazard	80	95	0
High Hazard	50	95	0
CAPEX [$k]	0	2733	0
OPEX [$k p.a]	0	55	0
Total [$K]	0.00	3957.26	0.00
Table B	**Smoke Management - Egress**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	80	95	95
High Hazard	60	95	80
CAPEX [$k]	0	4900	4900
OPEX [$k p.a]	0	25	25
Total [$K]	0.00	5448.71	5448.71
Table C	**Smoke Management - Fire Fighting**		
Condition Factor	0.8	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	20	95	95
High Hazard	20	95	80
CAPEX [$k]	0	0	0
OPEX [$k p.a]	0	0	0
Total [$K]	0.00	0.00	0.00
Table D	**Operations and Egress**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	20	95	40
Medium Hazard	20	95	40
High Hazard	20	95	40
CAPEX [$k]	0	100	50
OPEX [$k p.a]	0	10	5
Total [$K]	0.00	323.96	161.98
Table E	**Structural Protection**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	75	95	75
High Hazard	50	95	10
CAPEX [$k]	0	4264	0
OPEX [$k p.a]	0	43	0
Total [$K]	0.00	5218.44	0.00

YBI - upper			
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Jet Fans
Table A	**Fixed Fire Fighting System**		
Condition Factor	0.0	1.0	0.0
Operational Factor	0.0	1.0	0.0
Low Hazard	0	95	0
Medium Hazard	0	95	0
High Hazard	0	95	0
CAPEX [$k]	0	1570	0
OPEX [$k p.a]	0	31	0
Total [$K]	0.00	2273.32	0.00
Table B	**Smoke Management - Egress**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	95	95	95
High Hazard	95	95	95
CAPEX [$k]	0	4840	4840
OPEX [$k p.a]	0	24	24
Total [$K]	0.00	5381.99	5381.99
Table C	**Smoke Management - Fire Fighting**		
Condition Factor	0.8	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	60	95	95
High Hazard	60	95	80
CAPEX [$k]	0	0	0
OPEX [$k p.a]	0	0	0
Total [$K]	0.00	0.00	0.00
Table D	**Operations and Egress**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	20	95	40
Medium Hazard	20	95	40
High Hazard	20	95	40
CAPEX [$k]	0	100	50
OPEX [$k p.a]	0	10	5
Total [$K]	0.00	323.96	161.98
Table E	**Structural Protection**		
Condition Factor	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0
Low Hazard	95	95	95
Medium Hazard	75	95	75
High Hazard	10	95	10
CAPEX [$k]	0	2449	0
OPEX [$k p.a]	0	24	0
Total [$K]	0.00	2997.83	0.00

E105-N405									
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Jet Fans 1 (10 MW)	Option 4 Jet Fans 2 (50 MW)	Option 5 Jet Fans 3 (100 MW)	Option 6 Nozzle 1 (10 MW)	Option 7 Nozzle 2 (50 MW)	Option 8 Nozzle 3 (100 MW)	Option 9 Jet Fans 3 (100 MW) with fire board
Table A	**Fixed Fire Fighting System**								
Condition Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operational Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Hazard	0	95	0	0	0	0	0	0	0
Medium Hazard	0	95	0	0	0	0	0	0	0
High Hazard	0	95	0	0	0	0	0	0	0
CAPEX [$k]	0	1570	0	0	0	0	0	0	0
OPEX [$k p.a]	0	31	0	0	0	0	0	0	0
Total [$K]	0.00	2273.32	0.00	0.00	0.00	0.00	0	0.00	0.00
Table B	**Smoke Management - Egress**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	5	95	95	95	95	95	95	95	95
Medium Hazard	5	95	5	95	95	5	95	95	95
High Hazard	5	95	5	5	95	5	5	95	95
CAPEX [$k]	0	4550	3330	3930	4550	3770	5430	5950	4550
OPEX [$k p.a]	0	23	17	20	23	19	27	30	23
Total [$K]	0.00	5059.52	3702.90	4370.09	5059.52	4192.17	6038.06	6616.29	5059.52
Table C	**Smoke Management - Fire Fighting**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95
Medium Hazard	15	95	15	95	95	15	95	95	95
High Hazard	15	95	15	15	95	15	15	95	95
CAPEX [$k]	0	0	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40	40	40	40
Medium Hazard	20	95	40	40	40	40	40	40	40
High Hazard	20	95	40	40	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	75	75	95
High Hazard	10	95	10	10	10	10	10	10	95
CAPEX [$k]	0	3297	0	0	0	0	0	0	3297
OPEX [$k p.a]	0	33	0	0	0	0	0	0	33
Total [$K]	0.00	4035.54	0.00	0.00	0.00	0.00	0.00	0.00	4035.54

W105-S405									
Options	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
	Current condition	NFPA 502 Compliant	Jet Fans 1 (10 MW)	Jet Fans 2 (50 MW)	Jet Fans 3 (100 MW)	Nozzle 1 (10 MW)	Nozzle 2 (50 MW)	Nozzle 3 (100 MW)	Jet Fans 3 (100 MW) with fire board
Table A	**Fixed Fire Fighting System**								
Condition Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operational Factor	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Hazard	0	95	0	0	0	0	0	0	0
Medium Hazard	0	95	0	0	0	0	0	0	0
High Hazard	0	95	0	0	0	0	0	0	0
CAPEX [$k]	0	2071	0	0	0	0	0	0	0
OPEX [$k p.a]	0	41	0	0	0	0	0	0	0
Total [$K]	0.00	2999.10	0.00	0.00	0.00	0.00	0	0.00	0.00
Table B	**Smoke Management - Egress**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	5	95	95	95	95	95	95	95	95
Medium Hazard	5	95	5	95	95	5	95	95	95
High Hazard	5	95	5	5	95	5	5	95	95
CAPEX [$k]	0	4550	3330	3930	4550	3630	4780	5540	4550
OPEX [$k p.a]	0	23	17	20	23	18	24	28	23
Total [$K]	0.00	5059.52	3702.90	4370.09	5059.52	4036.50	5315.28	6160.38	5059.52
Table C	**Smoke Management - Fire Fighting**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95
Medium Hazard	10	95	10	95	95	10	95	95	95
High Hazard	10	95	10	10	95	10	10	95	95
CAPEX [$k]	0	0	0	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40	40	40	40
Medium Hazard	20	95	40	40	40	40	40	40	40
High Hazard	20	95	40	40	40	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98	161.98	161.98	161.98
Table E	**Structural Protection**								
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75	75	75	95
High Hazard	10	95	10	10	10	10	10	10	95
CAPEX [$k]	0	4350	0	0	0	0	0	0	4350
OPEX [$k p.a]	0	43	0	0	0	0	0	0	43
Total [$K]	0.00	5323.92	0.00	0.00	0.00	0.00	0.00	0.00	5323.92

Presidio						
Options	Option 1 Current condition	Option 2 NFPA 502 Compliant	Option 3 Axial Fans & Mode Based Operation	Option 4 Jet Fans	Option 5 Axial Fans + FFFS	Option 6 Jet Fans + FFFS
Table A	**Fixed Fire Fighting System**					
Condition Factor	0.0	1.0	0.0	0.0	1.0	1.0
Operational Factor	0.0	1.0	0.0	0.0	1.0	1.0
Low Hazard	0	95	0	0	95	95
Medium Hazard	0	95	0	0	95	95
High Hazard	0	95	0	0	95	95
CAPEX [$k]	0	3024	0	0	3024	3024
OPEX [$k p.a]	0	60	0	0	60	60
Total [$K]	0.00	4378.25	0.00	0.00	4378.25	4378.25
Table B	**Smoke Management - Egress**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	30	95	95	95	95	95
Medium Hazard	10	95	80	95	95	95
High Hazard	5	95	30	90	70	95
CAPEX [$k]	0	13190	23700	13190	23700	13190
OPEX [$k p.a]	0	66	119	66	119	66
Total [$K]	0.00	14667.05	26353.98	14667.05	26353.98	14667.05
Table C	**Smoke Management - Fire Fighting**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95
Medium Hazard	15	95	80	95	95	95
High Hazard	15	95	30	95	70	95
CAPEX [$k]	0	0	0	0	0	0
OPEX [$k p.a]	0	0	0	0	0	0
Total [$K]	0.00	0.00	0.00	0.00	0.00	0.00
Table D	**Operations and Egress**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	20	95	40	40	40	40
Medium Hazard	20	95	40	40	40	40
High Hazard	20	95	40	40	40	40
CAPEX [$k]	0	100	50	50	50	50
OPEX [$k p.a]	0	10	5	5	5	5
Total [$K]	0.00	323.96	161.98	161.98	161.98	161.98
Table E	**Structural Protection**					
Condition Factor	1.0	1.0	1.0	1.0	1.0	1.0
Operational Factor	1.0	1.0	1.0	1.0	1.0	1.0
Low Hazard	95	95	95	95	95	95
Medium Hazard	75	95	75	75	75	75
High Hazard	10	95	10	10	75	75
CAPEX [$k]	0	4989	0	0	0	0
OPEX [$k p.a]	0	50	0	0	0	0
Total [$K]	0.00	6106.69	0.00	0.00	0.00	0.00

ATTACHMENT C
Detour Plans

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	260	R1.2L	5	33

Claudia K. Fang 4-11-24
REGISTERED CIVIL ENGINEER DATE

April 15, 2024
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — Claudia K. Fang — No. 80493 — Exp. 3-31-25 — CIVIL — STATE OF CALIFORNIA

DETOUR PLAN No. 1

NB ROUTE 260 POSEY TUBE CLOSURE

TRAFFIC FROM EB ATLANTIC Ave AND WEBSTER St VIA:

EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
SB ROUTE 880 ON-RAMP

DETOUR VIA:

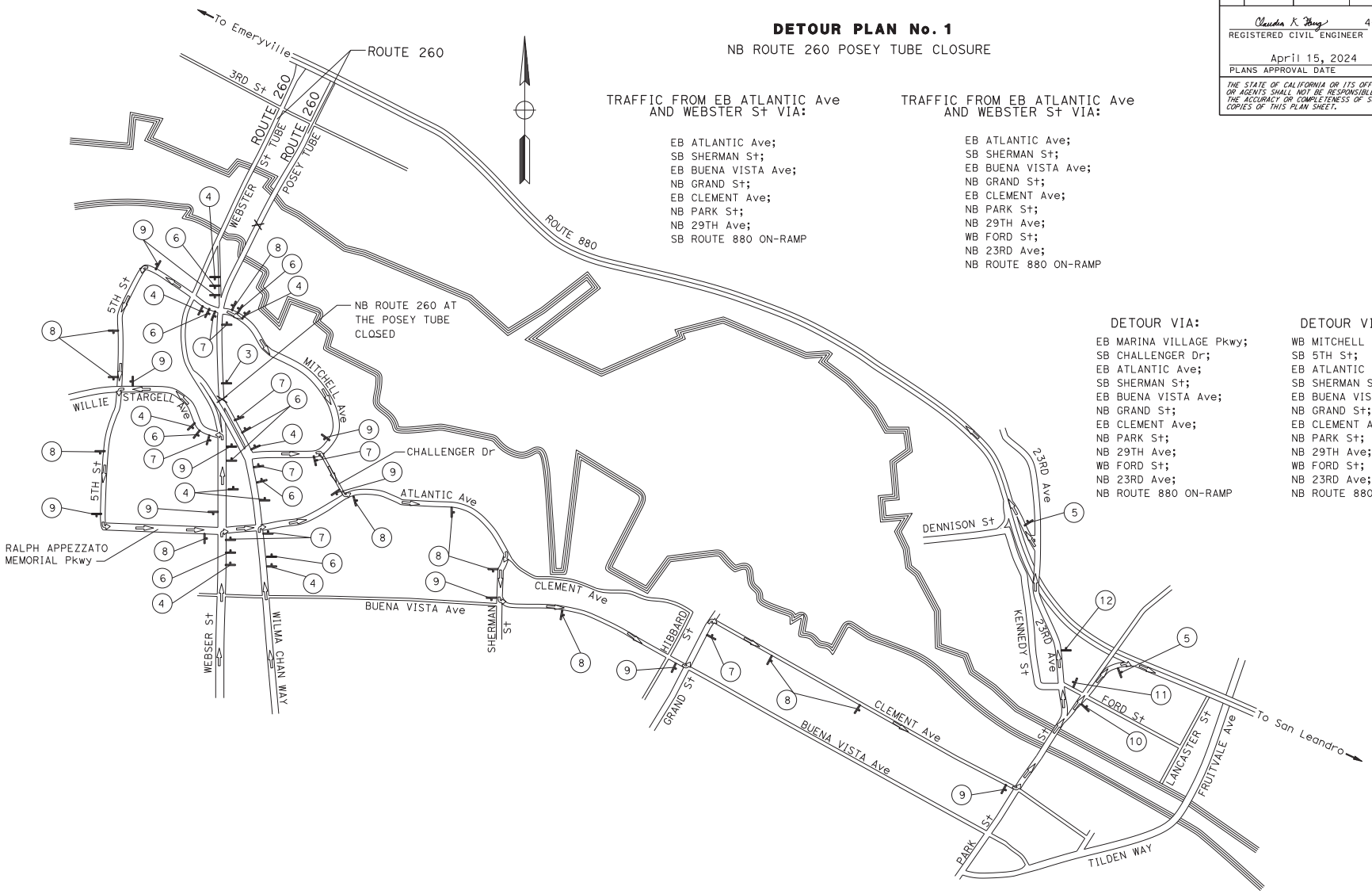
EB MARINA VILLAGE Pkwy;
SB CHALLENGER Dr;
EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP

TRAFFIC FROM EB ATLANTIC Ave AND WEBSTER St VIA:

EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP

DETOUR VIA:

WB MITCHELL Ave;
SB 5TH St;
EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP



CONSTRUCTION AREA SIGNS

NO SCALE

CS-3

APPROVED FOR CONSTRUCTION AREA SIGN WORK ONLY

FOR NOTES AND LEGEND, SEE SHEET CS-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
TRAFFIC
FUNCTIONAL SUPERVISOR: LESTER LEE
CALCULATED-DESIGNED BY: ABHINAY MOVVA
CHECKED BY: CLAUDIA FANG
REVISED BY: AM
DATE REVISED: 10-9-23

LAST REVISION 04-12-24
DATE PLOTTED => 18-APR-2024
TIME PLOTTED => 11:06

BORDER LAST REVISED 8/5/2020
USERNAME => s146009
DGN FILE => 04220004671a003.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0451
PROJECT NUMBER & PHASE 04220004671

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	260	R1.2L	6	33

Claudia K. Fang 4-11-24
REGISTERED CIVIL ENGINEER DATE

April 15, 2024
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Claudia K. Fang — No. 80493 — Exp. 3-31-25 — CIVIL — STATE OF CALIFORNIA

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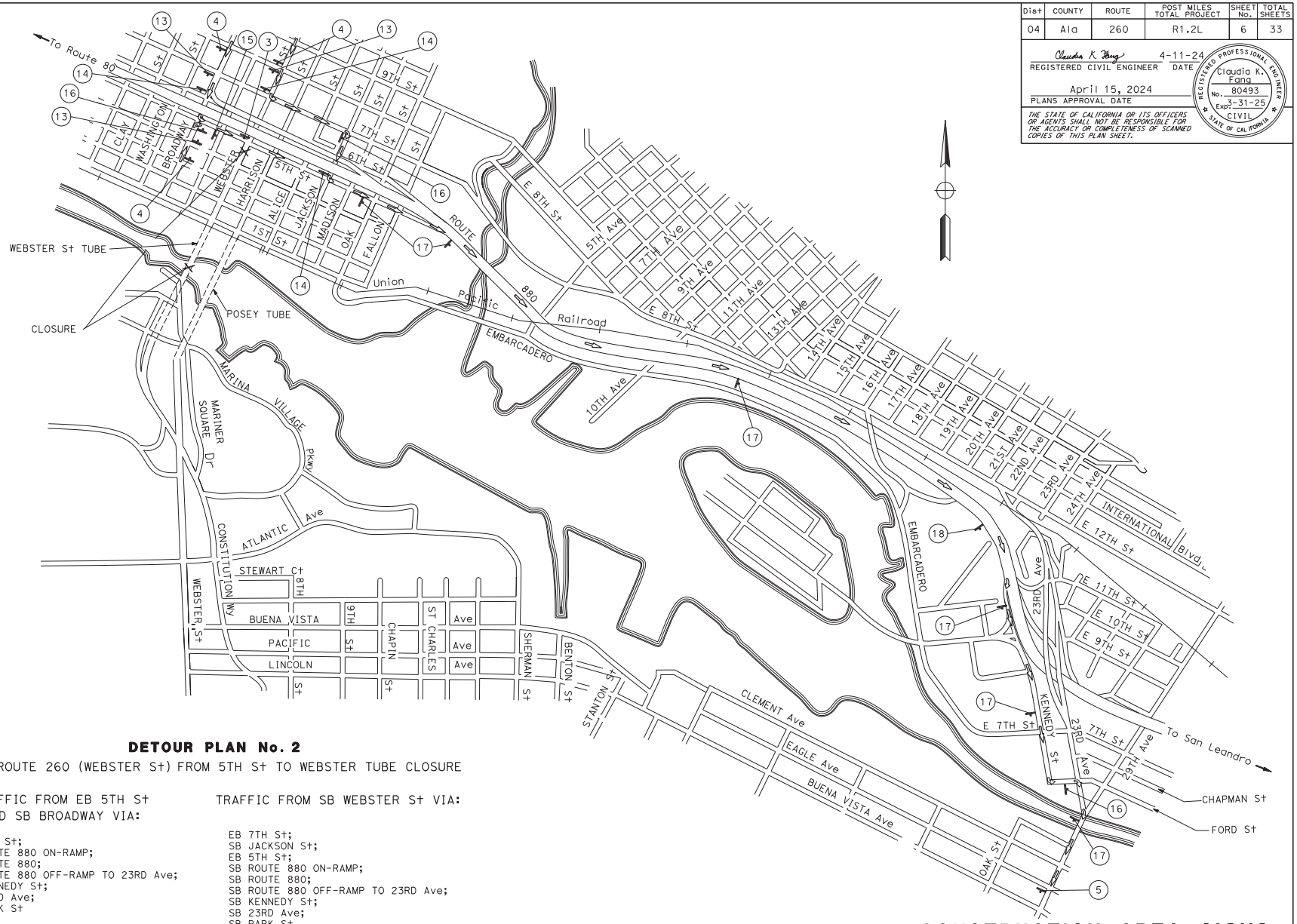
REVISED BY	DATE REVISED
AM	10-9-23

CALCULATED-DESIGNED BY	CHECKED BY
ABHINAY MOVVA	CLAUDIA FANG

FUNCTIONAL SUPERVISOR: LESTER LEE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
TRAFFIC



DETOUR PLAN No. 2

SB ROUTE 260 (WEBSTER St) FROM 5TH St TO WEBSTER TUBE CLOSURE

TRAFFIC FROM EB 5TH St AND SB BROADWAY VIA:

EB 5TH St;
SB ROUTE 880 ON-RAMP;
SB ROUTE 880;
SB ROUTE 880 OFF-RAMP TO 23RD Ave;
SB KENNEDY St;
SB 23RD Ave;
SB PARK St

TRAFFIC FROM SB WEBSTER St VIA:

EB 7TH St;
SB JACKSON St;
EB 5TH St;
SB ROUTE 880 ON-RAMP;
SB ROUTE 880;
SB ROUTE 880 OFF-RAMP TO 23RD Ave;
SB KENNEDY St;
SB 23RD Ave;
SB PARK St

CONSTRUCTION AREA SIGNS

NO SCALE

APPROVED FOR CONSTRUCTION AREA SIGN WORK ONLY

FOR NOTES AND LEGEND, SEE SHEET CS-1

CS-4

LAST REVISION 04-12-24 | DATE PLOTTED => 18-APR-2024 | TIME PLOTTED => 11:06

BORDER LAST REVISED 8/5/2020 | USERNAME => s146009 | DGN FILE => 04220004671a004.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0451 | PROJECT NUMBER & PHASE 04220004671

ATTACHMENT D
CEQA Exemption/NEPA Categorical Exclusion

CEQA EXEMPTION / NEPA CATEGORICAL EXCLUSION DETERMINATION FORM (rev. 06/2022)

Project Information

Project Name (if applicable): Posey Tube 33-0106R and Webster Tube 33-0106L - Ventilation Upgrade

DIST-CO-RTE: ALA-260 **PM/PM:** R1.100/R1.800

EA: 04-2Y780 **Federal-Aid Project Number:** 0423000158

Project Description

Caltrans proposes upgrades to the Posey and Webster Tubes which includes the addition of ceiling Jet Fans near the entry portal of the Webster Tube, reconfiguration of existing ventilation systems in both tubes, as well as the installation of a deluge sprinkler system. Continued on Continuation Sheet.

Caltrans CEQA Determination (Check one)

☐ **Not Applicable** – Caltrans is not the CEQA Lead Agency

☐ **Not Applicable** – Caltrans has prepared an IS or EIR under CEQA

Based on an examination of this proposal and supporting information, the project is:

☐ **Exempt by Statute.** (PRC 21080[b]; 14 CCR 15260 et seq.)

☒ **Categorically Exempt. Class** 1f. (PRC 21084; 14 CCR 15300 et seq.)

☒ No exceptions apply that would bar the use of a categorical exemption (PRC 21084 and 14 CCR 15300.2). See the SER Chapter 34 for exceptions.

☐ **Covered by the Common Sense Exemption**. This project does not fall within an exempt class, but it can be seen with certainty that there is no possibility that the activity may have a significant effect on the environment (14 CCR 15061[b][3].)

Senior Environmental Planner or Environmental Branch Chief

Wahida Rashid		12/11/2024
Print Name	Signature	Date

Project Manager

Hung Nguyen		12/11/2024
Print Name	Signature	Date

Caltrans NEPA Determination (Check one)

☐ **Not Applicable**

Caltrans has determined that this project has no significant impacts on the environment as defined by NEPA, and that there are no unusual circumstances as described in 23 CFR 771.117(b). See SER Chapter 30 for unusual circumstances. As such, the project is categorically excluded from the requirements to prepare an EA or EIS under NEPA and is included under the following:

☒ **23 USC 326:** Caltrans has been assigned, and hereby certifies that it has carried out the responsibility to make this determination pursuant to 23 USC 326 and the Memorandum of Understanding dated April 18, 2022, executed between FHWA and Caltrans. Caltrans has determined that the project is a Categorical Exclusion under:

- ☒ **23 CFR 771.117(c): activity (c)(27)**
- ☐ **23 CFR 771.117(d): activity (d)(Enter activity number)**
- ☐ **Activity Enter activity number listed in Appendix A of the MOU between FHWA and Caltrans**

☐ **23 USC 327:** Based on an examination of this proposal and supporting information, Caltrans has determined that the project is a Categorical Exclusion under 23 USC 327. The environmental review, consultation, and any other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by Caltrans pursuant to 23 USC 327 and the Memorandum of Understanding dated May 27, 2022, and executed by FHWA and Caltrans.

Senior Environmental Planner or Environmental Branch Chief

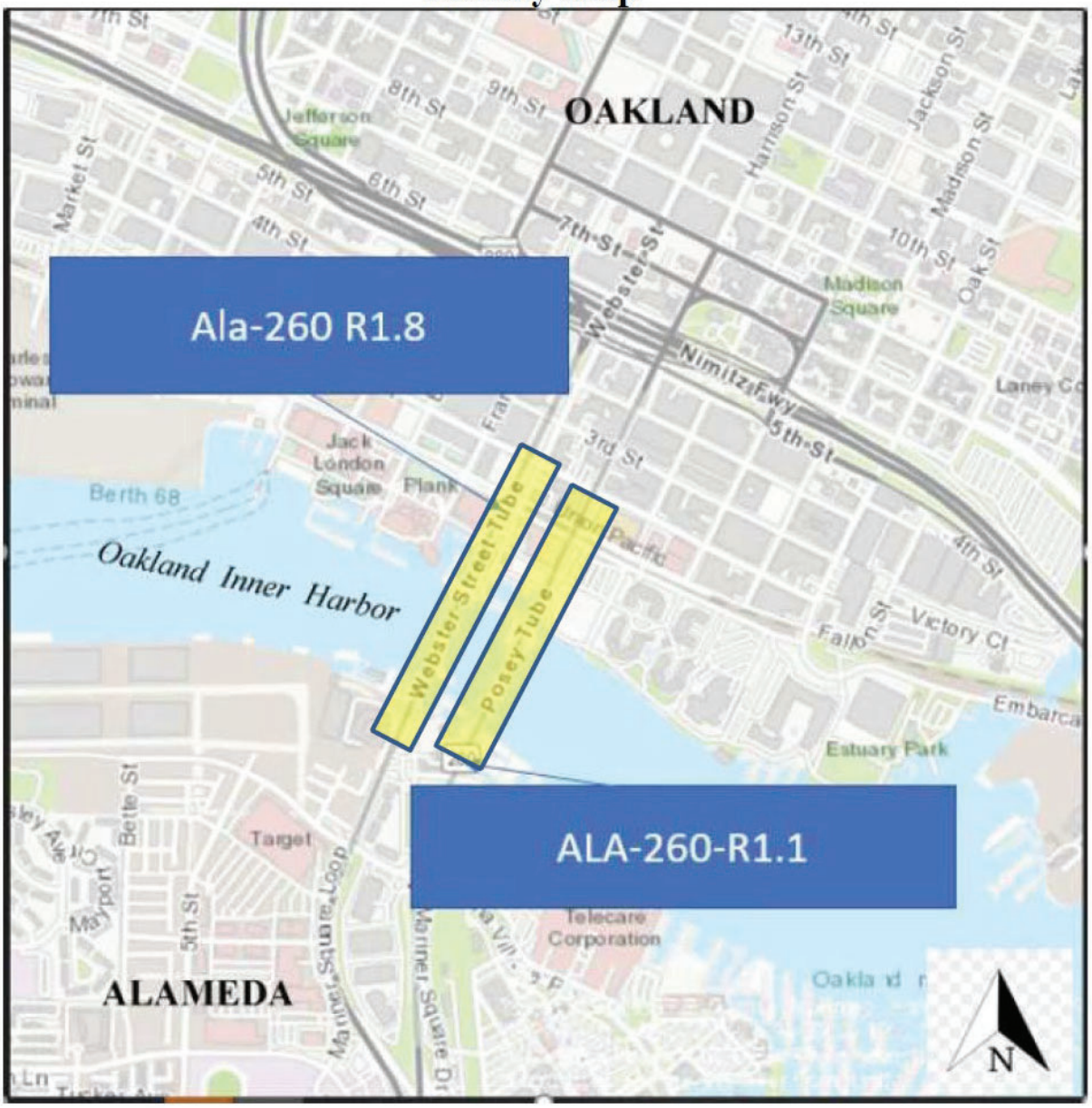
Wahida Rashid		12/11/2024
Print Name	Signature	Date

Project Manager/ DLA Engineer

Hung Nguyen		12/11/2024
Print Name	Signature	Date

Date of Categorical Exclusion Checklist completion (if applicable): 12/11/2024
Date of Environmental Commitment Record or equivalent: 12/11/2024

Vicinity Map



Continuation sheet:

Purpose: The purpose of this project is to improve smoke ventilation system performance for the Posey (Br. No. 33-0106R) and Webster tubes (Br. No. 33-0106L) on Route 260, in the cities of Oakland and Alameda, in Alameda County. The improvements to reconfiguration of existing ventilation systems and add jet fans at the entry portal to Webster Tube shall provide additional ventilation that will enable improved smoke management for egress and improve the fire-fighting operational response.

Need: The need for this project was identified in a Risk Analysis performed by an independent consultant (WSP) tasked by the Division of Engineering Services (DES) and District 04 to explore the ventilation capacities of the Complex Tunnel/Tubes within the State of California to address smoke from vehicle fires of current commercial vehicles. The risk analysis concluded that the two tubes, Posey and Webster, were of the top risk priority in the State and recommended ventilation upgrades.

Construction Access and Traffic Management:

- Work is expected to require lane closures and limited number of overnight full tunnel closures.
- Caltrans estimates that Webster tube will require between 11-20 nights of full closure consisting of 3 consecutive nights for cutting damper openings, 3 consecutive nights to prepare for and install dampers, and 5 consecutive nights to install jet fans.
- It is estimated that Posey tube will have full tunnel closures between 7-12 nights consisting of 3 consecutive nights for cutting damper opening and 3 consecutive nights to prepare for and install dampers.
- These estimates assume that the great majority of work can be done with lane closures at night. More precise partial and full closures will be examined during PS&E phase.
- An approximate detour map is shown in Attachment 1 routing traffic to South Island during tunnel lane closures. Detours are estimated to add 15min to travel time for week nighttime closures. Weekend nighttime closure may be longer.
- A Traffic Management Plan (TMP) is being developed and will be refined in the PS&E phase. It will include press releases to notify and inform motorists, businesses, community groups, local entities, and emergency services of upcoming closures or detours.
- Portable changeable message signs (CMS) and CHP COZEEP will be utilized to alleviate and minimize delays for the travelling public. Coordination with Metropolitan Transportation Commission (MTC) and other appropriate local agencies will be needed for work.

Construction Details:

- The project will be accessed through tunnel entry portal both on roadways and through the ventilation plenums.
- 300 working days are anticipated for construction of the project and both night, day work and weekend work are expected.

Air Quality:

- This project is exempt from the requirement to determine air quality conformity per 40 CFR 93.126 (Table 2-Exempt Projects: Safety - Widening narrow pavements or reconstructing bridges (no additional travel lanes)).

- Construction-related GHG Emissions Analysis:

  Implementation of Caltrans Standard Specifications, such as complying with air-pollution-control rules, regulations, ordinances, and statutes that apply to work performed under the Contract and the use of construction best management practices, would result in reducing GHG emissions from construction activities, including but not limited to:

  1. Regular vehicle and equipment maintenance
  2. Limit idling of vehicles and equipment onsite
  3. If practicable, recycle nonhazardous waste and excess material. If recycling is not practicable, dispose of material.
  4. Use solar-powered signal boards, if feasible

Table 1 Summary of Construction-related GHG Emissions

Project Location: Contra Costa County on Route 24, PM R0.1	PARAMETERS				PROJECT TOTAL
	CO2 (tons)	CH4 (tons)	N2O (tons)	HFC (tons)	CO2e (metric tons)
TOTAL EMISSIONS	412	0.009	0.023	0.012	403

Hazardous Waste:

The proposed ventilation system upgrade for the Posey and Webster tubes would require the removal of sections of the tunnels' concrete ceiling to create openings for installation of operable smoke dampers; and the aggregate in the ceiling concrete could potentially contain asbestos. However, since a hazardous materials survey conducted in March 2024 for the Posey and Webster tubes didn't identify any asbestos in the concrete of the tunnels ceiling, mitigation measures relating to asbestos will not be needed. No additional studies for hazardous materials/waste will be necessary.

Cultural – Section 106:

Caltrans, pursuant to Section 106 PA Stipulation X.B.1.a/b has determined a Finding of No Adverse Effect with Standard Conditions-Secretary of the Interior's Standards (FNAE-SC-SOIS), is appropriate for this undertaking. Caltrans completed a Historic Property Survey Report with attached FNAE-SC-SOIS Report, which was submitted to the Headquarters Cultural Studies Office (CSO) on November 20, 2024. CSO approved the undertaking's finding on December 5, 2024 (see attached).

No further archaeology or architectural history studies are required at this time. However, if project plans change, further studies may be necessary. If previously unidentified cultural resources are unearthed during construction, work shall be halted in that area until a qualified archaeologist can assess the significance of the discovery.

BCDC:

This project is expected to fall within Caltrans ongoing programmatic maintenance permit with the BCDC and an individual BCDC permit will not be required.

Section 4(f):

Caltrans has determined a Section 106 finding of no adverse effect. A finding of no adverse effect is a determination that a project's impact on historic properties does not meet the criteria for adverse effect and would not be considered use under Section 4(f).

Biology:

To avoid and minimize effects to special-status species and their habitats within the BSA, the Project will implement the following features included in the ECR:

AMM-BIO-01. Work Window for Nesting Birds. To the extent practicable work on the ventilation building rooftops will be conducted outside of the nesting bird season (occurs February 1 to September 30).

AMM-BIO-02. Preconstruction Surveys for Nesting Birds. If rooftop work must occur during nesting bird season (February 1 to September 30), preconstruction surveys for nesting birds will be conducted by a qualified biologist no more than 72 hours prior to the start of construction.

AMM-BIO-03. Non-Disturbance Buffer for Nesting Birds. If active nests are observed, a no-work buffer of 300 feet for raptor nests or 50 feet for passerine nests will be established. The non-disturbance buffers may be modified to sufficiently minimize disturbance based on the nest location, topography, cover, the species' sensitivity to disturbance, and the intensity/type of potential disturbance.

AMM-BIO-04. Preconstruction Surveys for Alameda Island Mole. Prior to trenching at the Alameda ventilation building, a qualified biologist should conduct a survey for surface evidence of Alameda Island mole holes. If an individual mole is discovered during the survey or during trenching it will be allowed to leave the area on its own before digging continues.

AMM-BIO-05. Preconstruction Surveys for Bats. Prior to work within ventilation buildings, dampers, or exhaust ducts, preconstruction surveys for bats will be conducted by a qualified biologist one year prior to the start of construction between April 15 – August 31 to survey for maternity colonies. If a maternity colony is observed roosting within the BSA, no work should occur during the bat maternity season (April 15 – August 31). If no maternity colonies or signs of active bat roosts are observed during the initial survey, no more than 72 hours prior to the start of construction a qualified biologist will conduct a final pre-construction clearance survey of any ventilation buildings, dampers or exhaust ducts. If bats are roosting in any part of the ventilation building, construction activity cannot begin until 30 minutes after sunset, and after a qualified biologist confirms that the roost is no longer occupied by bats.

AMM-BIO-06. Vehicle Use. Project employees will be required to comply with guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

AMM-BIO-07. Trash Control. All food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the work area.

AMM-BIO-08. Firearms. No firearms will be allowed in the BSA except for those carried by authorized security personnel, or local, state, or federal law enforcement officials.

AMM-BIO-09. Pets. To prevent harassment, injury, or mortality of sensitive species, no pets will be permitted within Project limits.

AMM-BIO-10. Caltrans Standard Best Management Practices (BMPs). The potential for adverse effects to water quality will be avoided by implementing temporary and permanent BMPs outlined in Section 13.2 of the 2019 Caltrans Standard Specifications. Caltrans erosion control BMPs will be used to minimize any wind- or water-related erosion. The State Water Resources Control Board has issued a National Pollution Discharge Elimination System Statewide Storm Water Permit to Caltrans to regulate storm water and non-storm water discharges from Caltrans facilities. A Stormwater Pollution Prevention Plan (SWPPP) will be developed for the Project, as one is required for all projects that have at least one acre of soil disturbance. The SWPPP complies with

the Caltrans Storm Water Management Plan (SWMP). The SWMP includes guidance for design staff to include provisions in construction contracts to include measures to protect sensitive areas and to prevent and minimize storm water and non-storm water discharges. The SWPPP will reference the Caltrans Construction Site BMPs Manual. This manual is comprehensive and includes many other protective measures and guidance to prevent and minimize pollutant discharges, and can be found at the following website:

https://dot.ca.gov/programs/construction/storm-water-and-water-pollution-

AMM-BIO-11. Water Features. No work will occur in any water features such as wetlands or jurisdictional waters.

AMM-BIO-12. Covering of Trenches and Excavated Holes. To prevent inadvertent entrapment of wildlife during construction, excavated holes or trenches more than one foot deep with walls steeper than 30 degrees will be covered by plywood or similar materials at the close of each working day. Alternatively, an additional four-foot-high vertical barrier, independent of exclusionary fences, will be used to further prevent the inadvertent entrapment of wildlife species. If it is not feasible to cover an excavation or provide an additional four-foot-high vertical barrier, independent of exclusionary fences, one or more escape ramps constructed of earth fill, or wooden planks will be installed. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals by the department biologist.

AMM-BIO-13. Monofilament Erosion Control. Plastic monofilament netting which could entangle, trap, or injure birds or other wildlife will not be used within the BSA.

AMM-BIO-14. Concrete Waste and Stockpiles. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of habitat and at a minimum of 150 feet from any aquatic habitat, culvert, or drainage feature.

Additional items included in the ECR.

Water Quality:

AMM-WQ-1. To prevent or reduce impacts, temporary Construction Site Best Management Practices (BMPs) can be implemented for sediment control and material management - although they do not appear to be of concern for this project scope. If any disturbed soil were within the project limit - drainage inlet protection and street sweeping could be considered.

AMM-WQ-2. Prior to commencement of construction activities, a WPCP will be prepared by the Contractor and approved by the Department. The WPCP addresses potential temporary impacts via implementation of appropriate BMPs, such as those mentioned above, to the Maximum Extent Practicable.

The disturbed soil area for the proposed project is less than 10,000 square feet (~0.23 acre). To comply with the 2022 Caltrans NPDES, Permit and address the temporary water quality impacts resulting from construction activities in this project, the construction activities need to comply with Standard Specifications 13-2 “Water Pollution Control Program: The Standard Specifications address the preparation of the WPCP document and the implementation of WPCP during construction.

Visual:

AMM-VIS-1. Avoid removing or damaging visual resources, such as mature trees and shrub group-ings, to the extent feasible. Vegetation to remain shall be protected from construction activities with temporary fencing where vegetation is close to construction work.

AMM-VIS-2. Trees and vegetation outside of clearing and grubbing limits shall be protected from the contractor’s operations, equipment, and materials storage.

AMM-VIS-3. All disturbed ground surfaces shall be restored and treated with erosion control.

AMM-VIS-4. During construction operations, unsightly materials and equipment in staging areas shall be placed where they are least visible and/or covered, to the extent feasible.

AMM-VIS-5. Construction activities shall limit all construction lighting to within the area of work and avoid light trespass to residential areas by utilizing directional lighting, shielding, and other measures as needed.

AMM-VIS-6. Use materials, forms, and finishes that mimic the existing structure within the two tunnel structures.

AMM-VIS-7. Minimize fugitive light from portable sources used during construction or determine if construction adjacent to residences can be limited to daylight hours to minimize nighttime impacts to sensitive viewers.

Community Impact:

AMM-CI-1. At no circumstances during construction, bike or pedestrian lane will be obstructed.

AMM-CI-2. Prior to construction, the public will be notified of any lane closure, detour, and its schedule.

AMM-CI-3. To avoid impacts to surrounding 4(f) resources all work, including temporary staging areas, shall be within Caltrans Right-of-Way.

Noise:

AMM-AN-1. At no circumstances, noise level will be higher than 86 db.

Air:

AMM-AN-2. Caltrans dust control measure will be implemented to protect AQ for any nearby residential area if needed.

Cultural:

AMM-CUL-1. Design Review and Constriction Monitoring: Prior to construction, the Architectural Historian (AH) will review the PS&E package to ensure that the project continues to meet the Secretary of the Interior's Standards for the Rehabilitation of Historic Properties (SOIS). The SOIS Action Plan should be included in the Resident Engineer (RE) Pending File. The RE will notify the AH at least three weeks in advance of the beginning of construction, and the AH will conduct Worker Environmental Awareness Training (WEAT) to emphasize the historical significance of the Posey Tube and the need to avoid damage. During construction, the AH conduct will spot monitoring and photo-documentation to ensure that the Project is being constructed to plans. Following completion of the Project and prior to release of the contractor, the Architectural Historian will perform a field review of the work, to document that the Project was constructed to plans.

AMM-CUL-2: Unanticipated Discovery. In the event that archaeological resources (sites, features, or artifacts) are exposed during construction activities, all construction work occurring within 60 feet of the find shall immediately stop until a qualified archaeologist, that meets the Secretary of the Interior Professional Qualifications for Archaeology, can evaluate the significance of the find in consultation with the Tribe to determine whether or not additional study is warranted. Additional archaeological survey will be needed if project limits are extended beyond the present survey limits. Contact the Lead Caltrans Archaeologist in the Office of Cultural Resource Studies.

If any Tribal Cultural Resources (TCR) as defined by the Tribe and CEQA are found during construction, a Professionally Qualified Staff archaeologist shall assess the find. The Office of Cultural Resource Studies will notify local consulting Tribes if the resource is determined to be a TCR and consult with the contractor and the Tribe to determine whether the resources can be avoided by the Project. If the TCR cannot be avoided, then further consultation efforts with the Tribes would be necessary to determine its treatment.

AMM-CUL-3. If Caltrans Professionally Qualified Staff determines that cultural materials contain human remains, State Health and Safety Code Section 7050.5 states that further disturbances and activities shall stop in any area or nearby area suspected to overlie remains. Caltrans' Cultural Resources Studies Office will contact the County Coroner. Pursuant to CA PRC Section 5097.98, if the remains are thought by the coroner to be Native American, the coroner will notify the NAHC, which will then notify the Most Likely Descendent. Caltrans, District 4, Cultural Resources Studies Office will work with the Most Likely Descendent on the respectful treatment and disposition of the remains. Further provisions of PRC 5097.98 are to be followed as applicable.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	260	R1.2L	5	33

Claudia K. Fang 4-11-24
REGISTERED CIVIL ENGINEER DATE

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PLANS APPROVAL DATE

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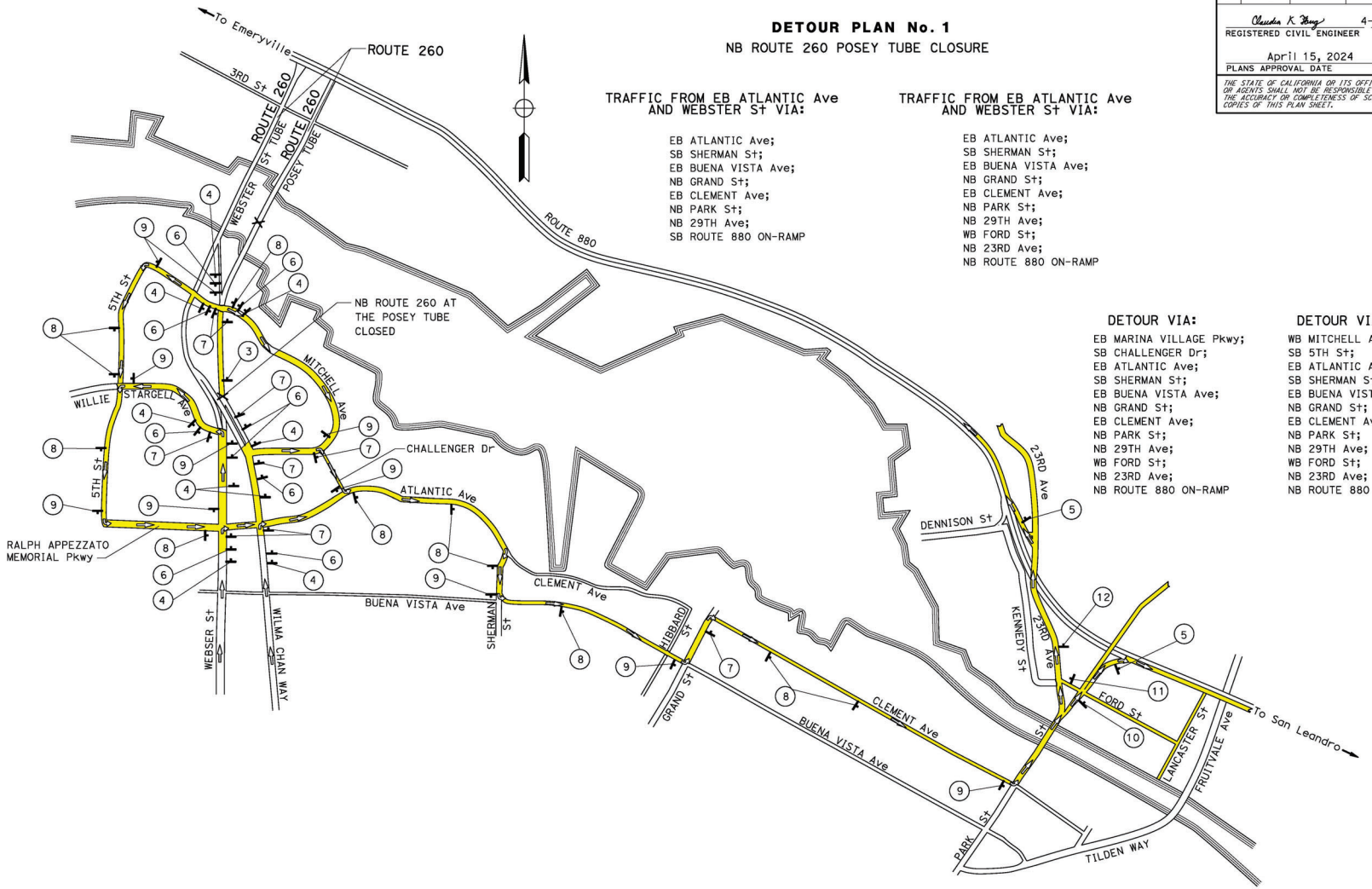
REGISTERED PROFESSIONAL ENGINEER — Claudia K. Fang — No. 80493 — Exp 3-31-25 — CIVIL — STATE OF CALIFORNIA

DETOUR PLAN No. 1

NB ROUTE 260 POSEY TUBE CLOSURE



TRAFFIC FROM EB ATLANTIC Ave AND WEBSTER St VIA:

EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
SB ROUTE 880 ON-RAMP

DETOUR VIA:

EB MARINA VILLAGE Pkwy;
SB CHALLENGER Dr;
EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP

TRAFFIC FROM EB ATLANTIC Ave AND WEBSTER St VIA:

EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP

DETOUR VIA:

WB MITCHELL Ave;
SB 5TH St;
EB ATLANTIC Ave;
SB SHERMAN St;
EB BUENA VISTA Ave;
NB GRAND St;
EB CLEMENT Ave;
NB PARK St;
NB 29TH Ave;
WB FORD St;
NB 23RD Ave;
NB ROUTE 880 ON-RAMP

CONSTRUCTION AREA SIGNS

NO SCALE

CS-3

APPROVED FOR CONSTRUCTION AREA SIGN WORK ONLY

FOR NOTES AND LEGEND, SEE SHEET CS-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
TRAFFIC
FUNCTIONAL SUPERVISOR: LESTER LEE
CALCULATED-DESIGNED BY: ABHINAY MOVVA
CHECKED BY: CLAUDIA FANG
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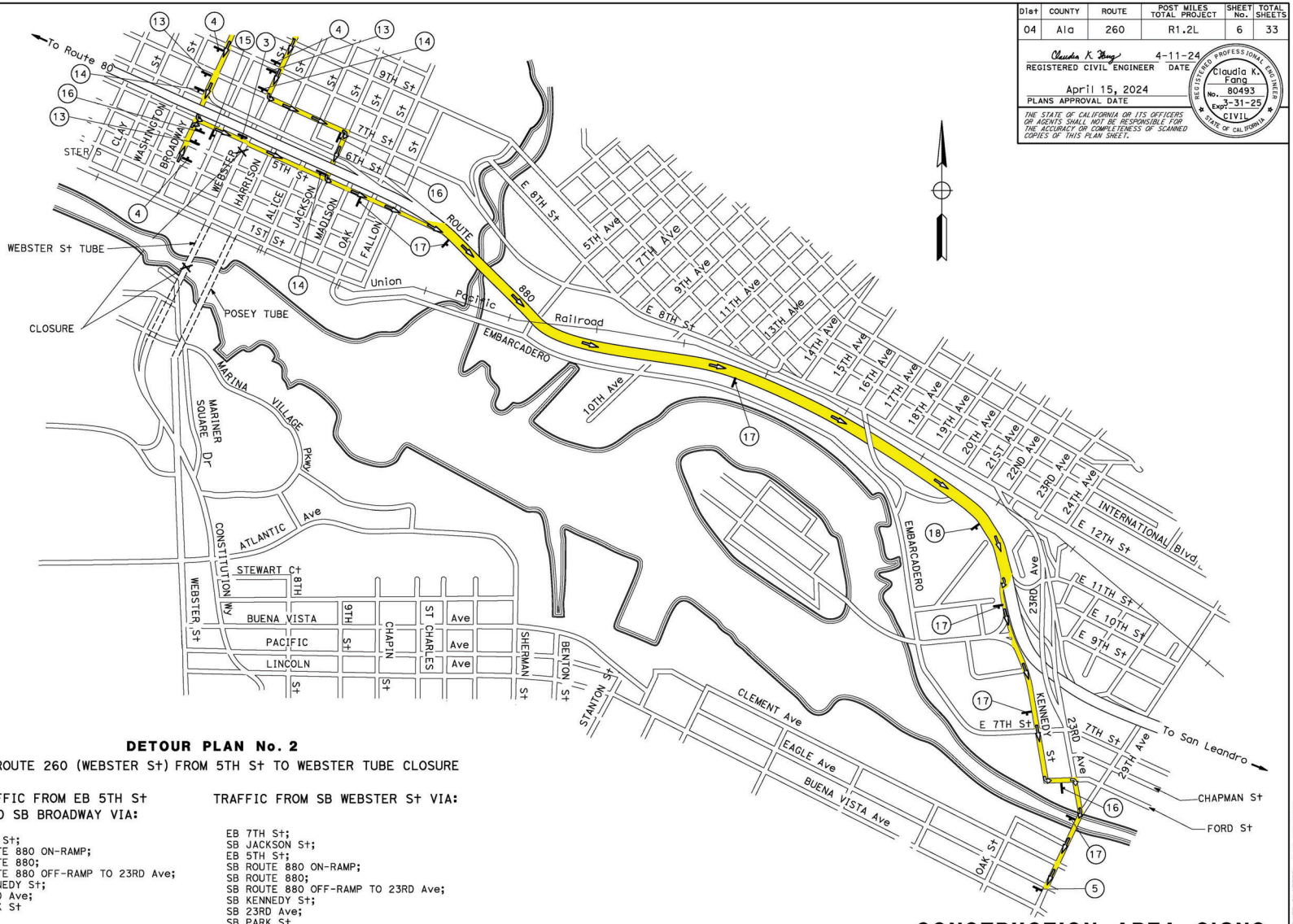

DETOUR PLAN No. 2

SB ROUTE 260 (WEBSTER St) FROM 5TH St TO WEBSTER TUBE CLOSURE

TRAFFIC FROM EB 5TH St AND SB BROADWAY VIA:

EB 5TH St;
SB ROUTE 880 ON-RAMP;
SB ROUTE 880;
SB ROUTE 880 OFF-RAMP TO 23RD Ave;
SB KENNEDY St;
SB 23RD Ave;
SB PARK St

TRAFFIC FROM SB WEBSTER St VIA:

EB 7TH St;
SB JACKSON St;
EB 5TH St;
SB ROUTE 880 ON-RAMP;
SB ROUTE 880;
SB ROUTE 880 OFF-RAMP TO 23RD Ave;
SB KENNEDY St;
SB 23RD Ave;
SB PARK St

CONSTRUCTION AREA SIGNS

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FOR NOTES AND LEGEND, SEE SHEET CS-1

CS-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
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UNIT 0451
PROJECT NUMBER & PHASE 04220004671

ATTACHMENT E
Right of Way Data Sheet

To: The Office of Design Alameda

Date: 10/24/2024
Dist 04 Co Ala Rte 260 PM R1.1//1.8

Attention: William Fong
Senior Transportation Engineer

Project ID: 0419000011

From: MONA POON
Right of Way Resource Manager

E.A. 2Y780

D.S. 7847

Proj. Descr. Ala 260 Posey Tube and Webster Tube Ventilation Upgrade

Subject: Current Estimated Right of Way Costs

We have completed an estimate of the right of way costs for the above referenced project based on maps we received from you on August 26, 2024 and the following assumptions and limiting conditions.

[ ] 1. The mapping did not provide sufficient detail to determine the limits of the right of way required.
[ ] 2. The transportation facilities have not been sufficiently designed so our estimator could determine the damages to any of the remainder parcels affected by the project.
[ ] 3. Additional right of way requirements are anticipated, but are not defined due to the preliminary nature of the early design requirements.
[ ] 4. This estimate does not include $_____right of way costs previously incurred on the project, which may affect the total project right of way costs for programming purposes.
[ ] 5. We have determined there are no right of way functional involvements in the proposed project at this time, as designed.
[X] 6. This Data Sheet is being completed without an estimate for Environmental Permit Fees or Mitigation Costs.

Right of Way Lead Time will require a minimum of 6 months after we begin receiving final right of way requirements, necessary environmental clearance has been obtained, and freeway agreements have been approved. From the date of receipt of final right of way requirements, we will require a minimum of 4 months prior to the date of certification of the project. Shorter lead times will require either more right of way resources or an increased number of condemnation suits to be filed. Either of these actions may reflect adversely on the District's other programs or our public image generally.

Right of Way Resource Manager

Attachments:

[X] Right of Way Data Sheet – Page One (always required)
[X] Right of Way Data Sheet – All Pages (required when interest in real property is being acquired)
[X] Utility Information Sheet
[ ] Railroad Information Sheet

RIGHT OF WAY DATA SHEET

TO: Office of Design Alameda

Date 10/24/2024 D.S. # 7847

Dist. 04 Co. Ala Rte 260 PM R1.1/1.8

EA 2Y780 (0423000158)

ATTN: William Fong
Senior Transpotation Engineer

Project Description: Posey Tube and Webster Tube Ventilation Upgrade

SUBJECT: Right of Way Data - Alternate No.

1. Right of Way Cost Estimate:

		Current Value (Future Use)	Escalation Rate	Escalated Value
A.	Acquisition, including Excess Lands, Damages, and Goodwill	$0.00	%	$0.00
	Permits			$0.00
	Environmental Mitigation			$0.00
	Grantor's Appraisal Cost			$0.00
B.	Utility Relocation (State Share)	$50,000.00	%	$50,000.00
C.	Railroad (from page 6)			$0.00
D.	Relocation Assistance	$0.00	%	$0.00
E.	Clearance Demolition	$0.00	%	$0.00
F.	Title and Escrow Fees	$0.00	%	$0.00
G.	TOTAL ESCALATED VALUE			$50,000.00
H.	Construction Contract Work	$0.00		
I.	Railroad Phase 4 Costs	$0.00		
J.	Utility Phase 4 Costs	$0.00		

2. Anticipated Date of Right of Way Certification 5/1/2025

Parcel Data:

	Type	Dual/Appr
X		
A		
B		
C		
D		
E	XXXX	
F	XXXX	

Total 0

Utilities Involvements	
Utility Verification	16
Positive Identification	50
Utility Relocation	0
Other (Specify)	0

RR Involvements	
None	X
C&M Agrmt	
R/W Agrmt	
Design	
Const.	
Lic/RE/Clauses	
Misc R/W Work	
RAP Displ	0
Clear Demo	0
Const. Permits	0
Condemnation	0

Areas: Right of Way ____ No. Excess Parcels ____ Excess ____

4. Are there any major items of construction contract work?
Yes ☐ No ☑ (If yes, explain)

5. Provide a general description of the right of way and excess lands required(zoning, use, major improvements critical or sensitive parcels, etc.).
No right of way required. ☑
All work will take place in existing right of way, per request memo.

6. Is there an effect on assessed valuation? (If yes explain)
Yes ☐ Not Significant ☐ No ☑

7. Are utility facilities or rights of way affected? Yes ☑ No ☐
(If yes, attach Utility Information Sheet Exhibit 01-01-05)

8. Are railroad facilities or rights of way affected? Yes ☐ No ☑
(If yes, attach Railroad Information Sheet Exhibit 01-01-06)

9. Were any previously unidentified sites with hazardous waste and/or material found?
Yes ☐ None evident ☑
(If yes, attach memorandum per Procedural Handbook Volume 1, Section 101.011)

10. Are RAP displacements required? Yes ☐ No ☑
(If yes, provide the following information)

No. of personal property relocations _____

No. of single family _____ No. of business/non profit _____

No. of multi-family _____ No. of farms _____

Based on Draft / Final Relocation Impact Statement / Study dated_____, it is anticipated that sufficient replacement housing will / will not be available without Last Resort Housing.

11. Are material borrow and / or disposal sites required? Yes ☐ No ☑
(If yes, explain)

12. Are there potential relinquishments / abandonments? Yes ☐ No ☑
(If yes, explain)

13. Are there any existing and/or potential Airspace sites? Yes ☑ No ☐
(If yes, explain)
FLA-04-ALA-260-02,-04 & -07 are all within the project limits.

14. Are there Permit Fees? Yes ☐ No ☑
(If yes, explain)
No Permit Fees per RW data sheet request memo.

15. Are there Environmental Mitigation Costs? Yes ☐ No ☑
(If yes, explain)
No Mitigation Fees per RW data sheet request memo.

16. Indicate the anticipated Right of Way schedule and lead time requirements.
Based on the R/W Requirements on Page 1 of this Data Sheet, R/W will require a lead time of 6 months from the date regular appraisals can begin to project certification

17. Is it anticipated that all Right of Way work be performed by CALTRANS staff?
Yes ☑ No ☐ (If no, discuss)

Assumptions and Limiting Conditions

- This data sheet was completed without a hazardous waste/materials report or an estimate for Permit Fees or Environmental Mitigation Costs.

- Information on this data sheet was based on maps provided by William Fong on 8/26/2024

Evaluation Prepared By: Dan Asprogerakas

Right of Way: Name Dan Asprogerakas Date 10/16/2024

Railroad: Name Alden Chalk Date 10/16/2024

Utilities: Name Yadira Young Date 10/16/2024

Recommended for Approval:

Right of Way Capital Cost Coordinator

I have personally reviewed this Right of Way Data Sheet and all supporting information. It is my opinion that the probable Highest and Best Use, estimated values, escalation rates, and assumptions are reasonable and proper subject to the limiting conditions set fourth, and find this Data Sheet complete and current.

Chief, R/W Appraisal Services

10/24/2024
Date

cc: Program Manager
Project Manger

UTILITY INFORMATION SHEET

1. Utility owners located within project limits:
Alameda Municipal Power, AT&T, City of Alameda, Comcast, Crown Castle CA, EBMUD, EBMUD Wastewater Department, EverLine - NCPA, ExteNet Systems LLC - CA, Kinder Morgan/SFPP CA, Level 3/LUMEN, MCI WorldCom CA, PG&E, Paxio Inc, Terradex Inc

2. Facilities potentially impacted by project (if known, include Owners(s) & facility type(s)):
East Bay MUD 8" service pipe, relocation of tie-ins and private water meters

3. Anticipated Workload:

16	Utility Verification Required
50	Positive Identification
0	Utility Relocation
0	Other (Specify)

4. Additional information concerning anticipated utility involvements (include limiting conditions and a narative addressing likelihood that conflicts will occur);

_____ Involves possible relocation of electric transmission facilities
(If X'd, Data sheet should be forwarded to environmental)

_____ Utility agreements will be required for this project due to CCW on public utility facilities for all public utility relocations and adjustments, including but not limited to, manhole cover adjustments to grade (unless determined & specified in writing by the Utility Engineering Workgroup (UEW) that none are required for this project). A minimum lead-time of 12 months from PA&ED to RWC is needed to secure the utility agreement(s) and specifications as required for the RWC and PS&E milestones. Leadtime requires that UEW provide RW Utilities with a conflict memo and maps no later than the PA&ED milestone.

5. Estimated Costs:

Positive Identification $ 50,000.00

Estimate 50 POS-LOC.

Utility Relocation $ 0.00

Service facilities only.

Phase 4* $ 0.00

None anticipated.

*not apart of page 1 total

ESTIMATED STATE SHARE OF COSTS $ 50,000.00

Prepared by: Latorya Young

Latorya Young
Right of Way Utility Coordinator

09.19.24
Date

Right of Way Workplan

Date: 10/28/24

Project ID No:	0423000158
Project Manager:	H.Nguyen
Programmed RW Support:	$25,000
PA&ED Date or Transmittal:	9/30/25
RWC Date:	6/1/26
Prepared by:	D.Mars

Please note that this estimate only contains the hours needed by RW Agents. You must also obtain an estimate from Land Surveys for a complete support cost total for the Office of Right of Way.

150 Phase K — Start Date: — End Date:

(Data Sheet & PID)		Hours Needed
0849	DDD R/W	
0850	Acq/P&M O.C.	
0852	Utilities O.C.	
0851	Appraisals O.C.	
0856	Proj. Coord.	
0859	Capital Mgmt.	
0860	Appraisals	
0867	Railroad	
0869	Utilities	

160 Phase 0 — Start Date: — End Date:

(Util. Verifications, RR study, PR, &/or Updated Datasheet)		Hours Needed
0849	DDD R/W	
0850	Acq./P&M O.C.	5
0851	Appraisals O.C.	
0852	Utilities O.C.	
0856	Proj. Coord.	20
0859	Capital Mgmt.	14
0860	Appraisals	20
0865	Acquisitions	
0867	Railroad	
0869	Utilities	20
0876	Rap	
0882	Clerical	

185 Phase 1 — Start Date: — End Date:

(Updated datasheet, if needed)		Hours Needed
0850	Acq/P&M O.C.	
0851	Appraisals O.C.	
0856	Proj. Coord.	
0859	Capital Mgmt.	
0860	Appraisals	
0867	Railroad	
0869	Utilities	

255 Phase 1 — Start Date: — End Date:

(Certification - PSE)		Hours Needed
0850	Acq./P&M O.C.	5
0851	Appraisals O.C.	
0852	Utilities O.C.	
0856	Proj. Coord.	40
0860	Appraisals	
0865	Acquisitions	
0867	Railroad	
0869	Utilities	60

100.25 Phase 2 — Start Date: 9/30/2025 — End Date: 6/2/2027

(Project Mgmt)		Hours Needed
0849	DDD R/W	
0850	Acq /P&M O.C.	
0856	Proj. Coord.	0
0859	Capital Mgmt	0
0854	Data Mgmt O.C.	
0763	Data Mgmt Staff	

195 Phase 2 — Start Date: — End Date:

(Prop Mgmt & Excess Land)		Hours Needed
0851	Appraisals O.C.	
0856	Proj. Coord.	
0860	Appraisals	
0872	Prop Mgmt	
0875	Excess Lands	
0874	Airspace	
0882	Clerical	

200 Phase 2 — Start Date: 9/30/2025 — End Date: 6/2/2027

(Utilities)		Hours Needed
0849	DDD R/W	
0852	Utilites O.C.	0
0856	Proj. Coord.	
0859	Capital Mgmt	
0869	Utilities	0
0882	Clerical	

225 Phase 2 — Start Date: 9/30/2025 — End Date: 6/1/2026

(Pre-Cert Work)		Hours Needed
0849	DDD R/W	
0850	Acq /P&M O.C.	0
0851	Appraisals O.C.	0
0856	Proj. Coord.	
0859	Capital Mgmt	0
0860	Appraisals	0
0865	Acquisitions	0
0867	Railroad	
0868	Acq. Spec. (R.A.)	
0873	Demolition	
0876	RAP	
0882	Clerical	0

245 Phase 2 — Start Date: 6/2/2026 — End Date: 6/2/2027

(Post-Cert Work)		Hours Needed
0849	DDD R/W	
0850	Acq /P&M O.C.	
0851	Apprasisals O.C.	
0859	Capital Mgmt	0
0860	Appraisals	
0865	Acquisitions	0
0867	Railroad	
0868	Acq. Spec. (R.A.)	
0873	Demolition	
0876	RAP	
0882	Clerical	

Total hours required (RW Agents Only): **184**

Total RW COS (RW Agents Only): **$24,840**

Phase 2 only COS (RW Agents Only): **$0**

Approved By:

Shella Orson (Oct 29, 2024 15:35 PDT)

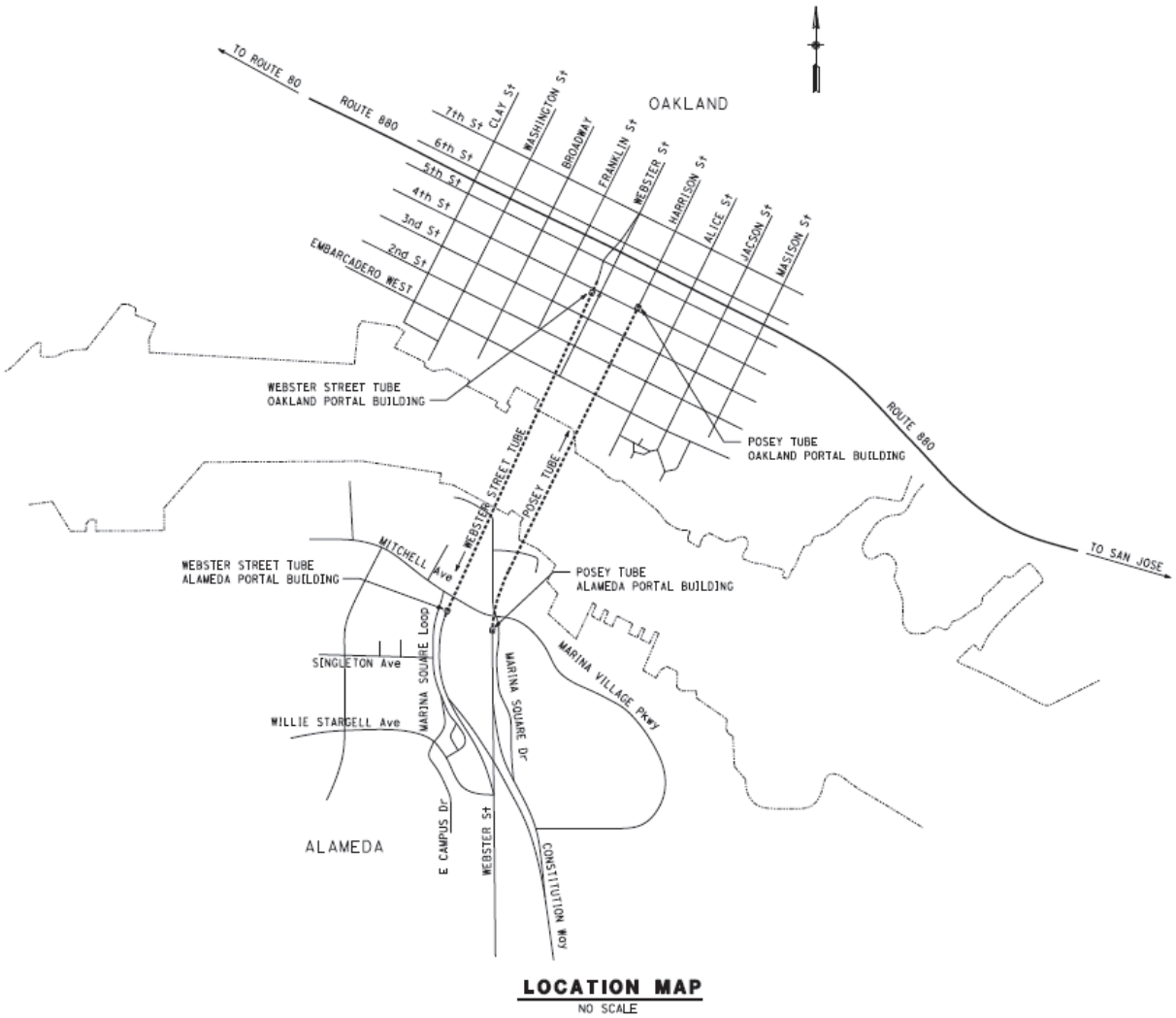
Shella Orson
District Branch Chief
R/W Project Coordination

Please contact 4-Land.Surveys@dot.ca.gov for Land Surveys Support Cost Estimates

ATTACHMENT F
Water Quality Study

Water Quality Study

04-ALAMEDA-260-PM 1.1 to 1.8



Vicinity Map

Water Quality and Stormwater Runoff

This Water Quality Study describes aspects of the proposed project from a water quality and stormwater management perspective, including project description; regulatory setting; project location and receiving water bodies; climatography; topography and soil characteristics; potential temporary and permanent water quality impacts; and avoidance, minimization, and/or mitigation.

Project Description

The project aims to upgrade the Posey and Webster Tubes to ensure compliance with the life-safety objectives outlined in NFPA 502, the Standard for Road Tunnels and Limited Access Highways. The primary focus of these upgrades will be on enhancing emergency ventilation systems. This includes installing ceiling jet fans near the Webster Tube's entry portal on State Route 260 and converting the existing ventilation systems in both the Posey and Webster Tubes from transverse to longitudinal configurations to align with the project's safety goals. These ventilation improvements will specifically target fire mitigation for heavy goods vehicle incidents, enhance smoke management for safe egress, and improve firefighting operational response. Furthermore, deluge sprinkler systems will be introduced within the tubes. The design of the ventilation system will be independent of the deluge system design.

The project NIS is less than 10,000 square feet (~0.23 acres) with no 404 or 401 permit requirements.

- Disturbed Soil Area (DSA) is 0 acre
- New impervious surface (NIS) is 0 acre
- Net New Impervious (NNI) is 0 acre
- Replaced impervious surface (RIS) is 0 acre

Regulatory Setting

The primary federal law regulating water quality is the Federal Clean Water Act (CWA), issued by the U.S. Environmental Protection Agency (USEPA). The USEPA delegated its authority in California to the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs). Each RWQCB prepares and adopts its water quality control plan (Basin Plan), which is a master policy document for managing surface and groundwater quality in the region. The SWRCB and RWQCBs issue permits that implement the standards included in the Basin Plan as well as other requirements of the State Water Code and the CWA.

Section 401 of the CWA requires a water quality certification from either the SWRCB or RWQCB when a project would require a federal permit, resulting from a discharge to waters of the United States. Impacts to Waters of the U.S. is not anticipated, thus a Section 404 permit, issued by the U.S. Army Corps of Engineers (USACE) and a Section 401 certification, issued by the North Coast RWQCB, are not required.

To ensure compliance with CWA Section 402, the SWRCB issued the Department a Statewide 2022 NPDES Stormwater Permit to regulate stormwater discharges from Department facilities. The SWRCB issued a statewide Construction General Permit for construction activities (2009-0009-DWQ, CAS000002, as amended by 2010-0014-DWQ and 2012-0006-DWQ), hereafter “CGP,” that applies to stormwater discharges from land where clearing, grading, and excavation result in a DSA of one

acre or greater. Construction activity resulting in a DSA of less than 1.0 acre is subject to the CGP if the construction activity is part of a larger Common Plan of Development totaling 1.0 acre or more of DSA, or if there is potential for significant water quality impairment resulting from the activity as determined by the RWQCB. Projects subject to the CGP require a Stormwater Pollution Prevention Plan (SWPPP). Projects not subject to the CGP require a Water Pollution Control Program (WPCP), per the Department's Standard Specifications. Since the DSA is under an acre, a WPCP will be required.

Project Location and Receiving Water Bodies

The project area is within the San Francisco Bay Regional Water Quality Board, hereafter “Region 2”, which is responsible for implementation of State and Federal laws and regulations for water quality protection.

The Hydrologic Sub-Area # is 204.10. The project is in South Bay and located in a high-risk receiving watershed area.

The Oakland Inner Harbor-San Francisco Bay is on the 2020-2022 303(d) List and impaired for Indicator Bacteria, Chlordane, DDT, Dieldrin, Furan Compounds, Invasive Species, Lead, Mercury, PCBs, Selenium and Zinc. Per San Francisco Bay Central and Lower Hydrologic Subarea contains all three beneficial uses commercial, estuarine habitat, industrial service supply, fish migration, navigation, rare and endangered species, water contact recreation, noncontact water recreation, shell, fish spawning and wildlife habitat. The characteristics confirm the high-risk area.

Climatography

The project is in a region characterized by moderate temperatures and a rainy season between November through April 15 (Department *Construction Site Best Management Practices (BMPs) Manual*, March 2010). Average annual precipitation is about 19.84 inches in the project area.

Topography and Soil Characteristics

The topography is mostly flat. The soil-erodibility factor (K) is characterized by 3 factors. (1) The susceptibility of surface or soil to erosion (2) transport of sediment (3) rate and amount of runoff given a rainfall input within standard conditions. Fine-textured soils that are high in clay have low K about 0.05 to 0.15. K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment, and they produce runoff at moderate rates. The soil-erodibility factor (K) is 0.15 for the project area.

Potential Temporary and Permanent Water Quality Impacts

Construction impacts to receiving waterbodies that should be addressed by the Department include turbidity and pH. This could result from the discharge of sediment and cement beyond the site perimeter. Post-construction impacts do not need to be addressed, since the project has no permits and the estimated acre of new and replaced impervious surfaces is than 1 acre.

Avoidance, Minimization, and/or Mitigation

Temporary Impacts

To prevent or reduce impacts, temporary Construction Site Best Management Practices (BMPs) can be implemented for sediment control and material management - although they do not appear to be of concern for this project scope. If any disturbed soil were within the project limit - drainage inlet protection and street sweeping could be considered.

Permanent Impacts

Under the 2022 NPDES Permit the project does not need to consider permanent Water Quality Treatment BMPs. Permanent treatment such as biofiltration strips or Biofiltration swales (area permitting) will not be required.

Water Pollution Control Program (WPCP)

Prior to commencement of construction activities, a WPCP will be prepared by the Contractor and approved by the Department. The WPCP addresses potential temporary impacts via implementation of appropriate BMPs, such as those mentioned above, to the Maximum Extent Practicable.

The disturbed soil area for the proposed project is less than 10,000 square feet (~0.23 acre). To comply with the 2022 Caltrans NPDES, Permit and address the temporary water quality impacts resulting from construction activities in this project, the construction activities need to comply with Standard Specifications 13-2 “Water Pollution Control Program: The Standard Specifications address the preparation of the WPCP document and the implementation of WPCP during construction.

Trash Capture

Caltrans must place trash capture for projects that are within a Significant Trash Generating Area. This project is in a low trash generating area, and thus a trash feasibility study is not required.

ATTACHMENT G
Transportation management Plan (TMP)
Data Sheet

TRANSPORTATION MANAGEMENT PLAN DATA SHEET
(Preliminary TMP Elements and Costs)

Co/Rte/PM: ALA/260/PM R1.1/R1.8 | EA: 2Y780 | ID: 0423000158 | Project Engineer: William Fong

Project Limit: In Alameda County at the Posey and Webster Tubes

Project Description: Upgrade the Posey and Webster Tubes. Improvement in emergency ventilation systems. Includes the addition of ceiling jet fans and reconfiguration of existing ventilation systems.

1) Public Information

- ☐ a. Brochures and Mailers $
- ☒ b. Press Release
- ☐ c. Paid Advertising $
- ☐ d. Public Information Center/Kiosk $
- ☐ e. Public Meeting/Speakers Bureau
- ☐ f. Telephone Hotline
- ☐ g. Internet, E-mail
- ☐ h. Notification to impacted groups (i.e. bicycle users, pedestrians with disabilities, others…)
- ☒ i. Others As determined by PIO $ 20,000

2) Traveler Information Strategies

- ☐ a. Changeable Message Signs (Fixed) $
- ☒ b. Changeable Message Signs (Portable) $ 350,000
- ☒ c. Ground Mounted Signs $ 20,000
- ☐ d. Highway Advisory Radio $
- ☐ e. Caltrans Highway Information Network (CHIN)
- ☐ f. Detour maps (i.e. bicycle, vehicle, pedestrian...etc)
- ☐ g. Revised Transit Schedules/maps
- ☐ h. Bicycle community information
- ☐ i. Others _____ $

3) Incident Management

- ☒ a. Construction Zone Enhanced Enforcement Program (COZEEP) $ 600,000
- ☐ b. Freeway Service Patrol $
- ☐ c. Traffic Management Team
- ☐ d. Helicopter Surveillance $
- ☐ e. Traffic Surveillance Stations (Loop Detector and CCTV) $
- ☐ f. Others _____ $

TMP Data Sheet (cont.)

4) Construction Strategies

- [x] a. Lane Closure Chart
- [ ] b. Reversible Lanes
- [ ] c. Total Facility Closure
- [ ] d. Contra Flow
- [ ] e. Truck Traffic Restrictions $ _____
- [ ] f. Reduced Speed Zone $ _____
- [ ] g. Connector and Ramp Closures
- [ ] h. Incentive and Disincentive $ _____
- [ ] i. Moveable Barrier $ _____
- [x] j. Maintain Traffic $ 400,000
- [x] k. Others Traffic Control (bid item) $ 400,000

5) Demand Management

- [ ] a. HOV Lanes/Ramps (New or Convert) $ _____
- [ ] b. Park and Ride Lots $ _____
- [ ] c. Rideshare Incentives $ _____
- [ ] d. Variable Work Hours
- [ ] e. Telecommute
- [ ] f. Ramp Metering (Temporary Installation) $ _____
- [ ] g. Ramp Metering (Modify Existing) $ _____
- [ ] h.Others _____ $ _____

6) Alternate Route Strategies

- [ ] a. Add Capacity to Freeway Connector $ _____
- [ ] b. Street Improvement (widening, traffic signal... etc) $ _____
- [ ] c. Traffic Control Officers $ _____
- [ ] d. Parking Restrictions
- [ ] e.Others _____ $ _____

7) Other Strategies

- [ ] a. Application of New Technology $ _____
- [ ] e.Others _____ $ _____

TOTAL ESTIMATED COST OF TMP ELEMENTS = $ 1,790,000

*Please note that any change in project scope, schedule, or cost will require re-submittal of TMP Data Sheet request.

PREPARED BY Lore Ahmadi DATE 12/13/24

APPROVAL RECOMMENDED BY Mike Kerns DATE 12/13/24

ATTACHMENT H
Complete Streets Decision Document

Complete Streets Decision Document (CSDD)

1) Is the project located entirely on a facility where bicyclists and pedestrians are legally prohibited and the project does not involve a shared use path, pedestrian/bicycle structure or work impacting a local road crossing or interchange? (For example, a project including freeway mainline and ramp work, not including the ramp connection with the minor road, where the project freeway segment legally prohibits bicyclists and pedestrians.)

___x__ NO - Proceed to Question 2
___ YES - Stop here. The project is exempt from further complete streets evaluation. Sign and attach to the Project Initiation Document (PID).

2) Is the primary project purpose to address assets that are outside of the roadbed where pedestrian and bicycle travel is not affected, and proposed project will not affect future pedestrian and bicycle facilities? Examples may include culvert outfalls, storm water treatment facilities, bridge substructure or scour mitigation, planting or vegetation removal, retaining walls, etc.

_____ NO - Continue to Question 3
___x__ YES - Stop here. The project is exempt from further complete streets evaluation. Sign and attach to PID.

3) Has a Transportation Planning Scoping Information Sheet (TPSIS) been completed for this project?

_____ NO – Proceed to Question 4
_____ YES – Skip to Question 5 (Note: TPSIS is attached to the PID)

4) Which of the following planning documents were consulted to determine bicycle, pedestrian or transit needs? Select all that apply and proceed to Question 5.
   - _____a. District Active Transportation Plan
   - _____b. Other Caltrans or local/regional agency bike/ped/transit/safe routes to school plans
   - _____c. ADA Transition Plan/Grievances (consult with the District ADA Coordinator)
   - _____d. Corridor planning documents
   - _____e. Other (list here) _____

5) Based on the reviews completed in Question 4 or identified in the TPSIS, after a review of the roadway geometrics, or identified by the PDT, are there any bicycle, pedestrian, or transit needs, deficiencies or opportunities for improvement identified for the project location?

_____ NO – Provide brief description of findings: _____
Stop here. The project meets the requirements for consideration of Complete Streets elements. Sign and attach to the PID.
_____ YES – Describe them here and proceed to Question 6: _____
_____
_____
_____

6) Based on the needs identified in Question 5, what would be the preferred complete streets elements to address those needs (e.g. road diet, separated bikeway, reconstructed sidewalk, etc.)? Resources include the Complete Streets Elements Toolbox, the Contextual Guidance for Bikeway Facility Selection, the Bikeway Facility Selection Guidance Memorandum, etc. List them in the table below and provide a rough estimated cost to construct preferred project complete streets elements (including right-of-way and support costs) and proceed to Question 7.

7) Was there any known public and stakeholder opposition to any preferred complete streets elements identified for the project? Provide response and proceed to Question 8.

_____ NO
_____ YES – Describe the opposition position here: _____
_____
_____

8) Does the programmable project alternative/project scope include all the complete streets elements identified in Question 6?

_____ NO - Proceed to Question 9
_____ YES - Stop here. The project has met the requirements for consideration of complete streets elements. Sign and attach to PID.

9) Does the project include any of the complete streets elements that are identified in Question 6? Or are there any proposed incremental improvements related to the complete streets elements in Question 6? Provide response and proceed to Question 10.

_____ NO – The programmable project alternative does not include any complete streets elements, and therefore does not address identified needs for complete streets elements.
_____ YES – List them here:

10) Does the project funding have constraints that would preclude the ability to incorporate additional complete streets elements into the project (For example, cannot combine funding with other sources.)? Provide response and proceed to Question 11.

_____ NO
_____ YES – Describe the constraints here:

11) Provide a rationale and justification for not including all the recommended complete streets elements into the project: (Consider the engineering justification, right-of-way constraints, environmental impacts, etc.).

_____
_____
_____
_____
_____
_____
_____
_____

Prepared by:

Markus Lansdowne
Name, PID Preparer in responsible charge
Branch/Company
Emergency Operation Coordinator – Maintenance Services
Concurred by: Byron Lim 12/23/2022

1/9/2023
Name : Sergio Ruiz — Date
District Complete Streets Coordinator

1/19/2023
Name: Sergio Ruiz (acting) — Date
Deputy District Director, Planning

1/20/2023
Name: Helena "Lenka" Culik-Caro — Date
Deputy District Director, Design or
Division Chief, Design/Project Development

Dina El-Tawansy 01/25/2023
Name: Dina El-Tawansy — Date
District Director

Distribution: Attach completed original CSDD to PID and email to HQ Division of Design at CSDD@dot.ca.gov

ATTACHMENT I
Climate Change Analysis Report

Memorandum

Making Conservation
a California Way of Life

To: WAHIDA RASHID
Branch Chief
Office of Environmental Analysis

Attention: David Rodriguez

Date: November 13, 2024

File: EA 04-2Y780
EFIS ID 0423000158
Ala – 260 – R1.10/ R1.80
POSEY TUBE & WEBSTER
TUBE VENTILATION UPGRADES

From: SHILPA MAREDDY
Branch Chief
Air Quality / Noise
Office of Environmental Engineering
Division of Environmental Planning & Engineering / D4
Specialist: Radhika Mothkuri

Subject: **CONSTRUCTION GREENHOUSE GAS EMISSIONS ANALYSIS**

This memo presents the results of an analysis of construction-related greenhouse gas (GHG) emissions for Posey Tube & Webster Tube ventilation upgrades on Route 260 in Alameda Count\y.

Construction-generated GHG includes emissions resulting from material processing by onsite construction equipment, workers commuting to and from the project site, and traffic delays due to construction. The emissions will be produced at different rates throughout the project depending on the activities involved at various phases of construction. The analysis was focused on vehicle-emitted GHG. Carbon dioxide (CO_2) is the single most important GHG pollutant due to its abundance when compared with other vehicle-emitted GHG, including methane (CH_4), nitrous oxide (N_20), hydrofluorocarbon (HFCs) and black carbon (BC).

Based on project information available for environmental studies, the construction-related GHG emissions were calculated using the Construction Emissions Tool 2021 (CAL-CET 2021), version 1.0, developed by the California Department of Transportation. It was estimated that for construction of this project, the total amount of CO_2 produced due to construction would be 412 tons.

The table below summarizes the construction related emissions, including the total CO_2e emission:

Table 1: Summary of Construction-related GHG Emissions

Project Location: Contra Costa County on Route 24, PM R0.1	PARAMETERS				PROJECT TOTAL
	CO2 (tons)	CH4 (tons)	N2O (tons)	HFC (tons)	CO2e (metric tons)
TOTAL EMISSIONS	412	0.009	0.023	0.012	403

Because construction activities are short-term, the GHG emissions resulting from construction activities would not result in long-term adverse effects. Implementation of Caltrans Standard Specifications, such as complying with air-pollution-control rules, regulations, ordinances, and statutes that apply to work performed under the Contract and the use of construction best management practices, would result in reducing GHG emissions from construction activities, including but not limited to:

1. Regular vehicle and equipment maintenance.
2. Limit idling of vehicles and equipment onsite.
3. If practicable, recycle nonhazardous waste and excess material. If recycling is not practicable, dispose of material.
4. Use solar-powered signal boards, if feasible.
5. Use tier 4 interim or tier 4 final engines.

In addition, with innovations such as longer pavement lives, improvement in traffic management and changes in materials, construction-related GHG emissions produced during construction can be offset to some degree by longer intervals between maintenance and rehabilitation activities.

ATTACHMENT J
Preliminary Cost Estimate

PROJECT

PLANNING COST ESTIMATE©

EA: 04-2Y780

EA: 04-2Y780 PID: 423000158

PID: 423000158

District-County-Route: 04-ALA-260

PM: 1.1/1.8

Type of Estimate : Project Report

Program Code : SHOPP

Project Limits : Posey and Webster Street Tubes

Project Description: Fire Life Safety Upgrades at Posey and Webster Tubes

Scope : Modify existing ventilation system, install FFFS and LHD system. Install Jet fans at Webster Tube

Alternative : NA

SUMMARY OF PROJECT COST ESTIMATE

	Current Year Cost	Escalated Cost
TOTAL ROADWAY COST	$ 30,363,500	$ 36,902,376
TOTAL STRUCTURES COST	$ -	$ -
SUBTOTAL CONSTRUCTION COST	$ 30,363,500	$ 36,902,376
TOTAL RIGHT OF WAY COST	$ 50,000	$ 50,000
TOTAL CAPITAL OUTLAY COSTS	**$ 30,414,000**	**$ 36,953,000**
PA/ED SUPPORT	$ 3,748,000	$ 3,748,000
PS&E SUPPORT	$ 8,706,000	$ 8,706,000
RIGHT OF WAY SUPPORT	$ 25,000	$ 25,000
CONSTRUCTION SUPPORT	$ 9,191,000	$ 9,191,000
TOTAL SUPPORT COST	**$ 21,670,000**	**$ 21,670,000**
TOTAL PROJECT COST	**$ 52,100,000**	**$ 58,700,000** *

Programmed Amount

	Month	Year
Date of Estimate (Month/Year)	1	2023
Estimated Construction Start (Month/Year)	11	2026
Number of Working Days =		300
Estimated Mid-Point of Construction (Month/Year)	12	2027
Estimated Construction End (Month/Year)	12	2028
Number of Plant Establishment Days		

Estimated Project Schedule

PID Approval	1/25/2023
PA/ED Approval	2/1/2025
PS&E	12/1/2025
RTL	2/1/2026
Begin Construction	11/1/2026

Reviewed by District O.E. or Cost Estimate Certifier

Office Engineer / Cost Estimate Certifier	Date	Phone
	xx/xx/xxxx	(xxx) xxx-xxxx

Approved by Project Manager

Project Manager	Date	Phone
	xx/xx/xxxx	(xxx) xxx-xxxx

I. ROADWAY ITEMS SUMMARY

	Section		Cost
1	Earthwork	$	-
2	Pavement Structural Section	$	-
3	Drainage	$	-
4	Specialty Items	$	15,817,300
5	Environmental	$	746,800
6	Traffic Items	$	3,635,000
7	Detours	$	-
8	Minor Items	$	1,010,000
9	Roadway Mobilization	$	1,425,800
10	Supplemental Work	$	848,400
11	State Furnished	$	1,647,100
12	Time-Related Overhead	$	1,272,600
13	Total Roadway Contingency	$	3,960,500
	TOTAL ROADWAY ITEMS	**$**	**30,363,500**

Estimate Prepared By :

Name and Title | Date | Phone

Estimate Reviewed By :

Name and Title | Date | Phone

By signing this estimate you are attesting that you have discussed your project with all functional units and have incorporated all their comments or have discussed with them why they will not be incorporated.

SECTION 1: EARTHWORK

Item code		Unit	Quantity		Unit Price ($)		Cost
190101	Roadway Excavation	CY		x	=	$	-
19010X	Roadway Excavation (Insert Type) ADL	CY		x	=	$	-
19801X	Imported Borrow	CY/TON		x	=	$	-
194001	Ditch Excavation	CY		x	=	$	-
192037	Structure Excavation (Retaining Wall)	CY		x	=	$	-
193013	Structure Backfill (Retaining Wall)	CY		x	=	$	-
193031	Pervious Backfill Material (Retaining Wall)	CY		x	=	$	-
17010X	Clearing & Grubbing	LS/ACRE		x	=	$	-
100100	Develop Water Supply	LS		x	=	$	-
19801X	Imported Borrow	CY/TON		x	=	$	-
21012X	Duff	ACRE/SQFT		x	=	$	-
XXXXXX	Some Item	Unit		x	=	$	-

TOTAL EARTHWORK SECTION ITEMS	$	-

SECTION 2: PAVEMENT STRUCTURAL SECTION

Item code		Unit	Quantity		Unit Price ($)		Cost
401050	Jointed Plain Concrete Pavement	CY		x	=	$	-
400050	Continuously Reinforced Concrete Pavement	CY		x	=	$	-
390132	Hot Mix Asphalt (Type A)	TON		x	=	$	-
26020X	Class 2 Aggregate Base	TON/CY		x	=	$	-
250401	Class 4 Aggregate Subbase	CY		x	=	$	-
414240	Isolation Joint Seal (Asphalt Rubber)	LF		x	=	$	-
414241	Isolation Joint Seal (Silicone)	LF		x	=	$	-
280010	Rapid Strength Concrete Base	CY		x	=	$	-
410096	Drill and Bond (Dowel Bar)	EA		x	=	$	-
390137	Rubberized Hot Mix Asphalt (Gap Graded)	TON		x	=	$	-
391006	Asphalt Binder (Geosynthetic Pavement Interlayer)	TON		x	=	$	-
290201	Asphalt Treated Permeable Base	CY		x	=	$	-
374002	Asphaltic Emulsion (Fog Seal Coat)	TON		x	=	$	-
397005	Tack Coat	TON		x	=	$	-
377501	Slurry Seal	TON		x	=	$	-
374493	Polymer Asphaltic Emulsion (Seal Coat)	TON		x	=	$	-
370001	Sand Cover (Seal)	TON		x	=	$	-
731530	Minor Concrete (Textured Paving)	CY		x	=	$	-
731502	Minor Concrete (Miscellaneous Construction)	CY		x	=	$	-
39407X	Place Hot Mix Asphalt Dike (Insert Type)	LF		x	=	$	-
398100	Remove Asphalt Concrete Dike	LF		x	=	$	-
420201	Grind Existing Concrete Pavement	SQYD		x	=	$	-
398300	Remove Base and Surfacing	CY		x	=	$	-
390095	Replace Asphalt Concrete Surfacing	CY		x	=	$	-
41800X	Remove Concrete Pavement	SQYD/CY		x	=	$	-
394090	Place Hot Mix Asphalt (Miscellaneous Area)	SQYD		x	=	$	-
398200	Cold Plane Asphalt Concrete Pavement	SQYD		x	=	$	-
846046	6" Rumble Strip (Asphalt Concrete Pavement)	STA		x	=	$	-
846049	6" Rumble Strip (Concrete Pavement)	STA		x	=	$	-
846051	12" Rumble Strip (Asphalt Concrete Pavement)	STA		x	=	$	-
846052	12" Rumble Strip (Concrete Pavement)	STA		x	=	$	-
420102	Groove Existing Concrete Pavement	SQYD		x	=	$	-
394095	Roadside Paving (Miscellaneous Areas)	SQYD		x	=	$	-
390136	Minor Hot Mix Asphalt	TON		x	=	$	-
XXXXXX	Some Item	Unit		x	=	$	-

TOTAL PAVEMENT STRUCTURAL SECTION ITEMS	$	-

SECTION 3: DRAINAGE

Item code		Unit	Quantity		Unit Price ($)			Cost
71013X	Remove Culvert	EA/LF		x		=	$	-
710240	Modify Inlet	EA		x		=	$	-
710370	Sand Backfill	CY		x		=	$	-
71010X	Abandon Culvert	EA/LF		x		=	$	-
710196	Adjust Inlet	LF		x		=	$	-
710262	Cap Inlet	EA		x		=	$	-
510501	Minor Concrete	CY		x		=	$	-
510502	Minor Concrete (Minor Structure)	CY		x		=	$	-
731627	Minor Concrete (Curb, Sidewalk, and Curb Ramp)	CY		x		=	$	-
6101XX	XX" Alternative Pipe Culvert (Insert Type)	LF		x		=	$	-
6411XX	XX" Plastic Pipe	LF		x		=	$	-
65XXXX	XX" Reinforced Concrete Pipe (Insert Type)	LF		x		=	$	-
6811XX	XX" Plastic Pipe (Edge Drain)	LF		x		=	$	-
6901XX	XX" Corrugated Steel Pipe Downdrain (0.XXX" Thick)	LF		x		=	$	-
7006XX	XX" Corrugated Steel Pipe Inlet (0.XXX" Thick)	LF		x		=	$	-
7032XX	XX" Corrugated Steel Pipe Riser (0.XXX" Thick)	LF		x		=	$	-
7050XX	XX" Steel Flared End Section	EA		x		=	$	-
703233	Grated Line Drain	LF		x		=	$	-
72XXXX	Rock Slope Protection (Type and Method)	CY/TON		x		=	$	-
72901X	Rock Slope Protection Fabric (Insert Class)	SQYD		x		=	$	-
721420	Concrete (Ditch Lining)	CY		x		=	$	-
721430	Concrete (Channel Lining)	CY		x		=	$	-
750001	Miscellaneous Iron and Steel	LB		x		=	$	-
XXXXXX	Additional Drainage	LS		x		=	$	-

TOTAL DRAINAGE ITEMS $ -

SECTION 4: SPECIALTY ITEMS

Item code		Unit	Quantity		Unit Price ($)			Cost
	Water Supply Connection (material of pipe, backflow, and FDC). Price per portal building.	EA	4	x	70,468.00	=	$	281,872
	Posey - Tube FFFS/Deluge cost per zone	EA	34	x	92,487.00	=	$	3,144,558
	Webster - Tube FFFS/Deluge cost per zone	EA	31	x	92,487.00	=	$	2,867,097
	Posey - Demo Tunnel Ceiling for Dampers	LS	1	x	89,798.50	=	$	89,799
	Webster - Demo Tunnel Ceiling for Dampers	LS	1	x	89,798.50	=	$	89,799
	Posey - Damper Material and Install	LS	1	x	343,740.00	=	$	343,740
	Webster - Damper Material and Install	LS	1	x	343,740.00	=	$	343,740
	Posey - Remove (E) exhaust grilles and install (N) cover plates	LS	1	x	523,922.28	=	$	523,922
	Webster - Remove (E) exhaust grilles and install (N) cover plates	LS	1	x	523,922.28	=	$	523,922
	Posey - Install (N) cover plates at supply plenum	LS	1	x	205,286.25	=	$	205,286
	Webster - Install (N) cover plates at supply plenum	LS	1	x	205,286.25	=	$	205,286
	Bulkhead removal at Posey and Webster Tubes	EA	4	x	10,716.67	=	$	42,867
	Webster - Jet Fan Material and Install	EA	3	x	156,000.00	=	$	468,000
	Posey and Webster Electrical Work	LS	1	x	1,871,132.40	=	$	1,871,132
	Posey - FAS Main Panel & SLC Ckt Install in Tunnel	LS	1	x	1,229,690.76	=	$	1,229,691
	Webster - FAS Main Panel & SLC Ckt Install in Tunnel	LS	1	x	1,402,659.84	=	$	1,402,660
	Posey - FAS/Deluge System Connection in Tunnel	LS	1	x	12,000.00	=	$	12,000
	Webster - FAS/Deluge System Connection in Tunnel	LS	1	x	12,000.00	=	$	12,000
	Posey - Linear Heat Detection Cost (per zone)	EA	34	x	8,283.32	=	$	281,633
	Webster - Linear Heat Detection Cost (per zone)	EA	32	x	8,283.32	=	$	265,066
	Mobilization, Surveying & Safety (Posey Tunnel Plenum)	LS	1	x	135,000.00	=	$	135,000
	Mobilization, Surveying & Safety (Webster Tunnel Plenum)	LS	1	x	120,000.00	=	$	120,000
	Commissioning (Posey Tunnel) FAS & Power	LS	1	x	136,832.34	=	$	136,832
	Commissioning (Webster Tunnel) FAS & Power	LS	1	x	130,489.97	=	$	130,490
	Posey - Public Address & Variable Message Signage	LS	1	x	545,434.00	=	$	545,434
	Webster - Public Address & Variable Message Signage	LS	1	x	545,434.00	=	$	545,434

TOTAL SPECIALTY ITEMS $ 15,817,300

Effective immediately, districts must input estimated item quantities in blue text above in the PRSM database for the pay items listed in the Design Memo, dated April 9, 2018, when Project Report is approved (Milestone 200). Link to Desgin Memo.

SECTION 5: ENVIRONMENTAL

5A - ENVIRONMENTAL MITIGATION

Item code		Unit	Quantity		Unit Price ($)		Cost
	Biological Mitigation (on-site)	LS		x		= $	-
80010X	Temporary Fence (Insert Type)	LF		x		= $	-
130670	Temporary Reinforced Silt Fence	LF		x		= $	-
					Subtotal Environmental Mitigation	*$*	-

5B - LANDSCAPE AND IRRIGATION

Item code		Unit	Quantity		Unit Price ($)		Cost
20XXXX	Highway Planting	LS		x		= $	-
20XXXX	Irrigation System	LS		x		= $	-
204099	Plant Establishment Work	LS		x		= $	-
20XXXX	Follow-up Landscape Project	LS		x		= $	-
206405	Remove Irrigation Facility	LS		x		= $	-
204096	Maintain Existing Planted Areas	LS		x		= $	-
206400	Check and Test Existing Irrigation Facilities	LS		x		= $	-
21011X	Imported Topsoil	CY/TON		x		= $	-
200114	Rock Blanket	SQFT/SQYD		x		= $	-
200122	Weed Germination	SQYD		x		= $	-
995100	Water Meter Charges	LS		x		= $	-
2087XX	XX" Conduit (Use for Irrigation x-overs)	LF		x		= $	-
20890X	Extend X" Conduit (Use for Extension of Irrigation	LF		x		= $	-
					Subtotal Landscape and Irrigation	*$*	-

5C - EROSION CONTROL

Item code		Unit	Quantity		Unit Price ($)		Cost
211111	Permanent Erosion Control Establishment Work	LS		x		= $	-
210010	Move-In/Move-Out (Erosion Control)	EA		x		= $	-
210350	Fiber Rolls	LF		x		= $	-
210360	Compost Sock	LF		x		= $	-
2102XX	Rolled Erosion Control Product (Insert Type)	SQFT		x		= $	-
21025X	Bonded Fiber Matrix	SQFT/ACRE		x		= $	-
210300	Hydromulch	SQFT		x		= $	-
210420	Straw	SQFT		x		= $	-
210430	Hydroseed	SQFT		x		= $	-
210610	Compost	CY		x		= $	-
210630	Incorporate Materials	SQFT					
					Subtotal Erosion Control	*$*	-

5D - NPDES

Item code		Unit	Quantity		Unit Price ($)		Cost
130300	Prepare SWPPP	LS		x		= $	-
130200	Prepare WPCP	LS	1	x	746,750.00	= $	746,750
130100	Job Site Management	LS		x		= $	-
130330	Storm Water Annual Report	EA		x		= $	-
130310	Rain Event Action Plan	EA		x		= $	-
130320	Storm Water Sampling and Analysis Day	EA		x		= $	-
130520	Temporary Hydraulic Mulch	SQYD		x		= $	-
130550	Temporary Hydroseed	SQYD		x		= $	-
130505	Move-In/Move-Out (Temporary Erosion Control)	EA		x		= $	-
130640	Temporary Fiber Roll	LF		x		= $	-
130900	Temporary Concrete Washout	LS		x		= $	-
130710	Temporary Construction Entrance	EA		x		= $	-
130610	Temporary Check Dam	LF		x		= $	-
130620	Temporary Drainage Inlet Protection	EA		x		= $	-
130730	Street Sweeping	LS		x		= $	-
					Subtotal NPDES	*$*	*746,750*

TOTAL ENVIRONMENTAL	**$**	**746,800**

Supplemental Work for NPDES

066595	Water Pollution Control Maintenance Sharing*	LS		x		= $	-
066596	Additional Water Pollution Control**	LS		x		= $	-
066597	Storm Water Sampling and Analysis***	LS		x		= $	-
XXXXXX	Some Item	LS		x		= $	-
					Subtotal Supplemental Work for NDPS	*$*	-

*Applies to all SWPPPs and those WPCPs with sediment control or soil stabilization BMPs.

**Applies to both SWPPPs and WPCP projects.

*** Applies only to project with SWPPPs.

SECTION 6: TRAFFIC ITEMS

6A - Traffic Electrical

Item code		Unit	Quantity		Unit Price ($)			Cost
870200	Lighting System	LS		x		=	$	-
870300	Sign Illumination System	LS		x		=	$	-
870400	Signal and Lighting System	LS		x		=	$	-
870510	Ramp Metering System	LS		x		=	$	-
87181X	Interconnection Conduit and Cable	LF/LS		x		=	$	-
5602XX	Furnish Sign Structure (Insert Type)	LB		x		=	$	-
5602XX	Install Sign Structure (Insert Type)	LB		x		=	$	-
4980XX	XX" CIDHC Pile (Sign Foundation)	LF		x		=	$	-
87011X	Inductive Loop Detector	EA/LS		x		=	$	-
870600	Traffic Monitoring Station System	LS		x		=	$	-
56804X	Remove Sign Structure	EA/LS		x		=	$	-
568054	Reconstruct Sign Structure	EA		x		=	$	-
568060	Modify Sign Structure	EA		x		=	$	-
870009	Elements During Construction	LS		x		=	$	-
86XXXX	Fiber Optic Conduit System	LS		x		=	$	-
XXXXX	Some Item	Unit		x		=	$	-

Subtotal Traffic Electrical $ -

6B - Traffic Signing and Striping

Item code		Unit	Quantity		Unit Price ($)			Cost
820840	Roadside Sign - One Post	EA		x		=	$	-
820850	Roadside Sign - Two Post	EA		x		=	$	-
5602XX	Furnish Sign Structure (Insert Type)	SQFT		x		=	$	-
820890	Install Sign Panel on Existing Frame	SQFT		x		=	$	-
846020	Remove Painted Traffic Stripe	LF		x		=	$	-
141102	Remove Yellow Painted Traffic Stripe (Hazardous '	LF		x		=	$	-
846025	Remove Painted Pavement Marking	SQFT		x		=	$	-
820250	Remove Roadside Sign	EA		x		=	$	-
820530	Reset Roadside Sign	EA		x		=	$	-
820610	Relocate Roadside Sign	EA		x		=	$	-
8101XX	Delineator (Insert Class)	EA		x		=	$	-
840502	Thermoplastic Traffic Stripe (Enhanced Wet Night	LF		x		=	$	-
846012	Thermoplastic Crosswalk and Pavement Marking (Enhanced Wet Night Visibility)	SQFT		x		=	$	-
120090	Construction Area Signs	LS	1	x	45,000.00	=	$	45,000
84XXXX	Permanent Pavement Delineation	LS		x		=	$	-

Subtotal Traffic Signing and Striping $ *45,000*

6C - Traffic Management Plan

Item code		Unit	Quantity		Unit Price ($)			Cost
12865X	Portable Changeable Message Sign	EA/LS	1	x	$ 350,000	=	$	350,000
	Ground Mounted Signs	EA/LS	1	x	$ 20,000	=	$	20,000
	Maintain Traffic	EA/LS	1	x	$ 400,000	=	$	400,000
066063	Traffic Management Plan - Public Information	LS	1	x	$ 50,000	=	$	50,000
	Others (Determined by PIO)	EA/LS	1	x	$ 20,000	=	$	20,000

Subtotal Traffic Management Plan $ *840,000*

6C - Stage Construction and Traffic Handling

Item code		Unit	Quantity		Unit Price ($)			Cost
120198	Plastic Traffic Drums	EA		x		=	$	-
12016X	Channelizer (Insert Type)	EA		x		=	$	-
120116	Type II Barricade	EA		x		=	$	-
120120	Type III Barricade	EA		x		=	$	-
129100	Temporary Crash Cushion Module	EA		x		=	$	-
120100	Traffic Control System	LS	1	x	1,500,000.00	=	$	1,500,000
129110	Temporary Crash Cushion	EA		x		=	$	-
129000	Temporary Railing (Type K)	LF		x		=	$	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		=	$	-
120152	Temporary Pavement Marking (Tape)	SQFT		x		=	$	-
8101XX	Delineator (Insert Class)	EA		x		=	$	-
120103	Stationary Impact Attenuator Vehicle	DAY	150	x	1,000.00	=	$	150,000
120207	Portable radar speed feedback sign system	DAY	150	x	6,000.00	=	$	900,000
124000	Temporary Pedestrian Access Route	LS	1	x	200,000.00	=	$	200,000

Subtotal Stage Construction and Traffic Handling $ *2,750,000*

TOTAL TRAFFIC ITEMS $ 3,635,000

SECTION 7: DETOURS

Includes constructing, maintaining, and removal

Item code		Unit	Quantity		Unit Price ($)		Cost
190101	Roadway Excavation	CY		x		= $	-
19801X	Imported Borrow	CY/TON		x		= $	-
390132	Hot Mix Asphalt (Type A)	TON		x		= $	-
26020X	Class 2 Aggregate Base	CY/TON		x		= $	-
250401	Class 4 Aggregate Subbase	CY		x		= $	-
130620	Temporary Drainage Inlet Protection	EA		x		= $	-
129000	Temporary Railing (Type K)	LF		x		= $	-
128601	Temporary Signal System	LS		x		= $	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		= $	-
80010X	Temporary Fence (Insert Type)	LF		x		= $	-
XXXXXX	Some Item	LS		x		= $	-

TOTAL DETOURS **$ -**

SUBTOTAL SECTIONS 1 through 7 $ 20,199,100

SECTION 8: MINOR ITEMS

8A - Americans with Disabilities Act Items					
	ADA Items	1.0%	$	201,991	
8B - Bike Path Items					
	Bike Path Items	1.0%	$	201,991	
8C - Other Minor Items					
	Other Minor Items	3.0%	$	605,973	
	Total of Section 1-7	$ 20,199,100 x 5.0%	= $	1,009,955	

TOTAL MINOR ITEMS **$ 1,010,000**

SECTIONS 9: ROADWAY MOBILIZATION *

Item code							
999990	Total Section 1-8	$ 21,209,100	x	10%	= $	2,120,910	

TOTAL ROADWAY MOBILIZATION **$ 1,425,800**

SECTION 10: SUPPLEMENTAL WORK

Item code		Unit	Quantity		Unit Price ($)		Cost
066670	Payment Adjustments For Price Index Fluctuations	LS		x		= $	-
066094	Value Analysis	LS		x		= $	-
066070	Maintain Traffic	LS		x		= $	-
066919	Dispute Resolution Board	LS		x		= $	-
066921	Dispute Resolution Advisor	LS		x		= $	-
066015	Federal Trainee Program	LS		x		= $	-
066610	Partnering	LS		x		= $	-
066204	Remove Rock and Debris	LS		x		= $	-
066222	Locate Existing Crossover	LS		x		= $	-
XXXXXX	Some Item	Unit		x		= $	-

*Cost of **NPDES** Supplemental Work specified in Section 5D* = $ -

Total Section 1-8	$ 21,209,100	4%	= $	848,364	

TOTAL SUPPLEMENTAL WORK **$ 848,400**

SECTION 11: STATE FURNISHED MATERIALS AND EXPENSES

Item code		Unit	Quantity		Unit Price ($)		Cost
066105	Resident Engineers Office	LS	1	x	100,000.00	=	$100,000
066901	Water Expenses	LS	1	x	5,000.00	=	$5,000
8609XX	Traffic Monitoring Station (X)	LS		x		=	$0
066841	Traffic Controller Assembly	LS		x		=	$0
066840	Traffic Signal Controller Assembly	LS		x		=	$0
066062	COZEEP Contract	LS	1	x	1,300,000.00	=	$1,300,000
066838	Reflective Numbers and Edge Sealer	LS		x		=	$0
066065	Tow Truck Service Patrol	LS	1	x	30,000.00	=	$30,000
066916	Annual Construction General Permit Fee	LS		x		=	$0
XXXXXX	Some Item	Unit		x		=	$0
	Total Section 1-8	$	21,209,100		1%	= $	212,091

TOTAL STATE FURNISHED **$1,647,100**

SECTION 12: TIME-RELATED OVERHEAD

Total of Roadway and Structures Contract Items excluding Mobilization $21,209,100 (used to calculate total TRO)

Estimated Time-Related Overhead (TRO) Percentage (0% to 10%) = **6%**

Item code		Unit	Quantity		Unit Price ($)		Cost
090100	Time-Related Overhead	WD	300	X	$4,242	=	$1,272,600

TOTAL TIME-RELATED OVERHEAD **$1,272,600**

SECTION 13: ROADWAY CONTINGENCY*

Risk Amount from Risk Register	(for Known Risks)				0%		
Additional or Residual Contingency	(for Unknown/Undefined Risks)				15%		$3,960,450
Total Section 1-12	$	26,403,000	x	**15%**		=	$3,960,450

TOTAL CONTINGENCY* **$3,960,500**

II. STRUCTURE ITEMS

	Bridge 1		Bridge 2		
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Bridge Name	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	0 LF		0 LF		0 LF
Total Bridge Length (Feet)	0 LF		0 LF		0 LF
Total Area (Square Feet)	0 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$150		$150		$0
COST OF EACH	**$0**		**$0**		**$0**

	Building 1		Bridge 2		
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Building Name	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	0 LF		0 LF		0 LF
Total Building Length (Feet)	0 LF		0 LF		0 LF
Total Area (Square Feet)	0 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$300		$0		$0
COST OF EACH	**$0**		**$0**		**$0**

TOTAL COST OF BRIDGES		**$0**
TOTAL COST OF BUILDINGS		**$0**
Time-Related Overhead	10%	**$0**
STRUCTURES MOBILIZATION	10%	**$0**
STRUCTURES CONTINGENCY*	15%	**$0**
TOTAL COST OF STRUCTURES		**$0**

Estimate Prepared By: _____ _____

XXXXXXXXXXXXXXXX ------ Division of Structures — Date

EA: 04-2Y780 PID: 423000158

III. RIGHT OF WAY

Fill in all of the available information from the Right of Way Data Sheet.

				Current Value Future Use		*Escalated Value*
A)	A1)	Acquisition, including Excess Land, Fees, Damages, Goodwill	$	0	$	0
	A2)	Acquisition of Offsite Mitigation	$	0	$	0
	A3)	Railroad Acquisition	$	0	$	0
B)	B1)	Utility Relocation (State Share)	$	0	$	0
	B2)	Potholing (Design Phase)	$	0	$	0
C)	Utility - Advance Engineering Estimate (Encumber with State Only Funds)		$	0	$	0
D)	RAP and/or Last Resort Housing		$	0	$	0
E)	Clearance & Demolition		$	0	$	0
F)	Relocation Assistance (RAP and/or Last Resort Housing Costs)		$	0	$	0
G)	Title and Escrow		$	0	$	0
H)	Environmental Review		$	0	$	0
I)	Condemnation Settlements	0%	$	0	$	0
J)	Design Appreciation Factor	0%	$	0	$	0
K)	Utility Relocation (Construction Cost)		$	50,000	$	50,000

L)	**TOTAL RIGHT OF WAY ESTIMATE**	**$50,000**
M)	**TOTAL R/W ESTIMATE: Escalated**	**$50,000**
N)	**RIGHT OF WAY SUPPORT**	**$25,000**

Support Cost Estimate Prepared By _____ Project Coordinator[1] _____ Phone

Utility Estimate Prepared By _____ Utility Coordinator[2] _____ Phone

R/W Acquisition Estimate Prepared By _____ Right of Way Estimator[3] _____ Phone

Note: Items G & H applied to items A + B

[1] When estimate has Support Costs only [2] When estimate has Utility Relocation [3] When R/W Acquisition is required

ATTACHMENT K
Risk Register

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

RISK REGISTER CERTIFICATION (ACCOUNTABILITY CHECKPOINTS) FORM

PPM-0001 (REV 03/2016)

The risk register is to be approved and signed-off by the District Deputies* listed below for all scalability levels. By signing this form, you are certifying that you have reviewed the risks documented in the register and agree that they have been managed to the extent possible by the PDT.

Project Information ☒ Capital Project ☐ Major Maintenance Project (Check One) Total Estimated Cost: $49,522,000

Project ID/District-EA	0423000158/ 04- 2Y780	Date:	
Project Description	ALA 260- Webster/Posey Tubes Ventilation Upgrade	Date:	
Project Manager (PM)	Hung Nguyen	Date:	12/16/2024
Project Risk Manager (For Risk Level 3 Projects)	Gurmukh Thiara	Date:	12/17/2024

☐ No Risk Register Certification Required-Check box if project is less than $1 million in total cost and risk register not prepared. Sign below and submit this form with PID, PA&ED, PS&E submittal, and RE Handoff File (as applicable).

Project Manager Signature		Date:	

PID (Recommended for Capital Projects Only excluding Minor Projects)

Project Manager		Date:	
Deputy District Director, Planning		Date:	
Deputy District Director*, Design**		Date:	
Deputy District Director, Project Management		Date:	

PA&ED (Required for Capital Projects Only)

Project Manager		Date:	12/16/2024
Deputy District Director*, Environmental	Mougan Mostaghimi	Date:	12/18/2024
Deputy District Director*, Design**	Morteza Azimi	Date:	12/18/2024
Deputy District Director, Project Management		Date:	12/26/2024

Prior to PS&E (Required for Capital Projects and Major Maintenance Projects

Project Manager		Date:	
Deputy District Director*, Design**		Date:	
Deputy District Director*, Construction		Date:	
Deputy District Director*, Right of Way		Date:	
Deputy District Director*, Environmental		Date:	
Deputy District Director, Project Management**		Date:	

RE File hand-off (Recommended for Capital Projects and Major Maintenance Projects

Project Manager		Date:	
Deputy District Director*, Design**		Date:	
Deputy District Director*, Construction		Date:	
Deputy District Director, Project Management**		Date:	

*or the respective Project Delivery Division Chief signatures in the North Region or Central Region

**or Deputy District Director, Maintenance signature for HM Projects designed by the District Maintenance Division

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

RISK REGISTER CERTIFICATION (ACCOUNTABILITY CHECKPOINTS) FORM

PPM-0001 (REV 03/2016)

General Instructions

What's New

The Risk Register Certification Form (Accountability Checkpoints) was established by Project Delivery Directive 09 referencing Project Risk Management Manual: A Scalable Approach, effective July 1, 2012. The signing of the risk register form at the various accountability checkpoints certifies that the Deputies and Division Chiefs have reviewed the project and risks identified in the Risk Register and agree that they have been managed to the extent possible by the Project Development Team (PDT).

Requirements

Risk Register Certification Form is needed for all capital and major maintenance projects for which the Department has delivery responsibility. The minimum risk management requirements based solely on the total project cost are:

Level	Estimated Cost (Capital and Support)	Risk Management Requirements
	Minor A, Minor B and other projects less than $1 million	Risk register encouraged
1	<$5 million	Risk register
2	$5 million to $100 million	Risk register with qualitative analysis
3	>$100 million	Risk register with quantitative analysis

However, the project's overall complexity should determine the Risk Management Requirements for that project. Project-specific changes to the above minimum levels (1 through 3) must be approved by the Deputy District Director for Program/Project Management. The risk register shall be maintained throughout the project's lifecycle.

Risk Register Certification (Accountability Checkpoints)

The Risk Register Certification Form (PPM-0001 REV 03/2016) is to be signed off by the appropriate Deputy District Director, Project Delivery Division Chief, and Project Manager at the appropriate accountability checkpoints to ensure that risks identified on a project have been captured in the project risk register and communicated the next phase of project delivery.

The Risk Register Certification Form Accountability Checkpoints are:

- Project Initiation Document (PID) Phase: Sign-off is recommended prior to the approval of the PID for capital projects only, excluding minor projects.
- Project Approval and Environmental Document (PA&ED) Phase: Sign-off is required prior to the approval of the Project Report (PR) for capital projects only.
- Plans, Specifications, & Estimate (PS&E): Sign-off is required prior to submittal of PS&E to DES Office Engineers (Milestone 380) for capital and major maintenance projects. For Authority to Advertise District Delegation (AADD) projects, sign-off is required prior to the PS&E submittal to District Office Engineer (Milestone 377) for projects that are submitted to DES Office Engineers for advertisement.
- RE File Hand-off: Sign-off is recommended prior to the transmittal of the RE File to the Resident Engineer for capital and major maintenance projects.

General Instructions for Signing Form

Project Risk Register Certification Form is to be signed-off by the District Deputy Directors or Project Delivery Division Chiefs for capital and major maintenance projects as follows:

- For capital projects, sign-off from Project Manager and Deputy District Directors, Project Delivery Division Chiefs signatures are needed in the North Region or Central Region.
- For major maintenance projects designed by Division of Maintenance, sign-off by Maintenance Design Engineer as Project Manager if no project manager is assigned and signature by the Deputy District Director for Maintenance under Deputy District Director, Design and Project Management signature lines.
- Deputy District Directors or Division Chiefs not shown on the Risk Register Certification Form may be requested to be added to the form by the District with approval from the Division of Project Management.
- For projects less than $1 million in total cost with no risk register, check "No Risk Register Certification Required" with sign-off by the Project Manager or Maintenance Engineer for HM projects (if no Project Manager).

RISK REGISTER LEVEL	2	PROJECT NAME	Alameda 260 - Webster-Posey Ventilation Upgrade		DIST-EA	04-2Y780 (0423000158)	Project Manager	Hung Nguyen	RISK MANAGER	Gurmukh Thiara		TOTAL COST (Capital +Support)		$49,522,000.00
PROJECT PHASE	PA&ED	PDT MEMBERS	Hung Nguyen (PM), WSP, William Fong, Wahida Rashid, Guang-Ru Li, Amir Mahboubi, Jason Kebles, Max Dabilly, Sheila Orson, Michael Kerns		RISK ASSESSMENT INFORMATION							TOTAL DAYS (Construction + Initial review (30 days)+ Closeout (60 days))		390
Risk Identification					Probability	Cost Impact		Time Impact		Phase	Capital / Support	Individual Risk	Risk Response			
Status	ID #	Category	Title	Risk Statement	Current Status/ Assumptions	Rating	Rating	Score	Rating	Score	ENG/ CON	C/S	Rationale	Strategy	Response Actions	Risk Owner	Updated
Active	1	Construction	Unidentified Utility Conflicts	Unanticipated utilities may be encountered during construction leading to extra work for relocation or mitigation resulting to additional project costs and schedule delays.	Utility conflicts will be identified and resolved prior to the construction phase. All utility protection measures will be identified during project delivery.	2-Low	02-Low	4	02-Low	4	CON	C	Based on PDT's input and past projects of similar scope.	Mitigate	Potholing will be conducted in PS&E. Further development of the utilities in the project area will be studied in PS&E. Right of Way will proactively coordinate with the respective agency if there are any conflicts to avoid delays.	ROW	11/15/2024
Active	2	Design	Scope Changes	Outside agencies (Fire Marshal and other outside agencies), local residents, or other State Subject Matter Experts (SME) may request or recommend additional or changed scope resulting in additional cost and schedule delays.	No new scope added to the project	3-Moderate	04-Moderate	12	04-Moderate	12	ENG	S	Receipt of information on the tunnel and input from SMEs and others become available.	Accept	The PDT to work early and often to resolve all scope change or increases due to information received.	Design	11/15/2024
Active	3	Stakeholders	Public Engagement	During project development, public concerns or homeless issues may need to be addressed, which may lead to schedule delays or increased costs.	Project is located next to residential condo complex and surrounding area consists of unsheltered and encampment.	3-Moderate	04-Moderate	12	04-Moderate	12	ENG	S	Requests received by the public to address their concerns.	Mitigate	As early as possible during project development, the PDT will work with Public Affairs to address concerns by the public and the homeless.	Project Manager	11/15/2024
Active	4	Utility	Utilities Coordination	Coordination efforts with PG&E, Alameda Power and Bloom Energy may result in conflicting schedules, and may lead to additional schedule delays and increased project costs.	Project coordination with PG&E, Alameda Power and Bloom Energy occurs smoothly.	3-Moderate	04-Moderate	12	04-Moderate	12	ENG	S	PG&E, Alameda Power and Bloom Energy inform Caltrans that they have conflicts.	Mitigate	The PDT will work with PG&E, Alameda Power and Bloom Energy early and often to address any schedule conflicts as soon as possible	Project Manager	11/15/2024
Retired	5	Structure	Scope Changes	Relocation and/or realignment of the jet fan to avoid conflict with traffic height restriction, which may result in delays to the project schedule or increased costs.	Design determines that the jet fan needs to be relocated or aligned.	3-Moderate	04-Moderate	12	08-High	24	ENG	S	Design determines that the jet fan needs to be relocated or aligned.	Mitigate	The PDT will need to determine as soon as surveys are completed or any other technical studies are completed if the jet fan needs to be reconfigured or if the jet fan needs to be relocated.	Design	11/15/2024
Active	6	Cultural Resources	Scope Changes	State Historic Preservation Office review, evaluation and approval process.	Approval Process to be identified during PA&ED.	3-Moderate	04-Moderate	12	04-Moderate	12	ENG	S	Environmental determines cultural preservation.	Mitigate	Cultural Resource office coordination with State Historic Preservation Officer (SHPO) and Advisory Council on Historic Preservations (ACHP) early as possible and to be completed during PA&ED phase.	Environmental	11/15/2024
Active	7	Environmental	Federally Listed Species	Federally and State listed species found in project site may impact construction activities, leading to stopped work, resulting in additional project cost and schedule delays	The project may encountered endangered species within the project footprint.	1-Very Low	01-Very Low	1	01-Very Low	1	ENG	S	Based on past projects of similar scope	Mitigate	The Environmental team will perform a biological survey prior to construction to reduce the probability of the risk occurring. Design to work with Environmental during PS&E phase to include all mitigation measures.	Environmental	11/15/2024
Active	8	Design	Coordination with other Projects	The project may be in conflict with other on-going projects within the project limits leading to overlapping work areas or incorrect sequence of work resulting in additional cost and schedule delays.	Known conflicts will be resolved prior to the construction phase	2-Low	02-Low	4	02-Low	4	ENG	S	Based on PDT input and past experience with other projects.	Mitigate	Design and PM to investigate concurrent projects within the project limit.	Design	11/15/2024
Active	9	Design	Utility Design Constraint	EBMUD connection points	Ductile iron pipes are to be installed to draw water service from the nearby EBMUD water mains for the tunnel's fire suppression system. There may be delays due to EBMUD not providing as-builts due to NDA issues. This issue is beyond the control of the project, leading to potential schedule delays affecting final design of tunnel fire suppression system.	3-Moderate	04-Moderate	12	08-High	24	ENG	S	Based on experience with previous projects in the vicinity.	Mitigate	Utility Engineering and R/W Utility to begin request meetings with EBMUD to resolve the issue.	Design, Utility Engineering and R/W Utility	11/15/2025
Active	10	Construction	Traffic Control	As a result of one full tunnel closure for stage construction, if there is significantly more traffic impact than expected, it may cause public opposition, which may result in construction schedule delay.	Transportation Management Plan is adequate	3-Moderate	04-Moderate	12	04-Moderate	12	CON	C	Significant traffic delays during construction	Mitigate	TMP will be developed during PAED and the subsequent project development phases.	Construction	12/2/2024

Printed Date: 12/12/2024

ATTACHMENT L
Performance Asset Management

SHOPP Project - Accomplishment - Performance Measures - Benefits

District: 04 Tool ID: 23713 Project ID: 0423000158 EA: 2Y780 Co-Rte-PM: ALA-260-R1.2R/R1.2R (Primary Location) View/Print PIR (Performance) Report

Bridge B | Pavement | Drainage | Facilities | Signs and Lighting | Mobility | Roadside | Complete Streets | Sustainability /Climate Change | Advance Mitigation /Mitigation | Major Damage & Betterments | Green-house Gases | Relinquishment

Performance & Accomplishments (TYP)

	ActID	Activity Detail	Performance Objective	Unit of Measurement	Quantity	Pre-Good	Pre-Fair	Pre-Poor	New	Post-Good	Post-Fair	Post-Poor	HQ Program Review - Agree with District?	HQ Comment	Review Date	Performance Change Date After Review	Comment
1	A08	Number of Bridges	No Performance Objective in the SHSMP	Each	2.000												
2	A11	Fish Passage Not in the Priority List	No Performance Objective in the SHSMP	Each													
3	A12	Fish Passage in the Priority List	Fish Passage	Each													
4	H32	Is any Location Within the Project Limits Ped/Bike Accessible?	No Performance Objective in the SHSMP	Yes/No	Yes												
5	H55	Justification for Complete Streets Not Applicable	Br/Tun Mech/Elec	1,2,3													

(Last Saved - 01/19/23 @ 4:31 PM by Deepthi Madabushi)

Programming Performance Summary (All Locations)

Program Code	Activity Category	Asset Class	Asset	Performance Value	Performance Measure	Unit	Pre-Good	Pre-Fair	Pre-Poor	Pre-Total	Post Good	New	Post Good+New	Post-Fair	Post-Poor	Post-Total
201.110	Bridge - Health	Primary	Bridge	2.0	Bridge(s)	Square Feet	0.0	666,509.0	0.0	666,509.0	0.0	0.0	0.0	666,509.0	0.0	666,509.0

Bridge/Tunnel Number	Pre-Health	Post-Health	Area
33 0106L	Fair	Fair	320042
33 0106R	Fair	Fair	346467

Notes:

1. The crosswalk for reporting performance in the "Programming Performance Summary" was developed to assist the districts on performance reporting requirements for CTC and PCRs. For discrepancies or errors, please notify AM Tool admins via e-mail at CT-TAM@dot.ca.gov.
2. The data summarized in the table represents the performance reported or to be reported in CTIPS.
3. Programming only requires the breakdown of Good, Fair and Poor for Primary and Supplementary Asset Classes.
4. Reporting of bridge pre and post conditions may contain errors if the project RTL is before 2024/25.
5. Reporting drainage pre-total and post good may differ whenever projects contain abandoned/removed culverts as the culvert no longer exists at post construction, is deleted from the pre-total value for posting of the post good value, and gets deleted from the statewide CIP inventory database.
6. Reactive Safety projects will temporally use the same performance outputs of Safety Improvement projects. When the reporting requirements for CTC changes, the logic in the AM Tool will change.
7. During the transition to the new Proactive Safety objective, the performance output for projects with a primary activity category of Proactive Safety (under program codes 015, 112, or 235) will continue to be presented here in the units of measure corresponding to the activities historically reported to date. A change in units to "Annual Fatal and Serious Injury Collisi

10.56.12.86/pirs/TenYrShopp/performance_measures_view.cfm?ID=23713

ATTACHMENT M
Section 106 Memo

Memorandum

To: WAHIDA RASHID
Branch Chief, Contra Costa/Alameda North
Office of Environmental Analysis
District 4

Date: December 9, 2024
File: 04-ALA-260 R1.10/R1.80
EA: 04-2Y780
EFIS: 0423000158

From: HELEN BLACKMORE
Branch Chief
Office of Cultural Resource Studies
District 4

Subject: **OFFICE OF CULTURAL RESOURCE STUDIES (OCRS) SECTION 106 CLOSEOUT MEMO FOR THE POSEY TUBE 33-0106R AND WEBSTER TUBE 33-0106L VENTILATION UPGRADE PROJECT FROM POSTMILE R1.10 TO R1.80, ON STATE ROUTE 260, IN ALAMEDA COUNTY.**

The California Department of Transportation (Caltrans), District 4, proposes to improve smoke ventilation system performance for the Posey (Br. No. 33-0106R) and Webster tubes (Br. No. 33-0106L) on State Route 260 (SR 260), in the cities of Oakland and Alameda, in Alameda County between the post miles (PM) R1.10 and R1.80 (Undertaking). All project activities are within Caltrans right of way.

Caltrans District 4 Professionally Qualified Staff (PQS) Lindsay Busse, Principal Investigator – Prehistoric Archaeology, and PQS Charles Palmer, Principal Architectural Historian, have reviewed the request for studies dated July 15, 2024, and the provided project information, along with the Caltrans Cultural Resource Database, as-built plans, aerial photographs, and maps. The review was conducted in accordance with the January 2014 *First Amended Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (PA) and January 2015 *Memorandum of Understanding Between the California Department of Transportation and the California State Historic Preservation Officer Regarding Compliance with Public Resources Code (PRC) Section 5024 and Governor's Executive Order W-26-92*, as addended 2019 (MOU).

The Area of Potential Effects (APE) for the project was established on October 23

2024, by Caltrans Professionally Qualified Staff (PQS) Charles Palmer, Principal Architectural Historian, in consultation with Lindsay Busse, PQS Principal Investigator – Prehistoric Archaeology, and Hung T. Nguyen, Project Manager. The APE was established to include the entire area of project activities, including construction and lay down areas, and encompasses the Oakland Waterfront Warehouse District and the project footprint along SR 260, which is limited to the Posey and Webster Tunnels (Postmiles R1.1/R1.9). No temporary construction easements (TCEs) are required for the project.

Caltrans contacted the Native American Heritage Commission (NAHC) on August 6, 2024, requesting a review of their Sacred Lands File (SLF) to determine if there were known cultural resources within or near the APE. The results of the SLF, September 6, 2024, were positive and a list of Native American contacts affiliated with nine tribes with potential interest or information was provided.

The individuals from nine tribes were sent consultation letters under Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA), specifically Public Resources Code 21080.3.1 and Chapter 532 Statutes of 2014 (i.e., AB 52) regarding the proposed project on September 17, 2024. The Tribes contacted included: Amah Mutsun Tribal Band, Amah Mutsun Tribal Band of Mission San Juan Bautista, Confederated Villages of Lisjan Nation, Costanoan Rumsen Carmel Tribe, Indian Canyon Mutsun Band of Costanoan, Muwekma Ohlone Tribe of the SF Bay Area, Northern Valley Yokut / Ohlone Tribe, The Ohlone Indian Tribe, and Wuksachi Indian Tribe/Eshom Valley Band.

Responses have been received from six groups and requested follow-up information was sent to five groups on November 5, 2024. Consultation is ongoing. No other responses have been received.

Caltrans contacted eleven local agencies and interest groups with an invitation to a built resources stakeholder meeting scheduled for February 27, 2024. The meeting covered both the Caldecott Tunnel Bores 1, 2, and 3 Rehabilitation Project (EA 04-0J540) and the Posey Tube and Webster Tube Ventilation Upgrade Project (EA 04-2Y870) because of the similarities between the two projects. Since the meeting consultation has been conducted separately for the two projects given the differences in the degree of project effect.

The stakeholders included the Oakland Heritage Alliance; County of Alameda Parks, Recreation and Historical Commission; City of Oakland Landmarks Preservation Advisory Board; Oakland Cultural Heritage Survey; Contra Costa County Historical Landmarks Advisory Committee; City of Orinda Historic Landmarks Committee; Alameda County Historical Society; California Preservation Foundation; Contra Costa County Historical Society; Orinda Historical

Society; and Lafayette Historical Society. Of those invited the Oakland Heritage Alliance and the City of Orinda Landmarks Committee attended the meeting.

On November 7, 2024, Caltrans provided a Draft Finding of Effect to the Oakland Heritage Alliance; County of Alameda Parks, Recreation and Historical Commission; City of Oakland Landmarks Preservation Advisory Board; Oakland Cultural Heritage Survey; California Preservation Foundation; and the South of Nimitz Improvement Council, given their proximity, experience, and knowledge of the Posey Tube. Follow-up emails were sent on November 20 and no comments have been received on the Finding of Effect to date. Consultation is ongoing.

Caltrans, pursuant to Section 106 PA Stipulation X.B.1.a/b and Attachment 5, has determined a Finding of No Adverse Effect with Standard Conditions-Secretary of the Interior's Standards (FNAE-SC-SOIS), is appropriate for this undertaking. Caltrans completed a Historic Property Survey Report with attached FNAE-SC-SOIS Report, which was submitted to the Headquarters Cultural Studies Office (CSO) on November 20, 2024. CSO approved the undertaking's finding on December 5, 2024.

No further archaeology or architectural history studies are required at this time. However, if project plans change, further studies may be necessary. If previously unidentified cultural resources are unearthed during construction, work shall be halted in that area until a qualified archaeologist can assess the significance of the discovery.

The tasks from the Secretary of the Interior's Action Plan must be included in the Environmental Commitments Record (ECR), the Plans, Specifications and Estimates Package (PS&E), and implemented during construction, as follows:

AMM-CUL-1: Design Review and Constriction Monitoring: Prior to construction, the Architectural Historian (AH) will review the PS&E package to ensure that the project continues to meet the Secretary of the Interior's Standards for the Rehabilitation of Historic Properties (SOIS). The SOIS Action Plan should be included in the Resident Engineer (RE) Pending File. The RE will notify the AH at least three weeks in advance of the beginning of construction, and the AH will conduct Worker Environmental Awareness Training (WEAT) to emphasize the historical significance of the Posey Tube and the need to avoid damage. During construction, the AH conduct will spot monitoring and photo-documentation to ensure that the Project is being constructed to plans. Following completion of the Project and prior to release of the contractor, the Architectural Historian will perform a field review of the work, to document that the Project was constructed to plans.

The following standard commitments should also be included:

PF-CUL-1: Unanticipated Discovery. In the event that archaeological resources (sites, features, or artifacts) are exposed during construction activities, all construction work occurring within 60 feet of the find shall immediately stop until a qualified archaeologist, that meets the Secretary of the Interior Professional Qualifications for Archaeology, can evaluate the significance of the find in consultation with the Tribe to determine whether or not additional study is warranted. Additional archaeological survey will be needed if project limits are extended beyond the present survey limits. Contact the Lead Caltrans Archaeologist in the Office of Cultural Resource Studies.

If any Tribal Cultural Resources (TCR) as defined by the Tribe and CEQA are found during construction, a Professionally Qualified Staff archaeologist shall assess the find. The Office of Cultural Resource Studies will notify local consulting Tribes if the resource is determined to be a TCR and consult with the contractor and the Tribe to determine whether the resources can be avoided by the Project. If the TCR cannot be avoided, then further consultation efforts with the Tribes would be necessary to determine its treatment.

PF-CUL-2: If Caltrans Professionally Qualified Staff determines that cultural materials contain human remains, State Health and Safety Code Section 7050.5 states that further disturbances and activities shall stop in any area or nearby area suspected to overlie remains. Caltrans' Cultural Resources Studies Office will contact the County Coroner. Pursuant to CA PRC Section 5097.98, if the remains are thought by the coroner to be Native American, the coroner will notify the NAHC, which will then notify the Most Likely Descendent. Caltrans, District 4, Cultural Resources Studies Office will work with the Most Likely Descendent on the respectful treatment and disposition of the remains. Further provisions of PRC 5097.98 are to be followed as applicable.

If there are any questions about the content of this memo or other project related items, please contact Lindsay Busse at (510) 847-1977, Lindsay.Busse@dot.ca.gov, or Charles Palmer at (510) 847-2654, Charles.Palmer@dot.ca.gov.

c: OCRS, HRC

ATTACHMENT N
SWDR (Storm Water Data Report)

EA 2Y780 October 2024

Short Form - Stormwater Data Report Template

Dist-County-Route: 04-ALAMEDA-260
Post Mile Limits: 1.1/1.8
Project Type: Posey and Webster Tubes
Project ID (EA): 2Y780

☐ PID ☒ PA/ED ☐ PS&E

Regional Water Quality Control Board(s): San Francisco Bay - Region 2

1.	Does the project disturb 5 or more acres of soil?	Yes ☐	No ☒
2.	Does the project disturb 1 or more acres of soil and not qualify for the	Yes ☐	No ☒
3.	Is the project required to implement Treatment BMPs?	Yes ☐	No ☒
4.	Does the project impact existing Treatment BMPs?	Yes ☐	No ☒

Phase:

Rainfall Erosivity Waiver?

If the answer to any of the preceding questions is "Yes", prepare a Long Form – Stormwater Data Report. Unless otherwise agreed upon by the District/Regional Design Stormwater Coordinator.

Applicable Caltrans Permit Post Construction Treatment Requirement: 2012 ☐ 2022 ☒

Total Disturbed Soil Area: 0 New Impervious Surface: 0

Estimated Const. Start Date: 10/01/2026 Estimated Const. Completion Date: 12/30/28

Risk Level:	RL 1 ☐	RL 2 ☐	RL 3 ☐	Not Applicable ☒
Is (M)WELO applicable?	Yes ☐	No ☒		

This Short Form – Stormwater Data Report has been prepared under the direction of the following Licensed Person. The Licensed Person attests to the technical information contained

herein and the data upon which recommendations, conclusions, and decisions are based. Professional Engineer or Landscape Architect stamp required at PS&E only.

10/29/2024

Demeke M Tsige, Registered Project Engineer/Landscape Architect *Date*

I have reviewed the stormwater quality design issues and find this report to be complete, current, and accurate:

Stamp Required at PS&E on

Mojgan Osooli 10/30/2024

Mojgan Osooli, District/Regional Design SW Coordinator or Designee *Date*

1. Project Description

The project aims to upgrade the Posey and Webster Tubes to ensure compliance with the life-safety objectives outlined in NFPA 502, the Standard for Road Tunnels and Limited Access Highways. The primary focus of these upgrades will be on enhancing emergency ventilation systems. This includes installing ceiling jet fans near the Webster Tube's entry portal on State Route 260 and converting the existing ventilation systems in both the Posey and Webster Tubes from transverse to longitudinal configurations to align with the project's safety goals. These ventilation improvements will specifically target fire mitigation for heavy goods vehicle incidents, enhance smoke management for safe egress, and improve firefighting operational response. Furthermore, deluge sprinkler systems will be introduced within the tubes. The design of the ventilation system will be independent of the deluge system design.

The project NIS is less than 10,000 square feet (~0.23 acres) with no 404 or 401 permit requirements.

Disturbed Soil Area (acres)	Net New Impervious (acres)	Replaced Impervious Area (acre)	New Impervious Surface (acres)
0	0	0	0

2. Site Data and Stormwater Quality Design Issues

The primary federal law regulating water quality is the Federal Clean Water Act (CWA), issued by the U.S. Environmental Protection Agency (USEPA). The USEPA delegated its authority in California to the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs). Each RWQCB prepares and adopts its water quality control plan (Basin Plan), which is a master policy document for managing surface and groundwater quality in the region. The SWRCB and RWQCBs issue permits that implement the standards included in the Basin Plan as well as other requirements of the State Water Code and the CWA.

Section 401 of the CWA requires a water quality certification from either the SWRCB or RWQCB when a project would require a federal permit, resulting from a discharge to waters of the United States. Impacts to Waters of the U.S. is not anticipated, thus a Section 404 permit, issued by the U.S. Army Corps of Engineers (USACE) and a Section 401 certification, issued by the North Coast RWQCB, are not required.

To ensure compliance with CWA Section 402, the SWRCB issued the Department a Statewide 2022 NPDES Stormwater Permit to regulate stormwater discharges from Department facilities. The SWRCB issued a statewide Construction General Permit for construction activities (2009-0009-DWQ, CAS000002, as amended by 2010-0014-DWQ and 2012-0006-DWQ), hereafter "CGP," that applies to stormwater discharges from land where clearing, grading, and excavation result in a DSA of one acre or greater. Construction activity resulting in a DSA of less than 1.0 acre is subject to the CGP if the construction activity is part of a larger Common Plan of Development totaling 1.0 acre or more of DSA, or if there is potential for significant water quality impairment resulting from the activity as determined by the RWQCB. Projects subject to the CGP require a Stormwater Pollution Prevention Plan (SWPPP). Projects not subject to the CGP require a Water Pollution Control Program (WPCP), per the Department's Standard Specifications. Since the DSA is under an acre, a WPCP will be required.

Project Location and Receiving Water Bodies

The project area is within the San Francisco Bay Regional Water Quality Board, hereafter "Region 2", which is responsible for implementation of State and Federal laws and regulations for water quality protection.

The Hydrologic Sub-Area # is 204.10. The project is in South Bay and located in a high-risk receiving watershed area.

The Oakland Inner Harbor-San Francisco Bay is on the 2020-2022 303(d) List and impaired for Indicator Bacteria, Chlordane, DDT, Dieldrin, Furan Compounds, Invasive Species, Lead, Mercury, PCBs, Selenium and Zinc. Per San Francisco Bay Central and Lower Hydrologic Subarea contains all three beneficial uses commercial, estuarine habitat, industrial service supply, fish migration, navigation, rare and endangered species, water contact recreation, noncontact water recreation, shell, fish spawning and wildlife habitat. The characteristics confirm the high-risk area.

Climatography

The project is in a region characterized by moderate temperatures and a rainy season between November through April 15 (Department *Construction Site Best Management Practices (BMPs) Manual*, March 2010). Average annual precipitation is about 19.84 inches in the project area.
Topography and Soil Characteristics

The topography is mostly flat. The soil-erodibility factor (K) is characterized by 3 factors. (1) The susceptibility of surface or soil to erosion (2) transport of sediment (3) rate and amount of runoff given a rainfall input within standard conditions. Fine-textured soils that are high in clay have low K about 0.05 to 0.15. K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment, and they produce runoff at moderate rates. The soil-erodibility factor (K) is 0.15 for the project area.

3. Construction Site BMPs

Potential Temporary and Permanent Water Quality Impacts

Construction impacts to receiving waterbodies that should be addressed by the Department include turbidity and pH. This could result from the discharge of sediment and cement beyond the site perimeter. Post-construction impacts do not need to be addressed, since the project has no permits and the estimated acre of new and replaced impervious surfaces is than 1 acre.

Avoidance, Minimization, and/or Mitigation

Temporary Impacts

To prevent or reduce impacts, temporary Construction Site Best Management Practices (BMPs) can be implemented for sediment control and material management - although they do not appear to be of concern for this project scope. If any disturbed soil were within the project limit - drainage inlet protection and street sweeping could be considered.

Permanent Impacts

Under the 2022 NPDES Permit the project does not need to consider permanent Water Quality Treatment BMPs. Permanent treatment such as biofiltration strips or Biofiltration swales (area permitting) will not be required.

Water Pollution Control Program (WPCP)

Prior to commencement of construction activities, a WPCP will be prepared by the Contractor and approved by the Department. The WPCP addresses potential temporary impacts via implementation of appropriate BMPs, such as those mentioned above, to the Maximum Extent Practicable.

Project specific BMP measures will be specified and quantified during the design phase. Temporary construction BMPs have been estimated at (2%) of the total project cost ($37,337,522) resulting in $746,750 in accordance with the Project Initiation Cost Estimate Method, Appendix F.3.1. This is a conservative approach as based on the project scope it is anticipated to be less than estimated.

The disturbed soil area for the proposed project is less than 10,000 square feet (~0.23 acre). To comply with the 2022 Caltrans NPDES, Permit and address the temporary water quality impacts resulting from construction activities in this project, the construction activities need to comply with Standard Specifications 13-2 “Water Pollution Control Program: The Standard Specifications address the preparation of the WPCP document and the implementation of WPCP during construction.

Trash Capture

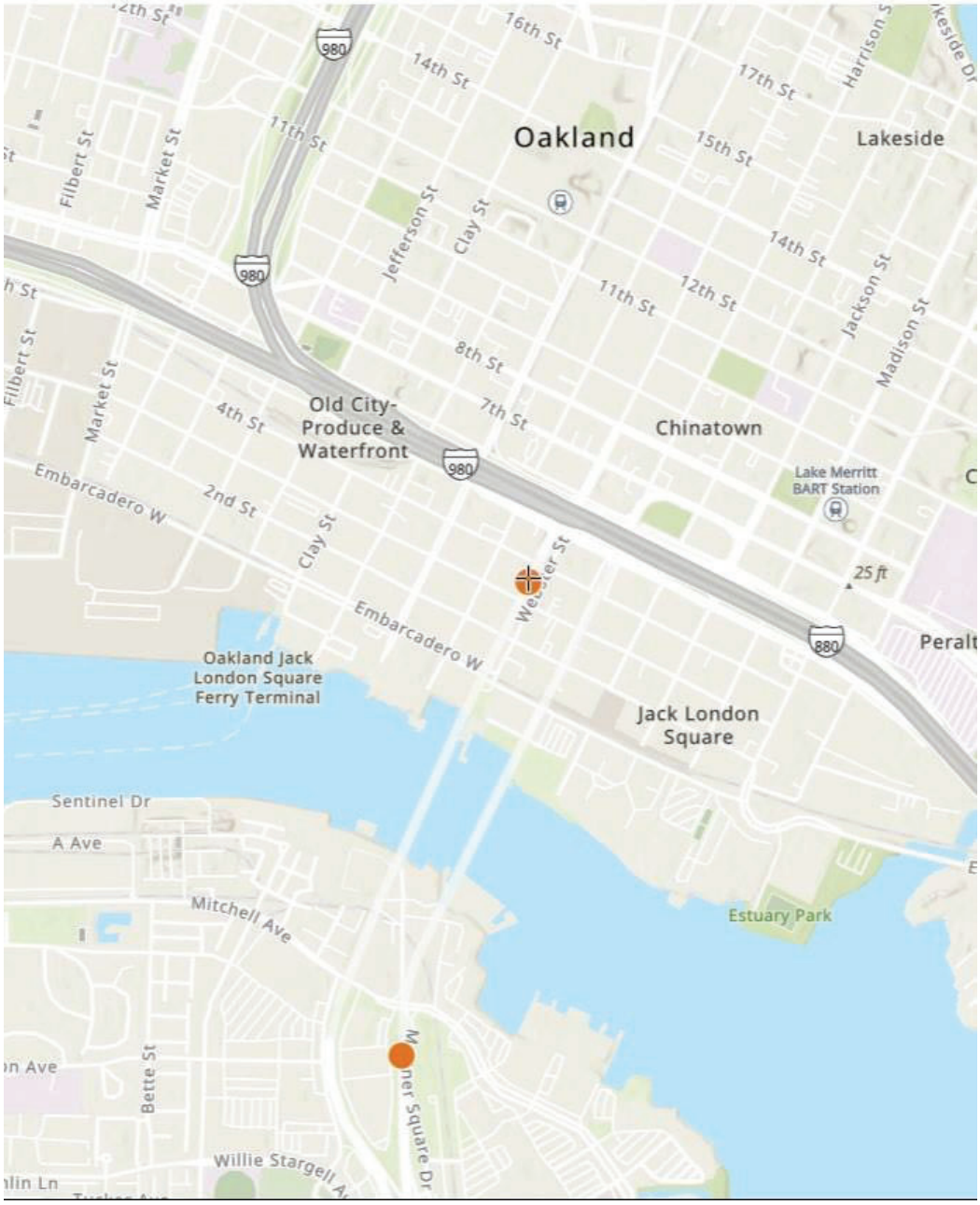
Caltrans must place trash capture for projects that are within a Significant Trash Generating Area. This project is within a low trash generating area, and thus a trash feasibility study is not required.

Required Attachments[1]

- Vicinity Map
- Evaluation Documentation Form

[1] Additional attachments may be required as applicable or directed by the District/Regional Design Stormwater Coordinator (e.g., BMP line item estimate, SW, DPP, and CS Checklists).

Vicinity Map



Evaluation Documentation Form

No.	Criteria	Yes ✓	No ✓	Supplemental Information for Evaluation
1.	Begin Project evaluation regarding requirement for implementation of Treatment BMPs	✓		Continue to 2.
2.	Is the scope of the Project to install Treatment BMPs (e.g., Alternative Compliance or TMDL requirement)?		✓	If Yes, go to 8. If No, continue to 3.
3.	Is there a direct or indirect discharge to surface waters?	✓		If Yes, continue to 4. If No, go to 9.
4.	As defined in the WQAR or ED, does the project: a. discharge to Areas of Special Biological Significance (ASBS), or b. discharge to a TMDL watershed where Caltrans is named stakeholder, or c. have other pollution control requirements for surface waters within the project limits (e.g. STGA)?		✓	If Yes to any, contact the District/Regional Design Stormwater Coordinator or District/Regional NPDES Coordinator to discuss the Department's obligations, go to 8 or 5. _____(Dist./Reg. Coordinator initials) If No to all, continue to 5.
		✓		
			✓	
5.	Are any existing Treatment BMPs partially or completely removed? (ATA Condition 1, Section 4.3.1)		✓	If Yes, go to 8 AND continue to 6. If No, continue to 6.
6.	Is this a Routine Maintenance Project?		✓	If Yes, go to 9. If No, continue to 7.
7.	Does the project result in an increase of 10,000 ft² or more of new impervious surface (NIS)?		✓	If Yes, go to 8. If No, go to 9.
8.	Project is required to implement Treatment BMPs.	Complete Checklist T-1, Part 1.		
9.	Project is not required to implement Treatment BMPs. _____ (Dist./Reg. Design SW Coord. Initials) _____ (Project Engineer Initials) 10/29/2024 _____ (Date)	Document for Project Files by completing this form and attaching it to the SWDR.		