



Noise Abatement Decision Report

Vol. I – Text & Tables

State Route 710 North Study

County of Los Angeles

07-LA-710 (SR 710)

E.A. 187900

EFIS 0700000191

September 2014

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September 2014

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List of Abbreviated Terms

23 CFR 772	Title 23, Code of Federal Regulations, Part 772
ADL	aerially deposited lead
APE	Area of Potential Effects
ATM	Active Traffic Management
BACMs	best available control measures
BMPs	Best Management Practices
BNB	BRT Noise Barrier
BRT	Bus Rapid Transit
BSA	biological study area
Cal State LA	California State University, Los Angeles
Cal-IPC	California Invasive Plant Inventory
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CIDH	cast-in-drilled-hole
CMS	changeable message signs
County	Los Angeles County
dB	decibels
dba	A-weighted decibels
ED	environmental document
ESA	Environmentally Sensitive Area
FHWA	Federal Highway Administration
ft	feet
FTA	Federal Transit Administration
FTIP	Federal Transportation Improvement Program
FTNB	Freeway Tunnel Noise Barrier
I-10	Interstate 10
I-210	Interstate 210
I-5	Interstate 5
I-605	Interstate 605
I-710	Interstate 710

IEN	Information Exchange Network
ITS	Intelligent Transportation Systems
L _{eq}	equivalent continuous sound level
LRT	Light Rail Transit
LRTP	Long Range Transportation Plan
LSA	LSA Associates, Inc.
Metro	Los Angeles County Metropolitan Transportation Authority
mi	miles
MLD	Most Likely Descendant
mph	miles per hour
NAC	Noise Abatement Criteria
NADR	Noise Abatement Decision Report
NAHC	Native American Heritage Commission
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NSR	Noise Study Report
O&M	operations and maintenance
PIR/PER	Paleontological Identification Report/Paleontological Evaluation Report
PMP	Paleontological Mitigation Plan
PRC	Public Resources Code
Protocol	Traffic Noise Analysis Protocol
PS&E	Plans, Specifications, and Estimates
ROW	right of way
RTP	Regional Transportation Plan
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCS	Sustainable Communities Strategy
SR 110	State Route 110
SR 134	State Route 134
SR 2	State Route 2
SR 60	State Route 60
SR 710	State Route 710

SWPPP	Storm Water Pollution Prevention Plan
TAP	Transit Access Pass
TDM	Transportation Demand Management
TeNS	Technical Noise Supplement
TNB	TSM/TDM Noise Barrier
TNM	Traffic Noise Model
TRB	Transportation Research Board
TSM	Transportation System Management
TSSP	Traffic Signal Synchronization Program

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Chapter 1. Introduction

The Noise Abatement Decision Report (NADR) presents the preliminary noise abatement decision as defined in the California Department of Transportation (Caltrans) 2011 Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol). This report has been approved by a California licensed professional civil engineer. The *Noise Study Report* (NSR) for the State Route 710 (SR 710) North Study, prepared by LSA Associates, Inc. (LSA) in May 2014, is hereby incorporated by reference. All figures associated with this report are found in the supplemental State Route 710 North Study Noise Abatement Decision Report Volume II.

1.1. Noise Abatement Assessment Requirements

Title 23, Code of Federal Regulations, Part 772 (23 CFR 772) of the Federal Highway Administration (FHWA) standards and the Protocol require that noise abatement be considered for projects that are predicted to result in traffic noise impacts. A traffic noise impact is considered to occur when future predicted design-year noise levels with the project “approach or exceed” the Noise Abatement Criteria (NAC) defined in 23 CFR 772 or when the predicted design-year noise levels with the project substantially exceed existing noise levels. A predicted design-year noise level is considered to “approach” the NAC when it is within 1 decibel (dB) of the NAC. A substantial increase is defined as being 12 A-weighted decibels (dBA) or more over the corresponding existing noise level.

The FHWA standards (23 CFR 772) require noise abatement measures that are reasonable and feasible and that are likely to be incorporated into the project be identified before adoption of the final environmental document (ED).

The Protocol establishes a process for assessing the reasonableness and feasibility of noise abatement. Before publication of the Draft ED, a preliminary noise abatement decision is made. The preliminary noise abatement decision is based on the feasibility of evaluated abatement and the preliminary reasonableness determination. Noise abatement is considered to be acoustically feasible if it provides a noise reduction of 5 dBA or more at receptors subject to noise impacts. Other non-acoustical factors relating to geometric standards (e.g., sight distances), safety, maintenance, and security can also affect feasibility.

For a noise barrier to be considered reasonable, the noise level reduction design goal of 7 dBA must be achieved at one or more benefited receptors. Once it is determined that one or more receptors satisfy the minimum noise reduction required, the preliminary reasonableness determination is made by calculating an allowance that is considered to be a reasonable amount of money, per benefited residence, to spend on abatement. This reasonable allowance is then compared to the engineer's cost estimate for the abatement, including with and without right-of-way costs. If the engineer's cost estimate is less than the allowance, the preliminary determination is that the abatement is reasonable. If the cost estimate is higher than the allowance, the preliminary determination is that abatement is not reasonable.

The NADR presents the preliminary noise abatement decision based on acoustical and non-acoustical feasibility factors and the relationship between noise abatement allowances and the engineer's cost estimate. The NADR does not present the final decision regarding noise abatement; rather, it presents key information on abatement to be considered throughout the environmental review process that is based on the best available information at the time the Draft ED is published. The final overall reasonableness decision will take this information into account, along with other reasonableness factors identified during the environmental review process. These factors may include:

- The noise reduction design goal;
- The cost of noise abatement; and
- The viewpoints of the benefited receptors (including property owners and residents of the benefited receptors).

At the end of the public review process for the ED, the final noise abatement decision is made and is indicated in the Final ED. The final decision of the noise abatement will be made upon completion of the project design and public involvement processes.

1.2. Purpose of the Noise Abatement Decision Report

The purpose of the NADR is to:

- Summarize the conclusions of the NSR relating to acoustical feasibility and the reasonable allowances for abatement evaluated;
- Present the engineer's cost estimate for evaluated abatement;
- Present the engineer's evaluation of non-acoustical feasibility issues;

- Present the preliminary noise abatement decision; and
- Present preliminary information on the secondary effects of abatement (e.g., impacts on cultural resources, scenic views, hazardous materials, and biological resources).

The NADR does not address noise barriers or other noise-reducing treatments required as mitigation for significant adverse environmental effects identified under the California Environmental Quality Act (CEQA).

1.3. Project Description

Caltrans, in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro), proposes transportation improvements to improve mobility and relieve congestion in the area between State Route 2 (SR 2) and Interstates 5, 10, 210 and 605 (I-5, I-10, I-210, and I-605, respectively) in east/northeast Los Angeles and the western San Gabriel Valley. The study area for the SR 710 North Study as depicted on Figure 1-1 is approximately 100 square miles and is generally bounded by I-210 on the north, I-605 on the east, I-10 on the south, and I-5 and SR 2 on the west. Caltrans is the Lead Agency under CEQA and the National Environmental Policy Act (NEPA).

1.3.1. Alternatives

The proposed alternatives include the No Build Alternative, the Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative, the Bus Rapid Transit (BRT) Alternative, the Light Rail Transit (LRT) Alternative, and the Freeway Tunnel Alternative. These alternatives are each discussed below.

1.3.1.1. No Build Alternative

The No Build Alternative includes projects/planned improvements through 2035 that are contained in the Federal Transportation Improvement Program (FTIP), as listed in the Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) Measure R and the funded portion of Metro's 2009 Long Range Transportation Plan (LRTP). The No Build Alternative does not include any planned improvements to the SR 710 Corridor. Figure 1-2 illustrates the projects in the No Build Alternative.

1.3.1.2. TSM/TDM Alternative

The TSM/TDM Alternative consists of strategies and improvements to increase efficiency and capacity for all modes in the transportation system with lower capital

cost investments and/or lower potential impacts. The TSM/TDM Alternative is designed to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. Components of the TSM/TDM Alternative are shown on Figure 1-3. TSM strategies increase the efficiency of existing facilities (i.e., TSM strategies are actions that increase the number of vehicle trips a facility can carry without increasing the number of through lanes).

Transportation System Management

TSM strategies include Intelligent Transportation Systems (ITS), local street and intersection improvements, and Active Traffic Management (ATM):

ITS Improvements

ITS improvements include traffic signal upgrades, synchronization and transit prioritization, arterial changeable message signs (CMS), and arterial video and speed data collection systems. The TSM/TDM Alternative includes signal optimization on corridors with signal coordination hardware already installed by Metro's Traffic Signal Synchronization Program (TSSP). These corridors include Del Mar Avenue, Rosemead Boulevard, Temple City Boulevard, Santa Anita Avenue, Fair Oaks Avenue, Fremont Avenue, and Peck Road. The only remaining major north-south corridor in the San Gabriel Valley in which TSSP has not been implemented is Garfield Avenue; therefore, TSSP on this corridor is included in the TSM/TDM Alternative. The locations are shown in Table 1.1.

Table 1.1 TSM/TDM Alternative Elements

ID No.	Description	Location
ITS Improvements		
ITS-1	Transit Signal Priority	Rosemead Boulevard (from Foothill Boulevard to Del Amo Boulevard)
ITS-2	Install Video Detection System on SR 110	SR 110 north of US-101
ITS-3	Install Video Detection System at Intersections	At key locations in study area
ITS-4	Arterial Speed Data Collection	On key north/south arterials
ITS-5	Install Arterial CMS	At key locations in study area
ITS-6	Traffic Signal Synchronization on Garfield Avenue	Huntington Drive to I-10
ITS-7	Signal optimization on Del Mar Avenue	Huntington Drive to I-10
ITS-8	Signal optimization on Rosemead Boulevard	Foothill Boulevard to I-10
ITS-9	Signal optimization on Temple City Boulevard	Duarte Road to I-10
ITS-10	Signal optimization on Santa Anita Avenue	Foothill Boulevard to I-10
ITS-11	Signal optimization on Peck Road	Live Oak Avenue to I-10
ITS-12	Signal optimization on Fremont Avenue	Huntington Drive to I-10

CMS = changeable message signs
 I-10 = Interstate 10
 ITS = Intelligent Transportation Systems
 SR 110 = State Route 110
 TDM = Transportation Demand Management
 TSM = Transportation System Management
 US-101 = United States Route 101

The following provide a further explanation of the ITS elements listed above:

- Traffic signal upgrades include turn arrows, vehicle and/or bicycle detection, pedestrian countdown timers, incorporation into regional management traffic center for real-time monitoring of traffic and updating of signal timing.
- Synchronization is accomplished through signal coordination to optimize travel times and reduce delay.
- Transit signal prioritization includes adjusting signal times for transit vehicles to optimize travel times for public transit riders.
- Arterial CMS are used to alert travelers about unusual road conditions, special event traffic, accident detours, and other incidents.
- Video and speed data collection includes cameras and other vehicle detection systems that are connected to a central monitoring location, allowing for faster detection and response to traffic incidents and other unusual traffic conditions.

Local Street and Intersection Improvements

The local street and intersection improvements are within the Cities of Los Angeles, Pasadena, South Pasadena, Alhambra, San Gabriel, Rosemead, and San Marino. Table 1.2 outlines the locations of the proposed improvements to local streets, intersections, and freeway ramps as well as two new local roadways. As identified in Table 1.2, Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road) would only be constructed with the BRT and TSM/TDM Alternatives.

Active Traffic Management

ATM technology and strategies are also included in the TSM/TDM Alternative. The major elements of ATM are arterial speed data collection and CMS. Data on arterial speeds would be collected and distributed through Los Angeles County's Information Exchange Network (IEN). Many technologies are available for speed data collection or the data could be purchased from a third-party provider. Travel time data collected through this effort could be provided to navigation system providers for distribution to the traveling public. In addition, arterial CMS or "trailblazer" message signs would be installed at key locations to make travel time and other traffic data available to the public.

Table 1.2 Local Street and Intersection Improvements of the TSM/TDM Alternative

ID No.	Description	Location
Local Street Improvements		
L-1	Figueroa Street from SR 134 to Colorado Boulevard	City of Los Angeles (Eagle Rock)
L-2a	Fremont Avenue from Huntington Drive to Alhambra Road	City of South Pasadena
L-2c	Fremont Avenue from Mission Road to Valley Boulevard	City of Alhambra
L-3 ¹	Atlantic Boulevard from Glendon Way to I-10	City of Alhambra
L-4	Garfield Avenue from Valley Boulevard to Glendon Way	City of Alhambra
L-5	Rosemead Boulevard from Lower Azusa Road to Marshall Street	City of Rosemead
L-8 ¹	Fair Oaks Avenue from Grevelia Street to Monterey Road	City of South Pasadena
Intersection Improvements		
I-1	West Broadway/Colorado Boulevard	City of Los Angeles (Eagle Rock)
I-2	Eagle Rock Boulevard/York Boulevard	City of Los Angeles (Eagle Rock)
I-3	Eastern Avenue/Huntington Drive	City of Los Angeles (El Sereno)
I-4	SR 710 SB On-Ramp/Valley Boulevard	City of Alhambra
I-5	SR 710 NB Off-Ramp/Valley Boulevard	City of Alhambra
I-8	Fair Oaks Avenue/Monterey Road	City of South Pasadena
I-9	Fremont Street/Monterey Road	City of South Pasadena
I-10	Huntington Drive/Fair Oaks Avenue	City of South Pasadena
I-11	Fremont Avenue/Huntington Drive	City of South Pasadena
I-13	Huntington Drive/Garfield Avenue	Cities of Alhambra/South Pasadena/San Marino
I-14	Huntington Drive/Atlantic Boulevard	Cities of Alhambra/South Pasadena/San Marino
I-15	Atlantic Boulevard/Garfield Avenue	Cities of Alhambra/South Pasadena/San Marino
I-16	Garfield Avenue/Mission Road	City of Alhambra
I-18	San Gabriel Boulevard/Huntington Drive	City of San Marino/Unincorporated Los Angeles County (East Pasadena/East San Gabriel)
I-19	Del Mar Avenue/Mission Road	City of San Gabriel
I-22	San Gabriel Boulevard/Marshall Street	City of San Gabriel
I-24	Huntington Drive/Oak Knoll Avenue	City of San Marino
I-25	Huntington Drive/Sierra Madre Boulevard	City of San Marino
I-43	Del Mar Avenue/Valley Boulevard	City of San Gabriel
I-44	Hellman Avenue/Fremont Avenue	City of Alhambra
I-45	Eagle Rock Boulevard/Colorado Boulevard	City of Los Angeles (Eagle Rock)
Other Road Improvements		
T-1 ²	Valley Boulevard to Mission Road Connector Road	Cities of Alhambra/Los Angeles (El Sereno)
T-2	SR 110/Fair Oaks Avenue Hook Ramps	Cities of South Pasadena/Pasadena
T-3 ³	St. John Avenue Extension between Del Mar Boulevard and California Avenue	City of Pasadena

¹ Local Street Improvements L-3 and L-8 would not be constructed with the BRT Alternative.

² Other Road Improvement T-1 would only be constructed with the BRT and TSM/TDM Alternatives.

³ Other Road Improvement T-3 would not be constructed with either the single-bore or dual-bore design variation of the Freeway Tunnel Alternative.

I-10 = Interstate 10

I-710 = Interstate 710

NB = northbound

SB = southbound

SR 110 = State Route 110

SR 134 = State Route 134

TDM = Transportation Demand Management

TSM = Transportation System Management

Transportation Demand Management

TDM strategies focus on regional means of reducing the number of vehicle trips and vehicle miles traveled as well as increasing vehicle occupancy. TDM strategies facilitate higher vehicle occupancy or reduce traffic congestion by expanding the traveler's transportation options in terms of travel method, travel time, travel route, travel costs, and the quality and convenience of the travel experience. The TDM strategies include reducing the demand for travel during peak periods, reducing the use of motor vehicles, shifting the use of motor vehicles to uncongested times of the day, encouraging rideshare and transit use, eliminating trips (i.e., telecommuting), and improved transportation options. The TDM strategies include expanded bus service, bus service improvements, and bicycle improvements:

- **Expanded Bus Service and Bus Service Improvements:** Transit service improvements included in the TSM/TDM Alternative are summarized in Tables 1.3 and 1.4 and illustrated on Figure 1-3. The transit service improvements enhance bus headways between 10 and 30 minutes during the peak hour and 15 to 60 minutes during the off-peak period. Bus headways are the amount of time between consecutive bus trips (traveling in the same direction) on the bus route. Some of the bus service enhancements almost double existing bus service.
- **Bicycle Facility Improvements:** The bicycle facility improvements include on-street Class III bicycle facilities that support access to transit facilities through the study area and expansion of bicycle parking facilities at existing Metro Gold Line stations. Proposed bicycle facility improvements are outlined in Table 1.4.

1.3.1.3. BRT Alternative

The BRT Alternative would provide high-speed, high-frequency bus service through a combination of new, dedicated, and existing bus lanes, and mixed-flow traffic lanes to key destinations between East Los Angeles and Pasadena. The proposed route length is approximately 12 miles (mi). Figure 1-4 illustrates the BRT Alternative.

The BRT Alternative includes the BRT trunk line arterial street and station improvements, frequent bus service, new bus feeder services, and enhanced connecting bus services. The BRT Alternative also includes the active transportation and local street and intersection improvements that are part of the TSM/TDM Alternative. BRT includes bus enhancements identified in the TSM/TDM Alternative, except for improvements to Route 762.

Table 1.3 Transit Refinements of the TSM/TDM Alternative

Bus Route	Operator	Route Type	Route Description	Existing Headways		Enhanced Headways	
				Peak	Off-Peak	Peak	Off-Peak
70	Metro	Local	From Downtown Los Angeles to El Monte via Garvey Avenue	10-12	15	10	15
770	Metro	Rapid	From Downtown Los Angeles to El Monte via Garvey Avenue/Cesar Chavez Avenue	10-13	15	10	15
76	Metro	Local	From Downtown Los Angeles to El Monte via Valley Boulevard	12-15	16	10	15
78	Metro	Local	From Downtown Los Angeles to Irwindale via Las Tunas Drive	10-20	16-40	10	15
378	Metro	Limited	From Downtown Los Angeles to Irwindale via Las Tunas Drive	18-23	-	20	30
79	Metro	Local	From Downtown Los Angeles to Santa Anita via Huntington Drive	20-30	40-45	15	30
180	Metro	Local	From Hollywood to Altadena via Los Feliz/Colorado Boulevard	30	30-32	15	30
181	Metro	Local	From Hollywood to Pasadena via Los Feliz/Colorado Boulevard	30	30-32	15	30
256	Metro	Local	From Commerce to Altadena via Hill Avenue/Avenue 64/Eastern Avenue	45	45	30	40
258	Metro	Local	From Paramount to Alhambra via Fremont Avenue/Eastern Avenue	48	45-55	20	30
260	Metro	Local	From Compton to Altadena via Fair Oaks Avenue/Atlantic Boulevard	16-20	24-60	15	30
762 ¹	Metro	Rapid	From Compton to Altadena via Atlantic Boulevard	25	30-60	15	30
266	Metro	Local	From Lakewood to Pasadena via Rosemead Boulevard/Lakewood Boulevard	30-35	40-45	15	30
267	Metro	Local	From El Monte to Pasadena via Temple City Boulevard/Del Mar Boulevard	30	30	15	30
485	Metro	Express	From Union Station to Altadena via Fremont/Lake Avenue	40	60	30	60
487	Metro	Express	From Westlake to El Monte via Santa Anita Avenue/Sierra Madre Boulevard/San Gabriel Boulevard	18-30	45	15	30
489	Metro	Express	From Westlake to East San Gabriel via Rosemead Boulevard	18-20	-	15	-
270	Metro	Local	From Norwalk to Monrovia via Workman Mill/Peck Road	40-60	60	30	60
780	Metro	Rapid	From West LA to Pasadena via Fairfax Avenue/Hollywood Boulevard/Colorado Boulevard	10-15	22-25	10	20
187	Foothill	Local	From Pasadena to Montclair via Colorado Boulevard/Huntington Drive/Foothill Boulevard	20	20	15	15

¹ This route would not be included as part of the BRT Alternative because the BRT Alternative would replace this service.

BRT = Bus Rapid Transit

Express = Express Bus

Foothill = Foothill Transit

Metro = Los Angeles County Metropolitan Transportation Authority

Rapid = Bus Rapid Transit

TDM = Transportation Demand Management

TSM = Transportation System Management

Table 1.4 Active Transportation and Bus Enhancements of the TSM/TDM Alternative

ID No.	Description	Location
Bus Service Improvements		
Bus-1	Additional bus service	See Table 1.3 and Figure 1-3
Bus-2	Bus stop enhancements	Along TSM routes
Bicycle Facility Improvements		
Bike-1	Rosemead Boulevard bike route (Class III)	Colorado Boulevard to Valley Boulevard (through Los Angeles County, Temple City, Rosemead)
Bike-2	Del Mar Avenue bike route (Class III)	Huntington Drive to Valley Boulevard (through San Marino, San Gabriel)
Bike-3	Huntington Drive bike route (Class III)	Mission Road to Santa Anita Avenue (through the City of Los Angeles, South Pasadena, San Marino, Alhambra, Los Angeles County, Arcadia)
Bike-4	Foothill Boulevard bike route (Class III)	In La Cañada Flintridge
Bike-5	Orange Grove bike route (Class III)	Walnut Street to Columbia Street (in Pasadena)
Bike-6	California Boulevard bike route (Class III)	Grand Avenue to Marengo Avenue (in Pasadena)
Bike-7	Add bike parking at transit stations	Metro Gold Line stations
Bike-8	Improve bicycle detection at existing intersections	Along bike routes in study area

Metro = Los Angeles County Metropolitan Transportation Authority

TDM = Transportation Demand Management

TSM = Transportation System Management

Buses are expected to operate every 10 minutes during peak hours and every 20 minutes during off-peak hours. The BRT service would generally replace, within the study area, the existing Metro Route 762 service. The 12 mi route would begin at Atlantic Boulevard and Whittier Boulevard to the south, follow Atlantic Boulevard, Huntington Drive, Fair Oaks Avenue, Del Mar Boulevard, and end with a terminal loop in Pasadena to the north. Buses operating in the corridor would be given transit signal priority from a baseline transit signal priority project that will be implemented separately by Metro.

Where feasible, buses would run in dedicated bus lanes adjacent to the curb, either in one direction or both directions, during peak periods. The new dedicated bus lanes would generally be created within the existing street rights of way (ROW) through a variety of methods that include restriping the roadway, restricted on-street parking during peak periods, narrowing medians, planted parkways, or sidewalks. Buses would share existing lanes with other traffic in cases where there is not enough ROW. The exclusive lanes would be exclusive to buses and right-turning traffic during a.m. and p.m. peak hours only. At other times of day, the exclusive lanes would be available for on-street parking use.

A total of 17 BRT stations with amenities would be placed on average, at approximately 0.8 mi intervals at major activity centers and cross streets. Typical station amenities would include new shelters, branding elements, seating, wind

screens, leaning rails, variable message signs (next bus information), lighting, bus waiting signals, trash receptacles, and stop markers. Some of these stops will be combined with existing stops, while in some cases, new stops for BRT will be provided. The BRT service would include 60-foot (ft) articulated buses with three doors, and would have the latest fare collection technology such as on-board smart card (Transit Access Pass [TAP] card) readers to reduce dwell times at stations. The BRT stops would be provided at the following 17 locations:

- Atlantic Boulevard at Whittier Boulevard
- Atlantic Boulevard between Pomona Boulevard and Beverly Boulevard
- Atlantic Boulevard at Cesar Chavez Avenue/Riggin Street
- Atlantic Boulevard at Garvey Avenue
- Atlantic Boulevard at Valley Boulevard
- Atlantic Boulevard at Main Street
- Huntington Drive at Garfield Avenue
- Huntington Drive at Marengo Avenue
- Fair Oaks Avenue at Mission Street
- Fair Oaks Avenue at Glenarm Street
- Fair Oaks Avenue at California Boulevard
- Fair Oaks Avenue at Del Mar Boulevard
- Del Mar Boulevard at Los Robles Avenue
- Del Mar Boulevard at Lake Avenue
- Del Mar Boulevard at Hill Avenue (single direction only)
- Colorado Boulevard at Hill Avenue (single direction only)
- Colorado Boulevard at Lake Avenue (single direction only)

Additionally, this alternative would include bus feeder routes that would connect additional destinations with the BRT mainline. Two bus feeder routes are proposed: one that would run along Colorado Boulevard, Rosemead Boulevard, and Valley Boulevard to the El Monte transit station; and another bus feeder route that would travel from Atlantic Boulevard near the Gold Line station to the Metrolink stations in the City of Commerce and Montebello via Beverly Boulevard and Garfield Avenue. In addition, other existing bus services in the study area would be increased in frequency and/or span of service.

The TSM/TDM Alternative improvements would also be constructed as part of the BRT Alternative. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. As identified in Table 2.2, Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road) is one of the TSM/TDM Alternative improvements that would be constructed with the BRT Alternative. Local Street Improvements L-8 (Fair Oaks Avenue from Grevelia Street to Monterey Road) and the reversible lane component of L-3 (Atlantic Boulevard from Glendon Way to I-10) would not be constructed with the BRT Alternative.

1.3.1.4. LRT Alternative

The LRT Alternative would include passenger rail operated along a dedicated guideway, similar to other Metro light rail lines. The LRT alignment is approximately 7.5 mi long, with 3 mi of aerial segments and 4.5 mi of bored tunnel segments. Figure 1-5 illustrates the LRT Alternative.

The LRT Alternative would begin at an aerial station on Mednik Avenue adjacent to the existing East Los Angeles Civic Center Station on the Metro Gold Line. The alignment would remain elevated as it travels north on Mednik Avenue, west on Floral Drive, north across Corporate Center Drive, and then along the west side of Interstate 710 (I-710) and State Route 110 (SR 110), primarily in Caltrans ROW, to a station adjacent to the California State University, Los Angeles (Cal State LA). The alignment would descend into a tunnel south of Valley Boulevard and travel northeast to Fremont Avenue, north under Fremont Avenue, and easterly to Fair Oaks Avenue. The alignment would then cross under SR 110 and end at an underground station beneath Raymond Avenue adjacent to the existing Fillmore Station on the Metro Gold Line.

Two directional tunnels are proposed with tunnel diameters approximately 20 ft each, located approximately 60 ft below the ground surface. Other supporting tunnel systems include emergency evacuation cross passages for pedestrians, a ventilation system consisting of exhaust fans at each portal and an exhaust duct along the entire length of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring, similar to the existing LRT system.

Trains would operate at speeds of up to 65 miles per hour (mph) approximately every 5 minutes during peak hours and 10 minutes during off-peak hours.

Seven stations would be located along the LRT alignment at Mednik Avenue in East Los Angeles, Floral Drive in Monterey Park, Cal State LA, Fremont Avenue in Alhambra, Huntington Drive in South Pasadena, Mission Street in South Pasadena, and Fillmore Street in Pasadena. The Fremont Avenue Station, the Huntington Drive Station, the Mission Street Station, and the Fillmore Street Station would be underground stations. New Park-and-Ride facilities would be provided at all of the proposed stations except for the Mednik Avenue, Cal State LA, and Fillmore Street stations.

A maintenance yard to clean, maintain, and store light rail vehicles would be located on both sides of Valley Boulevard at the terminus of SR 710. A track spur from the LRT mainline to the maintenance yard would cross above Valley Boulevard.

Two bus feeder services would be provided. One would travel from the Commerce Station on the Orange County Metrolink line and the Montebello Station on the Riverside Metrolink line to the Floral Station, via East Los Angeles College. The other would travel from the El Monte Bus Station to the Fillmore Station via Rosemead and Colorado Boulevards. In addition, other existing bus services in the study area would be increased in frequency and/or span of service.

As part of the LRT Alternative, the SR 710 southbound on-ramp at Valley Boulevard would be modified.

The TSM/TDM Alternative improvements would also be constructed as part of the LRT Alternative. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only component of the TSM/TDM Alternative improvements that would not be constructed with the LRT Alternative is Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road).

1.3.1.5. Freeway Tunnel Alternative

The alignment for the Freeway Tunnel Alternative starts at the existing southern stub of SR 710 in Alhambra, just north of I-10, and connects to the existing northern stub of SR 710, south of the I-210/State Route 134 (SR 134) interchange in Pasadena. The Freeway Tunnel Alternative has two design variations: a dual-bore tunnel and a single-bore tunnel. Both tunnel design variations would include the following tunnel support systems: emergency evacuation for pedestrians and vehicles, air scrubbers, a ventilation system consisting of exhaust fans at each portal, an exhaust duct along the

entire length of the tunnel and jet fans within the traffic area of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring. An operations and maintenance (O&M) building would be constructed at the northern and southern ends of the tunnel. There would be no operational restrictions for the tunnel, with the exception of vehicles carrying flammable or hazardous materials. Figure 1-6 illustrates the dual-bore and single-bore tunnel design variations for the Freeway Tunnel Alternative.

As part of both design variations of the Freeway Tunnel Alternative, the SR 710 northbound off-ramp and southbound on-ramp at Valley Boulevard would be modified.

The TSM/TDM Alternative improvements would also be constructed as part of the Freeway Tunnel Alternative, including either the dual-bore or single-bore design variations. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only components of the TSM/TDM Alternative improvements that would not be constructed with the Freeway Tunnel Alternative are Other Road Improvements T-1 (Valley Boulevard to Mission Road Connector Road) and T-3 (St. John Avenue Extension between Del Mar Boulevard and California Avenue).

Design Variations

The Freeway Tunnel Alternative includes two design variations. These variations relate to the number of tunnels constructed. The dual-bore design variation includes two tunnels that independently convey northbound and southbound vehicles. The single-bore design variation includes one tunnel that carries both northbound and southbound vehicles. Each of these design variations is described below.

- **Dual-Bore Tunnel:** The dual-bore tunnel variation is approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The dual-bore tunnel variation would consist of two side-by-side tunnels (one northbound, one southbound), each tunnel of which would have two levels. Each tunnel would consist of two lanes of traffic on each level, traveling in one direction, for a total of four lanes in each tunnel. The northbound tunnel would be constructed for northbound traffic, and the southbound tunnel would be constructed for southbound traffic. Each bored tunnel would have an outside diameter of approximately 60 ft and would be located approximately 120 to 160 ft

below the ground surface. Vehicle cross passages would be provided throughout this tunnel variation that would connect one tunnel to the other tunnel for use in an emergency situation. Figure 1-6 illustrates the dual-bore tunnel variation of the Freeway Tunnel Alternative.

Short segments of cut-and-cover tunnels would be located at the south and north termini to provide access via portals to the bored tunnels. The portal at the southern terminus would be located south of Valley Boulevard. The portal at the northern terminus would be located north of Del Mar Boulevard. No intermediate interchanges are planned for the tunnel.

- **Single-Bore Tunnel:** The single-bore tunnel design variation is also approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The single-bore tunnel variation would consist of one tunnel with two levels. Each level would have two lanes of traffic traveling in one direction. The northbound traffic would traverse the upper level, and the southbound traffic would traverse the lower level. The single-bore tunnel would provide a total of four lanes. The single-bore tunnel would also have an outside diameter of approximately 60 ft and would be located approximately 120 to 160 ft below the ground surface. The single-bore tunnel would be in the same location as the northbound tunnel in the dual-bore tunnel design variation. Figure 1-7 illustrates the single-bore tunnel variation cross section of the Freeway Tunnel Alternative.

Operational Variations

Five operational variations have been identified for the Freeway Tunnel Alternative, as described below:

- **Freeway Tunnel Alternative without Tolls:** The facility would operate as a conventional freeway with lanes open to all vehicles. This operational variation would be considered for only the dual-bore tunnel design variation.
- **Freeway Tunnel Alternative with Trucks Excluded:** The facility would operate as a conventional freeway; however, trucks would be excluded from using the tunnel. This operational variation would be considered for the dual-bore tunnel only. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction.
- **Freeway Tunnel Alternative with Tolls:** This operational variation would be considered for both the dual- and single-bore tunnels described above. All vehicles, including trucks, using the tunnel would be tolled.

- **Freeway Tunnel Alternative with Tolls and Trucks Excluded:** The facility would operate as a conventional freeway; however, trucks would be excluded from using the tunnel. This operational variation would be considered for the single-bore tunnel only. All automobiles would be tolled; however, trucks would be excluded from using the tunnel. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction.
- **Freeway Tunnel Alternative with Toll and Express Bus:** This operational variation would be considered for the single-bore tunnel only. The single-bore freeway tunnel would operate as a tolled facility and include an Express Bus component. The Express Bus would be allowed in any of the travel lanes in the tunnel; no bus-restricted lanes would be provided. The Express Bus route would start at the Commerce Station on the Orange County Metrolink line, and then serve the Montebello Station on the Riverside Metrolink line and East Los Angeles College before entering I-710 at Floral Drive. The bus would travel north to Pasadena via the proposed freeway tunnel, making a loop serving Pasadena City College, the California Institute of Technology, and downtown Pasadena before re-entering the freeway and making the reverse trip.

1.4. Affected Land Uses

Developed and undeveloped land uses in the project vicinity were identified through land use maps, aerial photography, and site inspection. Within each land use category, receptors were identified.

1.4.1. TSM/TDM Alternative

Existing land uses in the vicinity of the physical improvements included in the TSM/TDM Alternative include single-family and multifamily residences, five schools, commercial uses, two restaurants, a hospital, a church, a sports field, a park, office uses, industrial uses, and vacant land. Single-family and multifamily residential uses with private areas of frequent human use are evaluated under Activity Category B, which has an exterior NAC of 67 dBA equivalent continuous sound level (L_{eq}). Day-care centers, parks, medical facilities, museums, schools, and places of worship with frequent human outdoor uses are evaluated under Activity Category C, which has an exterior NAC of 67 dBA L_{eq} . Any residential uses or uses mentioned above in Category C that do not have areas of frequent human use are evaluated under Activity Category D, which has an interior NAC of 52 dBA L_{eq} . Hotels, office buildings, and commercial uses with areas of frequent human use are evaluated under Activity Category E, which has an exterior NAC of 72 dBA L_{eq} . Noise levels for industrial

uses and commercial uses without areas of frequent human use are classified as Activity Category F, which does not have an NAC level, and are presented for reporting purposes only. Existing land uses in the vicinity of each of the TSM/TDM Alternative improvements are described in further detail below.

- **Local Street Improvement L-2a:**
 - **Fremont Avenue South of Alhambra Road:** Land uses in this area include single-family and multifamily residences. Land uses along the northbound and southbound sides are at-grade with Fremont Avenue.
 - **Fremont Avenue Between Alhambra Road and Maple Street:** Land uses in this area include single-family residences. Land uses along the northbound and southbound sides are at-grade with Fremont Avenue.
 - **Fremont Avenue Between Maple Street and Huntington Drive:** Land uses in this area include single-family residences and a school. Land uses along the northbound and southbound sides are at-grade with Fremont Avenue.
- **Local Street Improvement L-3:**
 - **Atlantic Boulevard Between I-10 and Valley Boulevard:** Land uses in this area include single-family and multifamily residences and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 15 ft higher in elevation than Atlantic Boulevard.
- **Local Street Improvement L-4:**
 - **Garfield Avenue Between I-10 and Valley Boulevard:** Land uses in this area include single-family and multifamily residences, office uses, and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Garfield Avenue to 15 ft higher in elevation than Garfield Avenue.
- **Local Street Improvement L-5:**
 - **Rosemead Boulevard Between Marshall Street and Valley Boulevard:** Land uses in this area include single-family and multifamily residences, a restaurant, office uses, and commercial uses. Land uses along the northbound and southbound sides are at-grade with Rosemead Boulevard.
 - **Rosemead Boulevard Between Valley Boulevard and North of Lower Azusa Road:** Land uses in this area include single-family and multifamily residences, a restaurant, a school, a church, office uses, and commercial uses. Land uses along the northbound and southbound sides are at-grade with Rosemead Boulevard.

- **Local Street Improvement L-8:**
 - **Fair Oaks Avenue Between South of Monterey Road and Grevelia Street:** Land uses in this area include single-family and multifamily residences and commercial uses with frequent outdoor use areas. Land uses along the northbound and southbound sides are at-grade with Fair Oaks Avenue.
- **Other Road Improvement T-1:**
 - **SR 710 and Connector Road Between Paseo Rancho Castilla/Hellman Avenue and Alhambra Avenue/Mission Road:** Land uses in this area include single-family residences and a commercial use area (gas station). Land uses in this area range from 5 ft lower in elevation than SR 710 to 45 ft higher in elevation than SR 710 and the new connector road.
- **Other Road Improvement T-2:**
 - **SR 110 Between Fair Oaks Avenue and Glenarm Street:** Land uses in this area include single-family and multifamily residences, a public works facility, and a school. Land uses in this area range from 10 ft lower in elevation than SR 110 to 23 ft higher in elevation than SR 110.
- **Other Road Improvement T-3:**
 - **Pasadena Avenue Between Bellefontaine Street and Union Street:** Land uses in this area include multifamily residences, a church with frequent outdoor human use areas, a hospital, vacant land, and commercial uses with and without frequent outdoor use areas. Land uses in this area range from 5 ft lower in elevation than SR 710 to 30 ft higher in elevation than SR 710 and are generally at-grade with Pasadena Avenue.
 - **St. John Avenue Between Bellefontaine Street and Union Street:** Land uses in this area include single-family and multifamily residences, two schools, a sports field, and a park. Land uses in this area range from 5 ft lower in elevation than SR 710 to 40 ft higher in elevation than SR 710 and are generally at-grade with St. John Avenue.

1.4.2. BRT Alternative

Existing land uses in the vicinity of the BRT Alternative include single-family and multifamily residences, a day-care center, two parks, hospital/medical centers, a museum, two schools, two preschools, seven churches, three hotels, commercial uses, office uses, and industrial uses. Single-family and multifamily residential uses with private areas of frequent human use are evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq} . Day-care centers, parks, medical facilities,

museums, schools, and places of worship with frequent human outdoor uses are evaluated under Activity Category C, which has an exterior NAC of 67 dBA L_{eq} . Any residential uses or uses mentioned above in Category C that do not have areas of frequent human use are evaluated under Activity Category D, which has an interior NAC of 52 dBA L_{eq} . Hotels, office buildings, and commercial uses with areas of frequent human use are evaluated under Activity Category E, which has an exterior NAC of 72 dBA L_{eq} . Noise levels for industrial uses and commercial uses without areas of frequent human use are classified as Activity Category F, which does not have an NAC level, and are presented for reporting purposes only. Existing land uses in the vicinity of the BRT Alternative are described in further detail below.

- **Atlantic Boulevard Between Olympic Boulevard and Whittier Boulevard:** Land uses in this area include single-family residences and commercial uses. Land uses along the northbound and southbound sides are at-grade with Atlantic Boulevard.
- **Atlantic Boulevard Between Whittier Boulevard and Beverly Boulevard:** Land uses in this area include single-family and multifamily residences, a preschool, a church, a park, and commercial uses with and without outdoor eating areas. Land uses along the northbound and southbound sides are at-grade with Atlantic Boulevard.
- **Atlantic Boulevard Between Beverly Boulevard and State Route 60 (SR 60):** Land uses in this area include single-family and multifamily residences and commercial uses with and without outdoor eating areas. Land uses along the northbound and southbound sides are at-grade with Atlantic Boulevard.
- **Atlantic Boulevard Between SR 60 and Brightwood Street:** Land uses in this area include single-family and multifamily residences, a church, and commercial uses with and without outdoor eating areas. Land uses along the northbound side range from at-grade with Atlantic Boulevard to 50 ft higher in elevation than Atlantic Boulevard. Land uses along the southbound side range from at-grade with Atlantic Boulevard to 30 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between Brightwood Street and Cadiz Street:** Land uses in this area include single-family and multifamily residences, two churches, a health care center, and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 45 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between Cadiz Street and Garvey Avenue:** Land uses in this area include single-family and multifamily residences, a church, two hotels,

and commercial uses with and without outdoor eating areas. Land uses along the northbound side range from 25 ft lower in elevation than Atlantic Boulevard to 5 ft higher in elevation than Atlantic Boulevard. Land uses along the southbound side range from at-grade with Atlantic Boulevard to 80 ft higher in elevation than Atlantic Boulevard.

- **Atlantic Boulevard Between Garvey Avenue and I-10:** Land uses in this area include single-family and multifamily residences, a hotel with an outdoor pool area, an office with an outdoor eating area, and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 15 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between I-10 and Valley Boulevard:** Land uses in this area include single-family and multifamily residences, and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 15 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between Valley Boulevard and Main Street:** Land uses in this area include single-family and multifamily residences, a school with outdoor recreational areas, a church with frequent outdoor use areas, and office and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 5 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between Main Street and Alhambra Road:** Land uses in this area include single-family and multifamily residences, a church with frequent outdoor use areas, and commercial uses. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 5 ft higher in elevation than Atlantic Boulevard.
- **Atlantic Boulevard Between Alhambra Road and Huntington Drive:** Land uses in this area include single-family and multifamily residences, and commercial uses with and without outdoor eating areas. Land uses along the northbound and southbound sides range from at-grade with Atlantic Boulevard to 5 ft higher in elevation than Atlantic Boulevard.
- **Huntington Drive Between Atlantic Boulevard and Fletcher Avenue:** Land uses in this area include single-family and multifamily residences, a preschool with outdoor frequent human use, a medical building, a parcel under construction, and commercial uses. Land uses along the westbound side range from at-grade with Huntington Drive to 5 ft higher in elevation than Huntington Drive. Land uses along the eastbound side range from 5 ft lower in elevation than Huntington Drive to at-grade with Huntington Drive.

- **Huntington Drive Between Fletcher Avenue and Fair Oaks Avenue:** Land uses in this area include single-family and multifamily residences, and commercial uses. Land uses along the westbound side range from at-grade with Huntington Drive to 15 ft higher in elevation than Huntington Drive. Land uses along the eastbound side range from 5 ft lower in elevation than Huntington Drive to 10 ft higher in elevation than Huntington Drive.
- **Fair Oaks Avenue Between Huntington Drive and Monterey Road:** Land uses in this area include single-family and multifamily residences, a school, and office and commercial uses with and without outdoor eating areas. Land uses along the northbound side range from at-grade with Fair Oaks Avenue to 5 ft higher in elevation than Fair Oaks Avenue. Land uses along the southbound side range from at-grade with Fair Oaks Avenue to 15 ft higher in elevation than Fair Oaks Avenue.
- **Fair Oaks Avenue Between Monterey Road and SR 110:** Land uses in this area include single-family and multifamily residences, and commercial uses with frequent outdoor use areas. Land uses along the northbound and southbound sides are at-grade with Fair Oaks Avenue.
- **Fair Oaks Avenue Between SR 110 and Glenarm Street:** Land uses in this area include single-family and multifamily residences, a medical center, a museum, and office, commercial, and industrial uses. Land uses along the northbound side range from 5 ft lower in elevation than Fair Oaks Avenue to 30 ft higher in elevation than Fair Oaks Avenue. Land uses along the southbound side range from 5 ft lower in elevation than Fair Oaks Avenue to 15 ft higher in elevation than Fair Oaks Avenue.
- **Fair Oaks Avenue Between Glenarm Street and California Boulevard:** Land uses in this area include single-family and multifamily residences, a nursing home, medical centers, and office and commercial uses with frequent outdoor use areas. Land uses along the northbound and southbound sides are at-grade with Fair Oaks Avenue.
- **Fair Oaks Avenue Between California Boulevard and Del Mar Boulevard:** Land uses in this area include a park and commercial uses with frequent outdoor use areas. Land uses along the northbound side range from at-grade with Fair Oaks Avenue to 40 ft higher in elevation than Fair Oaks Avenue. Land uses along the southbound side range from 10 ft to 30 ft higher in elevation than Fair Oaks Avenue.

1.4.3. Freeway Tunnel Alternative

Existing land uses in the vicinity of the Freeway Tunnel Alternative study area include single-family and multifamily residences, a golf course, four schools, Cal State LA, a church, a hospital, office, commercial, and recreational uses, and vacant land. In addition, a planned office development is located within the project area at the intersection of South Pasadena Avenue and West Dayton Street. Single-family and multifamily uses with private areas of frequent human use are evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq} . Day-care centers, parks, golf courses, medical facilities, museums, schools, and places of worship with frequent human outdoor uses are evaluated under Activity Category C, which has an exterior NAC of 67 dBA L_{eq} . Any residential uses or uses mentioned above in Category C that do not have areas of frequent human use are evaluated under Activity Category D, which has an interior NAC of 52 dBA L_{eq} . Hotels, office buildings, and commercial uses with areas of frequent human use are evaluated under Activity Category E, which has an exterior NAC of 72 dBA L_{eq} . Noise levels for industrial uses and commercial uses without areas of frequent human use are classified as Activity Category F, which does not have an NAC level, and are presented for reporting purposes only. Areas of vacant or undeveloped land fall under Activity Category G, which also does not have an NAC level; therefore, noise levels for vacant or undeveloped land are presented for reporting purposes only. Existing land uses are described in further detail below.

- **Southeast Quadrant of SR 710 and I-10 Interchange:** Land uses in this area include single-family and multifamily residences, a golf course, and office and commercial uses. Land uses in this area are 10 to 150 ft higher in elevation than SR 710 and range from at-grade with I-10 to 175 ft higher in elevation than I-10. The single-family and multifamily residences were evaluated under Activity Category B, which has an exterior NAC of 67 dBA L_{eq} .
- **Northeast Quadrant of SR 710 and I-10 Interchange South of Paseo Rancho Castilla/Hellman Avenue:** Land uses in this area include single-family and multifamily residences. Land uses in this area range from 15 ft lower in elevation than SR 710 to 40 ft higher in elevation than SR 710, and range from 25 ft lower in elevation than I-10 to 50 ft higher in elevation than I-10.
- **SR 710 Northbound Side Between Paseo Rancho Castilla/Hellman Avenue and Alhambra Avenue/Mission Road:** Land uses in this area include single-family residences and a commercial use area (gas station). Land uses in this area

range from 5 ft lower in elevation than SR 710 to 45 ft higher in elevation than SR 710.

- **SR 710 Southbound Side Between Paseo Rancho Castilla/Hellman Avenue and Alhambra Avenue/Mission Road:** Land uses in this area include single-family and multifamily residences. Land uses in this area range from 5 ft lower in elevation than SR 710 to 30 ft higher in elevation than SR 710.
- **Northwest Quadrant of SR 710 and I-10 Interchange South of Paseo Rancho Castilla/Hellman Avenue:** Land uses in this area include multifamily residences, Cal State LA classrooms and sports fields, and commercial uses. Land uses in this area are 30 ft to 95 ft higher in elevation than SR 710 and 35 ft to 50 ft higher in elevation than I-10.
- **Southwest Quadrant of SR 710 and I-10 Interchange:** Land uses in this area include single-family residences, police training areas, and office uses. Land uses in this area are 50 ft to 210 ft higher in elevation than SR 710 and 95 ft to 170 ft higher in elevation than I-10.
- **SR 710 Northbound Side Between Bellefontaine Street and Union Street:** Land uses in this area include multifamily residences, a church with frequent outdoor human use areas, a hospital, vacant land, and commercial uses with and without frequent outdoor use areas. Land uses in this area range from 5 ft lower in elevation than SR 710 to 30 ft higher in elevation than SR 710.
- **Southeast Quadrant of SR 710 and SR 134/I-210 Interchange North of Union Street:** Land uses in this area include commercial and office uses. Land uses in this area are at-grade with SR 710 and range from at-grade with I-210 to 20 ft higher in elevation than I-210.
- **Northeast Quadrant of SR 710 and SR 134/I-210 Interchange, West of Fair Oaks Avenue:** Land uses in this area include single-family and multifamily residences, a school with an outdoor basketball court, and commercial uses. Land uses in this area range from 10 ft to 35 ft higher in elevation than I-210.
- **I-210 Southbound Side Between Walnut Street and Mountain Street:** Land uses in this area include single-family and multifamily residences and a school. Land uses in this area are 14 ft to 50 ft higher in elevation than I-210 and 15 ft to 20 ft lower in elevation than SR 134.
- **SR 134 Westbound Side West of Orange Grove Boulevard:** Land uses in this area include single-family and multifamily residences and commercial uses. Land uses in this area range from 10 ft lower in elevation than SR 134 to 35 ft higher in elevation than SR 134.

- **Southwest Quadrant of SR 710 and SR 134/I-210 Interchange, North of Union Street:** Land uses in this area include commercial uses. Land uses in this area are 40 ft higher in elevation than SR 710, and range from 40 ft lower in elevation than SR 134 to 20 ft higher in elevation than SR 134.
- **SR 710 Southbound Side Between Bellefontaine Street and Union Street:** Land uses in this area include single-family and multifamily residences, two schools, a sports field, and a park. Land uses in this area range from 5 ft lower in elevation than SR 710 to 40 ft higher in elevation than SR 710.

1.4.4. LRT Alternative

Existing land uses in the vicinity of the LRT Alternative include single-family and multifamily residences, vacant land, and office, commercial, and recreational uses. Receptors considered for analysis were located within 1,000 ft of the LRT alignment. Existing land uses are described in further detail below.

- **LRT Alignment Between 3rd Street and SR 60:** Land uses in this area include single-family residences, multifamily residences, and commercial uses. Under Federal Transit Administration (FTA) criteria, the single-family and multifamily residences are the noise sensitive uses considered for abatement.
- **LRT Alignment Between SR 60 and Floral Drive:** Land uses in this area include single-family residences, multifamily residences, a learning facility, an active park, and office and commercial uses. Under FTA criteria, the single-family residences, multifamily residences, and learning facility are the noise sensitive uses considered for abatement.
- **LRT Alignment Between Mednik Avenue and I-710:** Land uses in this area include single-family residences, multifamily residences, and office and commercial uses. Under FTA criteria, the single-family residences and multifamily residences are the noise sensitive uses considered for abatement.
- **LRT Alignment Along I-710 South of I-10:** Land uses in this area include single-family residences, a golf course, and office and commercial uses. Under FTA criteria, the single-family residences are the noise sensitive uses considered for abatement.
- **LRT Alignment Along SR 710 Between I-10 and Hellman Avenue:** Land uses in this area include single-family residences, multifamily residences, and a university (Cal State LA). Under FTA criteria, the single-family residences, multifamily residences, and the university are the noise sensitive uses considered for abatement.

- **LRT Alignment Along SR 710 between Hellman Avenue and Valley Boulevard:** Land uses in this area include single-family residences and multifamily residences. Under FTA criteria, the single-family residences and multifamily residences are the noise sensitive uses considered for abatement.

Chapter 2. Results of the Noise Study Report

The NSR for this project was prepared by LSA in May 2014.

2.1. TSM/TDM Alternative

The following section describes the results of the noise analysis for the TSM/TDM Alternative.

2.1.1. Noise Impact Locations

Potential long-term noise impacts associated with operation of the physical improvements associated with the TSM/TDM Alternative are solely from traffic noise. Traffic noise was evaluated for the worst-case traffic condition. Using coordinates obtained from the topographic maps, a total of 227 receptor locations were evaluated. Land uses in the vicinity of the TSM/TDM Alternative improvements include single-family and multifamily residences, five schools, commercial uses, two restaurants, a hospital, a church, a sports field, a park, office uses, industrial uses, and vacant land.

Future traffic noise levels at 227 receptor locations were determined with existing property line walls and noise barriers using the future (2035) peak-hour traffic volumes obtained from the *SR 710 North Study Transportation Technical Report* (CH2M HILL 2014) or the worst-case traffic operations (prior to speed degradation). The modeled future traffic noise levels for the TSM/TDM Alternative were compared to the modeled existing noise levels (after calibration) from Traffic Noise Model (TNM) 2.5 to determine whether a substantial noise increase would occur. Also, the modeled future noise levels for the TSM/TDM Alternative were compared to the NAC under Activity Categories B, C, D, and E to determine whether a traffic noise impact would occur.

Traffic noise impacts result from one or more of the following occurrences: (1) if the traffic noise level at a receptor location is predicted to “approach or exceed” its NAC, or (2) if the predicted traffic noise level is 12 dBA or more over its corresponding modeled existing noise level at the receptor location analyzed. When traffic noise impacts occur, noise abatement measures must be considered. Of the 227 receptors, 70 receptors would approach or exceed the NAC under the TSM/TDM Alternative. Of the 70 receptors that would approach or exceed the NAC under the TSM/TDM

Alternative, 43 are not considered for abatement due to the potential to affect driveway or pedestrian access or having abatement placed along the ROW of the TSM/TDM Alternative that would not provide efficient shielding to the impacted receivers due to lack of space to place noise barriers. No receptors would experience a substantial increase over their corresponding modeled existing noise levels.

The noise levels at the following receptor locations for existing and future conditions would approach or exceed the NAC under Activity Categories B, C, D, and E for the TSM/TDM Alternative and were considered for abatement.

- **Local Street Improvement L-3:**
 - **Receptor TR-22 (L3/TR-22):** This receptor location represents an existing swimming pool area on the west side of Atlantic Boulevard. Currently, there are no existing walls that shield this area. One noise barrier, TSM/TDM Noise Barrier (L3/TNB) No. 1, was modeled along the private property line to shield this residence.
 - **Receptor TR-34 (L3/TR-34):** This receptor location represents an existing residence along Glendon Way on the west side of Atlantic Boulevard. Currently, there are no existing walls that shield this residence. One noise barrier, L3/TNB No. 2, was modeled along the private property line to shield this residence.
- **Local Street Improvement L-5:**
 - **Receptor TR-33 (L5/TR-33):** This receptor location represents an existing residence on the west side of Rosemead Boulevard. Currently, there are no existing walls that shield this residence. One noise barrier, L5/TNB No. 1, was modeled along the private property line to shield this residence.
- **Other Road Improvement T-1:**
 - **Receptors TR-6 (T1/TR-6) through TR-13 (T1/TR-13):** These receptor locations represent existing residences along the east side of SR 710. Currently, there are no existing walls that shield these residences. One noise barrier, T1/TNB No. 1, was modeled along the private property line to shield these residences.
 - **Receptors TR-30 (T1/TR-30) through TR-36 (T1/TR-36):** These receptor locations represent existing residences along the west side of SR 710. Currently, there are no existing walls that shield these residences. Three noise barriers, T1/TNB Nos. 2 through 4, were modeled along the edge of shoulder of SR 710 and the private property lines to shield these residences. Two

scenarios were analyzed: Scenario 1 only includes modeled TNB No. 2, and Scenario 2 includes modeled T1/TNB Nos. 3 and 4.

- **Other Road Improvement T-2:**
 - **Receptors TR-1 (T2/TR-1) and TR-2 (T2/TR-2):** These receptor locations represent existing single-family and multifamily residences along the east side of SR 110. Currently, there are no existing walls that shield these residences. One noise barrier, T2/TNB No. 1, was modeled along the ROW/private property line to shield these residences and multifamily residence balconies.
 - **Receptors TR-8 (T2/TR-8) through TR-14 (T2/TR-14):** These receptor locations represent existing multifamily residences along the west side of SR 110. Currently, there are no existing walls that shield these residences. One noise barrier, T2/TNB No. 2, was modeled along the ROW/edge of roadway to shield the first, second, and third floor balconies of these multifamily residences.

2.1.2. Locations for Evaluated Noise Abatement

Noise barriers were considered to shield receptors along Atlantic Boulevard, Garfield Avenue, Fair Oaks Avenue, Fremont Avenue, SR 110, Rosemead Boulevard, St. John Avenue, and the Connector Road between Valley Boulevard and Mission Road where receptors would continue to be exposed to traffic noise levels approaching or exceeding the NAC. All properties requiring abatement consideration are within Categories B and C (which have a 67 dBA L_{eq} NAC) and Category E (which has a 72 dBA L_{eq} NAC). At each location, noise barrier heights were evaluated at 2 ft increments from 6 ft to 20 ft along private property lines and from 8 ft to 20 ft along Caltrans and City ROW. Each noise barrier was evaluated for feasibility based on the achievable noise reduction. For each noise barrier found to be acoustically feasible, reasonable cost allowances were calculated. The locations of the noise barriers evaluated under the TSM/TDM Alternative are shown on Figure 2-1.

The following noise barriers were analyzed to shield receptor locations that would be exposed to traffic noise levels approaching or exceeding the 67 dBA L_{eq} NAC under Activity Category B for the TSM/TDM Alternative.

- **Local Street Improvement L-3/TNB No. 1:** A 48 ft long barrier along the perimeter of the private swimming pool area at the Atlantic Riviera Apartments, located at 1417 South Atlantic Boulevard, was analyzed to shield Receptor L3/TR-22.

- **Local Street Improvement L-3/TNB No. 2:** A 46 ft long barrier along the private property line of 1721 South Atlantic Boulevard was analyzed to shield Receptor L3/TR-34.
- **Local Street Improvement L-5/TNB No. 1:** A 202 ft long barrier along the private property line of 3955 Rosemead Boulevard was analyzed to shield Receptor L5/TR-33.
- **Other Road Improvement T-1/TNB No. 1:** A 1,247 ft long barrier along the Caltrans ROW/private property line along the northbound side of SR 710 south of Valley Boulevard was analyzed to shield Receptors T1/TR-6 through T1/TR-13.
- **Other Road Improvement T-1/TNB No. 2:** A 963 ft long barrier along the edge of shoulder on the southbound side of SR 710 south of Valley Boulevard was analyzed to shield Receptors T1/TR-30 through T1/TR-36.
- **Other Road Improvement T-1/TNB No. 3:** A 673 ft long barrier along the private property line as an alternative to Other Road Improvement T-1/TNB No. 2 was analyzed to shield Receptors T1/TR-30 through T1/TR-33.
- **Other Road Improvement T-1/TNB No. 4:** A 349 ft long barrier along the private property line as an alternative to Other Road Improvement T-1/TNB No. 2 was analyzed to shield Receptors T1/TR-34 through T1/TR-36.
- **Other Road Improvement T-2/TNB No. 1:** A 743 ft long barrier was modeled along the Caltrans ROW/private property line to shield Receptors T2/TR-1 and T2/TR-2.
- **Other Road Improvement T-2/TNB No. 2:** A 963 ft long barrier was modeled along the edge of shoulder to shield first, second, and third floor Receptors T2/TR-8 through T2/TR-14.

2.1.3. Feasible Noise Barriers

Section 3 of the Protocol states that a minimum noise reduction of 5 dBA must be achieved at the impacted receptors in order for the proposed noise abatement measure to be considered feasible. Greater noise reductions are encouraged if they can be reasonably achieved. Feasibility may also be restricted by the following factors: (1) topography, (2) access requirement for driveways, (3) presence of local cross streets, (4) underground utilities, (5) other noise sources in the area, and (6) safety considerations.

Table 2.1, which summarizes the feasibility of the modeled noise barriers, lists the noise barrier heights, approximate lengths, the receptors benefited, the number of benefited units/receptors, the reasonable allowance per benefited unit/receptor,

Table 2.1 Summary of Feasible Noise Barriers for the TSM/TDM Alternative from the Noise Study Report

TSM/TDM Intersection ID No.	Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station No.	
								Begin	End
L-3	TNB No. 1	6	48	L3/TR-22	1	\$55,000	\$55,000	29+85	30+15
		8 ²		L3/TR-22	1	\$55,000	\$55,000		
		10		L3/TR-22	1	\$55,000	\$55,000		
		12		L3/TR-22	1	\$55,000	\$55,000		
		14		L3/TR-22	1	\$55,000	\$55,000		
		16		L3/TR-22	1	\$55,000	\$55,000		
		18		L3/TR-22	1	\$55,000	\$55,000		
	20	L3/TR-22	1	\$55,000	\$55,000				
	TNB No. 2	6	46	L3/TR-34	1	\$55,000	\$55,000	19+10	19+23
		8 ²		L3/TR-34	1	\$55,000	\$55,000		
		10		L3/TR-34	1	\$55,000	\$55,000		
		12		L3/TR-34	1	\$55,000	\$55,000		
		14		L3/TR-34	1	\$55,000	\$55,000		
		16		L3/TR-34	1	\$55,000	\$55,000		
18		L3/TR-34		1	\$55,000	\$55,000			
20	L3/TR-34	1	\$55,000	\$55,000					
L-5	TNB No. 1	6	202	L5/TR-33	2	\$55,000	\$110,000	30+18	30+23
		8		L5/TR-33	2	\$55,000	\$110,000		
		10 ²		L5/TR-33	2	\$55,000	\$110,000		
		12		L5/TR-33	2	\$55,000	\$110,000		
		14		L5/TR-33	2	\$55,000	\$110,000		
		16		L5/TR-33	2	\$55,000	\$110,000		
		18		L5/TR-33	2	\$55,000	\$110,000		
20	L5/TR-33	2	\$55,000	\$110,000					
T-1	TNB No. 1	8	1247	T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000	40+95	53+67
		10		T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000		
		12		T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000		
		14		T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000		
		16 ²		T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000		
		18		T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000		
	20	T1/TR-7 to T1/TR-13	18	\$55,000	\$990,000				
	TNB No. 2	10	963	T1/TR-31	4	\$55,000	\$220,000	39+75	48+53
		12		T1/TR-30, T1/TR-31	5	\$55,000	\$275,000		
		14		T1/TR-30, T1/TR-31, T1/TR-33, T1/TR-34	11	\$55,000	\$605,000		
		16		T1/TR-30, T1/TR-31, T1/TR-33, T1/TR-34, T1/TR-36	15	\$55,000	\$825,000		
		18		T1/TR-30 to T1/TR-34, T1/TR-36	16	\$55,000	\$880,000		
20 ³		T1/TR-30 to T1/TR-34, T1/TR-36		16	\$55,000	\$880,000			

Table 2.1 Summary of Feasible Noise Barriers for the TSM/TDM Alternative from the Noise Study Report

TSM/TDM Intersection ID No.	Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station No.	
								Begin	End
T-1	TNB No. 3	6	673	T1/TR-33	4	\$55,000	\$220,000	43+00	49+52
		8		T1/TR-33	4	\$55,000	\$220,000		
		10		T1/TR-33	4	\$55,000	\$220,000		
		12		T1/TR-33	4	\$55,000	\$220,000		
		14		T1/TR-31, T1/TR-33	8	\$55,000	\$440,000		
		16		T1/TR-31, T1/TR-33	8	\$55,000	\$440,000		
		18		T1/TR-31, T1/TR-33	8	\$55,000	\$440,000		
		20 ³		T1/TR-30, T1/TR-31, T1/TR-33	9	\$55,000	\$495,000		
	TNB No. 4	6	406	T1/TR-34	6	\$55,000	\$330,000	39+36	42+40
		8		T1/TR-34	6	\$55,000	\$330,000		
		10		T1/TR-34	6	\$55,000	\$330,000		
		12		T1/TR-34	6	\$55,000	\$330,000		
		14		T1/TR-34	6	\$55,000	\$330,000		
		16		T1/TR-34	6	\$55,000	\$330,000		
18		T1/TR-34		6	\$55,000	\$330,000			
20 ²	T1/TR-34	6	\$55,000	\$330,000					
T-2	TNB No. 1	6	349	T2/TR-2	4	\$55,000	\$220,000	79+28	82+63
		8		T2/TR-2	4	\$55,000	\$220,000		
		10 ²		T2/TR-2	4	\$55,000	\$220,000		
		12		T2/TR-2	4	\$55,000	\$220,000		
		14		T2/TR-2	4	\$55,000	\$220,000		
		16		T2/TR-2	4	\$55,000	\$220,000		
		18		T2/TR-2	4	\$55,000	\$220,000		
		20		T2/TR-2	4	\$55,000	\$220,000		
	TNB No. 2	8	743	T2/TR-9	13	\$55,000	\$715,000	82+37	89+95
		10		T2/TR-9	13	\$55,000	\$715,000		
		12		T2/TR-9 to T2/TR-11	34	\$55,000	\$1,870,000		
		14		T2/TR-9 to T2/TR-11	34	\$55,000	\$1,870,000		
		16		T2/TR-9 to T2/TR-11	34	\$55,000	\$1,870,000		
		18		T2/TR-9 to T2/TR-11	34	\$55,000	\$1,870,000		
20 ²	T2/TR-9 to T2/TR-11	34	\$55,000	\$1,870,000					

Source: *State Route 710 North Study Noise Study Report* (LSA 2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

³ Denotes that the maximum feasible barrier height would not break the line of sight between the receptor and the truck exhaust stack.

dBA = A-weighted decibels

ft = feet

TSM = Transportation System Management

TDM = Transportation Demand Management

TNB = Freeway Tunnel Noise Barrier

and the total reasonable allowance. Of the nine modeled noise barriers evaluated for the TSM/TDM Alternative, all nine were determined to be feasible.

2.2. BRT Alternative

The following section describes the results of the noise analysis for the BRT Alternative.

2.2.1. Noise Impact Locations

Potential long-term noise impacts associated with operations of the BRT Alternative are solely from traffic noise. Traffic noise was evaluated for the worst-case traffic condition. Using coordinates obtained from the topographic maps, a total of 506 receptor locations were evaluated. Land uses in the vicinity of the BRT Alternative include single-family and multifamily residences, two schools, two preschools, a daycare center, seven churches, two parks, three hotels, hospitals/medical centers, a museum, and office, industrial, and commercial uses.

Future traffic noise levels at 506 receptor locations were determined with existing property line walls and noise barriers using the future (2035) peak-hour traffic volumes obtained from the *SR 710 North Study Transportation Technical Report* (CH2M HILL 2014) or the worst-case traffic operations (prior to speed degradation). The modeled future traffic noise levels for the BRT Alternative were compared to the modeled existing noise levels (after calibration) from TNM 2.5 to determine whether a substantial noise increase would occur. Also, the modeled future noise levels for the BRT Alternative were compared to the NAC under Activity Categories B, C, D, and E to determine whether a traffic noise impact would occur.

Traffic noise impacts result from one or more of the following occurrences: (1) if the traffic noise level at a receptor location is predicted to “approach or exceed” its NAC, or (2) if the predicted traffic noise level is 12 dBA or more over its corresponding modeled existing noise level at the receptor location analyzed. When traffic noise impacts occur, noise abatement measures must be considered. Of the 506 receptors, 129 receptors would approach or exceed the NAC under the BRT Alternative. Of the 129 receptors that would approach or exceed the NAC under the BRT Alternative, 120 of them are not considered for abatement due to driveway or pedestrian access or due to abatement placed along the ROW of the BRT Alternative that would not break the line of sight to the impacted receivers. No receptors would experience a substantial increase over their corresponding modeled existing noise levels.

The noise levels at the following receptor locations for existing and future conditions would approach or exceed the NAC under Activity Categories B, C, D, and E for the BRT Alternative.

- **Receptor BR-122:** This receptor location represents an existing residence along San Marino Avenue on the east side of Atlantic Boulevard. Currently, there are no existing walls that shield this residence. One noise barrier, BRT Noise Barrier (BNB) No. 5, was modeled along the private property line to shield this residence.
- **Receptor BR-237:** This receptor location represents an existing apartment complex along Amberwood Drive on the east side of Atlantic Boulevard. Currently, there are no existing walls that shield these apartments. One noise barrier, BNB No. 6, was modeled along the private property line to shield these apartments.
- **Receptor BR-397:** This receptor location represents an existing pool area associated with an apartment complex along Shorb Street on the west side of Atlantic Boulevard. Currently, there are no existing walls that shield this pool area. One noise barrier, BNB No. 4, was modeled along the private property line to shield this pool area.
- **Receptors BR-443, BR-444, BR-446, BR-447, and BR-449:** These receptor locations represent existing single-family and multifamily residences along the west side of Atlantic Boulevard, between Harding Avenue and Mabel Avenue. Currently, there are no existing walls that shield these residences. Two noise barriers, BNB Nos. 2 and 3, were modeled along the City's ROW/private property line and at the top of slope to shield these residences.
- **Receptor BR-450:** This receptor location represents an existing multifamily residence along the west side of Atlantic Boulevard, between Harding Avenue and Mabel Avenue. Currently, there are no existing walls that shield this residence. One noise barrier, BNB No. 1, was modeled along the private property line to shield this residence.

2.2.2. Locations for Evaluated Noise Abatement

Noise barriers were considered to shield receptors along Atlantic Boulevard, Huntington Boulevard, and Fair Oaks Avenue where receptors would continue to be exposed to traffic noise levels approaching or exceeding the NAC. All properties requiring abatement consideration are within Categories B and C (which have a 67 dBA L_{eq} NAC) and Category E (which has a 72 dBA L_{eq} NAC). At each location, noise barrier heights were evaluated at 2 ft increments from 6 ft to 20 ft along private property lines and from 8 ft to 20 ft along Caltrans and City ROW. Each noise barrier

was evaluated for feasibility based on the achievable noise reduction. For each noise barrier found to be acoustically feasible, reasonable cost allowances were calculated. The locations of the noise barriers under the BRT Alternative are shown on Figure 2-2.

The following noise barriers were analyzed to shield receptor locations that would be exposed to traffic noise levels approaching or exceeding the 67 dBA L_{eq} NAC under Activity Category B for the BRT Alternative.

- **BNB No. 1:** A 340 ft long barrier along the private property line of the multifamily use at 228–230 South Atlantic Boulevard was analyzed to shield second-floor Receptor BR-450.
- **BNB No. 2:** An 826 ft long barrier along the private property line of the multifamily use at 228–230 South Atlantic Boulevard was analyzed to shield second-floor Receptors BR-443 through BR-449.
- **BNB No. 3:** A 623 ft long barrier along the private property line at top of slope of the multifamily use at 228–230 South Atlantic Boulevard was analyzed as an alternative to BNB No. 2 to shield second-floor Receptors BR-443 through BR-449.
- **BNB No. 4:** A 67 ft long barrier along the private property line was analyzed to shield Receptor BR-397 at the northwest corner of Atlantic Boulevard and Shorb Street.
- **BNB No. 5:** A 146 ft long barrier along the private property line was modeled to shield Receptor BR-122 at the northeast corner of Atlantic Boulevard and San Marino Avenue.
- **BNB No. 6:** A 488 ft long barrier along the private property line was analyzed to shield second-floor Receptors BR-237 and BR-238 , which represent multifamily uses on Amberwood Drive whose balconies face Atlantic Boulevard.

2.2.3. Feasible Noise Barriers

Section 3 of the Protocol states that a minimum noise reduction of 5 dBA must be achieved at the impacted receptors in order for the proposed noise abatement measure to be considered feasible. Greater noise reductions are encouraged if they can be reasonably achieved. Feasibility may also be restricted by the following factors: (1) topography, (2) access requirement for driveways, (3) presence of local cross streets, (4) underground utilities, (5) other noise sources in the area, and (6) safety considerations.

Table 2.2, which summarizes the feasibility of the modeled noise barriers, lists the noise barrier heights, approximate lengths, the receptors benefited, the noise attenuation range, the number of benefited units/receptors, the reasonable allowance per benefited unit/receptor, and the total reasonable allowance. Of the six modeled noise barriers evaluated for the BRT Alternative, five of them were determined to be feasible.

2.3. Freeway Tunnel Alternative

The following section describes the results of the noise analysis for the Freeway Tunnel Alternative.

2.3.1. Noise Impact Locations

Potential long-term noise impacts associated with operations of the Freeway Tunnel Alternative are solely from traffic noise. Traffic noise was evaluated for the worst-case traffic condition. Using coordinates obtained from the topographic maps, a total of 137 receptor locations were evaluated. Land uses in the vicinity of the Freeway Tunnel Alternative include single-family and multifamily residences, four schools and Cal State LA, a church, a hospital, a golf course, vacant land, and office, commercial, and recreational uses. In addition, a planned office development is located within the project area.

Future traffic noise levels at 137 receptor locations were determined with existing walls using the future (2035) peak-hour traffic volumes obtained from the *SR 710 North Study Transportation Technical Report* (CH2M HILL 2014) or the worst-case traffic operations (prior to speed degradation). The modeled future traffic noise levels for the Freeway Tunnel Alternative were compared to the modeled existing noise levels (after calibration) from TNM 2.5 to determine whether a substantial noise increase would occur. Also, the modeled future noise levels for the Freeway Tunnel Alternative were compared to the NAC under Activity Categories B, C, D, and E to determine whether a traffic noise impact would occur. Due to the complexity of the noise model, creating a “tunnel” within TNM 2.5 is not possible. In order to account for potential noise from the portals of the tunnel, the roadways were extended/ modeled approximately 500 to 800 ft into the covered area of the tunnel.

Traffic noise impacts result from one or more of the following occurrences: (1) if the traffic noise level at a receptor location is predicted to “approach or exceed” its NAC, or (2) if the predicted traffic noise level is 12 dBA or more over its corresponding modeled existing noise level at the receptor location analyzed. When traffic noise

Table 2.2 Summary of Feasible Noise Barriers for the BRT Alternative from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
BNB No. 1	10	340	BR-450	12	\$55,000	\$660,000	168+95	172+05
	12		BR-450	12	\$55,000	\$660,000		
	14		BR-450	12	\$55,000	\$660,000		
	16		BR-450	12	\$55,000	\$660,000		
	18		BR-450	12	\$55,000	\$660,000		
	20 ²		BR-450	12	\$55,000	\$660,000		
BNB No. 2	10	826	BR-448	3	\$55,000	\$165,000	173+00 & 177+02	176+85 & 181+48
	12		BR-447, BR-449	9	\$55,000	\$495,000		
	14		BR-444, BR-447, BR-449	16	\$55,000	\$880,000		
	16		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	18		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	20 ³		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
BNB No. 3	6	623	BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000	173+55 & 177+04	176+98 & 180+30
	8 ²		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	10		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	12		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	14		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	16		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	18		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
	20		BR-443, BR-444, BR-446, BR-447, BR-449	24	\$55,000	\$1,320,000		
BNB No. 4	8 ²	67	BR-397	1	\$55,000	\$55,000	248+20	248+58
	10		BR-397	1	\$55,000	\$55,000		
	12		BR-397	1	\$55,000	\$55,000		
	14		BR-397	1	\$55,000	\$55,000		
	16		BR-397	1	\$55,000	\$55,000		
	18		BR-397	1	\$55,000	\$55,000		
	20		BR-397	1	\$55,000	\$55,000		
BNB No. 5	6	146	BR-122	1	\$55,000	\$55,000	260+16	260+95
	8		BR-122	1	\$55,000	\$55,000		
	10 ²		BR-122	1	\$55,000	\$55,000		
	12		BR-122	1	\$55,000	\$55,000		
	14		BR-122	1	\$55,000	\$55,000		
	16		BR-122	1	\$55,000	\$55,000		
	18		BR-122	1	\$55,000	\$55,000		
	20		BR-122	1	\$55,000	\$55,000		

Source: State Route 710 North Study Noise Study Report (LSA 2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

³ Denotes that the maximum feasible barrier height would not break the line of sight between the receptor and the truck exhaust stack.

BNB = BRT Noise Barrier dBA = A-weighted decibels

BRT = Bus Rapid Transit ft = feet

impacts occur, noise abatement measures must be considered. Of the 137 receptors, 66 receptors would approach or exceed the NAC under the Freeway Tunnel Alternative single-bore design variation and 75 receptors would approach or exceed the NAC under the dual-bore design variation. No receptors would experience a substantial increase over their corresponding modeled existing noise levels.

The noise levels at the following receptor locations for existing and future conditions would approach or exceed the NAC under Activity Categories B, C, D, and E for both the single-bore and dual-bore design variations.

- **Receptor FR-2:** This receptor location represents an existing residence along Corporate Center Drive on the east side of I-710. Currently, there is an existing 6 ft high wall located along the private property line that shields this residence. Two separate noise barrier locations were modeled to shield this residence to compare their effectiveness. One noise barrier, Freeway Tunnel Noise Barrier (FTNB) No. 1, was modeled along the Caltrans ROW, and an alternative noise barrier, FTNB No. 2, was modeled along the private property line.
- **Receptors FR-6 through FR-22:** These receptor locations represent existing residences along Balzac Street on the north side of I-10 and Capetown Avenue, Charnwood Avenue, Julep Place, and Hellman Avenue on the east side of SR 710. Currently, there are two existing 5.5 to 6 ft high walls that shield some of these residences. Three noise barriers were modeled along the edge of shoulder and Caltrans ROW/private property line to shield these residences (FTNB Nos. 3A, 3B, and 4). FTNB No. 3A was evaluated at 2 ft increments from 6 ft to 20 ft while the existing walls were not touched. FTNB No. 3B would replace the existing wall and, along with FTNB No. 3A, was evaluated at 2 ft increments from 6 ft to 20 ft. A third scenario was modeled that includes leaving all existing walls at the residential property lines as is and modeling FTNB No. 4 along the shoulder of the connector ramp on the east side of SR 710. A small gap is necessary to allow access to the retention basin between the freeway and the residences.
- **Receptors FR-24 through FR-38:** These receptor locations represent existing residences along Charnwood Avenue and Westmont Drive on the east side of SR 710. Currently, there are no existing walls that shield these residences. One noise barrier, FTNB No. 5, was modeled along the Caltrans ROW/private property line to shield these residences.
- **Receptors FR-47 through FR-49:** These receptor locations represent existing residences along Highbury Avenue on the west side of SR 710. Currently, there are no existing walls that shield these residences. Two separate noise barrier

locations were modeled to shield these residences to compare their effectiveness. One noise barrier (FTNB No. 7) was modeled along the residential private property line for each design variation, and the other noise barrier (FTNB No. 6) was modeled along the edge of the shoulder for each design variation (6S for single bore and 6D for dual bore).

- **Receptors FR-50 and FR-51:** These receptor locations represent existing residences along Highbury Avenue on the west side of SR 710. Currently, there are no existing walls that shield these residences. Two separate noise barrier locations were modeled to shield these residences to compare their effectiveness. One noise barrier (FTNB No. 8) was modeled along the residential private property line for each design variation, and the other noise barrier (FTNB No. 6) was modeled along the edge of the shoulder for each design variation (6S for single bore and 6D for dual bore).
- **Receptor FR-72:** This receptor location represents an existing restaurant patio along Colorado Boulevard on the east side of SR 710. Currently, there is no existing wall that shields the outdoor frequent human use area associated with this restaurant patio. One noise barrier, FTNB No. 9, was modeled along the private property line to shield this outdoor frequent human use area.
- **Receptors FR-75 through FR-84:** These receptor locations represent existing multifamily residences along Orange Grove Place and Cypress Avenue on the east side of I-210. Currently, there is an existing 6.5 ft high wall that shields these residences. One noise barrier, FTNB No. 10, was modeled along the Caltrans ROW/private property line to shield these residences.
- **Receptors FR-85, FR-89, and FR-90:** These receptor locations represent existing residences along Cypress Avenue and a school along Orange Grove Boulevard on the east side of I-210. Currently, there is an existing 6 ft high wall that shields these residences and school. One noise barrier, FTNB No. 11, was modeled along the Caltrans ROW/private property line to shield these residences and school.
- **Receptors FR-96 through FR-98:** These receptor locations represent existing residences along Lincoln Avenue on the east side of I-210. Currently, there is an existing 6 ft high wall that shields these residences. One noise barrier, FTNB No. 12, was modeled along the Caltrans ROW/private property line to shield these residences.
- **Receptors FR-102 through FR-106, FR-108, FR-110 through FR-112:** These receptor locations represent existing residences along Winona Avenue, Pasadena Avenue, Mayview Lane, Ridgewood Lane, Rosewood Lane, Longwood Lane,

Orange Grove Boulevard, and Prospect Boulevard on the west side of I-210. Currently, there is an existing 6.5 to 10 ft high wall that shields some of these residences. Two options were modeled for the barrier. FTNB No. 13B was evaluated at 2 ft increments from 6 ft to 20 ft while the existing walls were not touched. For the second option, FTNB No. 13A (which would replace the existing wall) was evaluated at 2 ft increments from 10 ft to 20 ft along with FTNB No. 13B.

- **Receptor FR-115:** This receptor location represents an existing school along Pasadena Avenue on the west side of I-210. Currently, there are no existing walls that shield the outdoor frequent human use areas associated with the school. One noise barrier, FTNB No. 14, was modeled along the private property line to shield these outdoor frequent human use areas.
- **Receptors FR-116 and FR-117:** These receptor locations represent an existing pool and tennis court associated with an apartment complex along Walnut Street on the northwest side of the I-210/SR 134 interchange. Currently, there are no existing walls that shield the outdoor frequent human use areas associated with the apartments. One noise barrier, FTNB No. 15, was modeled along the private property line to shield these outdoor frequent human use areas.

2.3.2. Locations for Evaluated Noise Abatement

Noise barriers were considered to shield receptors along I-710, SR 60, SR 710, I-10, I-210, and SR 134, where receptors would continue to be exposed to traffic noise levels approaching or exceeding the NAC. All properties requiring abatement consideration are within Categories B and C, which have a 67 dBA L_{eq} NAC, and Category E, which has a 72 dBA L_{eq} NAC. At each location, noise barrier heights were evaluated at 2 ft increments from 6 to 20 ft. Each noise barrier was evaluated for feasibility based on the achievable noise reduction. For each noise barrier found to be acoustically feasible, reasonable cost allowances were calculated. The locations of the noise barriers under the Freeway Tunnel Alternative single-bore and dual-bore design variations are shown on Figures 2-3 and 2-4.

The following noise barriers were analyzed to shield receptor locations that would be exposed to traffic noise levels approaching or exceeding the 67 dBA L_{eq} NAC under Activity Category B and the 72 dBA L_{eq} NAC under Category D for the Freeway Tunnel Alternatives.

- **FTNB No. 1:** A 537 ft long barrier along the Caltrans ROW west of Corporate Center Drive was analyzed to shield Receptors FR-2.

- **FTNB No. 2:** A 115 ft long barrier along the private property line of 577 Casuda Canyon Drive was analyzed as an alternate to FTNB No. 1 to shield Receptor FR-2.
- **FTNB No. 3A:** A 3,128 ft long barrier along the Caltrans ROW/private property line at the northeast quadrant of the SR 710 and I-10 Freeways was analyzed to shield Receptors FR-6 through FR-17.
- **FTNB No. 3B:** A 3,649 ft long barrier, FTNB No. 3B (which includes FTNB No. 3A and an extension that would raise the existing wall), was analyzed along the Caltrans ROW/private property line at the northeast quadrant of the SR 710 and I-10 Freeways to shield Receptors FR-6 through FR-22.
- **FTNB No. 4:** A 2,621 ft long barrier along the edge of shoulder at the northeast quadrant of the SR 710 and I-10 Freeways was analyzed as an alternative to FTNB Nos. 3A and 3B to shield Receptors FR-6 through FR-22.
- **FTNB No. 5:** A 1,801 ft long barrier along the Caltrans ROW/private property line on the east side of SR 710 between Hellman Avenue and Valley Boulevard was analyzed to shield Receptors FR-24 through FR-38.
- **FTNB No. 6S:** A 1,454 ft long barrier along the edge of shoulder of the SR 710 Valley Boulevard southbound on-ramp was analyzed to shield Receptors FR-47 through FR-51 for the single-bore design variation.
- **FTNB No. 6D:** A 1,404 ft long barrier along the edge of shoulder of the SR 710 Valley Boulevard southbound on-ramp was analyzed to shield Receptors FR-47 through FR-51 for the dual-bore design variation.
- **FTNB No. 7:** A 673 ft long barrier along the Caltrans ROW/private property line on the west side of SR 710 south of Valley Boulevard was analyzed as an alternative to FTNB Nos. 6S and 6D to shield Receptors FR-47 through FR-49.
- **FTNB No. 8:** A 406 ft long barrier along the Caltrans ROW/private property line on the west side of SR 710 south of Valley Boulevard was analyzed as an alternative to FTNB Nos. 6S and 6D to shield Receptors FR-50 and FR-51.
- **FTNB No. 9:** An 84 ft long barrier along the private property line of the restaurant at the corner of Pasadena Avenue and Colorado Boulevard was analyzed to shield Receptor FR-72. Receptor FR-72 exceeds the NAC only for the Freeway Tunnel Alternative dual-bore design variation.
- **FTNB No. 10:** A 1,207 ft long barrier along the Caltrans ROW/private property line was analyzed at the northeast quadrant of the I-210 and SR 134 interchange to shield Receptors FR-75 through FR-84.

- **FTNB No. 11:** A 1,404 ft long barrier along the Caltrans ROW/private property line on the east side of the I-210 Freeway north of Orange Grove Boulevard was analyzed to shield Receptors FR-85, FR-89 and FR-90.
- **FTNB No. 12:** A 1,047 ft long barrier along the edge of shoulder on the east side of the I-210 Freeway south of Mountain Street was analyzed to shield Receptors FR-96 through FR-98.
- **FTNB No. 13A:** A 2,316 ft long barrier along the Caltrans ROW/private property line on the west side of the I-210 Freeway between Orange Grove Boulevard and Mountain Street was analyzed to shield Receptors FR-102 through FR-106, FR-108 and FR-110 through FR-112.
- **FTNB No. 13B:** A 709 ft long barrier and an extension of FTNB No. 13A along the Caltrans ROW/private property line on the west side of the I-210 Freeway north of Orange Grove Boulevard was analyzed to shield Receptors FR-102 through FR-105.
- **FTNB No. 14:** A 263 ft long barrier along the private property line of the Roosevelt Elementary School playground was analyzed to shield Receptor FR-115.
- **FTNB No. 15:** A 262 ft long barrier along the private property line of the Orange Grove Village tennis courts was analyzed to shield Receptors FR-116 and FR-117.

2.3.3. Feasible Noise Barriers

Section 3 of the Protocol states that a minimum noise reduction of 5 dBA must be achieved at the impacted receptors in order for the proposed noise abatement measure to be considered feasible. Greater noise reductions are encouraged if they can be reasonably achieved. Feasibility may also be restricted by the following factors: (1) topography, (2) access requirement for driveways, (3) presence of local cross streets, (4) underground utilities, (5) other noise sources in the area, and (6) safety considerations.

Tables 2.3 and 2.4, which summarize the feasibility of the modeled noise barriers, list the noise barrier heights, approximate lengths, the receptors benefited, the number of benefited units/receptors, the reasonable allowance per benefited unit/receptor, and the total reasonable allowance. Of the 18 modeled noise barriers evaluated for the Freeway Tunnel Alternative, 16 of them were determined to be feasible.

Table 2.3 Summary of Feasible Noise Barriers for the Single-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 1	14	537	FR-2	1	\$55,000	\$55,000	1376+15	1381+30
	16		FR-2	1	\$55,000	\$55,000		
	18		FR-2	1	\$55,000	\$55,000		
	20 ³		FR-2	1	\$55,000	\$55,000		
FTNB No. 2	6	115	FR-2	1	\$55,000	\$55,000	1378+57	1379+00
	8 ²		FR-2	1	\$55,000	\$55,000		
	10		FR-2	1	\$55,000	\$55,000		
	12		FR-2	1	\$55,000	\$55,000		
	14		FR-2	1	\$55,000	\$55,000		
	16		FR-2	1	\$55,000	\$55,000		
	18		FR-2	1	\$55,000	\$55,000		
	20		FR-2	1	\$55,000	\$55,000		
FTNB No. 3A	6	2453	FR-6, FR-8 to FR-11, FR-13, FR-15, FR-17	17	\$55,000	\$935,000	1406+90	1425+40
	8		FR-6, FR-8 to FR-11, FR-13, FR-15 to FR-17	20	\$55,000	\$1,100,000		
	10		FR-6, FR-8 to FR-13, FR-15 to FR-17	23	\$55,000	\$1,265,000		
	12 ²		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	14		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	16		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	18		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	20		FR-6 to FR-17	26	\$55,000	\$1,430,000		
FTNB No. 3B	6	3091	FR-6, FR-8 to FR-11, FR-13, FR-15, FR-17, FR-21	19	\$55,000	\$1,045,000	1425+21	1431+40
	8		FR-6, FR-8 to FR-11, FR-13, FR-15 to FR-19, FR-21	28	\$55,000	\$1,540,000		
	10		FR-6, FR-8 to FR-13, FR-15 to FR-21	34	\$55,000	\$1,870,000		
	12 ²		FR-6, FR-8 to FR-13, FR-15 to FR-21	34	\$55,000	\$1,870,000		
	14		FR-6, FR-8 to FR-13, FR-15 to FR-21	34	\$55,000	\$1,870,000		
	16		FR-6, FR-8 to FR-13, FR-15 to FR-21	34	\$55,000	\$1,870,000		
	18		FR-6, FR-8 to FR-13, FR-15 to FR-21	34	\$55,000	\$1,870,000		
	20		FR-6, FR-8 to FR-21	36	\$55,000	\$1,980,000		
FTNB No. 4	6	2621	FR-15, FR-18, FR-19, FR-21	10	\$55,000	\$550,000	1406+65 & 1414+22	1413+92 & 1431+40
	8		FR-14, FR-15, FR-17 to FR-19, FR-21	15	\$55,000	\$825,000		
	10		FR-13 to FR-15, FR-17 to FR-19, FR-21	18	\$55,000	\$990,000		
	12		FR-13 to FR-19, FR-21	21	\$55,000	\$1,155,000		
	14		FR-13 to FR-19, FR-21	21	\$55,000	\$1,155,000		
	16		FR-13 to FR-19, FR-21	21	\$55,000	\$1,155,000		
	18		FR-10, FR-12 to FR-19, FR-21	26	\$55,000	\$1,430,000		
	20 ³		FR-9 to FR-19, FR-21	29	\$55,000	\$1,595,000		

Table 2.3 Summary of Feasible Noise Barriers for the Single-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 5	6	1801	FR-25, FR-26, FR-33 to FR-37	19	\$55,000	\$1,045,000	1432+48	1449+75
	8		FR-25, FR-26, FR-33 to FR-37	19	\$55,000	\$1,045,000		
	10		FR-25, FR-26, FR-31, FR-33 to FR-37	22	\$55,000	\$1,210,000		
	12		FR-25, FR-26, FR-28 to FR-31, FR-33 to FR-37	32	\$55,000	\$1,760,000		
	14		FR-24 to FR-26, FR-28 to FR-31, FR-33 to FR-37	33	\$55,000	\$1,815,000		
	16		FR-24 to FR-31, FR-33 to FR-37	39	\$55,000	\$2,145,000		
	18		FR-24 to FR-37	42	\$55,000	\$2,310,000		
	20 ²		FR-24 to FR-37	42	\$55,000	\$2,310,000		
FTNB No. 6S	20 ³	1454	FR-47, FR-51	5	\$55,000	\$275,000	1432+85	1447+75
FTNB No. 7	6	673	FR-49	4	\$55,000	\$220,000	1440+20	1446+75
	8		FR-49	4	\$55,000	\$220,000		
	10		FR-49	4	\$55,000	\$220,000		
	12		FR-48, FR-49	8	\$55,000	\$440,000		
	14		FR-48, FR-49	8	\$55,000	\$440,000		
	16		FR-47 to FR-49	9	\$55,000	\$495,000		
	18		FR-47 to FR-49	9	\$55,000	\$495,000		
	20 ²		FR-47 to FR-49	9	\$55,000	\$495,000		
FTNB No. 8	6	406	FR-50, FR-51	6	\$55,000	\$330,000	1436+65	1439+70
	8		FR-50, FR-51	6	\$55,000	\$330,000		
	10		FR-50, FR-51	6	\$55,000	\$330,000		
	12		FR-50, FR-51	6	\$55,000	\$330,000		
	14		FR-50, FR-51	6	\$55,000	\$330,000		
	16		FR-50, FR-51	6	\$55,000	\$330,000		
	18		FR-50, FR-51	6	\$55,000	\$330,000		
	20 ²		FR-50, FR-51	6	\$55,000	\$330,000		
FTNB No. 9	6	84	FR-72	1	\$55,000	\$55,000		
	8 ²		FR-72	1	\$55,000	\$55,000		
	10		FR-72	1	\$55,000	\$55,000		
	12		FR-72	1	\$55,000	\$55,000		
	14		FR-72	1	\$55,000	\$55,000		
	16		FR-72	1	\$55,000	\$55,000		
	18		FR-72	1	\$55,000	\$55,000		
	20		FR-72	1	\$55,000	\$55,000		
FTNB No. 10	8	1207	FR-75, FR-80	10	\$55,000	\$550,000	1774+35	1784+20
	10		FR-75, FR-80	10	\$55,000	\$550,000		
	12		FR-75, FR-78, FR-80	12	\$55,000	\$660,000		
	14 ²		FR-75 to FR-78, FR-80	18	\$55,000	\$990,000		
	16		FR-75 to FR-80	22	\$55,000	\$1,210,000		

Table 2.3 Summary of Feasible Noise Barriers for the Single-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 11	18	1404	FR-75 to FR-80	22	\$55,000	\$1,210,000	1786+00	1800+28
	20		FR-75 to FR-80	22	\$55,000	\$1,210,000		
	12 ²		FR-91	2	\$55,000	\$110,000		
	14		FR-91, FR-92	5	\$55,000	\$275,000		
	16		FR-91, FR-92	5	\$55,000	\$275,000		
	18		FR-85, FR-89 to FR-92	12	\$55,000	\$660,000		
FTNB No. 12	20	556	FR-85, FR-89 to FR-92	12	\$55,000	\$660,000	1800+20	1805+95
	14		FR-96	3	\$55,000	\$165,000		
	16		FR-96	3	\$55,000	\$165,000		
	18		FR-96	3	\$55,000	\$165,000		
FTNB No. 13A	20 ³	2315	FR-96, FR-97	5	\$55,000	\$275,000	1783+50	1806+20
	10 ²		FR-104, FR-105	5	\$55,000	\$275,000		
	12		FR-104, FR-105	5	\$55,000	\$275,000		
	14		FR-104, FR-105	5	\$55,000	\$275,000		
	16		FR-104, FR-105	5	\$55,000	\$275,000		
	18		FR-104, FR-105	5	\$55,000	\$275,000		
FTNB No. 14	20	263	FR-102, FR-104, FR-105, FR-107	10	\$55,000	\$550,000	1774+15	1776+22
	8		FR-115	1	\$55,000	\$55,000		
	10		FR-115	1	\$55,000	\$55,000		
	12		FR-115	1	\$55,000	\$55,000		
	14		FR-115	1	\$55,000	\$55,000		
	16 ²		FR-115	1	\$55,000	\$55,000		
	18		FR-115	1	\$55,000	\$55,000		
FTNB No. 15	20	262	FR-115	1	\$55,000	\$55,000	1768+60	1769+90
	8		FR-116	1	\$55,000	\$55,000		
	10		FR-116	1	\$55,000	\$55,000		
	12 ²		FR-116	1	\$55,000	\$55,000		
	14		FR-116, FR-117	2	\$55,000	\$110,000		
	16		FR-116, FR-117	2	\$55,000	\$110,000		
	18		FR-116, FR-117	2	\$55,000	\$110,000		
20	FR-116, FR-117	2	\$55,000	\$110,000				

Source: Supplemental Noise Study Report (LSA 2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

³ Denotes that the maximum feasible barrier height would not break the line of sight between the receptor and the truck exhaust stack.

dBA = A-weighted decibels

ft = feet

FTNB = Freeway Tunnel Noise Barrier

Table 2.4 Summary of Feasible Noise Barriers for the Dual-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 2	6	115	FR-2	1	\$55,000	\$55,000	1378+57	1379+00
	8 ²		FR-2	1	\$55,000	\$55,000		
	10		FR-2	1	\$55,000	\$55,000		
	12		FR-2	1	\$55,000	\$55,000		
	14		FR-2	1	\$55,000	\$55,000		
	16		FR-2	1	\$55,000	\$55,000		
	18		FR-2	1	\$55,000	\$55,000		
	20		FR-2	1	\$55,000	\$55,000		
FTNB No. 3A	6	2453	FR-6, FR-8 to FR-11, FR-13, FR-15, FR-17	17	\$55,000	\$935,000	1407+00	1425+50
	8		FR-6 to FR-11, FR-13, FR-15 to FR-17	21	\$55,000	\$1,155,000		
	10		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	12 ²		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	14		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	16		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	18		FR-6 to FR-13, FR-15 to FR-17	24	\$55,000	\$1,320,000		
	20		FR-6 to FR-17	26	\$55,000	\$1,430,000		
FTNB No. 3B	6	3091	FR-6, FR-8 to FR-11, FR-13, FR-15, FR-17	17	\$55,000	\$935,000	1425+21	1431+40
	8		FR-6 to FR-11, FR-13, FR-15 to FR-17, FR-19, FR-21	26	\$55,000	\$1,430,000		
	10		FR-6 to FR-13, FR-15 to FR-19, FR-21	32	\$55,000	\$1,760,000		
	12 ²		FR-6 to FR-13, FR-15 to FR-21	35	\$55,000	\$1,925,000		
	14		FR-6 to FR-13, FR-15 to FR-21	35	\$55,000	\$1,925,000		
	16		FR-6 to FR-13, FR-15 to FR-21	35	\$55,000	\$1,925,000		
	18		FR-6 to FR-13, FR-15 to FR-21	35	\$55,000	\$1,925,000		
	20		FR-6 to FR-21	37	\$55,000	\$2,035,000		
FTNB No. 4	6	2621	FR-15, FR-17	5	\$55,000	\$275,000	1406+78 & 1414+25	1414+05 & 1431+40
	8		FR-13 to FR-15, FR-17	10	\$55,000	\$550,000		
	10		FR-10, FR-13 to FR-15, FR-17	12	\$55,000	\$660,000		
	12		FR-10, FR-12 to FR-17, FR-19	21	\$55,000	\$1,155,000		
	14		FR-10 to FR-17, FR-19	23	\$55,000	\$1,265,000		
	16		FR-10 to FR-19	26	\$55,000	\$1,430,000		
	18		FR-9 to FR-19	27	\$55,000	\$1,485,000		
	20 ³		FR-9 to FR-19	27	\$55,000	\$1,485,000		

**Table 2.4 Summary of Feasible Noise Barriers for the Dual-Bore Design Variation
from the Noise Study Report**

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 5	6	1801	FR-25, FR-26, FR-33 to FR-38	21	\$55,000	\$1,155,000	1432+48	1449+75
	8		FR-25, FR-26, FR-33 to FR-38	21	\$55,000	\$1,155,000		
	10		FR-25, FR-26, FR-33 to FR-38	21	\$55,000	\$1,155,000		
	12		FR-25, FR-26, FR-29, FR-33 to FR-38	25	\$55,000	\$1,375,000		
	14		FR-25, FR-26, FR-28 to FR-31, FR-33 to FR-38	34	\$55,000	\$1,870,000		
	16		FR-25 to FR-31, FR-33 to FR-38	40	\$55,000	\$2,200,000		
	18		FR-25 to FR-31, FR-33 to FR-38	40	\$55,000	\$2,200,000		
	20 ²	FR-25 to FR-38	43	\$55,000	\$2,365,000			
FTNB No. 6D	6	1404	FR-51	4	\$55,000	\$220,000	1432+85	1447+60
	8		FR-51	4	\$55,001	\$220,004		
	10		FR-51	4	\$55,002	\$220,008		
	12		FR-47, FR-48, FR-50, FR-51	11	\$55,003	\$605,033		
	14		FR-47-FR-51	15	\$55,004	\$825,060		
	16		FR-47-FR-51	15	\$55,005	\$825,075		
	18		FR-47-FR-51	15	\$55,006	\$825,090		
	20 ³	FR-47-FR-51	15	\$55,007	\$825,105			
FTNB No. 7	6	673	FR-49	4	\$55,000	\$220,000	1440+35	1446+80
	8		FR-49	4	\$55,000	\$220,000		
	10		FR-49	4	\$55,000	\$220,000		
	12		FR-48, FR-49	8	\$55,000	\$440,000		
	14		FR-48, FR-49	8	\$55,000	\$440,000		
	16		FR-47 to FR-49	9	\$55,000	\$495,000		
	18		FR-47 to FR-49	9	\$55,000	\$495,000		
	20 ²	FR-47 to FR-49	9	\$55,000	\$495,000			
FTNB No. 8	6	406	FR-50, FR-51	6	\$55,000	\$330,000	1436+80	1439+85
	8		FR-50, FR-51	6	\$55,000	\$330,000		
	10		FR-50, FR-51	6	\$55,000	\$330,000		
	12		FR-50, FR-51	6	\$55,000	\$330,000		
	14		FR-50, FR-51	6	\$55,000	\$330,000		
	16		FR-50, FR-51	6	\$55,000	\$330,000		
	18		FR-50, FR-51	6	\$55,000	\$330,000		
	20 ²	FR-50, FR-51	6	\$55,000	\$330,000			
FTNB No. 9	6	84	FR-72	1	\$55,000	\$55,000	1751+75	1752+25
	8 ²		FR-72	1	\$55,000	\$55,000		
	10		FR-72	1	\$55,000	\$55,000		
	12		FR-72	1	\$55,000	\$55,000		

Table 2.4 Summary of Feasible Noise Barriers for the Dual-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
	14		FR-72	1	\$55,000	\$55,000		
	16		FR-72	1	\$55,000	\$55,000		
	18		FR-72	1	\$55,000	\$55,000		
	20		FR-72	1	\$55,000	\$55,000		
FTNB No. 10	8	1207	FR-75, FR-80	10	\$55,000	\$550,000	1774+35	1784+20
	10		FR-75, FR-80	10	\$55,000	\$550,000		
	12		FR-75, FR-80	10	\$55,000	\$550,000		
	14 ²		FR-75 to FR-78, FR-80	18	\$55,000	\$990,000		
	16		FR-75 to FR-80	22	\$55,000	\$1,210,000		
	18		FR-75 to FR-80	22	\$55,000	\$1,210,000		
	20		FR-75 to FR-81	23	\$55,000	\$1,265,000		
FTNB No. 11	10 ²	1404	FR-91	2	\$55,000	\$110,000	1786+00	1800+28
	12		FR-91	2	\$55,000	\$110,000		
	14		FR-91, FR-92	5	\$55,000	\$275,000		
	16		FR-85, FR-91, FR-92	6	\$55,000	\$330,000		
	18		FR-85, FR-90 to FR-92	9	\$55,000	\$495,000		
	20		FR-85, FR-89 to FR-92	12	\$55,000	\$660,000		
FTNB No. 12	14	556	FR-96	3	\$54,997	\$164,991	1800+20	1805+95
	16		FR-96	3	\$54,998	\$164,994		
	18		FR-96	3	\$54,999	\$164,997		
	20 ³		FR-96	3	\$55,000	\$165,000		
FTNB No. 13A	10 ²	2315	FR-104, FR-105	5	\$55,000	\$275,000	1783+50	1806+20
	12		FR-104, FR-105	5	\$55,000	\$275,000		
	14		FR-104, FR-105, FR-108	7	\$55,000	\$385,000		
	16		FR-104, FR-105, FR-108	7	\$55,000	\$385,000		
	18		FR-104, FR-105, FR-108	7	\$55,000	\$385,000		
	20		FR-104, FR-105, FR-108, FR-109	9	\$55,000	\$495,000		
FTNB No. 13B	18 ²	709	FR-108	2	\$55,000	\$110,000	1790+65	1806+20
	20		FR-108	2	\$55,000	\$110,000		
FTNB No. 14	8	263	FR-115	1	\$55,000	\$55,000	1774+15	1776+22
	10		FR-115	1	\$55,000	\$55,000		
	12		FR-115	1	\$55,000	\$55,000		
	14		FR-115	1	\$55,000	\$55,000		
	16 ²		FR-115	1	\$55,000	\$55,000		
	18		FR-115	1	\$55,000	\$55,000		
	20		FR-115	1	\$55,000	\$55,000		

Table 2.4 Summary of Feasible Noise Barriers for the Dual-Bore Design Variation from the Noise Study Report

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Receiver Locations Benefited	Number of Benefited Units ¹	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	Station Number	
							Begin	End
FTNB No. 15	8	262	FR-116	1	\$55,000	\$55,000	1768+60	1769+90
	10		FR-116	1	\$55,000	\$55,000		
	12 ²		FR-116	1	\$55,000	\$55,000		
	14		FR-116, FR-117	2	\$55,000	\$110,000		
	16		FR-116, FR-117	2	\$55,000	\$110,000		
	18		FR-116, FR-117	2	\$55,000	\$110,000		
	20		FR-116, FR-117	2	\$55,000	\$110,000		

Source: Supplemental Noise Study Report (LSA 2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

³ Denotes that the maximum feasible barrier height would not break the line of sight between the receptor and the truck exhaust stack.

dBA = A-weighted decibels

ft = feet

FTNB = Freeway Tunnel Noise Barrier

2.4. Light Rail Alternative

As part of the SR 710 North Study Report, the LRT alternative would include a passenger rail operated along a dedicated guideway similar to other Metro light rail lines. The LRT alignment is approximately 7.5 mi long, with 3 mi of aerial segments and 4.5 mi of bored tunnel segments. For the aerial segments, the criteria used were taken from the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2006). These criteria were used to compare existing noise levels to future noise levels under future conditions. The impacts were then classified as either no impact, moderate, or severe. The classification of impact is based on a sliding scale that compares light rail impacts to existing noise levels as part of the *Transit Noise and Vibration Impact Assessment Manual*.

2.4.1. Noise Impact Locations

Once the train operation noise levels were compared to the existing daily noise levels, it was determined that receptors FR-2, LR-4, LR-5, LR-9, LR-11 through LR-15, and LR-20 through LR-22 would experience moderate impacts, while receptors LR-1, LR-3, LR-6, LR-8, and LR-10 would experience severe impacts. In order to eliminate potential future impacts, noise barriers were considered at the edge of track due to the track being elevated above ground. Table 2.5 shows the heights of proposed barriers that are required at each receptor location. Figure 2-5 shows the location of each track barrier along with its respective height.

Typically, noise abatement associated with the FTA criteria is designed to provide the minimum height in order to reduce impacts to no impact. Unlike the Protocol methodology, an analysis showing costs at multiple heights is not completed. The design of noise barriers presented in this report is preliminary and has been conducted at a level appropriate for environmental review and not for final design of the project. Preliminary information on the physical location, length, and height of noise barriers is provided in this report. If pertinent parameters change substantially during the final project design, preliminary noise barrier designs may be modified or eliminated from the final project. A final decision on the construction of the noise abatement would be made upon completion of the project design.

Table 2.5 Train Operations Noise Impact Analysis Abatement Summary

Receptor Location	Existing Noise Level (L _{dn})	Train Operations Noise Level (L _{dn})	Noise Exposure Increase (dBA)	No Impact, Moderate, Severe ¹	Proposed Barrier Height (ft) ²	Train Noise Level With Mitigation (dBA)	No Impact, Moderate, Severe After Mitigation ¹
LR-01	54.6	63.6	9.5	Severe	6.0	54.4	No Impact
LR-02	54.6	57.2	4.5	Moderate	4.0	51.8	No Impact
LR-03	63.1	67.5	5.7	Severe	5.5	59.5	No Impact
LR-04	63.1	60.5	1.9	Moderate	4.0	55.8	No Impact
LR-05	64.6	63.7	2.6	Moderate	4.0	58.4	No Impact
LR-06	58.0	67.3	9.8	Severe	9.5	56.9	No Impact
LR-07 ³	61.9	63.7	4.0	-	0.0	-	-
LR-08	61.9	68.3	7.3	Severe	7.0	58.7	No Impact
LR-09	60.0	59.1	2.6	Moderate	4.0	54.4	No Impact
LR-10	65.6	69.3	5.2	Severe	5.0	60.8	No Impact
LR-11	67.8	68.4	3.3	Moderate	4.0	61.4	No Impact
LR-12	67.6	67.9	3.2	Moderate	4.0	60.6	No Impact
LR-13	67.6	67.9	3.2	Moderate	4.0	60.6	No Impact
LR-14	67.6	67.3	2.9	Moderate	4.0	60.2	No Impact
LR-15	67.6	67.6	3.0	Moderate	4.0	60.4	No Impact
LR-16	67.7	60.5	0.8	No Impact	0.0	-	-
LR-17	61.7	54.7	0.8	No Impact	0.0	-	-
LR-18	67.0	56.3	0.4	No Impact	0.0	-	-
LR-19	64.4	55.9	0.6	No Impact	0.0	-	-
LR-20	61.9	61.9	3.0	Moderate	4.0	56.4	No Impact
LR-21	65.9	62.1	1.5	Moderate	4.0	56.5	No Impact
LR-22	61.8	62.0	3.1	Moderate	4.0	57.0	No Impact
LR-23	69.7	63.0	0.8	No Impact	0.0	-	-
LR-24	77.0	65.8	0.3	No Impact	0.0	-	-
LR-25	63.3	56.2	0.8	No Impact	0.0	-	-
LR-26	76.7	57.0	0.0	No Impact	0.0	-	-
LR-27	71.4	61.6	0.4	No Impact	0.0	-	-
LR-28	58.9	52.3	0.9	No Impact	0.0	-	-
LR-29	58.1	54.2	1.5	No Impact	0.0	-	-

¹ Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, Table 3-1.

² Proposed barrier height is relative to the track height level.

³ Non-noise-sensitive active park. Only passive parks are classified as being noise sensitive. Level shown for reporting purposes only.

dBA = A-weighted decibels

ft = feet

L_{dn} = day-night average sound level

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Chapter 3. Preliminary Noise Abatement Decision

3.1. Summary of Key Information

Utilizing the information in Chapter 2, all barriers considered to be feasible are analyzed to determine their reasonableness. As stated in Section 5.4 of the NSR, the overall reasonableness of noise abatement is determined by considering factors such as the noise reduction design goal and the construction cost of the barrier. For a noise barrier to be considered reasonable, the noise level reduction design goal of 7 dBA must be achieved at one or more of the benefited receptors. For any noise barrier to be considered reasonable from a cost perspective the estimated construction cost of the noise barrier would be equal to or less than the total cost allowance calculated for the barrier. The total reasonable allowance was determined based on the number of benefited receptors multiplied by the reasonable allowance per residence. The estimated noise barrier construction cost for each barrier under the TSM/TDM, BRT, and Freeway Tunnel Alternatives were developed by the project engineering team and is shown in Tables 3.1 through 3.4 as well as in Appendix A. If the estimated noise barrier construction cost exceeds the total reasonable allowance, the noise barrier is determined to be not reasonable. However, if the estimated noise barrier construction cost is within the total reasonable allowance, the noise barrier is determined to be reasonable.

A summary of abatement information in Tables 3.1 through 3.4 list all the feasible noise barriers along with their heights, approximate lengths, the noise attenuation range, the number of benefited units/receptors, the total reasonable allowance per barrier, and whether the barrier is reasonable.

3.2. Nonacoustical Factors Relating to Feasibility

Factors not relating to acoustics that must be considered during the construction of noise barriers include: geometric standards, safety, maintenance, security, geotechnical considerations, and utility relocations. The factors not relating to acoustics for L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation are addressed below.

Table 3.1 Summary of Abatement Information for the TSM/TDM Alternative

Inter-section ID No.	Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated				
									Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³			
L-3	TNB No. 1	6	48	5	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	-	No	-	No			
		8 ⁴		6	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	-	No	-	No			
		10		6	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	-	No	-	No			
		12		6	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	-	No	-	No			
		14		6	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	-	No	-	No			
		16		7	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	\$33,720	Yes	\$27,120	Yes			
		18		7	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	\$36,960	Yes	\$30,360	Yes			
		20		7	1	Caltrans ROW/Private Property Line	\$55,000	\$55,000	\$40,200	Yes	\$33,600	Yes			
	TNB No. 2	6	46	7	1	Private Property Line	\$55,000	\$55,000	\$49,053	Yes	\$10,178	Yes			
		8 ⁴		10	1	Private Property Line	\$55,000	\$55,000	\$52,158	Yes	\$13,283	Yes			
		10		13	1	Private Property Line	\$55,000	\$55,000	\$55,263	No	\$16,388	Yes			
		12		14	1	Private Property Line	\$55,000	\$55,000	\$58,368	No	\$19,493	Yes			
		14		15	1	Private Property Line	\$55,000	\$55,000	\$61,473	No	\$22,598	Yes			
		16		16	1	Private Property Line	\$55,000	\$55,000	\$64,578	No	\$25,703	Yes			
		18		17	1	Private Property Line	\$55,000	\$55,000	\$67,683	No	\$28,808	Yes			
		20		18	1	Private Property Line	\$55,000	\$55,000	\$70,788	No	\$31,913	Yes			
		L-5		TNB No. 1	6	202	7	2	Private Property Line	\$55,000	\$110,000	\$111,936	No	\$52,811	Yes
					8		9	2	Private Property Line	\$55,000	\$110,000	\$125,571	No	\$66,446	Yes
8 ⁴	9		2		Private Property Line		\$55,000	\$110,000	\$139,206	No	\$80,081	Yes			
12	10		2		Private Property Line		\$55,000	\$110,000	\$152,841	No	\$93,716	Yes			
14	10		2		Private Property Line		\$55,000	\$110,000	\$166,476	No	\$107,351	Yes			
16	10		2		Private Property Line		\$55,000	\$110,000	\$180,111	No	\$120,986	No			
18	10		2		Private Property Line		\$55,000	\$110,000	\$193,746	No	\$134,621	No			
20	10		2		Private Property Line		\$55,000	\$110,000	\$207,381	No	\$148,256	No			
T-1	TNB No. 1		8		1247		7-10	18	Caltrans ROW	\$55,000	\$990,000	\$981,972	Yes	\$921,009	Yes
		10	8-12	18		Caltrans ROW	\$55,000	\$990,000	\$1,184,171	No	\$1,123,209	No			
		12	8-13	18		Caltrans ROW	\$55,000	\$990,000	\$1,183,959	No	\$1,122,997	No			
		14	8-13	18		Caltrans ROW	\$55,000	\$990,000	\$1,175,061	No	\$1,114,098	No			
		16 ⁴	8-14	18		Caltrans ROW	\$55,000	\$990,000	\$1,436,514	No	\$1,375,552	No			
		18	8-15	18		Caltrans ROW	\$55,000	\$990,000	\$1,696,909	No	\$1,635,946	No			
		20	8-15	18		Caltrans ROW	\$55,000	\$990,000	\$1,825,093	No	\$1,764,131	No			
		TNB No. 2	10	963		5	4	Caltrans ROW	\$55,000	\$220,000	-	No	-	No	
	12		5-6		5	Caltrans ROW	\$55,000	\$275,000	-	No	-	No			
	14		5-6		11	Caltrans ROW	\$55,000	\$605,000	-	No	-	No			
	16		5-7		15	Caltrans ROW	\$55,000	\$825,000	\$541,387	Yes	\$541,387	Yes			
	18		5-8		16	Caltrans ROW	\$55,000	\$880,000	\$603,380	Yes	\$603,380	Yes			
	20 ⁵		5-8		16	Caltrans ROW	\$55,000	\$880,000	\$665,373	Yes	\$665,373	Yes			
	TNB No. 3		6		673	6	4	Private Property Line	\$55,000	\$220,000	-	No	-	No	
		8	7	4		Private Property Line	\$55,000	\$220,000	\$859,633	No	\$409,611	No			
		10	8	4		Private Property Line	\$55,000	\$220,000	\$905,060	No	\$455,039	No			

Table 3.1 Summary of Abatement Information for the TSM/TDM Alternative

Inter-section ID No.	Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated				
									Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³			
		12		8	4	Private Property Line	\$55,000	\$220,000	\$950,488	No	\$500,466	No			
		14		5-8	8	Private Property Line	\$55,000	\$440,000	\$995,915	No	\$545,894	No			
		16		7-9	8	Private Property Line	\$55,000	\$440,000	\$1,041,343	No	\$591,321	No			
		18		8-10	8	Private Property Line	\$55,000	\$440,000	\$1,086,770	No	\$636,749	No			
		20 ⁵		6-11	9	Private Property Line	\$55,000	\$495,000	\$1,132,198	No	\$682,176	No			
	TNB No. 4	6	406	6-8	6	Private Property Line	\$55,000	\$330,000	\$588,214	No	\$353,580	No			
		8		8-11	6	Private Property Line	\$55,000	\$330,000	\$615,619	No	\$380,985	No			
		10		10-13	6	Private Property Line	\$55,000	\$330,000	\$643,024	No	\$408,390	No			
		12		11-15	6	Private Property Line	\$55,000	\$330,000	\$670,429	No	\$435,795	No			
		14		12-16	6	Private Property Line	\$55,000	\$330,000	\$697,834	No	\$463,200	No			
		16		13-17	6	Private Property Line	\$55,000	\$330,000	\$725,239	No	\$490,605	No			
		18		14-17	6	Private Property Line	\$55,000	\$330,000	\$752,644	No	\$518,010	No			
		20 ⁴		15-18	6	Private Property Line	\$55,000	\$330,000	\$780,049	No	\$545,415	No			
		T-2		TNB No. 1	6	349	9	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$104,264	Yes	\$88,995	Yes
					8		10	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$127,821	Yes	\$112,553	Yes
					10 ⁴		11	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$151,379	Yes	\$136,110	Yes
					12		12	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$174,936	Yes	\$159,668	Yes
14	12		4		Caltrans ROW/Private Property Line		\$55,000	\$220,000	\$198,494	Yes	\$183,225	Yes			
16	14		4		Caltrans ROW/Private Property Line		\$55,000	\$220,000	\$222,051	No	\$206,783	Yes			
18	15		4		Caltrans ROW/Private Property Line		\$55,000	\$220,000	\$245,609	No	\$230,340	No			
20	16		4		Caltrans ROW/Private Property Line		\$55,000	\$220,000	\$269,166	No	\$253,898	No			
TNB No. 2	8		743	5	13	Caltrans ROW	\$55,000	\$715,000	-	No	-	No			
	10			6	13	Caltrans ROW	\$55,000	\$715,000	-	No	-	No			
	12			5-7	34	Caltrans ROW	\$55,000	\$1,870,000	\$347,353	Yes	\$314,846	Yes			
	14			7-8	34	Caltrans ROW	\$55,000	\$1,870,000	\$397,505	Yes	\$364,999	Yes			
	16			8-9	34	Caltrans ROW	\$55,000	\$1,870,000	\$447,658	Yes	\$415,151	Yes			
	18			9	34	Caltrans ROW	\$55,000	\$1,870,000	\$497,810	Yes	\$465,304	Yes			
	20 ⁴			9	34	Caltrans ROW	\$55,000	\$1,870,000	\$547,963	Yes	\$515,456	Yes			

Source: LSA Associates, Inc. (2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Sound barrier construction cost information provided by CH2M HILL.

³ Shaded area represents barrier heights that have been determined to be not reasonable because the barrier would not reduce noise levels by 7 dBA or more.

⁴ Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

⁵ Denotes that the maximum feasible barrier height would not break the line of sight between the receptor and the truck exhaust stack.

Caltrans = California Department of Transportation TDM = Transportation Demand Management

dBA = A-weighted decibels TNB = TSM/TDM Noise Barrier

ft = feet TSM = Transportation System Management

ROW = right of way

Table 3.2 Summary of Abatement Information for the BRT Alternative

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
BNB No. 1	10	340	9	12	Private Property Line	\$55,000	\$660,000	\$567,613	Yes	\$546,363	Yes
	12		11	12	Private Property Line	\$55,000	\$660,000	\$590,308	Yes	\$569,058	Yes
	14		12	12	Private Property Line	\$55,000	\$660,000	\$613,003	Yes	\$591,753	Yes
	16		13	12	Private Property Line	\$55,000	\$660,000	\$635,698	Yes	\$614,448	Yes
	18		14	12	Private Property Line	\$55,000	\$660,000	\$660,688	No	\$639,438	Yes
	20 ⁴		14	12	Private Property Line	\$55,000	\$660,000	\$683,638	No	\$662,388	No
BNB No. 2	10	826	5	3	Private Property Line	\$55,000	\$165,000	-	No	-	No
	12		6-7	9	Private Property Line	\$55,000	\$495,000	\$1,290,757	No	\$1,238,382	No
	14		5-9	16	Private Property Line	\$55,000	\$880,000	\$1,346,693	No	\$1,294,318	No
	16		5-9	24	Private Property Line	\$55,000	\$1,320,000	\$1,402,630	No	\$1,350,255	No
	18		6-11	24	Private Property Line	\$55,000	\$1,320,000	\$1,464,223	No	\$1,411,848	No
	20 ⁵		6-12	24	Private Property Line	\$55,000	\$1,320,000	\$1,520,788	No	\$1,468,413	No
BNB No. 3	6	623	7-11	24	Private Property Line	\$55,000	\$1,320,000	\$476,237	Yes	\$359,612	Yes
	8 ⁴		8-13	24	Private Property Line	\$55,000	\$1,320,000	\$519,699	Yes	\$403,074	Yes
	10		8-14	24	Private Property Line	\$55,000	\$1,320,000	\$563,161	Yes	\$446,536	Yes
	12		9-14	24	Private Property Line	\$55,000	\$1,320,000	\$606,624	Yes	\$489,999	Yes
	14		9-15	24	Private Property Line	\$55,000	\$1,320,000	\$650,086	Yes	\$533,461	Yes
	16		9-15	24	Private Property Line	\$55,000	\$1,320,000	\$693,548	Yes	\$576,923	Yes
	18		9-16	24	Private Property Line	\$55,000	\$1,320,000	\$741,209	Yes	\$624,584	Yes
	20		9-16	24	Private Property Line	\$55,000	\$1,320,000	\$785,138	Yes	\$668,513	Yes
BNB No. 4	8 ⁴	67	5	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	10		5	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	12		6	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	14		6	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	16		6	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	18		6	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
	20		6	1	Private Property Line	\$55,000	\$55,000	-	No	-	No
BNB No. 5	6	146	7	1	Private Property Line	\$55,000	\$55,000	\$39,413	Yes	\$33,788	Yes
	8		10	1	Private Property Line	\$55,000	\$55,000	\$49,425	Yes	\$43,800	Yes
	10 ⁴		12	1	Private Property Line	\$55,000	\$55,000	\$59,438	No	\$53,813	Yes
	12		14	1	Private Property Line	\$55,000	\$55,000	\$69,450	No	\$63,825	No
	14		15	1	Private Property Line	\$55,000	\$55,000	\$79,463	No	\$73,838	No
	16		17	1	Private Property Line	\$55,000	\$55,000	\$89,475	No	\$83,850	No
	18		18	1	Private Property Line	\$55,000	\$55,000	\$100,500	No	\$94,875	No
	20		19	1	Private Property Line	\$55,000	\$55,000	\$110,625	No	\$105,000	No

Source: LSA Associates, Inc. (2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Sound barrier construction cost information provided by CH2M HILL.

³ Shaded area represents barrier heights that have been determined to be not reasonable because the barrier would not reduce noise levels by 7 dBA or more.

⁴ Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

BNB = BRT Noise Barrier BRT = Bus Rapid Transit dBA = A-weighted decibels ft = feet

Table 3.3 Summary of Abatement Information for the Freeway Tunnel Alternative Single-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
FTNB No. 1	14	537	5	1	Caltrans ROW	\$55,000	\$55,000	-	NO	-	NO
	16		5	1	Caltrans ROW	\$55,000	\$55,000	-	NO	-	NO
	18		5	1	Caltrans ROW	\$55,000	\$55,000	-	NO	-	NO
	20 ⁵		5	1	Caltrans ROW	\$55,000	\$55,000	-	NO	-	NO
FTNB No. 2	6	115	5	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	8 ⁴		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	10		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	12		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	14		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	16		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	18		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	20		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
FTNB No. 3A	6	2453	5-11	17	Caltrans ROW/Private Property Line	\$55,000	\$935,000	\$4,117,108	NO	\$1,487,844	NO
	8		6-12	20	Caltrans ROW/Private Property Line	\$55,000	\$1,100,000	\$4,274,036	NO	\$1,644,773	NO
	10		5-13	23	Caltrans ROW/Private Property Line	\$55,000	\$1,265,000	\$4,434,284	NO	\$1,805,021	NO
	12 ⁴		5-14	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,607,528	NO	\$1,978,264	NO
	14		5-15	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,780,771	NO	\$2,151,508	NO
	16		6-15	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,954,014	NO	\$2,324,751	NO
	18		6-15	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$5,127,257	NO	\$2,497,994	NO
	20		6-16	26	Caltrans ROW/Private Property Line	\$55,000	\$1,430,000	\$5,300,500	NO	\$2,671,237	NO
FTNB No. 3A +3B	6	3091	5-11	19	Caltrans ROW/Private Property Line	\$55,000	\$1,045,000	\$4,468,534	NO	\$1,839,271	NO
	8		5-12	28	Caltrans ROW/Private Property Line	\$55,000	\$1,540,000	\$4,670,521	NO	\$2,041,258	NO
	10		5-13	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$4,875,828	NO	\$2,246,565	NO
	12 ⁴		5-14	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$5,094,130	NO	\$2,464,867	NO
	14		5-15	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$5,312,432	NO	\$2,683,169	NO
	16		5-15	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$5,530,734	NO	\$2,901,471	NO
	18		5-15	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$5,749,036	NO	\$3,119,773	NO
	20		5-16	36	Caltrans ROW/Private Property Line	\$55,000	\$1,980,000	\$5,967,338	NO	\$3,338,074	NO
FTNB No. 4	6	2621	5-6	10	Edge of Shoulder	\$55,000	\$550,000	-	NO	-	NO
	8		5-6	15	Edge of Shoulder	\$55,000	\$825,000	-	NO	-	NO
	10		5-7	18	Edge of Shoulder	\$55,000	\$990,000	\$1,009,649	NO	\$1,009,649	NO
	12		5-8	21	Edge of Shoulder	\$55,000	\$1,155,000	\$1,186,566	NO	\$1,186,566	NO
	14		5-10	21	Edge of Shoulder	\$55,000	\$1,155,000	\$1,363,484	NO	\$1,363,484	NO
	16		5-10	21	Edge of Shoulder	\$55,000	\$1,155,000	\$1,540,401	NO	\$1,540,401	NO
	18		5-11	26	Edge of Shoulder	\$55,000	\$1,430,000	\$1,717,319	NO	\$1,717,319	NO
	20 ⁵		5-12	29	Edge of Shoulder	\$55,000	\$1,595,000	\$1,894,236	NO	\$1,894,236	NO
FTNB No. 5	6	1801	5-12	19	Caltrans ROW/Private Property Line	\$55,000	\$1,045,000	\$607,438	YES	\$596,363	YES
	8		6-13	19	Caltrans ROW/Private Property Line	\$55,000	\$1,045,000	\$729,005	YES	\$717,930	YES
	10		5-15	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$850,573	YES	\$839,498	YES
	12		5-16	32	Caltrans ROW/Private Property Line	\$55,000	\$1,760,000	\$972,140	YES	\$961,065	YES

Table 3.3 Summary of Abatement Information for the Freeway Tunnel Alternative Single-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
	14		5-17	33	Caltrans ROW/Private Property Line	\$55,000	\$1,815,000	\$1,093,708	YES	\$1,082,633	YES
	16		5-18	39	Caltrans ROW/Private Property Line	\$55,000	\$2,145,000	\$1,215,275	YES	\$1,204,200	YES
	18		5-19	42	Caltrans ROW/Private Property Line	\$55,000	\$2,310,000	\$1,336,843	YES	\$1,325,768	YES
	20 ⁴		5-19	42	Caltrans ROW/Private Property Line	\$55,000	\$2,310,000	\$1,458,410	YES	\$1,447,335	YES
FTNB No. 6S	20 ⁵	1454	5	5	Edge of Shoulder	\$55,000	\$275,000	-	NO	-	NO
FTNB No. 7	6	673	6	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	-	NO	-	NO
	8		8	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$757,983	NO	\$327,649	NO
	10		9	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$803,410	NO	\$373,076	NO
	12		6-10	8	Caltrans ROW/Private Property Line	\$55,000	\$440,000	\$848,838	NO	\$418,504	YES
	14		8-11	8	Caltrans ROW/Private Property Line	\$55,000	\$440,000	\$894,265	NO	\$463,931	NO
	16		5-12	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$939,693	NO	\$509,359	NO
	18		8-12	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$985,120	NO	\$554,786	NO
	20 ⁴		10-13	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$1,030,548	NO	\$600,214	NO
FTNB No. 8	6	406	7-8	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$430,864	NO	\$200,393	YES
	8		9-11	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$458,269	NO	\$227,798	YES
	10		10-13	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$485,674	NO	\$255,203	YES
	12		12-14	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$513,079	NO	\$282,608	YES
	14		13-15	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$540,484	NO	\$310,013	YES
	16		14-16	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$567,889	NO	\$337,418	NO
	18		15-17	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$595,294	NO	\$364,823	NO
	20 ⁴		16-17	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$622,699	NO	\$392,228	NO
FTNB No. 10	8	1207	5	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	-	NO	-	NO
	10		7-9	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	\$437,797	YES	\$437,797	YES
	12		5-11	12	Caltrans ROW/Private Property Line	\$55,000	\$660,000	\$523,041	YES	\$523,041	YES
	14 ⁴		5-12	18	Caltrans ROW/Private Property Line	\$55,000	\$990,000	\$608,286	YES	\$608,286	YES
	16		5-13	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$693,530	YES	\$693,530	YES
	18		6-14	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$778,774	YES	\$778,774	YES
	20		6-15	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$864,019	YES	\$864,019	YES
FTNB No. 11	12 ⁴	1404	5	2	Caltrans ROW/Private Property Line	\$55,000	\$110,000	-	NO	-	NO
	14		5-6	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	-	NO	-	NO
	16		6-7	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,154,716	NO	\$1,044,248	NO
	18		5-8	12	Caltrans ROW/Private Property Line	\$55,000	\$660,000	\$1,253,874	NO	\$1,143,405	NO
	20		5-9	12	Caltrans ROW/Private Property Line	\$55,000	\$660,000	\$1,353,031	NO	\$1,242,563	NO
FTNB No. 12	14	556	5	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	16		5	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	18		5	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	20 ⁵		5-6	5	Edge of Shoulder	\$55,000	\$275,000	-	NO	-	NO

Table 3.3 Summary of Abatement Information for the Freeway Tunnel Alternative Single-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
FTNB No. 13A+B	10 ⁴	2315	5-7	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,239,683	NO	\$1,239,683	NO
	12		7-8	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,403,180	NO	\$1,403,180	NO
	14		8-9	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,566,677	NO	\$1,566,677	NO
	16		9-10	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,730,174	NO	\$1,730,174	NO
	18		9-11	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,893,671	NO	\$1,893,671	NO
	20		5-11	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	\$2,057,168	NO	\$2,057,168	NO
FTNB No. 14	8 ⁴	263	5	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	10		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	12		7	1	Private Property Line	\$55,000	\$55,000	\$142,135	NO	\$111,446	NO
	14		7	1	Private Property Line	\$55,000	\$55,000	\$159,888	NO	\$129,199	NO
	16		8	1	Private Property Line	\$55,000	\$55,000	\$177,640	NO	\$146,951	NO
	18		8	1	Private Property Line	\$55,000	\$55,000	\$195,393	NO	\$164,704	NO
FTNB No. 15	8	262	8	1	Private Property Line	\$55,000	\$55,000	\$117,687	NO	\$75,653	NO
	10		10	1	Private Property Line	\$55,000	\$55,000	\$135,372	NO	\$93,338	NO
	12 ⁴		11	1	Private Property Line	\$55,000	\$55,000	\$153,057	NO	\$111,023	NO
	14		6-12	2	Private Property Line	\$55,000	\$110,000	\$170,742	NO	\$128,708	NO
	16		7-13	2	Private Property Line	\$55,000	\$110,000	\$188,427	NO	\$146,393	NO
	18		7-14	2	Private Property Line	\$55,000	\$110,000	\$206,112	NO	\$164,078	NO
	20		8-15	2	Private Property Line	\$55,000	\$110,000	\$223,797	NO	\$181,763	NO

Source: LSA Associates, Inc. (2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Sound barrier construction cost information provided by CH2M HILL.

³ Shaded area represents barrier heights that have been determined to be not reasonable because the barrier would not reduce noise levels by 7 dBA or more.

⁴ Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

Caltrans = California Department of Transportation

dBA = A-weighted decibels

ft = feet

FTNB = Freeway Tunnel Noise Barrier

ROW = right of way

Table 3.4 Summary of Abatement Information for the Freeway Tunnel Alternative Dual-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
FTNB No. 2	6	115	5	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	8 ⁴		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	10		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	12		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	14		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	16		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	18		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	20		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
FTNB No. 3A	6	2453	6-11	17	Caltrans ROW/Private Property Line	\$55,000	\$935,000	\$4,098,717	NO	\$1,469,454	NO
	8		5-13	21	Caltrans ROW/Private Property Line	\$55,000	\$1,155,000	\$4,248,702	NO	\$1,619,439	NO
	10		5-14	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,401,859	NO	\$1,772,596	NO
	12 ⁴		5-14	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,567,437	NO	\$1,938,174	NO
	14		6-15	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,733,014	NO	\$2,103,751	NO
	16		7-16	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$4,898,592	NO	\$2,269,329	NO
	18		8-16	24	Caltrans ROW/Private Property Line	\$55,000	\$1,320,000	\$5,064,169	NO	\$2,434,906	NO
	20		6-16	26	Caltrans ROW/Private Property Line	\$55,000	\$1,430,000	\$5,229,747	NO	\$2,600,484	NO
FTNB No. 3A + 3B	6	3091	6-11	17	Caltrans ROW/Private Property Line	\$55,000	\$935,000	\$4,543,657	NO	\$2,777,134	NO
	8		5-13	26	Caltrans ROW/Private Property Line	\$55,000	\$1,430,000	\$4,752,299	NO	\$2,970,184	NO
	10		5-14	32	Caltrans ROW/Private Property Line	\$55,000	\$1,760,000	\$4,960,942	NO	\$3,166,406	NO
	12 ⁴		5-14	35	Caltrans ROW/Private Property Line	\$55,000	\$1,925,000	\$5,169,584	NO	\$3,375,049	NO
	14		5-15	35	Caltrans ROW/Private Property Line	\$55,000	\$1,925,000	\$5,378,227	NO	\$3,583,691	NO
	16		5-16	35	Caltrans ROW/Private Property Line	\$55,000	\$1,925,000	\$5,586,869	NO	\$3,792,334	NO
	18		5-16	35	Caltrans ROW/Private Property Line	\$55,000	\$1,925,000	\$5,795,512	NO	\$4,000,976	NO
	20		5-16	37	Caltrans ROW/Private Property Line	\$55,000	\$2,035,000	\$6,004,154	NO	\$4,209,619	NO
FTNB No. 4	6	2621	5	5	Edge of Shoulder	\$55,000	\$275,000	-	NO	-	NO
	8		5-6	10	Edge of Shoulder	\$55,000	\$550,000	-	NO	-	NO
	10		5-8	12	Edge of Shoulder	\$55,000	\$660,000	\$1,009,649	NO	\$1,009,649	NO
	12		5-9	21	Edge of Shoulder	\$55,000	\$1,155,000	\$1,186,566	NO	\$1,186,566	NO
	14		5-9	23	Edge of Shoulder	\$55,000	\$1,265,000	\$1,363,484	NO	\$1,363,484	NO
	16		5-10	26	Edge of Shoulder	\$55,000	\$1,430,000	\$1,540,401	NO	\$1,540,401	NO
	18		5-11	27	Edge of Shoulder	\$55,000	\$1,485,000	\$1,717,319	NO	\$1,717,319	NO
	20 ⁵		5-11	27	Edge of Shoulder	\$55,000	\$1,485,000	\$1,894,236	NO	\$1,894,236	NO
FTNB No. 5	6	1801	5-13	21	Caltrans ROW/Private Property Line	\$55,000	\$1,155,000	\$607,438	YES	\$596,363	YES
	8		5-14	21	Caltrans ROW/Private Property Line	\$55,000	\$1,155,000	\$729,005	YES	\$717,930	YES
	10		5-15	21	Caltrans ROW/Private Property Line	\$55,000	\$1,155,000	\$850,573	YES	\$839,498	YES
	12		5-16	25	Caltrans ROW/Private Property Line	\$55,000	\$1,375,000	\$972,140	YES	\$961,065	YES
	14		5-17	34	Caltrans ROW/Private Property Line	\$55,000	\$1,870,000	\$1,093,708	YES	\$1,082,633	YES
	16		5-18	40	Caltrans ROW/Private Property Line	\$55,000	\$2,200,000	\$1,215,275	YES	\$1,204,200	YES
	18		5-19	40	Caltrans ROW/Private Property Line	\$55,000	\$2,200,000	\$1,336,843	YES	\$1,325,768	YES
	20 ⁴		5-19	43	Caltrans ROW/Private Property Line	\$55,000	\$2,365,000	\$1,458,410	YES	\$1,447,335	YES

Table 3.4 Summary of Abatement Information for the Freeway Tunnel Alternative Dual-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
FTNB No. 6D	6	1404	6	4	Edge of Shoulder	\$55,000	\$220,000	-	NO	-	NO
	8		8	4	Edge of Shoulder	\$55,000	\$220,000	\$427,781	NO	\$427,781	NO
	10		10	4	Edge of Shoulder	\$55,000	\$220,000	\$518,164	NO	\$518,164	NO
	12		6-11	11	Edge of Shoulder	\$55,000	\$605,000	\$608,546	NO	\$608,546	NO
	14		5-12	15	Edge of Shoulder	\$55,000	\$825,000	\$698,929	YES	\$698,929	YES
	16		6-12	15	Edge of Shoulder	\$55,000	\$825,000	\$789,311	YES	\$789,311	YES
	18		9-13	15	Edge of Shoulder	\$55,000	\$825,000	\$879,694	NO	\$879,694	NO
	20 ⁵		10-13	15	Edge of Shoulder	\$55,000	\$825,000	\$970,076	NO	\$970,076	NO
FTNB No. 7	6	673	7	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$712,555	NO	\$282,221	NO
	8		10	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$757,983	NO	\$327,649	NO
	10		11	4	Caltrans ROW/Private Property Line	\$55,000	\$220,000	\$803,410	NO	\$373,076	NO
	12		7-12	8	Caltrans ROW/Private Property Line	\$55,000	\$440,000	\$848,838	NO	\$418,504	YES
	14		9-14	8	Caltrans ROW/Private Property Line	\$55,000	\$440,000	\$894,265	NO	\$463,931	NO
	16		6-16	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$939,693	NO	\$509,359	NO
	18		8-17	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$985,120	NO	\$554,786	NO
	20 ⁴		9-19	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$1,030,548	NO	\$600,214	NO
FTNB No. 8	6	406	7-8	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$430,864	NO	\$200,393	YES
	8		8-11	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$458,269	NO	\$227,798	YES
	10		10-13	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$485,674	NO	\$255,203	YES
	12		11-15	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$513,079	NO	\$282,608	YES
	14		12-16	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$540,484	NO	\$310,013	YES
	16		13-16	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$567,889	NO	\$337,418	NO
	18		14-17	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$595,294	NO	\$364,823	NO
	20 ⁴		14-17	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$622,699	NO	\$392,228	NO
FTNB No. 9	6	84	7	1	Private Property Line	\$55,000	\$55,000	\$26,985	YES	\$19,110	YES
	8 ⁴		8	1	Private Property Line	\$55,000	\$55,000	\$32,655	YES	\$24,780	YES
	10		10	1	Private Property Line	\$55,000	\$55,000	\$38,325	YES	\$30,450	YES
	12		11	1	Private Property Line	\$55,000	\$55,000	\$43,995	YES	\$36,120	YES
	14		12	1	Private Property Line	\$55,000	\$55,000	\$49,665	YES	\$41,790	YES
	16		13	1	Private Property Line	\$55,000	\$55,000	\$55,335	NO	\$47,460	YES
	18		14	1	Private Property Line	\$55,000	\$55,000	\$61,005	NO	\$53,130	YES
	20		14	1	Private Property Line	\$55,000	\$55,000	\$66,675	NO	\$58,800	NO
FTNB No. 10	8	1207	5-6	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	-	NO	-	NO
	10		8-9	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	\$437,797	YES	\$437,797	YES
	12		9-11	10	Caltrans ROW/Private Property Line	\$55,000	\$550,000	\$523,041	YES	\$523,041	YES
	14 ⁴		5-12	18	Caltrans ROW/Private Property Line	\$55,000	\$990,000	\$608,286	YES	\$608,286	YES
	16		5-13	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$693,530	YES	\$693,530	YES
	18		5-14	22	Caltrans ROW/Private Property Line	\$55,000	\$1,210,000	\$778,774	YES	\$778,774	YES
	20		6-15	23	Caltrans ROW/Private Property Line	\$55,000	\$1,265,000	\$864,019	YES	\$864,019	YES

Table 3.4 Summary of Abatement Information for the Freeway Tunnel Alternative Dual-Bore Design Variation

Noise Barrier No.	Height (ft)	Approx. Length (ft)	Noise Attenuation Range (dBA)	Number of Benefited Units ¹	Noise Barrier Location	Reasonable Allowance Per Benefited Unit	Total Reasonable Allowance	With ROW Costs		With ROW Donated	
								Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³	Estimated Sound Barrier Construction Cost ^{2,3}	Reasonable? ³
FTNB No. 11	10	1404	5	2	Caltrans ROW/Private Property Line	\$55,000	\$110,000	-	NO	-	NO
	12 ⁴		6	2	Caltrans ROW/Private Property Line	\$55,000	\$110,000	-	NO	-	NO
	14		5-7	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,055,559	NO	\$945,090	NO
	16		5-8	6	Caltrans ROW/Private Property Line	\$55,000	\$330,000	\$1,154,716	NO	\$1,044,248	NO
	18		5-8	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$1,253,874	NO	\$1,143,405	NO
	20		5-9	12	Caltrans ROW/Private Property Line	\$55,000	\$660,000	\$1,353,031	NO	\$1,242,563	NO
FTNB No. 12	14	556	5	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	16		6	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	18		6	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
	20 ⁴		6	3	Edge of Shoulder	\$55,000	\$165,000	-	NO	-	NO
FTNB No. 13A+B	10 ⁴	2315	5-7	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,239,683	NO	\$1,239,683	NO
	12		7-8	5	Caltrans ROW/Private Property Line	\$55,000	\$275,000	\$1,403,180	NO	\$1,403,180	NO
	14		5-9	7	Caltrans ROW/Private Property Line	\$55,000	\$385,000	\$1,566,677	NO	\$1,566,677	NO
	16		5-10	7	Caltrans ROW/Private Property Line	\$55,000	\$385,000	\$1,730,174	NO	\$1,730,174	NO
	18		5-11	7	Caltrans ROW/Private Property Line	\$55,000	\$385,000	\$1,893,671	NO	\$1,893,671	NO
	20		5-11	9	Caltrans ROW/Private Property Line	\$55,000	\$495,000	\$2,057,168	NO	\$2,057,168	NO
FTNB No. 13B	18 ⁴	709	5	2	Caltrans ROW/Private Property Line	\$55,000	\$110,000	-	NO	-	NO
	20		5	2	Caltrans ROW/Private Property Line	\$55,000	\$110,000	-	NO	-	NO
FTNB No. 14	8 ⁴	263	5	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	10		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	12		6	1	Private Property Line	\$55,000	\$55,000	-	NO	-	NO
	14		7	1	Private Property Line	\$55,000	\$55,000	\$159,888	NO	\$129,199	NO
	16 ⁴		8	1	Private Property Line	\$55,000	\$55,000	\$177,640	NO	\$146,951	NO
	18		8	1	Private Property Line	\$55,000	\$55,000	\$195,393	NO	\$164,704	NO
	20		8	1	Private Property Line	\$55,000	\$55,000	\$213,145	NO	\$182,456	NO
FTNB No. 15	8	262	8	1	Private Property Line	\$55,000	\$55,000	\$117,687	NO	\$75,653	NO
	10		10	1	Private Property Line	\$55,000	\$55,000	\$135,372	NO	\$93,338	NO
	12 ⁴		11	1	Private Property Line	\$55,000	\$55,000	\$153,057	NO	\$111,023	NO
	14		6-12	2	Private Property Line	\$55,000	\$110,000	\$170,742	NO	\$128,708	NO
	16		7-12	2	Private Property Line	\$55,000	\$110,000	\$188,427	NO	\$146,393	NO
	18		7-14	2	Private Property Line	\$55,000	\$110,000	\$206,112	NO	\$164,078	NO
	20		8-15	2	Private Property Line	\$55,000	\$110,000	\$223,797	NO	\$181,763	NO

Source: LSA Associates, Inc. (2014).

¹ Number of units that are attenuated by 5 dBA or more by the modeled barrier.

² Sound barrier construction cost information provided by CH2M HILL.

³ Shaded area represents barrier heights that have been determined to be not reasonable because the barrier would not reduce noise levels by 7 dBA or more.

⁴ Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.

Caltrans = California Department of Transportation FTNB = Freeway Tunnel Noise Barrier

dBA = A-weighted decibels ROW = right of way

ft = feet

- **Geometric Standards:** The noise barriers would not affect applicable geometric standards of adjacent roadways.
- **Safety:** L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would not affect sight distance for vehicular or pedestrian traffic. L3/TNB No. 2 and L5/TNB No. 1 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, and FTNB No. 9 for the Freeway Tunnel Alternative dual-bore design variation would be located outside of Caltrans ROW and along private property lines. T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1 and 3 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB No. 9 for the Freeway Tunnel Alternative dual-bore design variation would be located outside the Clear Recovery Zone of any roadway facility, which is the area beyond the travel lane that needs to be kept clear of potential fixed-object hazards.
- **Maintenance:** L3/TNB Nos. 1 and 2, L5/TNB No. 1, and T2/TNB No.1 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB No. 9 for the Freeway Tunnel Alternative dual-bore design variation would be located along private property lines. The property owners must support the noise barrier in order for it to be constructed. In addition, the property owners must enter into contracts with Caltrans to accept structural and aesthetic maintenance responsibility for their respective portion of the barrier upon completion.
- **Security:** L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would not create any safety or security issues.
- **Drainage:** The construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design

variation is not anticipated to result in impacts to existing drainages. However, further investigation will be conducted during the Plans, Specifications, and Estimates (PS&E) phase to ensure that the construction of all feasible and reasonable noise barriers would not interfere with existing and proposed drainages.

- **Geotechnical Considerations:** L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would be constructed at existing grade in native soil. The noise barriers would be constructed on soils with the potential for impacts from seismic ground shaking, liquefaction, and slope instability. The design and construction of the noise barriers would be conducted in accordance with standard design and construction practices. Geotechnical conditions for the noise barriers would be explored during final design and considered during design of the noise barrier.
- **Utility Relocations:** L3/TNB No. 2 and L5/TNB No. 1 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, and FTNB No. 9 for the Freeway Tunnel Alternative dual-bore design variation could interfere with existing utility lines, some below ground and some above ground; therefore, permanent relocation would be required. The costs to permanently relocate the utility lines were included in the construction cost estimates.

3.3. Preliminary Recommendation and Decision

The preliminary noise abatement decision presented in this report is based on preliminary project alignments and profiles, which may be subject to change. As such, the physical characteristics of noise abatement described herein may also be subject to change. If pertinent parameters change substantially during the final project design, the preliminary noise abatement decision may be changed or eliminated from the final project design. The final decision of the noise abatement will be made upon completion of the project design and public involvement processes.

Due to the locations of some affected receivers, the only acoustically feasible locations for some of the proposed noise barriers are outside Caltrans ROW, on the private property line. For those proposed barriers, the opinions of the affected property owners must be considered before making a final noise abatement decision. As part of the public review period for the project, the property owners and non-

owner occupants will be sent a sound wall survey letter to request each owner or occupant's opinion on whether or not they would prefer a sound wall based on the range of reasonable and feasible heights listed in Table 3.5.

Additionally, for any new walls replacing an existing wall, the newly constructed wall must have a top-of-wall elevation that is equal to or greater than the existing wall.

Table 3.5 Summary of Feasible and Reasonable Noise Barriers

Alternative	Noise Barrier No.	Noise Barrier Location	With ROW Costs		With ROW Donated	
			Height Range (ft)	Minimum Height to Break Line of Sight (ft) ¹	Height Range (ft)	Minimum Height to Break Line of Sight (ft) ¹
TSM/TDM	L3/TNB No. 1	City ROW/Private Property Line	16–20	16	16–20	16
	L3/TNB No. 2	Private Property Line	6–8	8	6–20	8
	L5/TNB No. 1	Private Property Line	-	-	6–14	10
	T1/TNB No. 1	Caltrans ROW	8		8	
	T1/TNB No. 2	Caltrans ROW	14–20		14–20	
	T2/TNB No. 1	Caltrans ROW/Private Property Line	6 to 14	10	6 to 16	10
	T2/TNB No. 2	Caltrans ROW	8 to 20	20	8 to 20	20
BRT	BNB No. 1	Private Property Line	10–16		10–18	
	BNB No. 3	Private Property Line	6–20	8	6–20	8
	BNB No. 5	Private Property Line	6–8		6–10	10
Freeway Tunnel Single-Bore Design Variation	FTNB No. 5	Caltrans ROW/Private Property Line	6–20	20	6–20	20
	FTNB No. 7	Caltrans ROW/Private Property Line	-	-	12	
	FTNB No. 8	Caltrans ROW/Private Property Line	-	-	6–14	
	FTNB No. 10	Caltrans ROW/Private Property Line	10–20	14	10–20	14
Freeway Tunnel Dual-Bore Design Variation	FTNB No. 5	Caltrans ROW/Private Property Line	6–20	20	6–20	20
	FTNB No. 6D	Edge of Shoulder	14–16		14–16	
	FTNB No. 7	Caltrans ROW/Private Property Line	-	-	12	
	FTNB No. 8	Caltrans ROW/Private Property Line	-	-	6–14	
	FTNB No. 9	Private Property Line	6–14	8	6–18	8
	FTNB No. 10	Caltrans ROW/Private Property Line	10–20	14	10–20	14

Source: LSA Associates, Inc., May 2014.

¹ - represents barriers that maximum reasonable height does not break the line of sight.

BNB = BRT Noise Barrier

BRT = Bus Rapid Transit

Caltrans = California Department of Transportation

ft = feet

FTNB = Freeway Tunnel Noise Barrier

ROW = right-of-way

TNB = TSM/TDM Noise Barrier

TSM/TDM = Transportation System Management/Transportation Demand Management

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Chapter 4. Secondary Effects of Abatement

The noise abatement recommendations in this NADR may have the potential to result in secondary environmental effects related to the construction of the feasible and reasonable noise barriers. Potential secondary environmental effects from the feasible and reasonable noise barrier are described below. The reasonable and feasible noise barriers are shown in Table 3.5 in Chapter 3. No discussion is provided under the environmental topics below for noise barriers that would have no environmental effects associated with that respective environmental topic. With the modeled noise barriers for the LRT Alternative being located at the edge of elevated track, there are no expected secondary effects of abatement.

4.1. Utilities and Emergency Services

Construction of noise barrier footings outside State ROW has the potential to interfere with utilities. Relocation of utilities as a result of noise barrier construction is not anticipated; however, if it is determined during final design that utility relocation is required, utility services will be maintained. The construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would not interfere with emergency response times or routes.

4.1.1. Avoidance, Minimization, and/or Mitigation Measures

Coordination with all affected utility providers, as well as an updated utility search and encroachment permits for surveying and utility potholing, will be required during final design to determine all utility conflicts that require positive location and/or relocation prior to and during construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation.

4.2. Visual/Aesthetics

Under the TSM/TDM Alternative, T1/TNB Nos.1 and 2 would be visible from adjacent residences along Highbury Avenue in Los Angeles, T2/TNB Nos. 1 and 2 would be visible from multifamily residential units along West State Street and from SR 110, L3/TNB Nos. 1 and 2 would be visible from adjacent residences along South Atlantic Boulevard, and L5/TNB No.1 would be visible from Rosemead Boulevard and adjacent businesses along Rosemead Boulevard. Under the BRT Alternative, BNB Nos. 1 and 3 would be visible from adjacent residences (both multifamily and single-family) along South Atlantic Boulevard, and BNB No. 5 would be visible from South Atlantic Boulevard and West San Marino Avenue. Under the Freeway Tunnel Alternative single-bore design variation, FTNB Nos. 5, 7, and 8 would be visible from residences along SR 710, and FTNB No. 10 would be visible from I-210 and Maple Street. Under the Freeway Tunnel Alternative dual-bore design variation, FTNB Nos. 5, 7, 8, and 9 would be visible from residences along SR 710, and FTNB No. 10 would be visible from I-210 and Maple Street.

Noise barriers protect surrounding neighborhoods from traffic noise and reduce noise levels in neighborhoods. The noise barrier design would follow the standards in the Caltrans Highway Design Manual (2012) and would take into consideration gathered community input. Aesthetic enhancements for the noise barriers would be incorporated into the final design of the proposed SR 710 North Study project. Possible enhancements may include, but would not be limited to, using graphic patterns and colors based on input gathered from the local community, stakeholders, Metro and Caltrans.

4.2.1. Avoidance, Minimization, and/or Mitigation Measures

Caltrans and the FHWA mandate that a qualitative/aesthetic approach should be taken to avoid, minimize, and/or mitigate for visual quality loss associated with the Build Alternative improvements, including noise barriers. This approach fulfills the letter and spirit of the FHWA requirements as it addresses the actual cumulative loss of visual quality that would occur within the viewshed of the Build Alternatives. It also constitutes mitigation that can more readily generate public acceptance of the proposed project.

In cases where noise barriers would result in visual impacts to existing views, other materials such as Plexiglas may be used per the Caltrans acceptable list of materials for noise barrier construction.

4.3. Cultural Resources

No prehistoric or historic archaeological sites have been documented within the Area of Potential Effects (APE) for the project. A total of 633 historic-period (pre-1971) resources were identified in the APE, and 98 of those are listed in or eligible for listing in the National Register of Historic Places (National Register). In addition, a total of 110 resources qualify as “historical resources” pursuant to CEQA. The below information is pending a determination of the Finding of Effects Report.

Under the TSM/TDM Alternative, L3/TNB Nos. 1 and 2, L5/TNB No. 1, and T1/TNB No. 1 may result in impacts to historic-period resources. In addition, T2/TNB Nos. 1 and 2 are adjacent to the 110 Freeway (Pasadena Freeway), which is listed in the National Register. Therefore, these noise barriers may result in an adverse impact to a “historic property.”

Under the BRT Alternative, BNB No. 5 (located at Atlantic Boulevard) is adjacent to historic-period resources that may be impacted by construction of this noise barrier.

Under the Freeway Tunnel Alternative single-bore and dual-bore design variations, FTNB No. 5 may result in impacts to historic-period resources, including potential historic districts. FTNB No. 5 is located adjacent to the Midwick Park/Granada Place Historic District, which is located east of SR 710 between Valley Boulevard and Hellman Avenue.

Although considered unlikely, there is potential to encounter unknown buried cultural materials or human remains within the APE during construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation.

4.3.1. Avoidance, Minimization, and/or Mitigation Measures

If cultural materials are discovered during construction, all earthmoving activity within and around the immediate discovery area will be halted until a qualified archaeologist can assess the nature and significance of the find.

If human remains are exposed during construction, State Health Code Section 7050.5 states that no further disturbance should occur until the County Coroner has made the

necessary findings as to the origin and disposition of the remains pursuant to Public Resources Code (PRC) 5097.98. If the remains are thought to be Native American, the County Coroner would notify the Native American Heritage Commission (NAHC), which would then notify the Most Likely Descendant (MLD).

4.4. Water Quality and Storm Water Runoff

During construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation, increased erosion could occur due to disturbance of surface soils and exposure of excavated soil. In addition, chemicals, liquid products, petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste could be spilled or leaked and have the potential to be transported via storm water runoff into receiving waters. Over the long term, construction of these noise barriers would not increase the volume of runoff during a storm due to the limited amount of impervious surface area introduced by construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation. In addition, noise barriers are typically constructed from concrete masonry block, which would not introduce pollutants of concern such as metals to storm water runoff.

4.4.1. Avoidance, Minimization, and/or Mitigation Measures

Construction activities will comply with the provisions of the *National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities* (Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; NPDES No. CAS000002) (Construction General Permit) and any subsequent permit as they relate to construction activities for the project. Under the Construction General Permit, the project would be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) and implement construction Best Management Practices (BMPs) designed to minimize erosion and prevent spills during construction activities.

4.5. Geology and Soils

Considering the proposed improvements associated with L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation, the primary geologic hazards that could affect construction of these noise barriers include seismic shaking, liquefaction, groundwater, and expansive and compressive soils. The design and construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would be conducted in accordance with standard design and construction practices. In addition, as discussed below, the geotechnical conditions in the study area would be explored during final design and considered during the design of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation.

4.5.1. Avoidance, Minimization, and/or Mitigation Measures

Additional subsurface investigations are required for the Freeway Tunnel Alternative single-bore and dual-bore design variations to evaluate subsurface conditions and provide geotechnical information for design and construction of structure foundations, tunnel, and remedial earthwork.

4.6. Paleontological Resources

The study area has a potential for significant, unrenewable paleontological resources to be encountered at depths greater than 10 ft. As such the TSM/TDM Alternative, BRT Alternative, and Freeway Tunnel Alternative single-bore and dual-bore design variations have the potential to impact scientifically significant, nonrenewable paleontological resources. Footings for L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB

Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would be constructed using cast-in-drilled-hole (CIDH) piles and driven piles to a depth of approximately 12 ft, which would encounter sensitive sediments. CIDH piles and driven piles are not conducive to the collection of paleontological resources because the resources would not usually be visible and there would be no way to safely collect results.

4.6.1. Avoidance, Minimization, and/or Mitigation Measures

To mitigate the potential impacts of the BRT Alternative and the Freeway Tunnel Alternative single-bore and dual-bore design variations to scientifically significant, nonrenewable paleontological resources and to comply with federal, State, and local regulations, the Paleontological Identification Report/Paleontological Evaluation Report (PIR/PER) prepared for this project recommends preparation of a Paleontological Mitigation Plan (PMP).

4.7. Hazardous Waste

BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation are not located near any of the properties listed in the *Phase I Initial Site Assessment* (2014) as having potential hazardous waste contamination.

Because the study area includes SR 710 and SR 210, which have been in existence for many years, there is potential for encountering aerially deposited lead (ADL) during excavation in unpaved areas at the edges of these freeways during construction of FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation. However, it is not anticipated that hazardous wastes or materials would be encountered during construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation.

During noise barrier construction, there is the potential for accidental release of hazardous substances. The level of risk associated with the accidental release of hazardous substances is not considered high due to the small volume and low

concentration of hazardous materials anticipated to be utilized during the construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation. In addition, typical hazardous materials used during construction (e.g., solvents, paints, and fuels) will be handled in conjunction with Caltrans standard procedures.

Routine maintenance activities for L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation during operation of the proposed project would be required to follow applicable regulations with respect to the use, storage, handling, transport, and disposal of potentially hazardous materials.

4.7.1.1. Avoidance, Minimization, and/or Mitigation Measures

If hazardous materials contamination or sources are suspected or identified during project construction activities, an environmental professional will evaluate the course of action required. This course of action will follow the Unknown Hazards Procedures described in Chapter 7 of the Caltrans *Construction Manual* (August 2006).

Prior to construction activities, an ADL investigation shall be conducted along SR 710 and SR 210 in unpaved areas that would be disturbed during construction of noise barriers. This investigation may be conducted during the recommended Phase II investigation. If the investigation identifies the potential for ADL impacts within these areas, the Caltrans ADL guidance documents (Caltrans 2007) should be followed to determine whether ADL-contaminated soil needs to be disposed of and to determine the requirements for disposal.

4.8. Air Quality

Construction activities produce fugitive dust and combustion emissions from various sources (e.g., site grading, utility engines, on-site heavy-duty construction vehicles, equipment hauling materials to and from the site, and motor vehicles transporting the construction crew). Construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1,

3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would result in additional construction activities, fugitive dust, and combustion emissions that would not occur if these barriers were not constructed. Once constructed, L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would not be a source of dust or emissions and therefore would not result in permanent air quality impacts.

4.8.1. Avoidance, Minimization, and/or Mitigation Measures

Caltrans Standard Specifications for Construction (Sections 10 and 18 for dust control) will be adhered to in order to reduce emissions generated by construction equipment. In addition, best available control measures (BACMs) from the South Coast Air Quality Management District (SCAQMD) Rule 403 will be incorporated into the project commitments to reduce fugitive dust during construction.

4.9. Animal Species

A thorough literature review resulted in the identification of 66 special-status wildlife species (14 of which are listed as federally and/or State-listed endangered or threatened, or proposed endangered or threatened, or are considered Fully Protected species by the State of California) with the potential to occur within and adjacent to the proposed project. However, no federally or State-listed animals were observed during the site surveys.

L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation are located adjacent to or within developed areas that have very limited suitability for any of the sensitive or special-status animal species with potential to occur in the biological study area (BSA). In addition, during the site visit, no sensitive or special-interest animal species were observed or otherwise detected in the area where these noise barriers would be located. Therefore, construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative,

FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation would not temporarily or permanently impact any special-status animal species. However, vegetation clearing and grading associated with the construction of these noise barriers would disturb nonnative trees and shrubs that may provide nesting habitat for migratory birds.

4.9.1. Avoidance, Minimization, and/or Mitigation Measures

In order to avoid impacts to nesting birds, vegetation should be trimmed or removed outside the core nesting period (February 1 through August 31). If project activities are required to begin during the core nesting period, a qualified biologist shall perform a preconstruction breeding/nesting bird survey. The survey should be completed no more than 7 days prior to the start of project activities.

If breeding/nesting birds are located within 300 ft of the limits of disturbance, a buffer shall be flagged around the nest and Environmentally Sensitive Area (ESA) signs posted. Any work within 300 ft of the flagged area would require a biologist to monitor the birds and ensure that the construction activities do not negatively impact the birds. Should breeding/nesting birds of prey be located within the area scheduled for construction, the buffer shall be extended to 500 ft because birds of prey are typically more sensitive to disturbance.

4.10. Invasive Species

Many exotic species considered to be highly invasive are present throughout the alignments for the Build Alternatives. Therefore, the construction of L3/TNB Nos. 1 and 2, L5/TNB No. 1, T1/TNB Nos. 1 and 2, and T2/TNB Nos. 1 and 2 for the TSM/TDM Alternative, BNB Nos. 1, 3, and 5 for the BRT Alternative, FTNB Nos. 5, 7, 8, and 10 for the Freeway Tunnel Alternative single-bore and dual-bore design variations, and FTNB Nos. 6D and 9 for the Freeway Tunnel Alternative dual-bore design variation has the potential to spread invasive species by the movement of construction equipment contaminated by invasives, the inclusion of invasive species in seed mixtures and mulch, and the improper removal and disposal of invasive species so that the seed is spread along the project area. With implementation of the avoidance, minimization and/or mitigation measures outlined below, potential impacts related to invasive species would not be adverse.

4.10.1. Avoidance, Minimization, and/or Mitigation Measures

In compliance with Executive Order 13112, all feasible and prudent measures, including weed control BMPs, will be implemented to minimize the importation of nonnative plant material during and after construction and prevent the spread of invasive species. After construction, species listed as having a high or moderate rating on the Cal-IPC will not be planted in any revegetated areas.

Examples of BMPs that may be appropriate include the following:

- Revegetation would occur as soon as practical after disturbances. To prevent the spread of weeds in the project site, weed-free products would be exclusively used for all activities including, but not limited to, landscaping materials and soil erosion materials (i.e., mulch, soil mats, straw fencing, or wattles).
- Any disturbance areas within the proposed project site not containing existing infestations of exotic plants would be monitored quarterly for 1 year post-construction to ensure that the establishment of invasive plants in the area has not occurred. If evidence of invasive plant establishment is found, weed control measures would be implemented immediately.
- Pre-construction surveys would be conducted to identify populations of invasive weeds with the potential to be encouraged by construction activities such as exposure to tilling of bare ground, disturbance of adjacent habitats that are not highly invaded, or enhanced distribution of pollen or seeds. Such populations would be controlled by mechanical or chemical means prior to construction.

Chapter 5. References

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Appendix A. Noise Barrier Construction Cost Estimates

This appendix contains the noise barrier construction cost estimates provided by the engineering team.

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Table A.1 Summary of Noise Barrier Construction Costs – TSM/TDM Alternative (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF, GR=\$8/LF)	Sound Wall Quantity (SQ FT)	Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) Cost of GR (\$19/LF)	Misc Construction Costs	Cost for RW (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																	
L-3/ TNB No.1	6	48	1	Right of Way/Property Line			\$55,000	SW	48	\$960	\$288	\$7,200	\$0	\$0	\$0	\$5,280	\$360	\$0	\$216	\$14,016	\$3,504	\$17,520	Yes
	8		1				\$55,000				\$384	\$9,600			\$0	\$5,280	\$480	\$0	\$288	\$16,608	\$4,152	\$20,760	Yes
	10		1				\$55,000				\$480	\$12,000			\$0	\$5,280	\$600	\$0	\$360	\$19,200	\$4,800	\$24,000	Yes
	12		1				\$55,000				\$576	\$14,400			\$0	\$5,280	\$720	\$0	\$432	\$21,792	\$5,448	\$27,240	Yes
	14		1				\$55,000				\$672	\$16,800			\$0	\$5,280	\$840	\$0	\$504	\$24,384	\$6,096	\$30,480	Yes
	16		1				\$55,000				\$768	\$19,200			\$0	\$5,280	\$960	\$0	\$576	\$26,976	\$6,744	\$33,720	Yes
	18		1				\$55,000				\$864	\$21,600			\$0	\$5,280	\$1,080	\$0	\$648	\$29,568	\$7,392	\$36,960	Yes
20	1	\$55,000	\$960	\$24,000	\$0	\$5,280	\$1,200	\$0	\$720	\$32,160	\$8,040	\$40,200	Yes										
L-3/ TNB No.2	6	46	1	Property Line			\$55,000	Fence	46	\$690	\$276	\$6,900	\$0	\$0	\$0	\$31,100	\$345	\$0	\$207	\$39,242	\$9,811	\$49,053	Yes
	8		1				\$55,000				\$368	\$9,200			\$0	\$31,100	\$460	\$0	\$276	\$41,726	\$10,432	\$52,158	Yes
	10		1				\$55,000				\$460	\$11,500			\$0	\$31,100	\$575	\$0	\$345	\$44,210	\$11,053	\$55,263	No
	12		1				\$55,000				\$552	\$13,800			\$0	\$31,100	\$690	\$0	\$414	\$46,694	\$11,674	\$58,368	No
	14		1				\$55,000				\$644	\$16,100			\$0	\$31,100	\$805	\$0	\$483	\$49,178	\$12,295	\$61,473	No
	16		1				\$55,000				\$736	\$18,400			\$0	\$31,100	\$920	\$0	\$552	\$51,662	\$12,916	\$64,578	No
	18		1				\$55,000				\$828	\$20,700			\$0	\$31,100	\$1,035	\$0	\$621	\$54,146	\$13,537	\$67,683	No
20	1	\$55,000	\$920	\$23,000	\$0	\$31,100	\$1,150	\$0	\$690	\$56,630	\$14,158	\$70,788	No										
L-5/ TNB No.1	6	202	2	Right of Way/Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$110,000	RW	30	\$1,800	\$1,212	\$30,300	\$7,725	\$0	\$0	\$47,300	\$1,515	\$0	\$909	\$89,549	\$22,387	\$111,936	No
	8		2				\$110,000				\$1,616	\$40,400			\$0	\$47,300	\$2,020	\$0	\$1,212	\$100,457	\$25,114	\$125,571	No
	10		2				\$110,000				\$2,020	\$50,500			\$0	\$47,300	\$2,525	\$0	\$1,515	\$111,365	\$27,841	\$139,206	No
	12		2				\$110,000				\$2,424	\$60,600			\$0	\$47,300	\$3,030	\$0	\$1,818	\$122,273	\$30,568	\$152,841	No
	14		2				\$110,000				\$2,828	\$70,700			\$0	\$47,300	\$3,535	\$0	\$2,121	\$133,181	\$33,295	\$166,476	No
	16		2				\$110,000				\$3,232	\$80,800			\$0	\$47,300	\$4,040	\$0	\$2,424	\$144,089	\$36,022	\$180,111	No
	18		2				\$110,000				\$3,636	\$90,900			\$0	\$47,300	\$4,545	\$0	\$2,727	\$154,997	\$38,749	\$193,746	No
20	2	\$110,000	\$4,040	\$101,000	\$0	\$47,300	\$5,050	\$0	\$3,030	\$165,905	\$41,476	\$207,381	No										
T-1/ TNB No.1	6	1247	0	Right of Way/Property Line	"A" Line - 42+00	"A" Line - 54+50	\$0	RW+Wall+Fences	RW=568, Wall=90, Fences=589	\$44,715	\$5,428	\$135,700	\$227,000	\$0	\$172,140	\$48,770	\$6,785	\$6,785	\$4,071	\$645,966	\$161,492	\$807,458	No
	8		18				\$990,000				\$10,370	\$259,250			\$172,140	\$48,770	\$12,963	\$12,963	\$7,778	\$785,578	\$196,394	\$981,972	Yes
	10		18				\$990,000				\$16,096	\$402,400			\$172,140	\$48,770	\$20,120	\$20,120	\$12,072	\$947,337	\$236,834	\$1,184,171	No
	12		18				\$990,000				\$16,090	\$402,250			\$172,140	\$48,770	\$20,113	\$20,113	\$12,068	\$947,168	\$236,792	\$1,183,959	No
	14		18				\$990,000				\$15,838	\$395,950			\$172,140	\$48,770	\$19,798	\$19,798	\$11,879	\$940,049	\$235,012	\$1,175,061	No
	16		18				\$990,000				\$23,242	\$581,050			\$172,140	\$48,770	\$29,053	\$29,053	\$17,432	\$1,149,212	\$287,303	\$1,436,514	No
	18		18				\$990,000				\$30,616	\$765,400			\$172,140	\$48,770	\$38,270	\$38,270	\$22,962	\$1,357,527	\$339,382	\$1,696,909	No
20	18	\$990,000	\$34,246	\$856,150	\$172,140	\$48,770	\$42,808	\$42,808	\$25,685	\$1,460,075	\$365,019	\$1,825,093	No										
T-1/ TNB No.2	6	963	0	Edge of Shoulder	"A" Line - 38+72	"A" Line - 48+00	\$0	N/A		\$0	\$2,889	\$72,225	\$0	\$110,745	\$0	\$0	\$0	\$0	\$2,167	\$185,137	\$46,284	\$231,421	No
	8		0				\$0				\$4,815	\$120,375			\$0	\$0	\$0	\$3,611	\$234,731	\$58,683	\$293,414	No	
	10		4				\$220,000				\$6,741	\$168,525			\$0	\$0	\$0	\$5,056	\$284,326	\$71,081	\$355,407	No	
	12		5				\$275,000				\$8,667	\$216,675			\$0	\$0	\$0	\$6,500	\$333,920	\$83,480	\$417,400	No	
	14		11				\$605,000				\$10,593	\$264,825			\$0	\$0	\$0	\$7,945	\$383,515	\$95,879	\$479,393	Yes	
	16		15				\$825,000				\$12,519	\$312,975			\$0	\$0	\$0	\$9,389	\$433,109	\$108,277	\$541,387	Yes	
	18		16				\$880,000				\$14,445	\$361,125			\$0	\$0	\$0	\$10,834	\$482,704	\$120,676	\$603,380	Yes	
20	16	\$880,000	\$16,371	\$409,275	\$0	\$0	\$0	\$12,278	\$532,298	\$133,075	\$665,373	Yes											
T-1/ TNB No.3	6	673	4	Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	\$2,826	\$70,650	\$125,745	\$0	\$65,570	\$360,017	\$0	\$3,533	\$2,120	\$651,364	\$162,841	\$814,205	No
	8		4				\$220,000				\$4,172	\$104,300			\$65,570	\$360,017	\$0	\$5,215	\$3,129	\$687,706	\$171,927	\$859,633	No
	10		4				\$220,000				\$5,518	\$137,950			\$65,570	\$360,017	\$0	\$6,898	\$4,139	\$724,048	\$181,012	\$905,060	No
	12		4				\$220,000				\$6,864	\$171,600			\$65,570	\$360,017	\$0	\$8,580	\$5,148	\$760,390	\$190,098	\$950,488	No
	14		8				\$440,000				\$8,210	\$205,250			\$65,570	\$360,017	\$0	\$10,263	\$6,158	\$796,732	\$199,183	\$995,915	No
	16		8				\$440,000				\$9,556	\$238,900			\$65,570	\$360,017	\$0	\$11,945	\$7,167	\$833,074	\$208,269	\$1,041,343	No
	18		8				\$440,000				\$10,902	\$272,550			\$65,570	\$360,017	\$0	\$13,628	\$8,177	\$869,416	\$217,354	\$1,086,770	No
20	9	\$495,000	\$12,248	\$306,200	\$65,570	\$360,017	\$0	\$15,310	\$9,186	\$905,758	\$226,440	\$1,132,198	No										
T-1 TNB No.4	6	406	6	Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	\$1,032	\$25,800	\$115,830	\$0	\$121,690	\$187,708	\$0	\$1,290	\$774	\$470,572	\$117,643	\$588,214	No
	8		6				\$330,000				\$1,844	\$46,100			\$121,690	\$187,708	\$0	\$2,305	\$1,383	\$492,496	\$123,124	\$615,619	No
	10		6				\$330,000				\$2,656	\$66,400			\$121,690	\$187,708	\$0	\$3,320	\$1,992	\$514,420	\$128,605	\$643,024	No
	12		6				\$330,000				\$3,468	\$86,700			\$121,690	\$187,708	\$0	\$4,335	\$2,601	\$536,344	\$134,086	\$670,429	No
	14		6				\$330,000				\$4,280	\$107,000			\$121,690	\$187,708	\$0	\$5,350	\$3,210	\$558,268	\$139,567	\$697,834	No
	16		6				\$330,000				\$5,092	\$127,300			\$121,690	\$187,708	\$0	\$6,365	\$3,819	\$580,192	\$145,048	\$725,239	No
	18		6				\$330,000				\$5,904	\$147,600			\$121,690	\$187,708	\$0	\$7,380	\$4,428	\$602,116	\$150,529	\$752,644	No
20	6	\$330,000	\$6,716	\$167,900	\$121,690	\$187,708	\$0	\$8,395	\$5,037	\$624,040	\$156,010	\$780,049	No										
T-2/ TNB No.1	6	349	4	Edge of Shoulder	79+61.86	83+00	\$220,000	Fence+ GR	349	\$8,027	\$2,094	\$52,350	\$0	\$6,631	\$0	\$12,215	\$2,618	\$0	\$1,571	\$83,411	\$20,853	\$104,264	Yes
	8		4				\$220,000				\$2,792	\$69,800			\$0	\$12,215	\$3,490	\$0	\$2,094	\$102,257	\$25,564	\$127,821	Yes
	10		4				\$220,000				\$3,490	\$87,250			\$0	\$12,215	\$4,363	\$0	\$2,618	\$121,103	\$30,276	\$151,379	Yes
	12		4				\$220,000				\$4,188	\$104,700			\$0	\$12,215	\$5,235	\$0	\$3,141	\$139,949	\$34,987	\$174,936	Yes
	14		4				\$220,000				\$4,886	\$122,150			\$0	\$12,215	\$6,108	\$0	\$3,665	\$158,795	\$39,699	\$198,494	Yes
	16		4				\$220,000				\$5,584	\$139,600			\$0	\$12,215	\$6,980	\$0	\$4,188	\$177,641	\$44,410	\$222,051	No
	18		4				\$220,000				\$6,282	\$157,050			\$0	\$12,215	\$7,853	\$0	\$4,712	\$196,487	\$49,122	\$245,609	No
20	4	\$220,000	\$6,980	\$174,500	\$0	\$12,215	\$8,725	\$0	\$5,235	\$215,333	\$53,833	\$269,166	No										

Table A.1 Summary of Noise Barrier Construction Costs – TSM/TDM Alternative (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF, GR=\$8/LF)	Sound Wall Quantity (SQ FT)	Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) Cost of GR (\$19/LF)	Misc Construction Costs	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																	
T-2/ TNB No.2	6	743	0	Right of Way/Property Line	83+00	91+00	\$0	Fence	743	\$11,145	\$4,458	\$111,450	\$0	\$0	\$0	\$26,005	\$5,573	\$0	\$3,344	\$157,516	\$39,379	\$196,895	No
	8		13				\$715,000				\$5,944	\$148,600			\$0	\$26,005	\$7,430	\$0	\$4,458	\$197,638	\$49,410	\$247,048	Yes
	10		13				\$715,000				\$7,430	\$185,750			\$0	\$26,005	\$9,288	\$0	\$5,573	\$237,760	\$59,440	\$297,200	Yes
	12		34				\$1,870,000				\$8,916	\$222,900			\$0	\$26,005	\$11,145	\$0	\$6,687	\$277,882	\$69,471	\$347,353	Yes
	14		34				\$1,870,000				\$10,402	\$260,050			\$0	\$26,005	\$13,003	\$0	\$7,802	\$318,004	\$79,501	\$397,505	Yes
	16		34				\$1,870,000				\$11,888	\$297,200			\$0	\$26,005	\$14,860	\$0	\$8,916	\$358,126	\$89,532	\$447,658	Yes
	18		34				\$1,870,000				\$13,374	\$334,350			\$0	\$26,005	\$16,718	\$0	\$10,031	\$398,248	\$99,562	\$497,810	Yes
	20		34				\$1,870,000				\$14,860	\$371,500			\$0	\$26,005	\$18,575	\$0	\$11,145	\$438,370	\$109,593	\$547,963	Yes

Assumption: Contingency includes: clear and grubbing, demolition and additional footing easement needed beyond existing footing easement.

Note: Guard Rail demo cost and construction cost are from Caltrans cost data 2012.

Caltrans = California Department of Transportation

CIDH = cast-in-drilled-hole

CMU = concrete masonry unit

ft = foot/feet

GR = guard rail

LF = linear foot/feet

N/A = Not Applicable

PW = private property wall

RW or R/W = right of way

SF or SQ FT = square foot/feet

SW = sound wall

TCE = Temporary Construction Easement

TDM = Transportation Demand Management

TNB = TSM/TDM Noise Barrier

TSM = Transportation System Management

WI Fence = wrought iron fence

Table A.2 Summary of Noise Barrier Construction Costs – TSM/TDM Alternative (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF, GR=\$8/LF)	Sound Wall Quantity (SQ FT)	Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) Cost of GR (\$19/LF)	Misc Construction Costs	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																	
L-3/ TNB No.1	6	48	1	Right of Way/Property Line			\$55,000	SW	48	\$960	288	\$7,200	\$0	\$0	\$0	\$0	\$360	\$0	\$216	\$8,736	\$2,184	\$10,920	Yes
	8		1				\$55,000				384	\$9,600			\$0	\$0	\$480	\$0	\$288	\$11,328	\$2,832	\$14,160	Yes
	10		1				\$55,000				480	\$12,000			\$0	\$0	\$600	\$0	\$360	\$13,920	\$3,480	\$17,400	Yes
	12		1				\$55,000				576	\$14,400			\$0	\$0	\$720	\$0	\$432	\$16,512	\$4,128	\$20,640	Yes
	14		1				\$55,000				672	\$16,800			\$0	\$0	\$840	\$0	\$504	\$19,104	\$4,776	\$23,880	Yes
	16		1				\$55,000				768	\$19,200			\$0	\$0	\$960	\$0	\$576	\$21,696	\$5,424	\$27,120	Yes
	18		1				\$55,000				864	\$21,600			\$0	\$0	\$1,080	\$0	\$648	\$24,288	\$6,072	\$30,360	Yes
	20		1				\$55,000				960	\$24,000			\$0	\$0	\$1,200	\$0	\$720	\$26,880	\$6,720	\$33,600	Yes
L-3/ TNB No.2	6	46	1	Property Line			\$55,000	Fence	46	\$690	276	\$6,900	\$0	\$0	\$0	\$0	\$345	\$0	\$207	\$8,142	\$2,036	\$10,178	Yes
	8		1				\$55,000				368	\$9,200			\$0	\$0	\$460	\$0	\$276	\$10,626	\$2,657	\$13,283	Yes
	10		1				\$55,000				460	\$11,500			\$0	\$0	\$575	\$0	\$345	\$13,110	\$3,278	\$16,388	Yes
	12		1				\$55,000				552	\$13,800			\$0	\$0	\$690	\$0	\$414	\$15,594	\$3,899	\$19,493	Yes
	14		1				\$55,000				644	\$16,100			\$0	\$0	\$805	\$0	\$483	\$18,078	\$4,520	\$22,598	Yes
	16		1				\$55,000				736	\$18,400			\$0	\$0	\$920	\$0	\$552	\$20,562	\$5,141	\$25,703	Yes
	18		1				\$55,000				828	\$20,700			\$0	\$0	\$1,035	\$0	\$621	\$23,046	\$5,762	\$28,808	Yes
	20		1				\$55,000				920	\$23,000			\$0	\$0	\$1,150	\$0	\$690	\$25,530	\$6,383	\$31,913	Yes
L-5/ TNB No.1	6	202	2	Right of Way/Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$110,000	RW	30	\$1,800	1,212	\$30,300	\$7,725	\$0	\$0	\$0	\$1,515	\$0	\$909	\$42,249	\$10,562	\$52,811	Yes
	8		2				\$110,000				1,616	\$40,400			\$0	\$0	\$2,020	\$0	\$1,212	\$53,157	\$13,289	\$66,446	Yes
	10		2				\$110,000				2,020	\$50,500			\$0	\$0	\$2,525	\$0	\$1,515	\$64,065	\$16,016	\$80,081	Yes
	12		2				\$110,000				2,424	\$60,600			\$0	\$0	\$3,030	\$0	\$1,818	\$74,973	\$18,743	\$93,716	Yes
	14		2				\$110,000				2,828	\$70,700			\$0	\$0	\$3,535	\$0	\$2,121	\$85,881	\$21,470	\$107,351	Yes
	16		2				\$110,000				3,232	\$80,800			\$0	\$0	\$4,040	\$0	\$2,424	\$96,789	\$24,197	\$120,986	No
	18		2				\$110,000				3,636	\$90,900			\$0	\$0	\$4,545	\$0	\$2,727	\$107,697	\$26,924	\$134,621	No
	20		2				\$110,000				4,040	\$101,000			\$0	\$0	\$5,050	\$0	\$3,030	\$118,605	\$29,651	\$148,256	No
T-1/ TNB No.1	6	1247	0	Right of Way/Property Line	"A" Line - 42+00	"A" Line - 54+50	\$0	RW+Wall+Fences	RW=568, Wall=90, Fences=589	\$44,715	5,428	\$135,700	\$227,000	\$0	\$172,140	\$0	\$6,785	\$6,785	\$4,071	\$597,196	\$149,299	\$746,495	No
	8		18				\$990,000				10,370	\$259,250			\$172,140	\$0	\$12,963	\$12,963	\$7,778	\$736,808	\$184,202	\$921,009	Yes
	10		18				\$990,000				16,096	\$402,400			\$172,140	\$0	\$20,120	\$20,120	\$12,072	\$898,567	\$224,642	\$1,123,209	No
	12		18				\$990,000				16,090	\$402,250			\$172,140	\$0	\$20,113	\$20,113	\$12,068	\$898,398	\$224,599	\$1,122,997	No
	14		18				\$990,000				15,838	\$395,950			\$172,140	\$0	\$19,798	\$19,798	\$11,879	\$891,279	\$222,820	\$1,114,098	No
	16		18				\$990,000				23,242	\$581,050			\$172,140	\$0	\$29,053	\$29,053	\$17,432	\$1,100,442	\$275,110	\$1,375,552	No
	18		18				\$990,000				30,616	\$765,400			\$172,140	\$0	\$38,270	\$38,270	\$22,962	\$1,308,757	\$327,189	\$1,635,946	No
	20		18				\$990,000				34,246	\$856,150			\$172,140	\$0	\$42,808	\$42,808	\$25,685	\$1,411,305	\$352,826	\$1,764,131	No
T-1/ TNB No.2	6	963	0	Edge of Shoulder	"A" Line - 38+72	"A" Line - 48+00	\$0	N/A	0	\$0	2,889	\$72,225	\$0	\$110,745	\$0	\$0	\$0	\$0	\$2,167	\$185,137	\$46,284	\$231,421	No
	8		0				\$0				4,815	\$120,375			\$0	\$0	\$3,611	\$234,731	\$58,683	\$293,414	No		
	10		4				\$220,000				6,741	\$168,525			\$0	\$0	\$0	\$0	\$5,056	\$284,326	\$71,081	\$355,407	No
	12		5				\$275,000				8,667	\$216,675			\$0	\$0	\$0	\$0	\$6,500	\$333,920	\$83,480	\$417,400	No
	14		11				\$605,000				10,593	\$264,825			\$0	\$0	\$0	\$0	\$7,945	\$383,515	\$95,879	\$479,393	Yes
	16		15				\$825,000				12,519	\$312,975			\$0	\$0	\$0	\$0	\$9,389	\$433,109	\$108,277	\$541,387	Yes
	18		16				\$880,000				14,445	\$361,125			\$0	\$0	\$0	\$0	\$10,834	\$482,704	\$120,676	\$603,380	Yes
	20		16				\$880,000				16,371	\$409,275			\$0	\$0	\$0	\$0	\$12,278	\$532,298	\$133,075	\$665,373	Yes
T-1/ TNB No.3	6	673	4	Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	2,826	\$70,650	\$125,745	\$0	\$65,570	\$0	\$0	\$3,533	\$2,120	\$291,347	\$72,837	\$364,184	No
	8		4				\$220,000				4,172	\$104,300			\$65,570	\$0	\$0	\$5,215	\$3,129	\$327,689	\$81,922	\$409,611	No
	10		4				\$220,000				5,518	\$137,950			\$65,570	\$0	\$0	\$6,898	\$4,139	\$364,031	\$91,008	\$455,039	No
	12		4				\$220,000				6,864	\$171,600			\$65,570	\$0	\$0	\$8,580	\$5,148	\$400,373	\$100,093	\$500,466	No
	14		8				\$440,000				8,210	\$205,250			\$65,570	\$0	\$0	\$10,263	\$6,158	\$436,715	\$109,179	\$545,894	No
	16		8				\$440,000				9,556	\$238,900			\$65,570	\$0	\$0	\$11,945	\$7,167	\$473,057	\$118,264	\$591,321	No
	18		8				\$440,000				10,902	\$272,550			\$65,570	\$0	\$0	\$13,628	\$8,177	\$509,399	\$127,350	\$636,749	No
	20		9				\$495,000				12,248	\$306,200			\$65,570	\$0	\$0	\$15,310	\$9,186	\$545,741	\$136,435	\$682,176	No
T-1/ TNB No.4	6	406	6	Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	1,032	\$25,800	\$115,830	\$0	\$121,690	\$0	\$0	\$1,290	\$774	\$282,864	\$70,716	\$353,580	No
	8		6				\$330,000				1,844	\$46,100			\$121,690	\$0	\$0	\$2,305	\$1,383	\$304,788	\$76,197	\$380,985	No
	10		6				\$330,000				2,656	\$66,400			\$121,690	\$0	\$0	\$3,320	\$1,992	\$326,712	\$81,678	\$408,390	No
	12		6				\$330,000				3,468	\$86,700			\$121,690	\$0	\$0	\$4,335	\$2,601	\$348,636	\$87,159	\$435,795	No
	14		6				\$330,000				4,280	\$107,000			\$121,690	\$0	\$0	\$5,350	\$3,210	\$370,560	\$92,640	\$463,200	No
	16		6				\$330,000				5,092	\$127,300			\$121,690	\$0	\$0	\$6,365	\$3,819	\$392,484	\$98,121	\$490,605	No
	18		6				\$330,000				5,904	\$147,600			\$121,690	\$0	\$0	\$7,380	\$4,428	\$414,408	\$103,602	\$518,010	No
	20		6				\$330,000				6,716	\$167,900			\$121,690	\$0	\$0	\$8,395	\$5,037	\$436,332	\$109,083	\$545,415	No
T-2/ TNB No.1	6	349	4	Edge of Shoulder	79+61.86	83+00	\$220,000	Fence+ GR	349	\$8,027	2,094	\$52,350	\$0	\$6,631	\$0	\$0	\$2,618	\$0	\$1,571	\$71,196	\$17,799	\$88,995	Yes
	8		4				\$220,000				2,792	\$69,800			\$0	\$0	\$3,490	\$0	\$2,094	\$90,042	\$22,511	\$112,553	Yes
	10		4				\$220,000				3,490	\$87,250			\$0	\$0	\$4,363	\$0	\$2,618	\$108,888	\$27,222	\$136,110	Yes
	12		4				\$220,000				4,188	\$104,700			\$0	\$0	\$5,235	\$0	\$3,141	\$127,734	\$31,934	\$159,668	Yes
	14		4				\$220,000				4,886	\$122,150			\$0	\$0	\$6,108	\$0	\$3,665	\$146,580	\$36,645	\$183,225	Yes
	16		4				\$220,000				5,584	\$139,600			\$0	\$0	\$6,980	\$0	\$4,188	\$165,426	\$41,357	\$206,783	Yes
	18		4				\$220,000				6,282	\$157,050			\$0	\$0	\$7,853	\$0	\$4,712	\$184,272	\$46,068	\$230,340	No
	20		4				\$220,000				6,980	\$174,500			\$0	\$0	\$8,725	\$0	\$5,235	\$203,118	\$50,780	\$253,898	No

Table A.2 Summary of Noise Barrier Construction Costs – TSM/TDM Alternative (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF, GR=\$8/LF)	Sound Wall Quantity (SQ FT)	Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) Cost of GR (\$19/LF)	Misc Construction Costs	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																	
T-2/ TNB No.2	6	743	0	Right of Way/Property Line	83+00	91+00	\$0	Fence	743	\$11,145	4,458	\$111,450	\$0	\$0	\$0	\$0	\$5,573	\$0	\$3,344	\$131,511	\$32,878	\$164,389	No
	8		13				\$715,000				5,944	\$148,600			\$0	\$0	\$7,430	\$0	\$4,458	\$171,633	\$42,908	\$214,541	Yes
	10		13				\$715,000				7,430	\$185,750			\$0	\$0	\$9,288	\$0	\$5,573	\$211,755	\$52,939	\$264,694	Yes
	12		34				\$1,870,000				8,916	\$222,900			\$0	\$0	\$11,145	\$0	\$6,687	\$251,877	\$62,969	\$314,846	Yes
	14		34				\$1,870,000				10,402	\$260,050			\$0	\$0	\$13,003	\$0	\$7,802	\$291,999	\$73,000	\$364,999	Yes
	16		34				\$1,870,000				11,888	\$297,200			\$0	\$0	\$14,860	\$0	\$8,916	\$332,121	\$83,030	\$415,151	Yes
	18		34				\$1,870,000				13,374	\$334,350			\$0	\$0	\$16,718	\$0	\$10,031	\$372,243	\$93,061	\$465,304	Yes
	20		34				\$1,870,000				14,860	\$371,500			\$0	\$0	\$18,575	\$0	\$11,145	\$412,365	\$103,091	\$515,456	Yes

Assumption: Contingency includes: clear and grubbing, demolition and additional footing easement needed beyond existing footing easement.

Note: Guard Rail demo cost and construction cost are from Caltrans cost data 2012.

Caltrans = California Department of Transportation

CIDH = cast-in-drilled-hole

CMU = concrete masonry unit

ft = foot/feet

GR = guard rail

LF = linear foot/feet

N/A = Not Applicable

PW = private property wall

RW or R/W = right of way

SF or SQ FT = square foot/feet

SW = sound wall

TCE = Temporary Construction Easement

TDM = Transportation Demand Management

TNB = TSM/TDM Noise Barrier

TSM = Transportation System Management

WI Fence = wrought iron fence

Table A.3 Summary of Noise Barrier Construction Costs – BRT Alternative (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW/PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)		Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Temporary Shoring (\$35/SF)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)									
					Begin	End																													
1	6	340	0	City Right of Way/Private Property Line	169+00	172+00	\$0	RW+Fence	340	\$25,500	2,040	\$51,000	\$45,900	\$117,810		\$39,100	\$118,000	TCE/Wall Footing Easement	\$17,000	\$2,550	\$0	\$918	\$417,778	\$104,445	\$522,223	No									
	8		0				\$0				2,720	\$68,000														\$39,100	\$118,000	\$17,000	\$3,400	\$0	\$1,224	\$435,934	\$108,984	\$544,918	No
	10		12				\$660,000				3,400	\$85,000														\$39,100	\$118,000	\$17,000	\$4,250	\$0	\$1,530	\$454,090	\$113,523	\$567,613	Yes
	12		12				\$660,000				4,080	\$102,000														\$39,100	\$118,000	\$17,000	\$5,100	\$0	\$1,836	\$472,246	\$118,062	\$590,308	Yes
	14		12				\$660,000				4,760	\$119,000														\$39,100	\$118,000	\$17,000	\$5,950	\$0	\$2,142	\$490,402	\$122,601	\$613,003	Yes
	16		12				\$660,000				5,440	\$136,000														\$39,100	\$118,000	\$17,000	\$6,800	\$0	\$2,448	\$508,558	\$127,140	\$635,698	Yes
	18		12				\$660,000				6,120	\$153,000														\$39,100	\$118,000	\$17,000	\$7,650	\$0	\$2,754	\$526,708	\$131,672	\$658,380	No
	20		12				\$660,000				6,800	\$170,000														\$39,100	\$118,000	\$17,000	\$8,500	\$0	\$3,054	\$544,858	\$136,215	\$681,073	No
2	6	838	0	City Right of Way/Private Property Line	173+00	181+50	\$0	RW	838	\$50,280	5,028	\$125,700	\$113,130	\$293,300		\$0	\$265,500	TCE/Wall Footing Easement	\$41,900	\$6,285	\$0	\$2,263	\$898,358	\$224,589	\$1,122,947	No									
	8		0				\$0				6,704	\$167,600														\$0	\$265,500	\$41,900	\$8,380	\$0	\$3,017	\$943,107	\$235,777	\$1,178,884	No
	10		3				\$165,000				8,380	\$209,500														\$0	\$265,500	\$3,771	\$987,856	\$0	\$3,771	\$246,964	\$1,234,820	No	
	12		9				\$495,000				10,056	\$251,400														\$0	\$265,500	\$41,900	\$12,570	\$0	\$4,525	\$1,032,605	\$258,151	\$1,290,757	No
	14		16				\$880,000				11,732	\$293,300														\$0	\$265,500	\$41,900	\$14,665	\$0	\$5,279	\$1,077,354	\$269,339	\$1,346,693	No
	16		24				\$1,320,000				13,408	\$335,200														\$0	\$265,500	\$41,900	\$16,760	\$0	\$6,034	\$1,122,104	\$280,526	\$1,402,630	No
	18		24				\$1,320,000				15,084	\$377,100														\$0	\$265,500	\$41,900	\$18,855	\$0	\$6,765	\$1,171,378	\$292,845	\$1,464,223	No
	20		24				\$1,320,000				16,760	\$419,000														\$0	\$265,500	\$41,900	\$20,950	\$0	\$7,519	\$1,216,630	\$304,158	\$1,520,788	No
3	6	622	24	Private Property Line	173+50	180+30	\$1,320,000	Fence	622	\$9,330	3,732	\$93,300	\$83,970	\$87,080		\$0	\$3,000	TCE/Wall Footing Easement/Maintenance Easement	\$93,300	\$4,665	\$4,665	\$1,679	\$380,989	\$95,247	\$476,237	Yes									
	8		24				\$1,320,000				4,976	\$124,400														\$0	\$3,000	\$93,300	\$6,220	\$6,220	\$2,239	\$415,759	\$103,940	\$519,699	Yes
	10		24				\$1,320,000				6,220	\$155,500														\$0	\$3,000	\$93,300	\$7,775	\$7,775	\$2,799	\$450,529	\$112,632	\$563,161	Yes
	12		24				\$1,320,000				7,464	\$186,600														\$0	\$3,000	\$93,300	\$9,330	\$9,330	\$3,359	\$485,299	\$121,325	\$606,624	Yes
	14		24				\$1,320,000				8,708	\$217,700														\$0	\$3,000	\$93,300	\$10,885	\$10,885	\$3,919	\$520,069	\$130,017	\$650,086	Yes
	16		24				\$1,320,000				9,952	\$248,800														\$0	\$3,000	\$93,300	\$12,440	\$12,440	\$4,478	\$554,838	\$138,710	\$693,548	Yes
	18		24				\$1,320,000				11,196	\$279,900														\$0	\$3,000	\$93,300	\$13,995	\$13,995	\$4,947	\$592,967	\$148,242	\$741,209	Yes
	20		24				\$1,320,000				12,440	\$311,000														\$0	\$3,000	\$93,300	\$15,550	\$15,550	\$5,317	\$628,110	\$157,028	\$785,138	Yes
4	6	67	0	City Right of Way/Private Property Line	248+20	248+50	\$0	N/A	0	\$0	402	\$10,050	\$0	\$0		\$0	\$1,000	TCE	\$2,010	\$503	\$0	\$181	\$13,743	\$3,436	\$17,179	No									
	8		1				\$55,000				536	\$13,400														\$0	\$1,000	\$2,010	\$670	\$0	\$241	\$17,321	\$4,330	\$21,652	Yes
	10		1				\$55,000				670	\$16,750														\$0	\$1,000	\$2,010	\$838	\$0	\$302	\$20,899	\$5,225	\$26,124	Yes
	12		1				\$55,000				804	\$20,100														\$0	\$1,000	\$2,010	\$1,005	\$0	\$362	\$24,477	\$6,119	\$30,596	Yes
	14		1				\$55,000				938	\$23,450														\$0	\$1,000	\$2,010	\$1,173	\$0	\$422	\$28,055	\$7,014	\$35,069	Yes
	16		1				\$55,000				1,072	\$26,800														\$0	\$1,000	\$2,010	\$1,340	\$0	\$482	\$31,632	\$7,908	\$39,540	Yes
	18		1				\$55,000				1,206	\$30,150														\$0	\$1,000	\$2,010	\$1,508	\$0	\$542	\$35,140	\$8,893	\$44,033	Yes
	20		1				\$55,000				1,340	\$33,500														\$0	\$1,000	\$2,010	\$1,675	\$0	\$602	\$38,615	\$9,668	\$48,283	Yes
5	6	150	1	City Right of Way/Private Property Line	260+10	261+95	\$55,000	PW	150	\$3,000	900	\$22,500	\$0	\$0		\$0	\$0	TCE	\$4,500	\$1,125	\$0	\$405	\$31,530	\$7,883	\$39,413	Yes									
	8		1				\$55,000				1,200	\$30,000														\$0	\$0	\$4,500	\$1,500	\$0	\$540	\$39,540	\$9,885	\$49,425	Yes
	10		1				\$55,000				1,500	\$37,500														\$0	\$0	\$4,500	\$1,875	\$0	\$675	\$47,550	\$11,888	\$59,438	No
	12		1				\$55,000				1,800	\$45,000														\$0	\$0	\$4,500	\$2,250	\$0	\$810	\$55,560	\$13,890	\$69,450	No
	14		1				\$55,000				2,100	\$52,500														\$0	\$0	\$4,500	\$2,625	\$0	\$945	\$63,570	\$15,893	\$79,463	No
	16		1				\$55,000				2,400	\$60,000														\$0	\$0	\$4,500	\$3,000	\$0	\$1,080	\$71,580	\$17,895	\$89,475	No
	18		1				\$55,000				2,700	\$67,500														\$0	\$0	\$4,500	\$3,375	\$0	\$1,215	\$80,400	\$20,100	\$100,500	No
	20		1				\$55,000				3,000	\$75,000														\$0	\$0	\$4,500	\$3,750	\$0	\$1,350	\$88,500	\$22,125	\$110,625	No
6	6	488	0	City Right of Way/Private Property Line	661+62	666+50	\$0	RW	488	\$29,280	2,050	\$51,240	\$65,880	\$30,744		\$0	\$3,500	TCE/Wall Footing Easement	\$28,470	\$2,562	\$2,562	\$1,318	\$215,556	\$53,889	\$269,444	No									
	8		0				\$0				3,026	\$75,640														\$0	\$3,500	\$28,470	\$3,782	\$3,782	\$1,757	\$242,835	\$60,709	\$303,543	No
	10		0				\$0				4,002	\$100,040														\$0	\$3,500	\$28,470	\$5,002	\$5,002	\$2,196	\$270,114	\$67,528	\$337,642	No
	12		0				\$0				4,978	\$124,440														\$0	\$3,500	\$28,470	\$6,222	\$6,222	\$2,635	\$297,393	\$74,348	\$371,741	No
	14		0				\$0				5,954	\$148,840														\$0	\$3,500	\$28,470	\$7,442	\$7,442	\$3,074	\$324,672	\$81,168	\$405,840	No
	16		0				\$0				6,930	\$173,240														\$0	\$3,500	\$28,470	\$8,662	\$8,662	\$3,514	\$351,952	\$87,988	\$439,939	No
	18		0				\$0				7,906	\$197,640														\$0	\$3,500	\$28,470	\$9,882	\$9,882	\$4,014	\$381,866	\$95,466	\$477,332	No
	20		0				\$0				8,882	\$222,040														\$0	\$3,500	\$28,470	\$11,102	\$11,102	\$4,521	\$409,438	\$102,359	\$511,797	No

BRT = Bus Rapid Transit
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 ft = foot/feet
 LF = linear foot/feet
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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Table A.4 Summary of Noise Barrier Construction Costs – BRT Alternative (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW/PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Sound Wall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Temporary Shoring (\$35/SF)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)		
					Begin	End																					
1	6	340	0	City Right of Way/Private Property Line	169+00	172+00	\$0	RW+Fence	340	\$25,500	2,040	\$51,000	\$45,900	\$117,810	\$39,100	\$118,000	TCE/Wall Footing Easement	\$0	\$2,550	\$0	\$918	\$400,778	\$100,195	\$500,973	No		
	8		0				\$0				2,720	\$68,000						\$39,100	\$118,000	\$0	\$3,400	\$0	\$1,224	\$418,934	\$104,734	\$523,668	No
	10		12				\$660,000				3,400	\$85,000						\$39,100	\$118,000	\$0	\$4,250	\$0	\$1,530	\$437,090	\$109,273	\$546,363	Yes
	12		12				\$660,000				4,080	\$102,000						\$39,100	\$118,000	\$0	\$5,100	\$0	\$1,836	\$455,246	\$113,812	\$569,058	Yes
	14		12				\$660,000				4,760	\$119,000						\$39,100	\$118,000	\$0	\$5,950	\$0	\$2,142	\$473,402	\$118,351	\$591,753	Yes
	16		12				\$660,000				5,440	\$136,000						\$39,100	\$118,000	\$0	\$6,800	\$0	\$2,448	\$491,558	\$122,890	\$614,448	Yes
	18		12				\$660,000				6,120	\$153,000						\$39,100	\$118,000	\$0	\$7,650	\$0	\$2,754	\$511,550	\$127,888	\$639,438	Yes
	20		12				\$660,000				6,800	\$170,000						\$39,100	\$118,000	\$0	\$8,500	\$0	\$3,054	\$529,910	\$132,478	\$662,388	No
2	6	838	0	City Right of Way/Private Property Line	173+00	181+50	\$0	RW	838	\$50,280	5,028	\$125,700	\$113,130	\$293,300	\$0	\$265,500	TCE/Wall Footing Easement	\$0	\$6,285	\$0	\$2,263	\$856,458	\$214,114	\$1,070,572	No		
	8		0				\$0				6,704	\$167,600						\$0	\$6,285	\$0	\$3,017	\$901,207	\$225,302	\$1,126,509	No		
	10		3				\$165,000				8,380	\$209,500						\$0	\$265,500	\$0	\$10,475	\$0	\$3,771	\$945,956	\$236,489	\$1,182,445	No
	12		9				\$495,000				10,056	\$251,400						\$0	\$265,500	\$0	\$12,570	\$0	\$4,525	\$990,705	\$247,676	\$1,238,382	No
	14		16				\$880,000				11,732	\$293,300						\$0	\$265,500	\$0	\$14,665	\$0	\$5,279	\$1,035,454	\$258,864	\$1,294,318	No
	16		24				\$1,320,000				13,408	\$335,200						\$0	\$265,500	\$0	\$16,760	\$0	\$6,034	\$1,080,204	\$270,051	\$1,350,255	No
	18		24				\$1,320,000				15,084	\$377,100						\$0	\$265,500	\$0	\$18,855	\$0	\$6,795	\$1,129,478	\$282,370	\$1,411,848	No
	20		24				\$1,320,000				16,760	\$419,000						\$0	\$265,500	\$0	\$20,950	\$0	\$7,545	\$1,174,730	\$293,683	\$1,468,413	No
3	6	622	24	Private Property Line	173+50	180+30	\$1,320,000	Fence	622	\$9,330	3,732	\$93,300	\$83,970	\$87,080	\$0	\$3,000	TCE/Wall Footing Easement/Maintenance Easement	\$0	\$4,665	\$4,665	\$1,679	\$287,689	\$71,922	\$359,612	Yes		
	8		24				\$1,320,000				4,976	\$124,400						\$0	\$3,000	\$0	\$6,220	\$6,220	\$2,239	\$322,459	\$80,615	\$403,074	Yes
	10		24				\$1,320,000				6,220	\$155,500						\$0	\$3,000	\$0	\$7,775	\$7,775	\$2,799	\$357,229	\$89,307	\$446,536	Yes
	12		24				\$1,320,000				7,464	\$186,600						\$0	\$3,000	\$0	\$9,330	\$9,330	\$3,359	\$391,999	\$98,000	\$489,999	Yes
	14		24				\$1,320,000				8,708	\$217,700						\$0	\$3,000	\$0	\$10,885	\$10,885	\$3,919	\$426,769	\$106,692	\$533,461	Yes
	16		24				\$1,320,000				9,952	\$248,800						\$0	\$3,000	\$0	\$12,440	\$12,440	\$4,478	\$461,538	\$115,385	\$576,923	Yes
	18		24				\$1,320,000				11,196	\$279,900						\$0	\$3,000	\$0	\$13,995	\$13,995	\$5,097	\$499,667	\$124,917	\$624,584	Yes
	20		24				\$1,320,000				12,440	\$311,000						\$0	\$3,000	\$0	\$15,550	\$15,550	\$5,505	\$534,810	\$133,703	\$668,513	Yes
4	6	67	0	City Right of Way/Private Property Line	248+20	248+50	\$0	N/A	0	\$0	402	\$10,050	\$0	\$0	\$0	\$1,000	TCE	\$0	\$503	\$0	\$181	\$11,733	\$2,933	\$14,667	No		
	8		1				\$55,000				536	\$13,400						\$0	\$1,000	\$0	\$670	\$0	\$241	\$15,311	\$3,828	\$19,139	Yes
	10		1				\$55,000				670	\$16,750						\$0	\$1,000	\$0	\$838	\$0	\$302	\$18,889	\$4,722	\$23,611	Yes
	12		1				\$55,000				804	\$20,100						\$0	\$1,000	\$0	\$1,005	\$0	\$362	\$22,467	\$5,617	\$28,084	Yes
	14		1				\$55,000				938	\$23,450						\$0	\$1,000	\$0	\$1,173	\$0	\$422	\$26,045	\$6,511	\$32,556	Yes
	16		1				\$55,000				1,072	\$26,800						\$0	\$1,000	\$0	\$1,340	\$0	\$482	\$29,622	\$7,406	\$37,028	Yes
	18		1				\$55,000				1,206	\$30,150						\$0	\$1,000	\$0	\$1,508	\$0	\$505	\$33,562	\$8,391	\$41,953	Yes
	20		1				\$55,000				1,340	\$33,500						\$0	\$1,000	\$0	\$1,675	\$0	\$595	\$37,180	\$9,295	\$46,475	Yes
5	6	150	1	City Right of Way/Private Property Line	260+10	261+95	\$55,000	PW	150	\$3,000	900	\$22,500	\$0	\$0	\$0	\$0	TCE	\$0	\$1,125	\$0	\$405	\$27,030	\$6,758	\$33,788	Yes		
	8		1				\$55,000				1,200	\$30,000						\$0	\$0	\$0	\$1,500	\$0	\$540	\$35,040	\$8,760	\$43,800	Yes
	10		1				\$55,000				1,500	\$37,500						\$0	\$0	\$0	\$1,875	\$0	\$675	\$43,050	\$10,763	\$53,813	Yes
	12		1				\$55,000				1,800	\$45,000						\$0	\$0	\$0	\$2,250	\$0	\$810	\$51,060	\$12,765	\$63,825	No
	14		1				\$55,000				2,100	\$52,500						\$0	\$0	\$0	\$2,625	\$0	\$945	\$59,070	\$14,768	\$73,838	No
	16		1				\$55,000				2,400	\$60,000						\$0	\$0	\$0	\$3,000	\$0	\$1,080	\$67,080	\$16,770	\$83,850	No
	18		1				\$55,000				2,700	\$67,500						\$0	\$0	\$0	\$3,375	\$0	\$1,205	\$75,900	\$18,975	\$94,875	No
	20		1				\$55,000				3,000	\$75,000						\$0	\$0	\$0	\$3,750	\$0	\$1,350	\$84,000	\$21,000	\$105,000	No
6	6	488	0	City Right of Way/Private Property Line	661+62	666+50	\$0	RW	488	\$29,280	2,050	\$51,240	\$65,880	\$30,744	\$0	\$3,500	TCE/Wall Footing Easement	\$0	\$2,562	\$2,562	\$1,318	\$187,086	\$46,771	\$233,857	No		
	8		0				\$0				3,026	\$75,640						\$0	\$3,500	\$0	\$3,782	\$3,782	\$1,757	\$214,365	\$53,591	\$267,956	No
	10		0				\$0				4,002	\$100,040						\$0	\$3,500	\$0	\$5,002	\$5,002	\$2,196	\$241,644	\$60,411	\$302,055	No
	12		0				\$0				4,978	\$124,440						\$0	\$3,500	\$0	\$6,222	\$6,222	\$2,635	\$268,923	\$67,231	\$336,154	No
	14		0				\$0				5,954	\$148,840						\$0	\$3,500	\$0	\$7,442	\$7,442	\$3,074	\$296,202	\$74,051	\$370,253	No
	16		0				\$0				6,930	\$173,240						\$0	\$3,500	\$0	\$8,662	\$8,662	\$3,514	\$323,482	\$80,870	\$404,352	No
	18		0				\$0				7,906	\$197,640						\$0	\$3,500	\$0	\$9,882	\$9,882	\$6,588	\$353,396	\$88,349	\$441,745	No
	20		0				\$0				8,882	\$222,040						\$0	\$3,500	\$0	\$11,102	\$11,102	\$7,320	\$380,968	\$95,242	\$476,210	No

BRT = Bus Rapid Transit
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 ft = foot/feet
 LF = linear foot/feet
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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Table A.5 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)								
					Begin	End																										
1	6	537	0	Edge of Shoulder	"B" Line - 1376+15	"B" Line - 1381+30	\$0	RW	54	\$3,240	1,503	\$37,575	\$16,740	\$61,755	\$0	N/A	\$0	\$1,879	\$1,879	\$1,127	\$124,195	\$31,049	\$155,243	No								
	8		0				\$0				2,577	\$64,425												\$0	\$0	\$3,221	\$3,221	\$1,933	\$154,535	\$38,634	\$193,169	No
	10		0				\$0				3,651	\$91,275												\$0	\$0	\$4,564	\$4,564	\$2,738	\$184,876	\$46,219	\$231,095	No
	12		0				\$0				4,725	\$118,125												\$0	\$0	\$5,906	\$5,906	\$3,544	\$215,216	\$53,804	\$269,020	No
	14		0				\$55,000				5,799	\$144,975												\$0	\$0	\$7,249	\$7,249	\$4,349	\$245,557	\$61,389	\$306,946	No
	16		0				\$55,000				6,873	\$171,825												\$0	\$0	\$8,591	\$8,591	\$5,155	\$275,897	\$68,974	\$344,872	No
	18		0				\$55,000				7,947	\$198,675												\$0	\$0	\$9,934	\$9,934	\$5,960	\$306,238	\$76,559	\$382,797	No
20	0	\$55,000	9,021	\$225,525	\$0	\$0	\$11,276	\$11,276	\$6,766	\$336,578	\$84,145	\$420,723	No																			
2	6	115	0	Private Property Line	"B" Line - 1378+89	"B" Line - 1378+90	\$55,000	RW	71	\$4,260	548	\$13,700	\$47,010	\$0	\$44,650	TCE/ME/ Wall Footing Easement	\$10,620	\$685	\$685	\$411	\$122,021	\$30,505	\$152,526	No								
	8		0				\$55,000				778	\$19,450												\$44,650	\$10,620	\$973	\$973	\$584	\$128,519	\$32,130	\$160,648	No
	10		0				\$55,000				1,008	\$25,200												\$44,650	\$10,620	\$1,260	\$1,260	\$756	\$135,016	\$33,754	\$168,770	No
	12		0				\$55,000				1,238	\$30,950												\$44,650	\$10,620	\$1,548	\$1,548	\$929	\$141,514	\$35,378	\$176,892	No
	14		0				\$55,000				1,468	\$36,700												\$44,650	\$10,620	\$1,835	\$1,835	\$1,101	\$148,011	\$37,003	\$185,014	No
	16		0				\$55,000				1,698	\$42,450												\$44,650	\$10,620	\$2,123	\$2,123	\$1,274	\$154,509	\$38,627	\$193,136	No
	18		0				\$55,000				1,928	\$48,200												\$44,650	\$10,620	\$2,410	\$2,410	\$1,446	\$161,006	\$40,252	\$201,258	No
20	0	\$55,000	2,158	\$53,950	\$44,650	\$10,620	\$2,698	\$2,698	\$1,619	\$167,504	\$41,876	\$209,379	No																			
3A	6	2453	17	Private Property Line	"D" Line - 400+18	"D" Line - 425+16	\$935,000	RW+Wall+Fences	RW=563, Wall=95, Fences=2353	\$70,975	11,770	\$294,250	\$698,813	\$0	\$87,985	TCE/ Wall Footing Easement/ Partial Property Take	\$2,103,411	\$14,713	\$14,713	\$8,828	\$3,293,686	\$823,422	\$4,117,108	No								
	8		20				\$1,100,000				16,214	\$405,350												\$87,985	\$2,103,411	\$20,268	\$20,268	\$12,161	\$3,419,229	\$854,807	\$4,274,036	No
	10		23				\$1,265,000				20,752	\$518,800												\$87,985	\$2,103,411	\$25,940	\$25,940	\$15,564	\$3,547,428	\$886,857	\$4,434,284	No
	12		24				\$1,320,000				25,658	\$641,450												\$87,985	\$2,103,411	\$32,073	\$32,073	\$19,244	\$3,686,022	\$921,506	\$4,607,528	No
	14		24				\$1,320,000				30,564	\$764,100												\$87,985	\$2,103,411	\$38,205	\$38,205	\$22,923	\$3,824,617	\$956,154	\$4,780,771	No
	16		24				\$1,320,000				35,470	\$886,750												\$87,985	\$2,103,411	\$44,338	\$44,338	\$26,603	\$3,963,211	\$990,803	\$4,954,014	No
	18		24				\$1,320,000				40,376	\$1,009,400												\$87,985	\$2,103,411	\$50,470	\$50,470	\$30,282	\$4,101,806	\$1,025,451	\$5,127,257	No
20	26	\$1,430,000	45,282	\$1,132,050	\$87,985	\$2,103,411	\$56,603	\$56,603	\$33,962	\$4,240,400	\$1,060,100	\$5,300,500	No																			
3A+3B	6	3091	19	Private Property Line	"D" Line - 400+18	"SNBT" Line - 1431+54	\$1,045,000	RW+Wall	RW=72, Wall=566	\$86,615	15,598	\$389,950	\$803,693	\$0	\$0	TCE/ME/ Wall Footing Easement	\$2,155,891	\$19,498	\$19,498	\$11,699	\$3,574,827	\$893,707	\$4,468,534	No								
	8		28				\$1,540,000				21,318	\$532,950												\$0	\$2,155,891	\$26,648	\$26,648	\$15,989	\$3,736,417	\$934,104	\$4,670,521	No
	10		34				\$1,870,000				27,132	\$678,300												\$0	\$2,155,891	\$33,915	\$33,915	\$20,349	\$3,900,663	\$975,166	\$4,875,828	No
	12		34				\$1,870,000				33,314	\$832,850												\$0	\$2,155,891	\$41,643	\$41,643	\$24,986	\$4,075,304	\$1,018,826	\$5,094,130	No
	14		34				\$1,870,000				39,496	\$987,400												\$0	\$2,155,891	\$49,370	\$49,370	\$29,622	\$4,249,946	\$1,062,486	\$5,312,432	No
	16		34				\$1,870,000				45,678	\$1,141,950												\$0	\$2,155,891	\$57,098	\$57,098	\$34,259	\$4,424,587	\$1,106,147	\$5,530,734	No
	18		34				\$1,870,000				51,860	\$1,296,500												\$0	\$2,155,891	\$64,825	\$64,825	\$38,895	\$4,599,229	\$1,149,807	\$5,749,036	No
20	36	\$1,980,000	58,042	\$1,451,050	\$0	\$2,155,891	\$72,553	\$72,553	\$43,532	\$4,773,870	\$1,193,468	\$5,967,338	No																			
4	6	2621	0	Edge of Shoulder	"B" Line - 1406+57	"B" Line - 1431+39	\$550,000	Fence	729	\$10,935	7,863	\$196,575	\$0	\$301,415	\$0	N/A	\$0	\$0	\$16,381	\$9,829	\$524,651	\$131,163	\$655,814	No								
	8		0				\$825,000				13,105	\$327,625												\$0	\$0	\$16,381	\$9,829	\$666,185	\$166,546	\$832,731	No	
	10		18				\$990,000				18,347	\$458,675												\$0	\$0	\$22,934	\$13,760	\$807,719	\$201,930	\$1,009,649	No	
	12		21				\$1,155,000				23,589	\$589,725												\$0	\$0	\$29,486	\$17,692	\$949,253	\$237,313	\$1,186,566	No	
	14		21				\$1,155,000				28,831	\$720,775												\$0	\$0	\$36,039	\$21,623	\$1,090,787	\$272,697	\$1,363,484	No	
	16		21				\$1,155,000				34,073	\$851,825												\$0	\$0	\$42,591	\$25,555	\$1,232,321	\$308,080	\$1,540,401	No	
	18		26				\$1,430,000				39,315	\$982,875												\$0	\$0	\$49,144	\$29,486	\$1,373,855	\$343,464	\$1,717,319	No	
20	29	\$1,595,000	44,557	\$1,113,925	\$0	\$0	\$55,696	\$33,418	\$1,515,389	\$378,847	\$1,894,236	No																				
5	6	1801	19	Caltrans Right of Way/Private Property Line	"SNBT" Line - 1431+53	"SNBT" Line - 1449+72	\$1,045,000	RW+Wall+Fences	RW=443, Wall=166, Fences=1192	\$46,780	8,915	\$222,875	\$188,605	\$0	\$0	Wall Footing Easement	\$8,860	\$0	\$11,144	\$6,686	\$485,950	\$121,488	\$607,438	Yes								
	8		19				\$1,045,000				12,517	\$312,925												\$0	\$0	\$15,646	\$9,388	\$583,204	\$145,801	\$729,005	Yes	
	10		22				\$1,210,000				16,119	\$402,975												\$0	\$0	\$20,149	\$12,089	\$680,458	\$170,115	\$850,573	Yes	
	12		32				\$1,760,000				19,721	\$493,025												\$0	\$0	\$24,651	\$14,791	\$777,712	\$194,428	\$972,140	Yes	
	14		33				\$1,815,000				23,323	\$583,075												\$0	\$0	\$29,154	\$17,492	\$874,966	\$218,742	\$1,093,708	Yes	
	16		39				\$2,145,000				26,925	\$673,125												\$0	\$0	\$33,656	\$20,194	\$972,220	\$243,055	\$1,215,275	Yes	
	18		42				\$2,310,000				30,527	\$763,175												\$0	\$0	\$38,159	\$22,895	\$1,069,474	\$267,369	\$1,336,843	Yes	
20	42	\$2,310,000	34,129	\$853,225	\$0	\$0	\$42,661	\$25,597	\$1,166,728	\$291,682	\$1,458,410	Yes																				
6S	6	1454	0	Edge of Shoulder	"V3" Line - 441+99	"V3" Line - 446+69	\$0	N/A	-	\$0	4,362	\$109,050	\$0	\$167,210	\$0	N/A	\$0	\$0	\$0	\$3,272	\$279,532	\$69,883	\$349,414	No								
	8		0				\$0				7,270	\$181,750												\$0	\$0	\$5,453	\$354,413	\$88,603	\$443,016	No		
	10		0				\$0				10,178	\$254,450												\$0	\$0	\$7,634	\$429,294	\$107,323	\$536,617	No		
	12		0				\$0				13,086	\$327,150												\$0	\$0	\$9,815	\$504,175	\$126,044	\$630,218	No		
	14		0				\$0				15,994	\$399,850												\$0	\$0	\$11,996	\$579,056	\$144,764	\$723,819	No		
	16		0				\$0				18,902	\$472,550												\$0	\$0	\$14,177	\$653,937	\$163,484	\$817,421	No		
	18		0				\$0				21,810	\$545,250												\$0	\$0	\$16,358	\$728,818	\$182,204	\$911,022	No		
20	0	\$275,000	24,718	\$617,950	\$0	\$0	\$18,539	\$803,699	\$200,925	\$1,004,623	No																					
7	6	673	0	Private Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	2,826	\$70,650	\$125,745	\$0	\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$344,267	\$0	\$3,533	\$2,120	\$570,044	\$142,511	\$712,555	No								
	8		4				\$220,000				4,172	\$104,300												\$0	\$0	\$5,215	\$3,129	\$606,386	\$151,597	\$757,983	No	
	10		4				\$220,000				5,518	\$137,950												\$0	\$0	\$6,898	\$4,139	\$642,728	\$160,682	\$803,410	No	
	12		8				\$440,000				6,864	\$171,600												\$0	\$0	\$8,580	\$5,148	\$679,070	\$169,768	\$848,838	No	
	14		8				\$440,000				8,210	\$205,250												\$0	\$0	\$10,263	\$6,158	\$715,412	\$178,853	\$894,265	No	
	16		9				\$495,000				9,556	\$238,900												\$0	\$0	\$11,945	\$7,167	\$751,754	\$187,939	\$939,693	No	
	18		9				\$495,000				10,902	\$272,550												\$0	\$0	\$13,628	\$8,177	\$788,096	\$197,024	\$985,120	No	
20	9	\$495,000	12,248	\$306,200	\$0	\$0	\$15,310	\$9,186	\$824,438	\$206,110	\$1,030,548	No																				

Table A.5 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW = \$60/LF, SW & PW = \$20/LF, WI Fence = \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																		
8	6	406	6	Private Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	1,032	\$25,800	\$115,830		\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$184,378	\$0	\$1,290	\$774	\$344,692	\$86,173	\$430,864	No
	8		\$330,000				1,844				\$46,100	\$184,378					\$0	\$2,305	\$1,383	\$366,616	\$91,654	\$458,269	No	
	10		\$330,000				2,656				\$66,400	\$184,378					\$0	\$3,320	\$1,992	\$388,540	\$97,135	\$485,674	No	
	12		\$330,000				3,468				\$86,700	\$184,378					\$0	\$4,335	\$2,601	\$410,464	\$102,616	\$513,079	No	
	14		\$330,000				4,280				\$107,000	\$184,378					\$0	\$5,350	\$3,210	\$432,388	\$108,097	\$540,484	No	
	16		\$330,000				5,092				\$127,300	\$184,378					\$0	\$6,365	\$3,819	\$454,312	\$113,578	\$567,889	No	
	18		\$330,000				5,904				\$147,600	\$184,378					\$0	\$7,380	\$4,428	\$476,236	\$119,059	\$595,294	No	
	20		\$330,000				6,716				\$167,900	\$184,378					\$0	\$8,395	\$5,037	\$498,160	\$124,540	\$622,699	No	
9	6-20	FTNB No. 9 was not modeled for the single-bore design variation of the Freeway Tunnel Alternative due to Receptor FR-72 not being an impacted receptor.																						
10	6	1207	0	Caltrans Right of Way/Private Property Line	"C" Line - 1775+05	"C" Line - 1784+10	\$0	SW	463	\$9,260	7,242	\$181,050	\$0		\$0	N/A	\$0	\$9,053	\$9,053	\$5,432	\$213,847	\$53,462	\$267,308	No
	8		\$550,000				9,656				\$241,400	\$0					\$12,070	\$7,242	\$282,042	\$70,511	\$352,553	No		
	10		\$550,000				12,070				\$301,750	\$0					\$15,088	\$9,053	\$350,238	\$87,559	\$437,797	Yes		
	12		\$660,000				14,484				\$362,100	\$0					\$18,105	\$10,863	\$418,433	\$104,608	\$523,041	Yes		
	14		\$990,000				16,898				\$422,450	\$0					\$21,123	\$12,674	\$486,629	\$121,657	\$608,286	Yes		
	16		\$1,210,000				19,312				\$482,800	\$0					\$24,140	\$14,484	\$554,824	\$138,706	\$693,530	Yes		
	18		\$1,210,000				21,726				\$543,150	\$0					\$27,158	\$16,295	\$623,020	\$155,755	\$778,774	Yes		
	20		\$1,210,000				24,140				\$603,500	\$0					\$30,175	\$18,105	\$691,215	\$172,804	\$864,019	Yes		
11	6	1404	0	Caltrans Right of Way/Private Property Line	"C" Line - 1785+47	"C" Line - 1800+13	\$0	RW+SW	RW=505, SW=899	\$48,280	6,404	\$160,100	\$209,575		\$0	FE/ME	\$88,375	\$8,005	\$8,005	\$4,803	\$527,143	\$131,786	\$658,929	No
	8		\$0				9,212				\$230,300	\$88,375					\$11,515	\$11,515	\$6,909	\$606,469	\$151,617	\$758,086	No	
	10		\$0				12,020				\$300,500	\$88,375					\$15,025	\$15,025	\$9,015	\$685,795	\$171,449	\$857,244	No	
	12		\$110,000				14,828				\$370,700	\$88,375					\$18,535	\$18,535	\$11,121	\$765,121	\$191,280	\$956,401	No	
	14		\$275,000				17,636				\$440,900	\$88,375					\$22,045	\$22,045	\$13,227	\$844,447	\$211,112	\$1,055,559	No	
	16		\$275,000				20,444				\$511,100	\$88,375					\$25,555	\$25,555	\$15,333	\$923,773	\$230,943	\$1,154,716	No	
	18		\$660,000				23,252				\$581,300	\$88,375					\$29,065	\$29,065	\$17,439	\$1,003,099	\$250,775	\$1,253,874	No	
	20		\$660,000				26,060				\$651,500	\$88,375					\$32,575	\$32,575	\$19,545	\$1,082,425	\$270,606	\$1,353,031	No	
12	6	556	0	Caltrans Right of Way/Private Property Line	"C" Line - 1800+41	"C" Line - 1805+13	\$0	RW+SW	RW=957, SW=90	\$59,220	3,336	\$83,400	\$263,175		\$60,000	N/A	\$0	\$4,170	\$0	\$2,502	\$472,467	\$118,117	\$590,584	No
	8		\$0				4,448				\$111,200	\$0					\$5,560	\$0	\$3,336	\$502,491	\$125,623	\$628,114	No	
	10		\$0				5,560				\$139,000	\$0					\$6,950	\$0	\$4,170	\$532,515	\$133,129	\$665,644	No	
	12		\$165,000				6,672				\$166,800	\$0					\$8,340	\$0	\$5,004	\$562,539	\$140,635	\$703,174	No	
	14		\$165,000				7,784				\$194,600	\$0					\$9,730	\$0	\$5,838	\$592,563	\$148,141	\$740,704	No	
	16		\$165,000				8,896				\$222,400	\$0					\$11,120	\$0	\$6,672	\$622,587	\$155,647	\$778,234	No	
	18		\$165,000				10,008				\$250,200	\$0					\$12,510	\$0	\$7,506	\$652,611	\$163,153	\$815,764	No	
	20		\$275,000				11,120				\$278,000	\$0					\$13,900	\$0	\$8,340	\$682,635	\$170,659	\$853,294	No	
13A+B	6	2315	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$0	RW+SW	RW=697, SW=909	\$60,000	11,799	\$294,975	\$191,675	\$80,155		N/A	\$0	\$14,749	\$14,749	\$8,849	\$730,152	\$182,538	\$912,690	No
	8		\$0				16,429				\$410,725	\$0					\$20,536	\$20,536	\$12,322	\$860,949	\$215,237	\$1,076,187	No	
	10		\$275,000				21,059				\$526,475	\$0					\$26,324	\$26,324	\$15,794	\$991,747	\$247,937	\$1,239,683	No	
	12		\$275,000				25,689				\$642,225	\$0					\$32,111	\$32,111	\$19,267	\$1,122,544	\$280,636	\$1,403,180	No	
	14		\$275,000				30,319				\$757,975	\$0					\$37,899	\$37,899	\$22,739	\$1,253,342	\$313,335	\$1,566,677	No	
	16		\$275,000				34,949				\$873,725	\$0					\$43,686	\$43,686	\$26,212	\$1,384,139	\$346,035	\$1,730,174	No	
	18		\$275,000				39,579				\$989,475	\$0					\$49,474	\$49,474	\$29,684	\$1,514,937	\$378,734	\$1,893,671	No	
	20		\$550,000				44,209				\$1,105,225	\$0					\$55,261	\$55,261	\$33,157	\$1,645,734	\$411,434	\$2,057,168	No	
13B	6	709	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1790+00	\$0	N/A	N/A	\$0	4,254	\$106,350	\$0	\$0	N/A	\$0	\$5,318	\$5,318	\$3,191	\$120,176	\$30,044	\$150,219	No	
	8		\$0				5,672				\$141,800	\$0				\$7,090	\$7,090	\$4,254	\$160,234	\$40,059	\$200,293	No		
	10		\$0				7,090				\$177,250	\$0				\$8,863	\$8,863	\$5,318	\$200,293	\$50,073	\$250,366	No		
	12		\$0				8,508				\$212,700	\$0				\$10,635	\$10,635	\$6,381	\$240,351	\$60,088	\$300,439	No		
	14		\$0				9,926				\$248,150	\$0				\$12,408	\$12,408	\$7,445	\$280,410	\$70,102	\$350,512	No		
	16		\$0				11,344				\$283,600	\$0				\$14,180	\$14,180	\$8,508	\$320,468	\$80,117	\$400,585	No		
	18		\$0				12,762				\$319,050	\$0				\$15,953	\$15,953	\$9,572	\$360,527	\$90,132	\$450,658	No		
	20		\$0				14,180				\$354,500	\$0				\$17,725	\$17,725	\$10,635	\$400,585	\$100,146	\$500,731	No		
14	6	263	0	Private Property Line	"SJ2" Line - 774+15	"SJ2" Line - 776+05	\$0	Fence	263	\$3,945	1,578	\$39,450	\$0	\$0	TCE/ME	\$24,551	\$1,973	\$0	\$1,184	\$71,102	\$17,776	\$88,878	No	
	8		\$55,000				2,104				\$52,600	\$24,551				\$2,630	\$0	\$1,578	\$85,304	\$21,326	\$106,630	No		
	10		\$55,000				2,630				\$65,750	\$24,551				\$3,288	\$0	\$1,973	\$99,508	\$24,877	\$124,383	No		
	12		\$55,000				3,156				\$78,900	\$24,551				\$3,945	\$0	\$2,367	\$113,708	\$28,427	\$142,135	No		
	14		\$55,000				3,682				\$92,050	\$24,551				\$4,603	\$0	\$2,762	\$127,910	\$31,978	\$159,888	No		
	16		\$55,000				4,208				\$105,200	\$24,551				\$5,260	\$0	\$3,156	\$142,112	\$35,528	\$177,640	No		
	18		\$55,000				4,734				\$118,350	\$24,551				\$5,918	\$0	\$3,551	\$156,314	\$39,079	\$195,393	No		
	20		\$55,000				5,260				\$131,500	\$24,551				\$6,575	\$0	\$3,945	\$170,516	\$42,629	\$213,145	No		

Table A.5 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW = \$60/LF, SW & PW = \$20/LF, WI Fence = \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)									
					Begin	End																											
15	6	262	0	Private Property Line	"SJ2" Line -768+17	"SJ2" Line -768+17	\$0	Fence	262	\$3,930	1,572	\$39,300	\$0	\$0	\$0	TCE/ME	\$33,628	\$1,965	\$0	\$1,179	\$80,002	\$20,000	\$100,002	No									
	8		1				\$55,000				2,096	\$52,400													\$0	\$33,628	\$2,620	\$0	\$1,572	\$94,150	\$23,537	\$117,687	No
	10		1				\$55,000				2,620	\$65,500													\$0	\$33,628	\$3,275	\$0	\$1,965	\$108,298	\$27,074	\$135,372	No
	12		1				\$55,000				3,144	\$78,600													\$0	\$33,628	\$3,930	\$0	\$2,358	\$122,446	\$30,611	\$153,057	No
	14		2				\$110,000				3,668	\$91,700													\$0	\$33,628	\$4,585	\$0	\$2,751	\$136,594	\$34,148	\$170,742	No
	16		2				\$110,000				4,192	\$104,800													\$0	\$33,628	\$5,240	\$0	\$3,144	\$150,742	\$37,685	\$188,427	No
	18		2				\$110,000				4,716	\$117,900													\$0	\$33,628	\$5,895	\$0	\$3,537	\$164,890	\$41,222	\$206,112	No
	20		2				\$110,000				5,240	\$131,000													\$0	\$33,628	\$6,550	\$0	\$3,930	\$179,038	\$44,759	\$223,797	No

Assumption: Contingency includes: clearing and grubbing, demolition.
 Caltrans = California Department of Transportation
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 FE = Footing Easement
 ft = foot/feet
 FTNB = Freeway Tunnel Noise Barrier
 LF = linear foot/feet
 ME = Maintenance Easement
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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Table A.6 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																		
1	6	537	0	Edge of Shoulder	"B" Line - 1376+15	"B" Line - 1381+30	\$0	RW	54	\$3,240	1,503	\$37,575	\$16,740	\$61,755	\$0	N/A	\$0	\$1,879	\$1,879	\$1,127	\$124,195	\$31,049	\$155,243	No
	8		0				\$0				2,577	\$64,425			\$0		\$3,221	\$3,221	\$1,933	\$154,535	\$38,634	\$193,169	No	
	10		0				\$0				3,651	\$91,275			\$0		\$4,564	\$4,564	\$2,738	\$184,876	\$46,219	\$231,095	No	
	12		0				\$0				4,725	\$118,125			\$0		\$5,906	\$5,906	\$3,544	\$215,216	\$53,804	\$269,020	No	
	14		0				\$55,000				5,799	\$144,975			\$0		\$7,249	\$7,249	\$4,349	\$245,557	\$61,389	\$306,946	No	
	16		0				\$55,000				6,873	\$171,825			\$0		\$8,591	\$8,591	\$5,155	\$275,897	\$68,974	\$344,872	No	
	18		0				\$55,000				7,947	\$198,675			\$0		\$9,934	\$9,934	\$5,960	\$306,238	\$76,559	\$382,797	No	
20	0	\$55,000	9,021	\$225,525	\$0	\$11,276	\$11,276	\$6,766	\$336,578	\$84,145	\$420,723	No												
2	6	115	0	Private Property Line	"B" Line - 1378+89	"B" Line - 1378+90	\$55,000	RW	71	\$4,260	548	\$13,700	\$47,010		\$44,650	TCE/ME/ Wall Footing Easement	\$0	\$685	\$685	\$411	\$111,401	\$27,850	\$139,251	No
	8		0				\$55,000				778	\$19,450			\$44,650		\$0	\$973	\$973	\$584	\$117,899	\$29,475	\$147,373	No
	10		0				\$55,000				1,008	\$25,200			\$44,650		\$0	\$1,260	\$1,260	\$756	\$124,396	\$31,099	\$155,495	No
	12		0				\$55,000				1,238	\$30,950			\$44,650		\$0	\$1,548	\$1,548	\$929	\$130,894	\$32,723	\$163,617	No
	14		0				\$55,000				1,468	\$36,700			\$44,650		\$0	\$1,835	\$1,835	\$1,101	\$137,391	\$34,348	\$171,739	No
	16		0				\$55,000				1,698	\$42,450			\$44,650		\$0	\$2,123	\$2,123	\$1,274	\$143,889	\$35,972	\$179,861	No
	18		0				\$55,000				1,928	\$48,200			\$44,650		\$0	\$2,410	\$2,410	\$1,446	\$150,386	\$37,597	\$187,983	No
20	0	\$55,000	2,158	\$53,950	\$44,650	\$0	\$2,698	\$2,698	\$1,619	\$156,884	\$39,221	\$196,104	No											
3A	6	2453	17	Private Property Line	"D" Line - 400+18	"D" Line - 425+16	\$935,000	RW+Wall+Fences	RW=563, Wall=95, Fences=2353	\$70,975	11,770	\$294,250	\$698,813		\$87,985	TCE/ Wall Footing Easement/ Partial Property Take	\$0	\$14,713	\$14,713	\$8,828	\$1,190,276	\$297,569	\$1,487,844	No
	8		20				\$1,100,000				16,214	\$405,350			\$87,985		\$0	\$20,268	\$20,268	\$12,161	\$328,955	\$1,644,773	No	
	10		23				\$1,265,000				20,752	\$518,800			\$87,985		\$0	\$25,940	\$25,940	\$15,564	\$1,444,017	\$361,004	\$1,805,021	No
	12		24				\$1,320,000				25,658	\$641,450			\$87,985		\$0	\$32,073	\$32,073	\$19,244	\$1,582,612	\$395,653	\$1,978,264	No
	14		24				\$1,320,000				30,564	\$764,100			\$87,985		\$0	\$38,205	\$38,205	\$22,923	\$1,721,206	\$430,302	\$2,151,508	No
	16		24				\$1,320,000				35,470	\$886,750			\$87,985		\$0	\$44,338	\$44,338	\$26,603	\$1,859,801	\$464,950	\$2,324,751	No
	18		24				\$1,320,000				40,376	\$1,009,400			\$87,985		\$0	\$50,470	\$50,470	\$30,282	\$1,998,395	\$499,599	\$2,497,994	No
20	26	\$1,430,000	45,282	\$1,132,050	\$87,985	\$0	\$56,603	\$56,603	\$33,962	\$2,136,990	\$534,247	\$2,671,237	No											
3A+3B	6	3091	19	Private Property Line	"D" Line - 400+18	"SNBT" Line - 1431+54	\$1,045,000	RW+Wall	RW=72, Wall=566	\$86,615	15,598	\$389,950	\$803,693		\$0	TCE/ME/ Wall Footing Easement	\$0	\$19,498	\$19,498	\$11,699	\$1,471,417	\$367,854	\$1,839,271	No
	8		28				\$1,540,000				21,318	\$532,950			\$0		\$26,648	\$26,648	\$15,989	\$1,633,007	\$408,252	\$2,041,258	No	
	10		34				\$1,870,000				27,132	\$678,300			\$0		\$33,915	\$33,915	\$20,349	\$1,797,252	\$449,313	\$2,246,565	No	
	12		34				\$1,870,000				33,314	\$832,850			\$0		\$41,643	\$41,643	\$24,986	\$1,971,894	\$492,973	\$2,464,867	No	
	14		34				\$1,870,000				39,496	\$987,400			\$0		\$49,370	\$49,370	\$29,622	\$2,146,535	\$536,634	\$2,683,169	No	
	16		34				\$1,870,000				45,678	\$1,141,950			\$0		\$57,098	\$57,098	\$34,259	\$2,321,177	\$580,294	\$2,901,471	No	
	18		34				\$1,870,000				51,860	\$1,296,500			\$0		\$64,825	\$64,825	\$38,895	\$2,495,818	\$623,955	\$3,119,773	No	
20	36	\$1,980,000	58,042	\$1,451,050	\$0	\$72,553	\$72,553	\$43,532	\$2,670,460	\$667,615	\$3,338,074	No												
4	6	2621	0	Edge of Shoulder	"B" Line - 1406+57	"B" Line - 1431+39	\$550,000	Fence	729	\$10,935	7,863	\$196,575	\$0	\$301,415	\$0	N/A	\$0	\$0	\$9,829	\$5,897	\$524,651	\$131,163	\$655,814	No
	8		0				\$825,000				13,105	\$327,625			\$0		\$16,381	\$9,829	\$666,185	\$166,546	\$832,731	No		
	10		18				\$990,000				18,347	\$458,675			\$0		\$22,934	\$13,760	\$807,719	\$201,930	\$1,009,649	No		
	12		21				\$1,155,000				23,589	\$589,725			\$0		\$29,486	\$17,692	\$949,253	\$237,313	\$1,186,566	No		
	14		21				\$1,155,000				28,831	\$720,775			\$0		\$36,039	\$21,623	\$1,090,787	\$272,697	\$1,363,484	No		
	16		21				\$1,155,000				34,073	\$851,825			\$0		\$42,591	\$25,555	\$1,232,321	\$308,080	\$1,540,401	No		
	18		26				\$1,430,000				39,315	\$982,875			\$0		\$49,144	\$29,486	\$1,373,855	\$343,464	\$1,717,319	No		
20	29	\$1,595,000	44,557	\$1,113,925	\$0	\$55,696	\$33,418	\$1,515,389	\$378,847	\$1,894,236	No													
5	6	1801	19	Caltrans Right of Way/Private Property Line	"SNBT" Line - 1431+53	"SNBT" Line - 1449+72	\$1,045,000	RW+Wall+Fences	RW=443, Wall=166, Fences=1192	\$46,780	8,915	\$222,875	\$188,605	\$0	\$0	Wall Footing Easement	\$0	\$11,144	\$6,686	\$477,090	\$119,273	\$596,363	Yes	
	8		19				\$1,045,000				12,517	\$312,925			\$0		\$15,646	\$9,388	\$574,344	\$143,586	\$717,930	Yes		
	10		22				\$1,210,000				16,119	\$402,975			\$0		\$20,149	\$12,089	\$671,598	\$167,900	\$839,498	Yes		
	12		32				\$1,760,000				19,721	\$493,025			\$0		\$24,651	\$14,791	\$768,852	\$192,213	\$961,065	Yes		
	14		33				\$1,815,000				23,323	\$583,075			\$0		\$29,154	\$17,492	\$866,106	\$216,527	\$1,082,633	Yes		
	16		39				\$2,145,000				26,925	\$673,125			\$0		\$33,656	\$20,194	\$963,360	\$240,840	\$1,204,200	Yes		
	18		42				\$2,310,000				30,527	\$763,175			\$0		\$38,159	\$22,895	\$1,060,614	\$265,154	\$1,325,768	Yes		
20	42	\$2,310,000	34,129	\$853,225	\$0	\$42,661	\$25,597	\$1,157,868	\$289,467	\$1,447,335	Yes													
6S	6	1454	0	Edge of Shoulder	"V3" Line - 441+99	"V3" Line - 446+69	\$0	N/A		\$0	4,362	\$109,050	\$0	\$167,210	\$0	N/A	\$0	\$0	\$3,272	\$279,532	\$69,883	\$349,414	No	
	8		0				\$0				7,270	\$181,750			\$0		\$5,453	\$354,413	\$88,603	\$443,016	No			
	10		0				\$0				10,178	\$254,450			\$0		\$7,634	\$429,294	\$107,323	\$536,617	No			
	12		0				\$0				13,086	\$327,150			\$0		\$9,815	\$504,175	\$126,044	\$630,218	No			
	14		0				\$0				15,994	\$399,850			\$0		\$11,996	\$579,056	\$144,764	\$723,819	No			
	16		0				\$0				18,902	\$472,550			\$0		\$14,177	\$653,937	\$163,484	\$817,421	No			
	18		0				\$0				21,810	\$545,250			\$0		\$16,358	\$728,818	\$182,204	\$911,022	No			
20	0	\$275,000	24,718	\$617,950	\$0	\$18,539	\$803,699	\$200,925	\$1,004,623	No														
7	6	673	0	Private Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	2,826	\$70,650	\$125,745		\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$0	\$0	\$3,533	\$2,120	\$225,777	\$56,444	\$282,221	No
	8		4				\$220,000				4,172	\$104,300			\$0		\$5,215	\$3,129	\$262,119	\$65,530	\$327,649	No		
	10		4				\$220,000				5,518	\$137,950			\$0		\$6,898	\$4,139	\$298,461	\$74,615	\$373,076	No		
	12		8				\$440,000				6,864	\$171,600			\$0		\$8,580	\$5,148	\$334,803	\$83,701	\$418,504	Yes		
	14		8				\$440,000				8,210	\$205,250			\$0		\$10,263	\$6,158	\$371,145	\$92,786	\$463,931	No		
	16		9				\$495,000				9,556	\$238,900			\$0		\$11,945	\$7,167	\$407,487	\$101,872	\$509,359	No		
	18		9				\$495,000				10,902	\$272,550			\$0		\$13,628	\$8,177	\$443,829	\$110,957	\$554,786	No		
20	9	\$495,000	12,248	\$306,200	\$0	\$15,310	\$9,186	\$480,171	\$120,043	\$600,214	No													

Table A.6 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																		
8	6	406	6	Private Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	1,032	\$25,800	\$115,830		\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$0	\$0	\$1,290	\$774	\$160,314	\$40,079	\$200,393	Yes
	8		\$330,000				1,844				\$46,100	\$0			\$0		\$2,305	\$1,383	\$182,238	\$45,560	\$227,798	Yes		
	10		\$330,000				2,656				\$66,400	\$0			\$0		\$3,320	\$1,992	\$204,162	\$51,041	\$255,203	Yes		
	12		\$330,000				3,468				\$86,700	\$0			\$0		\$4,335	\$2,601	\$226,086	\$56,522	\$282,608	Yes		
	14		\$330,000				4,280				\$107,000	\$0			\$0		\$5,350	\$3,210	\$248,010	\$62,003	\$310,013	Yes		
	16		\$330,000				5,092				\$127,300	\$0			\$0		\$6,365	\$3,819	\$269,934	\$67,484	\$337,418	No		
	18		\$330,000				5,904				\$147,600	\$0			\$0		\$7,380	\$4,428	\$291,858	\$72,965	\$364,823	No		
	20		\$330,000				6,716				\$167,900	\$0			\$0		\$8,395	\$5,037	\$313,782	\$78,446	\$392,228	No		
9	6	FTNB No. 9 was not modeled for the single-bore design variation of the Freeway Tunnel Alternative due to Receptor FR-72 not being an impacted receptor.																						
	8																							
	10																							
	12																							
	14																							
	16																							
	20																							
10	6	1207	0	Caltrans Right of Way/Private Property Line	"C" Line - 1775+05	"C" Line - 1784+10	\$0	SW	463	\$9,260	7,242	\$181,050	\$0		\$0	N/A	\$0	\$9,053	\$9,053	\$5,432	\$213,847	\$53,462	\$267,308	No
	8		\$550,000				9,656				\$241,400	\$0			\$0		\$12,070	\$7,242	\$282,042	\$70,511	\$352,553	No		
	10		\$550,000				12,070				\$301,750	\$0			\$0		\$15,088	\$9,053	\$350,238	\$87,559	\$437,797	Yes		
	12		\$660,000				14,484				\$362,100	\$0			\$0		\$18,105	\$10,863	\$418,433	\$104,608	\$523,041	Yes		
	14		\$990,000				16,898				\$422,450	\$0			\$0		\$21,123	\$12,674	\$486,629	\$121,657	\$608,286	Yes		
	16		\$1,210,000				19,312				\$482,800	\$0			\$0		\$24,140	\$14,484	\$554,824	\$138,706	\$693,530	Yes		
	18		\$1,210,000				21,726				\$543,150	\$0			\$0		\$27,158	\$16,295	\$623,020	\$155,755	\$778,774	Yes		
	20		\$1,210,000				24,140				\$603,500	\$0			\$0		\$30,175	\$18,105	\$691,215	\$172,804	\$864,019	Yes		
11	6	1404	0	Caltrans Right of Way/Private Property Line	"C" Line - 1785+47	"C" Line - 1800+13	\$0	RW+SW	RW=505, SW=899	\$48,280	6,404	\$160,100	\$209,575		\$0	FE/ME	\$0	\$8,005	\$8,005	\$4,803	\$438,768	\$109,692	\$548,460	No
	8		\$0				9,212				\$230,300	\$0			\$0		\$11,515	\$11,515	\$6,909	\$518,094	\$129,524	\$647,618	No	
	10		\$0				12,020				\$300,500	\$0			\$0		\$15,025	\$15,025	\$9,015	\$597,420	\$149,355	\$746,775	No	
	12		\$110,000				14,828				\$370,700	\$0			\$0		\$18,535	\$18,535	\$11,121	\$676,746	\$169,187	\$845,933	No	
	14		\$275,000				17,636				\$440,900	\$0			\$0		\$22,045	\$22,045	\$13,227	\$756,072	\$189,018	\$945,090	No	
	16		\$75,000				20,444				\$511,100	\$0			\$0		\$25,555	\$25,555	\$15,333	\$835,398	\$208,850	\$1,044,248	No	
	18		\$660,000				23,252				\$581,300	\$0			\$0		\$29,065	\$29,065	\$17,439	\$914,724	\$228,681	\$1,143,405	No	
	20		\$660,000				26,060				\$651,500	\$0			\$0		\$32,575	\$32,575	\$19,545	\$994,050	\$248,513	\$1,242,563	No	
12	6	556	0	Caltrans Right of Way/Private Property Line	"C" Line - 1800+41	"C" Line - 1805+13	\$0	RW+SW	RW=957, SW=90	\$59,220	3,336	\$83,400	\$263,175		\$60,000	N/A	\$0	\$4,170	\$0	\$2,502	\$472,467	\$118,117	\$590,584	No
	8		\$0				4,448				\$111,200	\$60,000			\$0		\$5,560	\$0	\$3,336	\$502,491	\$125,623	\$628,114	No	
	10		\$0				5,560				\$139,000	\$60,000			\$0		\$6,950	\$0	\$4,170	\$532,515	\$133,129	\$665,644	No	
	12		\$0				6,672				\$166,800	\$60,000			\$0		\$8,340	\$0	\$5,004	\$562,539	\$140,635	\$703,174	No	
	14		\$165,000				7,784				\$194,600	\$60,000			\$0		\$9,730	\$0	\$5,838	\$592,563	\$148,141	\$740,704	No	
	16		\$165,000				8,896				\$222,400	\$60,000			\$0		\$11,120	\$0	\$6,672	\$622,587	\$155,647	\$778,234	No	
	18		\$165,000				10,008				\$250,200	\$60,000			\$0		\$12,510	\$0	\$7,506	\$652,611	\$163,153	\$815,764	No	
	20		\$275,000				11,120				\$278,000	\$60,000			\$0		\$13,900	\$0	\$8,340	\$682,635	\$170,659	\$853,294	No	
13A+B	6	2315	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$0	RW+SW	RW=697, SW=909	\$60,000	11,799	\$294,975	\$191,675	\$80,155	\$65,000	N/A	\$0	\$14,749	\$14,749	\$8,849	\$730,152	\$182,538	\$912,690	No
	8		\$0				16,429				\$410,725	\$65,000			\$0		\$20,536	\$20,536	\$12,322	\$860,949	\$215,237	\$1,076,187	No	
	10		\$275,000				21,059				\$526,475	\$65,000			\$0		\$26,324	\$26,324	\$15,794	\$991,747	\$247,937	\$1,239,683	No	
	12		\$275,000				25,689				\$642,225	\$65,000			\$0		\$32,111	\$32,111	\$19,267	\$1,122,544	\$280,636	\$1,403,180	No	
	14		\$275,000				30,319				\$757,975	\$65,000			\$0		\$37,899	\$37,899	\$22,739	\$1,253,342	\$313,335	\$1,566,677	No	
	16		\$275,000				34,949				\$873,725	\$65,000			\$0		\$43,686	\$43,686	\$26,212	\$1,384,139	\$346,035	\$1,730,174	No	
	18		\$275,000				39,579				\$989,475	\$65,000			\$0		\$49,474	\$49,474	\$29,684	\$1,514,937	\$378,734	\$1,893,671	No	
	20		\$550,000				44,209				\$1,105,225	\$65,000			\$0		\$55,261	\$55,261	\$33,157	\$1,645,734	\$411,434	\$2,057,168	No	
13B	6	709	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1790+00	\$0	N/A	N/A	\$0	4,254	\$106,350	\$0	\$0	\$0	N/A	\$0	\$5,318	\$5,318	\$3,191	\$120,176	\$30,044	\$150,219	No
	8		\$0				5,672				\$141,800	\$0			\$0		\$7,090	\$7,090	\$4,254	\$160,234	\$40,059	\$200,293	No	
	10		\$0				7,090				\$177,250	\$0			\$0		\$8,863	\$8,863	\$5,318	\$200,293	\$50,073	\$250,366	No	
	12		\$0				8,508				\$212,700	\$0			\$0		\$10,635	\$10,635	\$6,381	\$240,351	\$60,088	\$300,439	No	
	14		\$0				9,926				\$248,150	\$0			\$0		\$12,408	\$12,408	\$7,445	\$280,410	\$70,102	\$350,512	No	
	16		\$0				11,344				\$283,600	\$0			\$0		\$14,180	\$14,180	\$8,508	\$320,468	\$80,117	\$400,585	No	
	18		\$0				12,762				\$319,050	\$0			\$0		\$15,953	\$15,953	\$9,572	\$360,527	\$90,132	\$450,658	No	
	20		\$0				14,180				\$354,500	\$0			\$0		\$17,725	\$17,725	\$10,635	\$400,555	\$100,146	\$500,701	No	
14	6	263	0	Private Property Line	"SJ2" Line - 774+15	"SJ2" Line - 776+05	\$0	Fence	263	\$3,945	1,578	\$39,450	\$0	\$0	\$0	TCE/ME	\$0	\$1,973	\$0	\$1,184	\$46,551	\$11,638	\$58,189	No
	8		\$55,000				2,104				\$52,600	\$0			\$0		\$2,630	\$0	\$1,578	\$60,753	\$15,188	\$75,941	No	
	10		\$55,000				2,630				\$65,750	\$0			\$0		\$3,288	\$0	\$1,973	\$74,955	\$18,739	\$93,694	No	
	12		\$55,000				3,156				\$78,900	\$0			\$0		\$3,945	\$0	\$2,367	\$89,157	\$22,289	\$111,446	No	
	14		\$55,000				3,682				\$92,050	\$0			\$0		\$4,603	\$0	\$2,762	\$103,359	\$25,840	\$129,199	No	
	16		\$55,000				4,208				\$105,200	\$0			\$0		\$5,260	\$0	\$3,156	\$117,561	\$29,390	\$146,951	No	
	18		\$55,000				4,734				\$118,350	\$0			\$0		\$5,918	\$0	\$3,551	\$131,763	\$32,941	\$164,704	No	
	20		\$55,000				5,260				\$131,500	\$0			\$0		\$6,575	\$0	\$3,945	\$145,965	\$36,491	\$182,456	No	

Table A.6 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Single-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW = \$60/LF, SW & PW = \$20/LF, WI Fence = \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)					
					Begin	End																							
15	6	262	0	Private Property Line	"SJ2" Line -768+17	"SJ2" Line -768+17	\$0	Fence	262	\$3,930	1,572	\$39,300	\$0	\$0	\$0	TCE/ME	\$0	\$1,965	\$0	\$1,179	\$46,374	\$11,594	\$57,968	No					
	8		1				\$55,000				2,096	\$52,400									\$0	\$0	\$2,620	\$0	\$1,572	\$60,522	\$15,131	\$75,653	No
	10		1				\$55,000				2,620	\$65,500									\$0	\$0	\$3,275	\$0	\$1,965	\$74,670	\$18,668	\$93,338	No
	12		1				\$55,000				3,144	\$78,600									\$0	\$0	\$3,930	\$0	\$2,358	\$88,818	\$22,205	\$111,023	No
	14		2				\$110,000				3,668	\$91,700									\$0	\$0	\$4,585	\$0	\$2,751	\$102,966	\$25,742	\$128,708	No
	16		2				\$110,000				4,192	\$104,800									\$0	\$0	\$5,240	\$0	\$3,144	\$117,114	\$29,279	\$146,393	No
	18		2				\$110,000				4,716	\$117,900									\$0	\$0	\$5,895	\$0	\$3,537	\$131,262	\$32,816	\$164,078	No
	20		2				\$110,000				5,240	\$131,000									\$0	\$0	\$6,550	\$0	\$3,930	\$145,410	\$36,353	\$181,763	No

Assumption: Contingency includes: clearing and grubbing, demolition.
 Caltrans = California Department of Transportation
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 FE = Footing Easement
 ft = foot/feet
 FTNB = Freeway Tunnel Noise Barrier
 LF = linear foot/feet
 ME = Maintenance Easement
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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Table A.7 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW = \$20/LF, WI Fence= \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)	
					Begin	End																			
1	6	537	0	Edge of Shoulder	"B" Line - 1376+15	"B" Line - 1381+30	\$0	RW	54	\$3,240	1,503	\$37,575	\$16,740	\$61,755	\$0	N/A	\$0	\$1,879	\$1,879	\$1,127	\$124,195	\$31,049	\$155,243	No	
	8		0				\$0				2,577	\$64,425					\$0	\$0	\$3,221	\$3,221	\$1,933	\$154,535	\$38,634	\$193,169	No
	10		0				\$0				3,651	\$91,275					\$0	\$0	\$4,564	\$4,564	\$2,738	\$184,876	\$46,219	\$231,095	No
	12		0				\$0				4,725	\$118,125					\$0	\$0	\$5,906	\$5,906	\$3,544	\$215,216	\$53,804	\$269,020	No
	14		0				\$0				5,799	\$144,975					\$0	\$0	\$7,249	\$7,249	\$4,349	\$245,557	\$61,389	\$306,946	No
	16		0				\$0				6,873	\$171,825					\$0	\$0	\$8,591	\$8,591	\$5,155	\$275,897	\$68,974	\$344,872	No
	18		0				\$0				7,947	\$198,675					\$0	\$0	\$9,934	\$9,934	\$5,960	\$306,238	\$76,559	\$382,797	No
	20		0				\$0				9,021	\$225,525					\$0	\$0	\$11,276	\$11,276	\$6,766	\$336,578	\$84,145	\$420,723	No
2	6	115	0	Private Property Line	"B" Line - 1378+89	"B" Line - 1378+90	\$55,000	RW	71	\$4,260	548	\$13,700	\$47,010	\$0	TCE/ME/ Wall Footing Easement	\$44,650	\$685	\$685	\$411	\$122,021	\$30,505	\$152,526	No		
	8		0				\$55,000				778	\$19,450				\$44,650	\$973	\$973	\$584	\$128,519	\$32,130	\$160,648	No		
	10		0				\$55,000				1,008	\$25,200				\$44,650	\$1,260	\$1,260	\$756	\$135,016	\$33,754	\$168,770	No		
	12		0				\$55,000				1,238	\$30,950				\$44,650	\$1,548	\$1,548	\$929	\$141,514	\$35,378	\$176,892	No		
	14		0				\$55,000				1,468	\$36,700				\$44,650	\$1,835	\$1,835	\$1,101	\$148,011	\$37,003	\$185,014	No		
	16		0				\$55,000				1,698	\$42,450				\$44,650	\$2,123	\$2,123	\$1,274	\$154,509	\$38,627	\$193,136	No		
	18		0				\$55,000				1,928	\$48,200				\$44,650	\$2,410	\$2,410	\$1,446	\$161,006	\$40,252	\$201,258	No		
	20		0				\$55,000				2,158	\$53,950				\$44,650	\$2,698	\$2,698	\$1,619	\$167,504	\$41,876	\$209,379	No		
3A	6	2453	17	Private Property Line	"D" Line - 400+18	"D" Line - 425+16	\$935,000	RW+Wall+Fences	RW=563, Wall=95, Fences=2353	\$70,975	11,770	\$294,250	\$698,813	\$0	TCE/ Wall Footing Easement/ Partial Property Take	\$87,985	\$2,103,411	\$0	\$14,713	\$8,828	\$3,278,974	\$819,743	\$4,098,717	No	
	8		21				\$1,155,000				16,214	\$405,350				\$87,985	\$2,103,411	\$0	\$20,268	\$12,161	\$3,398,962	\$849,740	\$4,248,702	No	
	10		24				\$1,320,000				20,752	\$518,800				\$87,985	\$2,103,411	\$0	\$25,940	\$15,564	\$3,521,488	\$880,372	\$4,401,859	No	
	12		24				\$1,320,000				25,658	\$641,450				\$87,985	\$2,103,411	\$0	\$32,073	\$19,244	\$3,653,950	\$913,487	\$4,567,437	No	
	14		24				\$1,320,000				30,564	\$764,100				\$87,985	\$2,103,411	\$0	\$38,205	\$22,923	\$3,786,412	\$946,603	\$4,733,014	No	
	16		24				\$1,320,000				35,470	\$886,750				\$87,985	\$2,103,411	\$0	\$44,338	\$26,603	\$3,918,874	\$979,718	\$4,898,592	No	
	18		24				\$1,320,000				40,376	\$1,009,400				\$87,985	\$2,103,411	\$0	\$50,470	\$30,282	\$4,051,336	\$1,012,834	\$5,064,169	No	
	20		26				\$1,430,000				45,282	\$1,132,050				\$87,985	\$2,103,411	\$0	\$56,603	\$33,962	\$4,183,798	\$1,045,949	\$5,229,747	No	
3A+3B	6	3091	17	Private Property Line	"D" Line - 400+18	"SNBT" Line - 1431+54	\$935,000	RW+Wall	RW=72, Wall=566	\$86,615	15,598	\$389,950	\$803,693	\$0	TCE/ME/ Wall Footing Easement	\$87,985	\$2,155,891	\$0	\$23,183	\$13,910	\$3,634,926	\$908,731	\$4,543,657	No	
	8		26				\$1,430,000				21,318	\$532,950				\$87,985	\$2,155,891	\$0	\$30,910	\$18,546	\$3,801,840	\$950,460	\$4,752,299	No	
	10		32				\$1,760,000				27,132	\$678,300				\$87,985	\$2,155,891	\$0	\$38,638	\$23,183	\$3,968,754	\$992,188	\$4,960,942	No	
	12		35				\$1,925,000				33,314	\$832,850				\$87,985	\$2,155,891	\$0	\$46,365	\$27,819	\$4,135,668	\$1,033,917	\$5,169,584	No	
	14		35				\$1,925,000				39,496	\$987,400				\$87,985	\$2,155,891	\$0	\$54,093	\$32,456	\$4,302,582	\$1,075,645	\$5,378,227	No	
	16		35				\$1,925,000				45,678	\$1,141,950				\$87,985	\$2,155,891	\$0	\$61,820	\$37,092	\$4,469,496	\$1,117,374	\$5,586,869	No	
	18		35				\$1,925,000				51,860	\$1,296,500				\$87,985	\$2,155,891	\$0	\$69,548	\$41,729	\$4,636,410	\$1,159,102	\$5,795,512	No	
	20		37				\$2,035,000				58,042	\$1,451,050				\$87,985	\$2,155,891	\$0	\$77,275	\$46,365	\$4,803,324	\$1,200,831	\$6,004,154	No	
4	6	2,621	0	Edge of Shoulder	"B" Line - 1406+57	"B" Line - 1431+39	\$275,000	Fence	729	\$10,935	7,863	\$196,575	\$0	\$301,415	N/A	\$0	\$0	\$0	\$5,829	\$5,897	\$524,651	\$131,163	\$655,814	No	
	8		0				\$550,000				13,105	\$327,625				\$0	\$0	\$16,381	\$9,829	\$666,185	\$166,546	\$832,731	No		
	10		12				\$660,000				18,347	\$458,675				\$0	\$0	\$22,934	\$13,760	\$807,719	\$201,930	\$1,009,649	No		
	12		21				\$1,155,000				23,589	\$589,725				\$0	\$0	\$29,486	\$17,692	\$949,253	\$237,313	\$1,186,566	No		
	14		23				\$1,265,000				28,831	\$720,775				\$0	\$0	\$36,039	\$21,623	\$1,090,787	\$272,697	\$1,363,484	No		
	16		26				\$1,430,000				34,073	\$851,825				\$0	\$0	\$42,591	\$25,555	\$1,232,321	\$308,080	\$1,540,401	No		
	18		27				\$1,485,000				39,315	\$982,875				\$0	\$0	\$49,144	\$29,486	\$1,373,855	\$343,464	\$1,717,319	No		
	20		27				\$1,485,000				44,557	\$1,113,925				\$0	\$0	\$55,696	\$33,418	\$1,515,389	\$378,847	\$1,894,236	No		
5	6	1801	21	Caltrans Right of Way/Private Property Line	"SNBT" Line - 1431+53	"SNBT" Line - 1449+72	\$1,155,000	RW+Wall+Fences	RW=443, Wall=166, Fences=1192	\$46,780	8,915	\$222,875	\$188,605	\$0	Wall Footing Easement	\$8,860	\$0	\$11,144	\$6,686	\$485,950	\$121,488	\$607,438	Yes		
	8		21				\$1,155,000				13,213	\$330,325				\$8,860	\$0	\$15,646	\$9,388	\$583,204	\$145,801	\$729,005	Yes		
	10		21				\$1,155,000				20,049	\$501,225				\$8,860	\$0	\$20,149	\$12,089	\$680,458	\$170,115	\$850,573	Yes		
	12		25				\$1,375,000				21,401	\$535,025				\$8,860	\$0	\$24,651	\$14,791	\$777,712	\$194,428	\$972,140	Yes		
	14		34				\$1,870,000				22,007	\$550,175				\$8,860	\$0	\$29,154	\$17,492	\$874,966	\$218,742	\$1,093,708	Yes		
	16		40				\$2,200,000				25,421	\$635,525				\$8,860	\$0	\$33,656	\$20,194	\$972,220	\$243,055	\$1,215,275	Yes		
	18		40				\$2,200,000				34,289	\$857,225				\$8,860	\$0	\$38,159	\$22,895	\$1,069,474	\$267,369	\$1,336,843	Yes		
	20		43				\$2,365,000				32,889	\$822,225				\$8,860	\$0	\$42,661	\$25,597	\$1,166,728	\$291,682	\$1,458,410	Yes		
6D	6	1,404	0	Edge of Shoulder	"V3" Line - 438+51	"V3" Line - 445+38	\$220,000	N/A	-	\$0	4,212	\$105,300	\$0	\$161,460	N/A	\$0	\$0	\$0	\$3,159	\$269,919	\$67,480	\$337,399	No		
	8		4				\$220,000				7,020	\$175,500				\$0	\$0	\$0	\$0	\$5,265	\$342,225	\$85,556	\$427,781	No	
	10		4				\$220,000				9,828	\$245,700				\$0	\$0	\$0	\$0	\$7,371	\$414,531	\$103,633	\$518,164	No	
	12		11				\$605,000				12,636	\$315,900				\$0	\$0	\$0	\$0	\$9,477	\$486,837	\$121,709	\$608,546	No	
	14		15				\$825,000				15,444	\$386,100				\$0	\$0	\$0	\$0	\$11,583	\$559,143	\$139,786	\$698,929	Yes	
	16		15				\$825,000				18,252	\$456,300				\$0	\$0	\$0	\$0	\$13,689	\$631,449	\$157,862	\$789,311	Yes	
	18		15				\$825,000				21,060	\$526,500				\$0	\$0	\$0	\$0	\$15,795	\$703,755	\$175,939	\$879,694	No	
	20		15				\$825,000				23,868	\$596,700				\$0	\$0	\$0	\$0	\$17,901	\$776,061	\$194,015	\$970,076	No	
7	6	673	4	Private Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	2,826	\$70,650	\$125,745	\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$344,267	\$0	\$3,533	\$2,120	\$570,044	\$142,511	\$712,555	No		
	8		4				\$220,000				4,172	\$104,300				\$0	\$0	\$5,215	\$3,129	\$606,386	\$151,597	\$757,983	No		
	10		4				\$220,000				5,518	\$137,950				\$0	\$0	\$6,898	\$4,139	\$642,728	\$160,682	\$803,410	No		
	12		8				\$440,000				6,864	\$171,600				\$0	\$0	\$8,580	\$5,148	\$679,070	\$169,768	\$848,838	No		
	14		8				\$440,000				8,210	\$205,250				\$0	\$0	\$10,263	\$6,158	\$715,412	\$178,853	\$894,265	No		
	16		9				\$495,000				9,556	\$238,900				\$0	\$0	\$11,945	\$7,167	\$751,754	\$187,939	\$939,693	No		
	18		9				\$495,000				10,902	\$272,550				\$0	\$0	\$13,628	\$8,177	\$788,096	\$197,024	\$985,120	No		
	20		9				\$495,000				12,248	\$306,200				\$0	\$0	\$15,310	\$9,186	\$824,438	\$206,110	\$1,030,548	No		

Table A.7 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW = \$20/LF, WI Fence= \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																		
8	6	406	6	Private Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	1,032	\$25,800	\$115,830		\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$184,378	\$0	\$1,290	\$774	\$344,692	\$86,173	\$430,864	No
	8		\$330,000				1,844				\$46,100	\$0					\$184,378	\$0	\$2,305	\$1,383	\$366,616	\$91,654	\$458,269	No
	10		\$330,000				2,656				\$66,400	\$0					\$184,378	\$0	\$3,320	\$1,992	\$388,540	\$97,135	\$485,674	No
	12		\$330,000				3,468				\$86,700	\$0					\$184,378	\$0	\$4,335	\$2,601	\$410,464	\$102,616	\$513,079	No
	14		\$330,000				4,280				\$107,000	\$0					\$184,378	\$0	\$5,350	\$3,210	\$432,388	\$108,097	\$540,484	No
	16		\$330,000				5,092				\$127,300	\$0					\$184,378	\$0	\$6,365	\$3,819	\$454,312	\$113,578	\$567,889	No
	18		\$330,000				5,904				\$147,600	\$0					\$184,378	\$0	\$7,380	\$4,428	\$476,236	\$119,059	\$595,294	No
	20		\$330,000				6,716				\$167,900	\$0					\$184,378	\$0	\$8,395	\$5,037	\$498,160	\$124,540	\$622,699	No
9	6	84	1	Private Property Line	"K" Line - 751+87	"K" Line - 752+26	\$55,000	SW	84	\$1,680	504	\$12,600	\$0		\$0	TCE/ME	\$6,300	\$630	\$0	\$378	\$21,588	\$5,397	\$26,985	Yes
	8		\$55,000				672				\$16,800	\$0					\$6,300	\$840	\$0	\$504	\$26,124	\$6,531	\$32,655	Yes
	10		\$55,000				840				\$21,000	\$0					\$6,300	\$1,050	\$0	\$630	\$30,660	\$7,665	\$38,325	Yes
	12		\$55,000				1,008				\$25,200	\$0					\$6,300	\$1,260	\$0	\$756	\$35,196	\$8,799	\$43,995	Yes
	14		\$55,000				1,176				\$29,400	\$0					\$6,300	\$1,470	\$0	\$882	\$39,732	\$9,933	\$49,665	Yes
	16		\$55,000				1,344				\$33,600	\$0					\$6,300	\$1,680	\$0	\$1,008	\$44,268	\$11,067	\$55,335	No
	18		\$55,000				1,512				\$37,800	\$0					\$6,300	\$1,890	\$0	\$1,134	\$48,804	\$12,201	\$61,005	No
	20		\$55,000				1,680				\$42,000	\$0					\$6,300	\$2,100	\$0	\$1,260	\$53,340	\$13,335	\$66,675	No
10	6	1207	0	Caltrans Right of Way/Private Property Line	"C" Line - 1775+05	"C" Line - 1784+10	\$0	SW	463	\$9,260	7,242	\$181,050	\$0		\$0	N/A	\$0	\$9,053	\$9,053	\$5,432	\$213,847	\$53,462	\$267,308	No
	8		\$550,000				9,656				\$241,400	\$0					\$0	\$12,070	\$12,070	\$7,242	\$282,042	\$70,511	\$352,553	No
	10		\$550,000				12,070				\$301,750	\$0					\$0	\$15,088	\$15,088	\$9,053	\$350,238	\$87,559	\$437,797	Yes
	12		\$550,000				14,484				\$362,100	\$0					\$0	\$18,105	\$18,105	\$10,863	\$418,433	\$104,608	\$523,041	Yes
	14		\$990,000				16,898				\$422,450	\$0					\$0	\$21,123	\$21,123	\$12,674	\$486,629	\$121,657	\$608,286	Yes
	16		\$1,210,000				19,312				\$482,800	\$0					\$0	\$24,140	\$24,140	\$14,484	\$554,824	\$138,706	\$693,530	Yes
	18		\$1,210,000				21,726				\$543,150	\$0					\$0	\$27,158	\$27,158	\$16,295	\$623,020	\$155,755	\$778,774	Yes
	20		\$1,265,000				24,140				\$603,500	\$0					\$0	\$30,175	\$30,175	\$18,105	\$691,215	\$172,804	\$864,019	Yes
11	6	1,404	0	Caltrans Right of Way/Private Property Line	"C" Line - 1785+47	"C" Line - 1800+13	\$0	RW+SW	RW=505, SW=899	\$48,280	6,404	\$160,100	\$209,575		\$0	FE/ME	\$88,375	\$8,005	\$8,005	\$4,803	\$527,143	\$131,786	\$658,929	No
	8		\$0				9,212				\$230,300	\$0					\$88,375	\$11,515	\$11,515	\$6,909	\$606,469	\$151,617	\$758,086	No
	10		\$110,000				12,020				\$300,500	\$0					\$88,375	\$15,025	\$15,025	\$9,015	\$685,795	\$171,449	\$857,244	No
	12		\$110,000				14,828				\$370,700	\$0					\$88,375	\$18,535	\$18,535	\$11,121	\$765,121	\$191,280	\$956,401	No
	14		\$275,000				17,636				\$440,900	\$0					\$88,375	\$22,045	\$22,045	\$13,227	\$844,447	\$211,112	\$1,055,559	No
	16		\$330,000				20,444				\$511,100	\$0					\$88,375	\$25,555	\$25,555	\$15,333	\$923,773	\$230,943	\$1,154,716	No
	18		\$495,000				23,252				\$581,300	\$0					\$88,375	\$29,065	\$29,065	\$17,439	\$1,003,099	\$250,775	\$1,253,874	No
	20		\$660,000				26,060				\$651,500	\$0					\$88,375	\$32,575	\$32,575	\$19,545	\$1,082,425	\$270,606	\$1,353,031	No
12	6	556	0	Caltrans Right of Way/Private Property Line	"C" Line - 1800+41	"C" Line - 1805+13	\$0	RW+SW	RW=957, SW=90	\$59,220	3,336	\$83,400	\$263,175		\$60,000	N/A	\$0	\$4,170	\$0	\$2,502	\$472,467	\$118,117	\$590,584	No
	8		\$0				4,448				\$111,200	\$60,000					\$0	\$5,560	\$0	\$3,336	\$502,491	\$125,623	\$628,114	No
	10		\$0				5,560				\$139,000	\$60,000					\$0	\$6,950	\$0	\$4,170	\$532,515	\$133,129	\$665,644	No
	12		\$0				6,672				\$166,800	\$60,000					\$0	\$8,340	\$0	\$5,004	\$562,539	\$140,635	\$703,174	No
	14		\$165,000				7,784				\$194,600	\$60,000					\$0	\$9,730	\$0	\$5,838	\$592,563	\$148,141	\$740,704	No
	16		\$165,000				8,896				\$222,400	\$60,000					\$0	\$11,120	\$0	\$6,672	\$622,587	\$155,647	\$778,234	No
	18		\$165,000				10,008				\$250,200	\$60,000					\$0	\$12,510	\$0	\$7,506	\$652,611	\$163,153	\$815,764	No
	20		\$165,000				11,120				\$278,000	\$60,000					\$0	\$13,900	\$0	\$8,340	\$682,635	\$170,659	\$853,294	No
13A+B	6	2,315	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$0	RW+SW	RW=697, SW=909	\$60,000	11,799	\$294,975	\$191,675	\$80,155	\$65,000	N/A	\$0	\$14,749	\$14,749	\$8,849	\$730,152	\$182,538	\$912,690	No
	8		\$0				16,429				\$410,725	\$65,000					\$0	\$20,536	\$20,536	\$12,322	\$860,949	\$215,237	\$1,076,187	No
	10		\$275,000				21,059				\$526,475	\$65,000					\$0	\$26,324	\$26,324	\$15,794	\$991,747	\$247,937	\$1,239,683	No
	12		\$275,000				25,689				\$642,225	\$65,000					\$0	\$32,111	\$32,111	\$19,267	\$1,122,544	\$280,636	\$1,403,180	No
	14		\$385,000				30,319				\$757,975	\$65,000					\$0	\$37,899	\$37,899	\$22,739	\$1,253,342	\$313,335	\$1,566,677	No
	16		\$385,000				34,949				\$873,725	\$65,000					\$0	\$43,686	\$43,686	\$26,212	\$1,384,139	\$346,035	\$1,730,174	No
	18		\$385,000				39,579				\$989,475	\$65,000					\$0	\$49,474	\$49,474	\$29,684	\$1,514,937	\$378,734	\$1,893,671	No
	20		\$495,000				44,209				\$1,105,225	\$65,000					\$0	\$55,261	\$55,261	\$33,157	\$1,645,734	\$411,434	\$2,057,168	No
13B	6	709	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1790+00	\$0	N/A	N/A	\$0	4,254	\$106,350	\$0		\$0	N/A	\$0	\$5,318	\$5,318	\$3,191	\$120,176	\$30,044	\$150,219	No
	8		\$0				5,672				\$141,800	\$0					\$0	\$7,090	\$7,090	\$4,254	\$160,234	\$40,059	\$200,293	No
	10		\$0				7,090				\$177,250	\$0					\$0	\$8,863	\$8,863	\$5,318	\$200,293	\$50,073	\$250,366	No
	12		\$0				8,508				\$212,700	\$0					\$0	\$10,635	\$10,635	\$6,381	\$240,351	\$60,088	\$300,439	No
	14		\$0				9,926				\$248,150	\$0					\$0	\$12,408	\$12,408	\$7,445	\$280,410	\$70,102	\$350,512	No
	16		\$0				11,344				\$283,600	\$0					\$0	\$14,180	\$14,180	\$8,508	\$320,468	\$80,117	\$400,585	No
	18		\$110,000				12,762				\$319,050	\$0					\$0	\$15,953	\$15,953	\$9,572	\$360,527	\$90,132	\$450,658	No
	20		\$110,000				14,180				\$354,500	\$0					\$0	\$17,725	\$17,725	\$10,635	\$400,585	\$100,146	\$500,731	No
14	6	263	0	Private Property Line	"SJ2" Line - 774+15	"SJ2" Line - 776+05	\$0	Fence	263	\$3,945	1,578	\$39,450	\$0		\$0	TCE/ME	\$24,551	\$1,973	\$0	\$1,184	\$71,102	\$88,878	\$150,730	No
	8		\$55,000				2,104				\$52,600	\$0					\$24,551	\$2,630	\$0	\$1,578	\$85,304	\$21,326	\$106,630	No
	10		\$55,000				2,630				\$65,750	\$0					\$24,551	\$3,288	\$0	\$1,973	\$99,506	\$24,877	\$124,383	No
	12		\$55,000				3,156				\$78,900	\$0					\$24,551	\$3,945	\$0	\$2,367	\$113,708	\$28,427	\$142,135	No
	14		\$55,000				3,682				\$92,050	\$0					\$24,551	\$4,603	\$0	\$2,762	\$127,910	\$31,978	\$159,888	No
	16		\$55,000				4,208				\$105,200	\$0					\$24,551	\$5,260	\$0	\$3,156	\$142,112	\$35,528	\$177,640	No
	18		\$55,000				4,734				\$118,350	\$0					\$24,551	\$5,918	\$0	\$3,551	\$156,314	\$39,079	\$195,393	No
	20		\$55,000				5,260				\$131,500	\$0					\$24,551	\$6,575	\$0	\$3,945	\$170,516	\$42,629	\$213,145	No

Table A.7 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Costs)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW = \$20/LF, WI Fence= \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)									
					Begin	End																											
15	6	262	0	Private Property Line	"SJ2" Line - 768+17	"SJ2" Line -768+17	\$0	Fence	262	\$3,930	1,572	\$39,300	\$0	\$0	\$0	TCE/ME	\$33,628	\$1,965	\$0	\$1,179	\$80,002	\$20,000	\$100,002	No									
	8		1				\$55,000				2,096	\$52,400													\$0	\$33,628	\$2,620	\$0	\$1,572	\$94,150	\$23,537	\$117,687	No
	10		1				\$55,000				2,620	\$65,500													\$0	\$33,628	\$3,275	\$0	\$1,965	\$108,298	\$27,074	\$135,372	No
	12		1				\$55,000				3,144	\$78,600													\$0	\$33,628	\$3,930	\$0	\$2,358	\$122,446	\$30,611	\$153,057	No
	14		2				\$110,000				3,668	\$91,700													\$0	\$33,628	\$4,585	\$0	\$2,751	\$136,594	\$34,148	\$170,742	No
	16		2				\$110,000				4,192	\$104,800													\$0	\$33,628	\$5,240	\$0	\$3,144	\$150,742	\$37,685	\$188,427	No
	18		2				\$110,000				4,716	\$117,900													\$0	\$33,628	\$5,895	\$0	\$3,537	\$164,890	\$41,222	\$206,112	No
	20		2				\$110,000				5,240	\$131,000													\$0	\$33,628	\$6,550	\$0	\$3,930	\$179,038	\$44,759	\$223,797	No

Assumption: Contingency includes: clearing and grubbing, demolition.
 Caltrans = California Department of Transportation
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 FE = Footing Easement
 ft = foot/feet
 LF = linear foot/feet
 ME = Maintenance Easement
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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Table A.8 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW = \$20/LF, WI Fence= \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)								
					Begin	End																										
1	6	537	0	Edge of Shoulder	"B" Line - 1376+15	"B" Line - 1381+30	\$0	RW	54	\$3,240	1,503	\$37,575	\$16,740	\$61,755	\$0	N/A	\$0	\$1,879	\$1,879	\$1,127	\$124,195	\$31,049	\$155,243	No								
	8		0				\$0				2,577	\$64,425												\$0	\$0	\$3,221	\$3,221	\$1,933	\$154,535	\$38,634	\$193,169	No
	10		0				\$0				3,651	\$91,275												\$0	\$0	\$4,564	\$4,564	\$2,738	\$184,876	\$46,219	\$231,095	No
	12		0				\$0				4,725	\$118,125												\$0	\$0	\$5,906	\$5,906	\$3,544	\$215,216	\$53,804	\$269,020	No
	14		0				\$0				5,799	\$144,975												\$0	\$0	\$7,249	\$7,249	\$4,349	\$245,557	\$61,389	\$306,946	No
	16		0				\$0				6,873	\$171,825												\$0	\$0	\$8,591	\$8,591	\$5,155	\$275,897	\$68,974	\$344,872	No
	18		0				\$0				7,947	\$198,675												\$0	\$0	\$9,934	\$9,934	\$5,960	\$306,238	\$76,559	\$382,797	No
2	6	115	0	Private Property Line	"B" Line - 1378+89	"B" Line - 1378+90	\$55,000	RW	71	\$4,260	548	\$13,700	\$47,010	\$-	\$44,650	TCE/ME/ Wall Footing Easement	\$0	\$685	\$685	\$411	\$336,578	\$84,145	\$420,723	No								
	8		0				\$55,000				778	\$19,450												\$44,650	\$0	\$973	\$973	\$584	\$128,519	\$29,475	\$147,373	No
	10		0				\$55,000				1,008	\$25,200												\$44,650	\$0	\$1,260	\$1,260	\$756	\$135,016	\$31,099	\$155,495	No
	12		0				\$55,000				1,238	\$30,950												\$44,650	\$0	\$1,548	\$1,548	\$929	\$141,514	\$32,723	\$163,617	No
	14		0				\$55,000				1,468	\$36,700												\$44,650	\$0	\$1,835	\$1,835	\$1,101	\$148,011	\$34,348	\$171,739	No
	16		0				\$55,000				1,698	\$42,450												\$44,650	\$0	\$2,123	\$2,123	\$1,274	\$154,509	\$35,972	\$179,861	No
	18		0				\$55,000				1,928	\$48,200												\$44,650	\$0	\$2,410	\$2,410	\$1,446	\$161,006	\$37,597	\$187,983	No
3A	6	2453	17	Private Property Line	"D" Line - 400+18	"D" Line - 425+16	\$935,000	RW+Wall+Fences	RW=563, Wall=95, Fences=2353	\$70,975	11,770	\$294,250	\$698,813	\$-	\$87,985	TCE/ Wall Footing Easement/ Partial Property Take	\$0	\$0	\$14,713	\$8,828	\$3,278,974	\$293,891	\$1,469,454	No								
	8		21				\$1,155,000				16,214	\$405,350												\$87,985	\$0	\$20,268	\$12,161	\$3,398,962	\$323,888	\$1,619,439	No	
	10		24				\$1,320,000				20,752	\$518,800												\$87,985	\$0	\$25,940	\$15,564	\$3,521,488	\$354,519	\$1,772,596	No	
	12		24				\$1,320,000				25,658	\$641,450												\$87,985	\$0	\$32,073	\$19,244	\$3,653,950	\$387,635	\$1,938,174	No	
	14		24				\$1,320,000				30,564	\$764,100												\$87,985	\$0	\$38,205	\$22,923	\$3,786,412	\$420,750	\$2,103,751	No	
	16		24				\$1,320,000				35,470	\$886,750												\$87,985	\$0	\$44,338	\$26,603	\$3,918,874	\$453,866	\$2,269,329	No	
	18		24				\$1,320,000				40,376	\$1,009,400												\$87,985	\$0	\$50,470	\$30,282	\$4,051,336	\$486,981	\$2,434,906	No	
3A+3B	6	3091	17	Private Property Line	"D" Line - 400+18	"SNBT" Line - 1431+54	\$935,000	RW+Wall	RW=72, Wall=566	\$86,615	15,598	\$389,950	\$803,693	\$-	\$87,985	TCE/ME/ Wall Footing Easement	\$0	\$0	\$23,183	\$13,910	\$3,634,926	\$555,427	\$2,777,134	No								
	8		26				\$1,430,000				21,318	\$532,950												\$87,985	\$0	\$30,910	\$18,546	\$3,801,840	\$594,037	\$2,970,184	No	
	10		32				\$1,760,000				27,132	\$678,300												\$87,985	\$0	\$38,638	\$23,183	\$3,968,754	\$633,281	\$3,166,406	No	
	12		35				\$1,925,000				33,314	\$832,850												\$87,985	\$0	\$46,365	\$27,819	\$4,135,668	\$675,010	\$3,375,049	No	
	14		35				\$1,925,000				39,496	\$987,400												\$87,985	\$0	\$54,093	\$32,456	\$4,302,582	\$716,738	\$3,583,691	No	
	16		35				\$1,925,000				45,678	\$1,141,950												\$87,985	\$0	\$61,820	\$37,092	\$4,469,496	\$758,467	\$3,792,334	No	
	18		35				\$1,925,000				51,860	\$1,296,500												\$87,985	\$0	\$69,548	\$41,729	\$4,636,410	\$800,195	\$4,000,976	No	
4	6	2,621	0	Edge of Shoulder	"B" Line - 1406+57	"B" Line - 1431+39	\$275,000	Fence	729	\$10,935	7,863	\$196,575	\$-	\$301,415	\$0	N/A	\$0	\$0	\$16,381	\$9,829	\$666,185	\$166,546	\$832,731	No								
	8		0				\$550,000				13,105	\$327,625												\$0	\$0	\$22,934	\$13,760	\$807,719	\$201,930	\$1,009,649	No	
	10		12				\$660,000				18,347	\$458,675												\$0	\$0	\$29,486	\$17,692	\$949,253	\$237,313	\$1,186,566	No	
	12		21				\$1,155,000				23,589	\$589,725												\$0	\$0	\$36,039	\$21,623	\$1,090,787	\$272,697	\$1,363,484	No	
	14		23				\$1,265,000				28,831	\$720,775												\$0	\$0	\$42,591	\$25,555	\$1,232,321	\$308,080	\$1,540,401	No	
	16		26				\$1,430,000				34,073	\$851,825												\$0	\$0	\$49,144	\$29,486	\$1,373,855	\$343,464	\$1,717,319	No	
	18		27				\$1,485,000				39,315	\$982,875												\$0	\$0	\$55,696	\$33,418	\$1,515,389	\$378,847	\$1,894,236	No	
5	6	1801	21	Caltrans Right of Way/Private Property Line	"SNBT" Line - 1431+53	"SNBT" Line - 1449+72	\$1,155,000	RW+Wall+Fences	RW=443, Wall=166, Fences=1192	\$46,780	8,915	\$222,875	\$188,605	\$-	\$0	Wall Footing Easement	\$0	\$0	\$11,144	\$6,686	\$485,950	\$119,273	\$596,363	Yes								
	8		21				\$1,155,000				13,213	\$330,325												\$0	\$0	\$15,646	\$9,388	\$583,204	\$143,586	\$717,930	Yes	
	10		21				\$1,155,000				20,049	\$501,225												\$0	\$0	\$20,149	\$12,089	\$680,458	\$167,900	\$839,498	Yes	
	12		25				\$1,375,000				21,401	\$535,025												\$0	\$0	\$24,651	\$14,791	\$777,712	\$192,213	\$961,065	Yes	
	14		34				\$1,870,000				22,007	\$550,175												\$0	\$0	\$29,154	\$17,492	\$874,966	\$216,527	\$1,082,633	Yes	
	16		40				\$2,200,000				25,421	\$635,525												\$0	\$0	\$33,656	\$20,194	\$972,220	\$240,840	\$1,204,200	Yes	
	18		40				\$2,200,000				34,289	\$857,225												\$0	\$0	\$38,159	\$22,895	\$1,069,474	\$265,154	\$1,325,768	Yes	
6D	6	1,404	0	Edge of Shoulder	"V3" Line - 438+51	"V3" Line - 445+38	\$220,000	N/A	-	\$0	4,212	\$105,300	\$-	\$161,460	\$0	N/A	\$0	\$0	\$3,159	\$269,919	\$67,480	\$337,399	No									
	8		4				\$220,000				7,020	\$175,500											\$0	\$0	\$5,265	\$342,225	\$85,556	\$427,781	No			
	10		4				\$220,000				9,828	\$245,700											\$0	\$0	\$7,371	\$414,531	\$103,633	\$518,164	No			
	12		11				\$605,000				12,636	\$315,900											\$0	\$0	\$9,477	\$486,837	\$121,709	\$608,546	No			
	14		15				\$825,000				15,444	\$386,100											\$0	\$0	\$11,583	\$559,143	\$139,786	\$698,929	Yes			
	16		15				\$825,000				18,252	\$456,300											\$0	\$0	\$13,689	\$631,449	\$157,862	\$789,311	Yes			
	18		15				\$825,000				21,060	\$526,500											\$0	\$0	\$15,795	\$703,755	\$175,939	\$879,694	No			
7	6	673	4	Private Property Line	"V3" Line - 437+08	"V3" Line - 440+00	\$220,000	RW+Fence	RW=303, Fence=370	\$23,730	2,826	\$70,650	\$125,745	\$-	\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$0	\$0	\$3,533	\$2,120	\$570,044	\$56,444	\$282,221	No								
	8		4				\$220,000				4,172	\$104,300												\$0	\$0	\$5,215	\$3,129	\$606,386	\$65,530	\$327,649	No	
	10		4				\$220,000				5,518	\$137,950												\$0	\$0	\$6,898	\$4,139	\$642,728	\$74,615	\$373,076	No	
	12		8				\$440,000				6,864	\$171,600												\$0	\$0	\$8,580	\$5,148	\$679,070	\$83,701	\$418,504	Yes	
	14		8				\$440,000				8,210	\$205,250												\$0	\$0	\$10,263	\$6,158	\$715,412	\$92,786	\$463,931	No	
	16		9				\$495,000				9,556	\$238,900												\$0	\$0	\$11,945	\$7,167	\$751,754	\$101,872	\$509,359	No	
	18		9				\$495,000				10,902	\$272,550												\$0	\$0	\$13,628	\$8,177	\$788,096	\$110,957	\$554,786	No	
20	9	\$495,000	12,248	\$306,200	\$0	\$0	\$15,310	\$9,186	\$824,438	\$120,043	\$600,214	No																				

Table A.8 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW=\$20/LF, WI Fence=\$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)
					Begin	End																		
8	6	406	6	Private Property Line	"V3" Line - 440+45	"V3" Line - 446+42	\$330,000	RW+Fence	RW=234, Fence=172	\$17,480	1,032	\$25,800	\$115,830		\$0	TCE/ME/ Wall Footing Easement/ Partial Property Take	\$0	\$0	\$1,290	\$774	\$344,692	\$40,079	\$200,393	Yes
	8		\$330,000				1,844				\$46,100	\$0					\$0	\$2,305	\$1,383	\$366,616	\$45,560	\$227,798	Yes	
	10		\$330,000				2,656				\$66,400	\$0					\$0	\$3,320	\$1,992	\$388,540	\$51,041	\$255,203	Yes	
	12		\$330,000				3,468				\$86,700	\$0					\$0	\$4,335	\$2,601	\$410,464	\$56,522	\$282,608	Yes	
	14		\$330,000				4,280				\$107,000	\$0					\$0	\$5,350	\$3,210	\$432,388	\$62,003	\$310,013	Yes	
	16		\$330,000				5,092				\$127,300	\$0					\$0	\$6,365	\$3,819	\$454,312	\$67,484	\$337,418	Yes	
	18		\$330,000				5,904				\$147,600	\$0					\$0	\$7,380	\$4,428	\$476,236	\$72,965	\$364,823	No	
9	6	84	1	Private Property Line	"K" Line - 751+87	"K" Line - 752+26	\$55,000	SW	84	\$1,680	504	\$12,600	\$-		\$0	TCE/ME	\$0	\$630	\$0	\$378	\$498,160	\$78,446	\$392,228	No
	8		\$55,000				672				\$16,800	\$0					\$0	\$840	\$0	\$504	\$26,124	\$4,956	\$24,780	Yes
	10		\$55,000				840				\$21,000	\$0					\$0	\$1,050	\$0	\$630	\$30,660	\$6,090	\$30,450	Yes
	12		\$55,000				1,008				\$25,200	\$0					\$0	\$1,260	\$0	\$756	\$35,196	\$7,224	\$36,120	Yes
	14		\$55,000				1,176				\$29,400	\$0					\$0	\$1,470	\$0	\$882	\$39,732	\$8,358	\$41,790	Yes
	16		\$55,000				1,344				\$33,600	\$0					\$0	\$1,680	\$0	\$1,008	\$44,268	\$9,492	\$47,460	Yes
	18		\$55,000				1,512				\$37,800	\$0					\$0	\$1,890	\$0	\$1,134	\$48,804	\$10,626	\$53,130	Yes
10	6	1207	0	Caltrans Right of Way/Private Property Line	"C" Line - 1775+05	"C" Line - 1784+10	\$0	SW	463	\$9,260	7,242	\$181,050	\$-		\$0	N/A	\$0	\$9,053	\$9,053	\$5,432	\$213,847	\$53,462	\$267,308	No
	8		\$550,000				9,656				\$241,400	\$0					\$0	\$12,070	\$7,242	\$282,042	\$70,511	\$352,553	No	
	10		\$550,000				12,070				\$301,750	\$0					\$0	\$15,088	\$9,053	\$350,238	\$87,559	\$437,797	Yes	
	12		\$550,000				14,484				\$362,100	\$0					\$0	\$18,105	\$10,863	\$418,433	\$104,608	\$523,041	Yes	
	14		\$990,000				16,898				\$422,450	\$0					\$0	\$21,123	\$12,674	\$486,629	\$121,657	\$608,286	Yes	
	16		\$1,210,000				19,312				\$482,800	\$0					\$0	\$24,140	\$14,484	\$554,824	\$138,706	\$693,530	Yes	
	18		\$1,210,000				21,726				\$543,150	\$0					\$0	\$27,158	\$16,295	\$623,020	\$155,755	\$778,774	Yes	
11	6	1,404	0	Caltrans Right of Way/Private Property Line	"C" Line - 1785+47	"C" Line - 1800+13	\$0	RW+SW	RW=505, SW=899	\$48,280	6,404	\$160,100	\$209,575		\$0	FE/ME	\$0	\$8,005	\$8,005	\$4,803	\$527,143	\$109,692	\$548,460	No
	8		\$0				9,212				\$230,300	\$0					\$0	\$11,515	\$6,909	\$606,469	\$129,524	\$647,618	No	
	10		\$110,000				12,020				\$300,500	\$0					\$0	\$15,025	\$9,015	\$685,795	\$149,355	\$746,775	No	
	12		\$110,000				14,828				\$370,700	\$0					\$0	\$18,535	\$11,121	\$765,121	\$169,187	\$845,933	No	
	14		\$275,000				17,636				\$440,900	\$0					\$0	\$22,045	\$13,227	\$844,447	\$189,018	\$945,090	No	
	16		\$330,000				20,444				\$511,100	\$0					\$0	\$25,555	\$15,333	\$923,773	\$208,850	\$1,044,248	No	
	18		\$495,000				23,252				\$581,300	\$0					\$0	\$29,065	\$17,439	\$1,003,099	\$228,681	\$1,143,405	No	
12	6	556	0	Caltrans Right of Way/Private Property Line	"C" Line - 1800+41	"C" Line - 1805+13	\$0	RW+SW	RW=957, SW=90	\$59,220	3,336	\$83,400	\$263,175		\$60,000	N/A	\$0	\$4,170	\$0	\$2,502	\$472,467	\$118,117	\$590,584	No
	8		\$0				4,448				\$111,200	\$0					\$0	\$5,560	\$0	\$3,336	\$502,491	\$125,623	\$628,114	No
	10		\$0				5,560				\$139,000	\$0					\$0	\$6,950	\$0	\$4,170	\$532,515	\$133,129	\$665,644	No
	12		\$0				6,672				\$166,800	\$0					\$0	\$8,340	\$0	\$5,004	\$562,539	\$140,635	\$703,174	No
	14		\$165,000				7,784				\$194,600	\$0					\$0	\$9,730	\$0	\$5,838	\$592,563	\$148,141	\$740,704	No
	16		\$165,000				8,896				\$222,400	\$0					\$0	\$11,120	\$0	\$6,672	\$622,587	\$155,647	\$778,234	No
	18		\$165,000				10,008				\$250,200	\$0					\$0	\$12,510	\$0	\$7,506	\$652,611	\$163,153	\$815,764	No
13A+B	6	2,315	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1806+52	\$0	RW+SW	RW=697, SW=909	\$60,000	11,799	\$294,975	\$191,675	\$80,155	\$65,000	N/A	\$0	\$14,749	\$14,749	\$8,849	\$730,152	\$182,538	\$912,690	No
	8		\$0				16,429				\$410,725	\$0					\$0	\$20,536	\$12,322	\$860,949	\$215,237	\$1,076,187	No	
	10		\$275,000				21,059				\$526,475	\$0					\$0	\$26,324	\$15,794	\$991,747	\$247,937	\$1,239,683	No	
	12		\$275,000				25,689				\$642,225	\$0					\$0	\$32,111	\$19,267	\$1,122,544	\$280,636	\$1,403,180	No	
	14		\$385,000				30,319				\$757,975	\$0					\$0	\$37,899	\$22,739	\$1,253,342	\$313,335	\$1,566,677	No	
	16		\$385,000				34,949				\$873,725	\$0					\$0	\$43,686	\$26,212	\$1,384,139	\$346,035	\$1,730,174	No	
	18		\$385,000				39,579				\$989,475	\$0					\$0	\$49,474	\$29,684	\$1,514,937	\$378,734	\$1,893,671	No	
13B	6	709	0	Caltrans Right of Way/Private Property Line	"C" Line - 1783+73	"C" Line - 1790+00	\$0	N/A	N/A	\$0	4,254	\$106,350	\$-	\$-	\$0	N/A	\$0	\$5,318	\$5,318	\$3,191	\$120,176	\$30,044	\$150,219	No
	8		\$0				5,672				\$141,800	\$0					\$0	\$7,090	\$4,254	\$160,234	\$40,059	\$200,293	No	
	10		\$0				7,090				\$177,250	\$0					\$0	\$8,863	\$5,318	\$200,293	\$50,073	\$250,366	No	
	12		\$0				8,508				\$212,700	\$0					\$0	\$10,635	\$6,381	\$240,351	\$60,088	\$300,439	No	
	14		\$0				9,926				\$248,150	\$0					\$0	\$12,408	\$7,445	\$280,410	\$70,102	\$350,512	No	
	16		\$0				11,344				\$283,600	\$0					\$0	\$14,180	\$8,508	\$320,468	\$80,117	\$400,585	No	
	18		\$110,000				12,762				\$319,050	\$0					\$0	\$15,953	\$9,572	\$360,527	\$90,132	\$450,658	No	
14	6	263	0	Private Property Line	"SJ2" Line - 774+15	"SJ2" Line - 776+05	\$0	Fence	263	\$3,945	1,578	\$39,450	\$-	\$-	\$0	TCE/ME	\$0	\$1,973	\$0	\$1,184	\$71,102	\$11,638	\$58,189	No
	8		\$55,000				2,104				\$52,600	\$0					\$0	\$2,630	\$0	\$1,578	\$85,304	\$15,188	\$75,941	No
	10		\$55,000				2,630				\$65,750	\$0					\$0	\$3,288	\$0	\$1,973	\$99,506	\$18,739	\$93,694	No
	12		\$55,000				3,156				\$78,900	\$0					\$0	\$3,945	\$0	\$2,367	\$113,708	\$22,289	\$111,446	No
	14		\$55,000				3,682				\$92,050	\$0					\$0	\$4,603	\$0	\$2,762	\$127,910	\$25,840	\$129,199	No
	16		\$55,000				4,208				\$105,200	\$0					\$0	\$5,260	\$0	\$3,156	\$142,112	\$29,390	\$146,951	No
	18		\$55,000				4,734				\$118,350	\$0					\$0	\$5,918	\$0	\$3,551	\$156,314	\$32,941	\$164,704	No
20	\$55,000	5,260	\$131,500	\$0	\$0	\$6,575	\$0	\$3,945	\$170,516	\$36,491	\$182,456	No												

Table A.8 Summary of Noise Barrier Construction Costs – Freeway Tunnel Alternative Dual-Bore Design Variation (With Right of Way Donated)

Noise Barrier No.	Height (ft)	Approximate Length (ft)	Number of Receptors Benefited	Noise Barrier Location	Noise Barrier Station Number		Total Reasonable Allowance	Demolition Type	Demolition of Existing Wall (ft) or WI Fence	Cost of Demolition (RW=\$60/LF, SW & PW =\$20/LF, WI Fence= \$15/LF)	Sound Wall Quantity (SQ FT)	Cost of Soundwall CMU and CIDH Foundation (\$65/SQ FT)	Cost of Retaining Wall (\$135/SF up to 10', \$152/SF 10'-15', \$160/SF 15'+)	Cost of Barrier (\$115/LF) ³	Misc Construction Costs	Right of Way	Cost for R/W (TCE, etc.)	Traffic Control (5% of SW cost)	Construction Access (5% of SW cost)	Landscape and/or Graffiti Abatement (3% of SW cost)	Subtotal Cost	Contingency (25%)	Total	Reasonable? (Yes/No)					
					Begin	End																							
15	6	262	0	Private Property Line	"SJ2" Line - 768+17	"SJ2" Line -768+17	\$0	Fence	262	\$3,930	1,572	\$39,300	\$ -	\$ -	\$0	TCE/ME	\$0	\$1,965	\$0	\$1,179	\$80,002	\$11,594	\$57,968	No					
	8		1				\$55,000				2,096	\$52,400									\$0	\$0	\$2,620	\$0	\$1,572	\$94,150	\$15,131	\$75,653	No
	10		1				\$55,000				2,620	\$65,500									\$0	\$0	\$3,275	\$0	\$1,965	\$108,298	\$18,668	\$93,338	No
	12		1				\$55,000				3,144	\$78,600									\$0	\$0	\$3,930	\$0	\$2,358	\$122,446	\$22,205	\$111,023	No
	14		2				\$110,000				3,668	\$91,700									\$0	\$0	\$4,585	\$0	\$2,751	\$136,594	\$25,742	\$128,708	No
	16		2				\$110,000				4,192	\$104,800									\$0	\$0	\$5,240	\$0	\$3,144	\$150,742	\$29,279	\$146,393	No
	18		2				\$110,000				4,716	\$117,900									\$0	\$0	\$5,895	\$0	\$3,537	\$164,890	\$32,816	\$164,078	No
	20		2				\$110,000				5,240	\$131,000									\$0	\$0	\$6,550	\$0	\$3,930	\$179,038	\$36,353	\$181,763	No

Assumption: Contingency includes: clearing and grubbing, demolition.
 Caltrans = California Department of Transportation
 CIDH = cast-in-drilled-hole
 CMU = concrete masonry unit
 FE = Footing Easement
 ft = foot/feet
 LF = linear foot/feet
 ME = Maintenance Easement
 N/A = Not Applicable
 PW = private property wall
 RW or R/W = right of way
 SF or SQ FT = square foot/feet
 SW = sound wall
 TCE = Temporary Construction Easement
 WI Fence = wrought iron fence

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