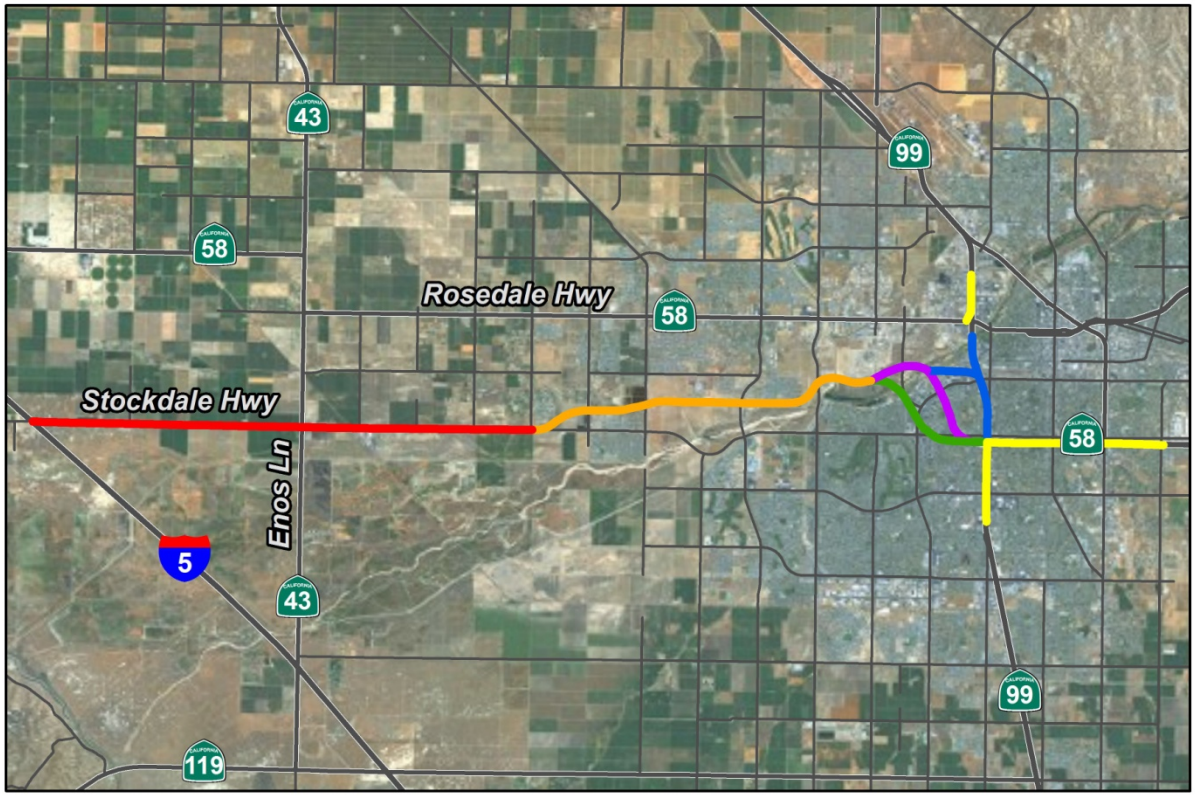
Centennial Corridor Project NSR



Noise Study Report

Centennial Corridor Project

In the City of Bakersfield from Westside Parkway to Cottonwood Road

06-Ker-58-PM T31.7/PM R55.6

06-Ker-99-PM 21.2/PM 26.2

Project ID#: 06-0000-0484

January 2013

(Revised March 2014)

Caltrans

For individuals with sensory disabilities, this document is available in Braille, in large print, on audiocassette, or on computer disk. To obtain a copy in one of these alternate formats, please call or write to Department of Transportation, Attn: Bryan Apper, Southern Valley Environmental Analysis Branch, Central Region Environmental Division, 855 M Street, Suite 200, Fresno, California 93721; (559) 445-6282. Voice, or use the California Relay Service TTY number: (559) 488-4067.

Noise Study Report

Centennial Corridor Project

In the City of Bakersfield from
Westside Parkway to Cottonwood Road
06-Ker-58-PM T31.7/PM R55.6
06-Ker-99-PM 21.2/PM 26.2

Project ID#: 06-0000-0484

January 2013

Prepared By: _____ Date: 1/17/13

Areg Gharabegian, P.E.
Noise Task Manager

Phone Number (626) 440-6047

Approved By: Allam Alhabaly Date: 5/20/13

Allam Alhabaly, Transportation Engineer

Phone Number (559) 445-6218
Office Name Caltrans, Fresno
District/Region 6/Central Region

Summary

The purpose of this Noise Study Report (NSR) is to evaluate traffic noise impacts and possible abatement measures under the requirements of Title 23, Part 772 of the Code of Federal Regulations (Title 23 CFR 772) "Procedures for Abatement of Highway Traffic Noise." Title 23 CFR 772 provides procedures for preparing operational and construction noise studies as well as evaluating noise abatement considered for federal and federal-aid highway projects. According to Title 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with Federal Highway Administration (FHWA) noise standards.

The proposed Centennial Corridor has been divided into three distinct segments. Segment 1 is the easternmost segment of the Centennial Corridor Project. It begins at State Route 58 (SR-58), at Cottonwood Road, and continues westerly to connect to the Westside Parkway. The study area for Segment 1 is bound on the east by Cottonwood Road and the west by Coffee Road. The proposed project also includes improvements along State Route 99 (SR-99) from Wilson Road to the south and Gilmore Avenue to the north. The segment west of State SR-99 is new construction and three alignment alternatives (A, B, and C) are being evaluated.

Segment 2 is composed of the Westside Parkway and extends from about Mohawk Street to Heath Road. This facility is currently under construction. This segment would be transferred into the State Highway System. A westbound lane would be added from Calloway Drive to Coffee Road as part of this project.

Segment 3 extends from Heath Road to Interstate 5 (I-5). The timing for construction of the remainder of Segment 3 is unknown but would not occur until there is sufficient funding and greater traffic demand. Therefore, other than the intersection improvements, the analysis of Segment 3 would be done at a conceptual level. The approval being sought is for a route adoption, with more detailed analysis occurring at the time construction is proposed. In conjunction with the construction of Segment 1, improvements to the Stockdale Highway/State Route 43 (known locally as Enos Lane) intersection would be made to accommodate additional traffic.

This Noise Study Report focuses primarily on Segment 1 as well as Segment 2 between Calloway Drive and Coffee Road. Because the only change to Segment 3 is the expansion of the Enos Lane and Stockdale Highway intersection, which would have minimal change in the roadway alignment near outdoor use areas, noise analysis is not warranted for Segment 3.

Three build alternatives (A, B, and C) and the No-Build alternative are under consideration for Segment 1. The No-Build Alternative proposes no improvements. The Westside Parkway would be constructed as a local freeway facility but would not connect to SR-58, SR-99, or I-5. SR-58 (West)/Rosedale Highway would continue to end at SR-99, where it shares routes with SR-99 for about 2 miles south to tie into the SR-58 (East) freeway.

Alternative A would run westerly from the existing SR-58/SR-99 interchange for about 1 mile south of Stockdale Highway. There, it would turn northwesterly and span Stockdale

Highway/Montclair Street, California Avenue/Lennox Avenue, Truxtun Avenue, and the Kern River before joining the east end of the Westside Parkway near the Mohawk Street interchange. A connection would be provided from northbound SR-99 to westbound SR-58 and from eastbound SR-58 to southbound SR-99 via high speed connectors/ramps.

Alternative B would extend westerly from the existing SR-58/SR-99 interchange for about 1,000 feet south of Stockdale Highway. There, it would turn northwesterly and span Stockdale Highway/Stine Road, California Avenue, Commerce Drive, Truxtun Avenue, and the Kern River before joining the east end of the Westside Parkway between the Mohawk Street and Coffee Road interchanges. Alternative B proposes the same connections to SR-99 as Build Alternative A and would require similar improvements on SR-99 and existing SR-58.

Near the existing SR-58/SR-99 interchange, Alternative C would run parallel to the west of SR-99 for about one mile. The freeway would turn west and span the BNSF Railway rail yard, Truxtun Avenue, and the Kern River. Connections would be provided from eastbound SR-58 to southbound SR-99 and northbound SR-99 to westbound SR-58.

Land uses identified along Segment 1 of the Centennial Corridor project include single-family and multi-family residences, Stockdale Christian School, Centennial Park, Saunders Park, Central Bakersfield Community Center/Clinica Sierra Vista, Montessori Children's Center, Camelot Park Family Fun Center, Bakersfield Fire Station #6, various hotels/motels, and six places of worship. The remaining land uses are commercial establishments, gas stations, restaurants, and office buildings. The terrain in the area is relatively flat with the exception of the existing freeways. SR-99 is depressed compared to the surrounding land. SR-58 is depressed at the SR-99 interchange through Chester Avenue, becoming elevated over P Street, depressed again under Union Avenue, and elevated over Madison Street, and Cottonwood Road.

Traffic on the existing portions of SR-58 and SR-99 are the main sources of noise in the study area along with local street traffic on Stockdale Highway, Mohawk Street, Wible Road, and Oak Street. This noise study analyzes 32 distinct areas. These groupings are based on major local interchanges, overcrossings, undercrossings, and direction of travel, as well as which freeway the project follows.

Noise measurements were conducted at selected locations along Segment 1 to evaluate the existing noise levels and to calibrate the traffic noise model. Short-term noise monitoring of 20 minutes each was conducted at 44 locations in October 2011. Meteorological conditions (temperature, wind speed and direction, and relative humidity) were logged for each measurement session using a hand-held weather station. Long-term noise monitoring was conducted at 28 locations in October 2011. Two additional measurements were conducted by another consultant in January 2010. Noise measurements were not conducted along the Westside Parkway. Instead, the results from the Westside Parkway noise study were used in this study.

Noise measurements were conducted with Larson-Davis models 812, 820, 824, and 870 as well as Brüel and Kjaer models 2238 and 2250 Type 1 sound level meters. Measured hourly averaged noise levels from both the short-term and long-term measurement sites ranged from 50 to 73 dBA in the peak noise hour. Concurrent with the collection of

sound level data at 15 locations, traffic counts on SR-58 and SR-99 were also performed. Traffic was counted on the freeways and ramps near a measurement site and classified by vehicle type (e.g., autos, medium trucks, heavy trucks). The purpose of the field traffic counts was to calibrate the Traffic Noise Model (TNM) 2.5 model so that the prediction of future noise levels can be made more accurately.

Level of service (LOS) C and 2038 forecasted traffic information were used to predict traffic noise levels and analyze noise impacts at receivers on both sides of the freeways. In general, modeled future noise levels were higher than measured noise levels: typically 0 to 6 dB above the existing peak hour noise levels in areas with existing freeways and 0 to 28 dB above the existing peak hour noise levels in areas without existing freeways.

Because of the constrained configuration and suburban location of the project, abatement in the form of noise barriers is the only abatement measure considered to be feasible. Noise barrier analysis was conducted by placing soundwalls at the highway mainline shoulders, on- and off-ramp shoulders, as well as right-of-way lines.

This report analyzes noise barriers with heights ranging from 8 to 16 feet to determine feasible noise abatement. Soundwalls are considered feasible when they provide a noise reduction of at least 5 dB. The Noise Reduction Design Goal, which is one measure in determining whether a soundwall is reasonable, is achieved when a barrier is predicted to provide a noise reduction of at least 7 dB at one or more benefitted receivers. The following summarizes the total number of impacts, soundwalls, benefitted land uses, and reasonable allowance identified for each alternative:

Alternative A:

Total Number of Impacts (Outdoor Use Areas) = 532

Total Number of Feasible Soundwalls = 23

Total Number of Benefitted Land Uses = 510 (320 single-family, 163 multi-family, and 22 mobile home residences; one school, one motel, and three recreational use areas)

Total Reasonable Allowance = $27,610,000

Alternative B:

Total Number of Impacts (Outdoor Use Areas) = 484

Total Number of Feasible Soundwalls = 28

Total Number of Benefitted Land Uses = 460 (373 single-family, 62 multi-family, and 22 mobile home residences; one school, one motel, and one recreational use area)

Total Reasonable Allowance = $24,475,000

Alternative C:

Total Number of Impacts (Outdoor Use Areas) = 401

Total Number of Feasible Soundwalls = 22

Total Number of Benefitted Land Uses = 340 (260 single-family, 53 multi-family, and 22 mobile home residences; one motel and four recreational use areas)

Total Reasonable Allowance = $18,645,000

Construction noise control shall conform to the provisions in Section 14-8.02, "Noise Control," of the Standard Specifications and 14-8.02 “Noise Control” of the Standard Special Provisions. The requirements state that all equipment must be fitted with adequate mufflers and operated according to the manufacturers’ specifications. Construction noise varies greatly depending on the construction process, type and condition of equipment used, as well as layout of the construction site. Temporary construction noise impacts would be unavoidable in areas immediately adjacent to the proposed project alignment.

Table of Contents

List of Figures

List of Tables

List of Abbreviated Terms

Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
dB	Decibels
EA	Environtment Assessment
EIR	Environmental Impact Report
ED	Environmental Document
FHWA	Federal Highway Administration
HOV	High Occupancy Vehicle
Hz	Hertz
kHz	Kilohertz
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
$L_{eq(h)}$	Equivalent Sound Level over one hour
L_{max}	Maximum Sound Level
LOS	Level of Service
L_n	Percentile-Exceeded Sound Level
µPa	micro Pascals
mph	miles per hour
NAC	Noise Abatement Criteria
NADR	Noise Abatement Decision Report
NEPA	National Environmental Policy Act
NSR	Noise Study Report
PDS	Project Development Support
Protocol	Caltrans Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SPL	sound pressure level
SR	State Route
TeNS	Caltrans' Technical Noise Supplement
TNM 2.5	FHWA Traffic Noise Model Version 2.5
TRIP	Thomas Roads Improvement Program
VPH	Vehicles per hour

Chapter 1. Introduction

1.1. Purpose of the Noise Study Report

The purpose of this Noise Study Report (NSR) is to evaluate traffic noise impacts and abatement under the requirements of Title 23, Part 772 of the Code of Federal Regulations (Title 23 CFR 772) "Procedures for Abatement of Highway Traffic Noise." Title 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. According to Title 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with Federal Highway Administration (FHWA) noise standards.

The California Department of Transportation (Caltrans) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) (Caltrans, 2011) provides Caltrans policy for implementing Title 23 CFR 772 in California. The Protocol outlines the requirements for preparing noise study reports (NSR) in support of State highway projects. Noise impacts associated with this project under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) are evaluated in the Environmental Impact Report/Statement, *Centennial Corridor from State Route 99 to Interstate 5 Draft EIR/EIS and Section 4(f) Evaluation.*

This noise study for the Centennial Corridor Project analyzes 32 distinct areas. These groupings are based on major local interchanges, overcrossings, undercrossings, and direction of travel (westbound [WB], eastbound [EB], northbound [NB], and southbound [SB]), as well as which freeway the project follows (Centennial Corridor Alternative A [ALT A], Centennial Corridor Alternative B [ALT B], Centennial Corridor Alternative C [ALT C], existing segment of State Route 58 [SR-58], and State Route 99 [SR-99]). The 32 areas are:

1) ALT A, Area 1 – Truxtun Avenue to California Avenue along WB SR-58;
2) ALT A, Area 2 – Truxtun Avenue to California Avenue along EB SR-58;
3) ALT A, Area 3 – California Avenue to Stockdale Highway along WB SR-58;
4) ALT A, Area 4 – Stockdale Highway to SR-99 along WB SR-58;
5) ALT A, Area 5 – Stockdale Highway to SR-99 along EB SR-58;
6) ALT B, Area 1 – California Avenue to Marella Way along WB SR-58;
7) ALT B, Area 2 – California Avenue to Marella Way along EB SR-58;
8) ALT B, Area 3 – Marella Way to Stockdale Highway along WB SR-58;
9) ALT B, Area 4 – Marella Way to Stockdale Highway along EB SR-58;
10) ALT B, Area 5 – Stockdale Highway to SR-99 along EB SR-58;
11) SR-58, Area 1 – SR-99 to Hughes Lane along WB SR-58;

12) SR-58, Area 2 – SR-99 to Hughes Lane along EB SR-58;
13) SR-58, Area 3 – Hughes Lane to H Street along WB SR-58;
14) SR-58, Area 4 - Hughes Lane to H Street along EB SR-58;
15) SR-58, Area 5 – H Street to Union Avenue along WB SR-58;
16) SR-58, Area 6 – H Street to Union Avenue along EB SR-58;
17) SR-58, Area 7 – Union Avenue to Cottonwood Road along WB SR-58;
18) SR-58, Area 8 – Union Avenue to Cottonwood Road along EB SR-58;
19) SR-99, Area 1 – Wilson Road to Ming Avenue along NB SR-99;
20) SR-99, Area 2 – Wilson Road to Ming Avenue along SB SR-99;
21) SR-99, Area 3 – Ming Avenue to Belle Terrace along NB SR-99;
22) SR-99, Area 4 – Ming Avenue to Belle Terrace along SB SR-99;
23) SR-99, Area 5 – Belle Terrace to SR-58 along NB SR-99;
24) SR-99, Area 6 – Belle Terrace to SR-58 along SB SR-99;
25) SR-99, Area 7/ALT C, Area 1 – SR-58 to California Avenue along SB SR-99;
26) SR-99, Area 8/ALT C, Area 2 – SR-58 to California Avenue along NB SR-99;
27) SR-99, Area 9 – California Avenue to Rosedale Highway along SB SR-99;
28) SR-99, Area 10 – California Avenue to Rosedale Highway along NB SR-99;
29) SR-99, Area 11 – Rosedale Highway to Gilmore Avenue along SB SR-99;
30) SR-99, Area 12 – Rosedale Highway to Gilmore Avenue along NB SR-99;
31) Westside Parkway – Calloway Drive to Coffee Road along WB Westside Parkway; and
32) Westside Parkway – Calloway Drive to Coffee Road along EB Westside Parkway.

The study includes (a) short-term noise measurements; (b) long-term noise measurements; (c) roadway traffic noise modeling using FHWA's Traffic Noise Model 2.5 (TNM 2.5); and (d) feasible noise abatement measures.

1.2. Project Purpose and Need

1.2.1. Purpose

The purpose of the Centennial Corridor project is to provide route continuity and associated traffic congestion relief along State Route 58 within Metropolitan Bakersfield and Kern County from the State Route 58 east (from Cottonwood Road) to I-5.

1.2.2. Need

State Route 58 is a critical link in the state transportation network that is used by interstate travelers, commuters, and a large number of trucks. Under existing conditions, State Route 58 does not meet the capacity needs of the area, and this is expected to get worse as the population grows. State Route 58 lacks continuity in central Bakersfield, which results in severe traffic congestion and reduced levels of service on adjoining highways and local streets. This route is offset by about 1 mile at State Route 43 and by about 2 miles at State Route 99. The merging of two major state routes (58 and 99) into one alignment between the eastern and western legs of State Route 58 degrades the traffic level of service on this segment of freeway. In addition, State Route 99's close spacing for its two interchanges with State Route 58 (East and West), in addition to an interchange at California Avenue, results in vehicles aggressively changing lanes, which adds to the congestion.

Chapter 2. Project Description

The California Department of Transportation (Caltrans) proposes to establish a new alignment for State Route 58, which would provide a continuous route along State Route 58 from Cottonwood Road on existing State Route 58, east of State Route 99 (post mile R55.6), to Interstate 5 (I-5) (post mile T31.7). Improvements to State Route 99 (post miles 21.2 to 26.2) and Westside Parkway would also be made to accommodate the connection with State Route 58.

The project is located at the southern end of the San Joaquin Valley in the city of Bakersfield in Kern County, California as shown in Figure 2-1. The study site is bound on the east by Cottonwood Road, on the west by I-5, on the north by Gilmore Avenue, and on the south by Wilson Road. Caltrans is the lead agency for the project pursuant to the California Environmental Quality Act and the National Environmental Policy Act.

The proposed continuous route, known as the Centennial Corridor, has been divided into three segments, as shown in Figure 2-2.

Segment 1 is the easternmost segment, which would connect the existing State Route 58 (East) freeway to the Westside Parkway. Multiple alignment alternatives are being evaluated for this segment and are discussed below.

Segment 2 is composed of the Westside Parkway, which extends westerly from Truxtun Avenue to Heath Road. This roadway is a local facility that is currently under construction and would be transferred into the State Highway System. The analysis evaluates potential impacts associated with incorporating the Westside Parkway as part of the State Highway System, as well as improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange which would be made to facilitate traffic operations between the Westside Parkway and the Centennial Corridor. The analysis reports the relevant results of the Westside Parkway Environmental Assessment/Final Environmental Impact Report and provides updates, as necessary.

Segment 3 would extend from Heath Road to I-5. This segment will need a temporary route adoption for the use of Stockdale Highway between Heath Road and I-5 as an interim alignment for State Route 58. A future new alignment (ultimate) as identified in the 2002 Route 58 Route Adoption Project Tier I Environmental Impact Statement/Environmental Impact Report (EIS/EIR) will be constructed when there is greater traffic demand and funding is available. Since traffic would use Stockdale Highway between Heath Road and I-5 on an interim basis, the potential impacts will also be evaluated for the interim use of Stockdale Highway. Improvements to the Stockdale Highway/State Route 43 (known locally as Enos Lane) intersection would be made to accommodate the additional traffic.

Figure 2-1. Project Vicinity Map

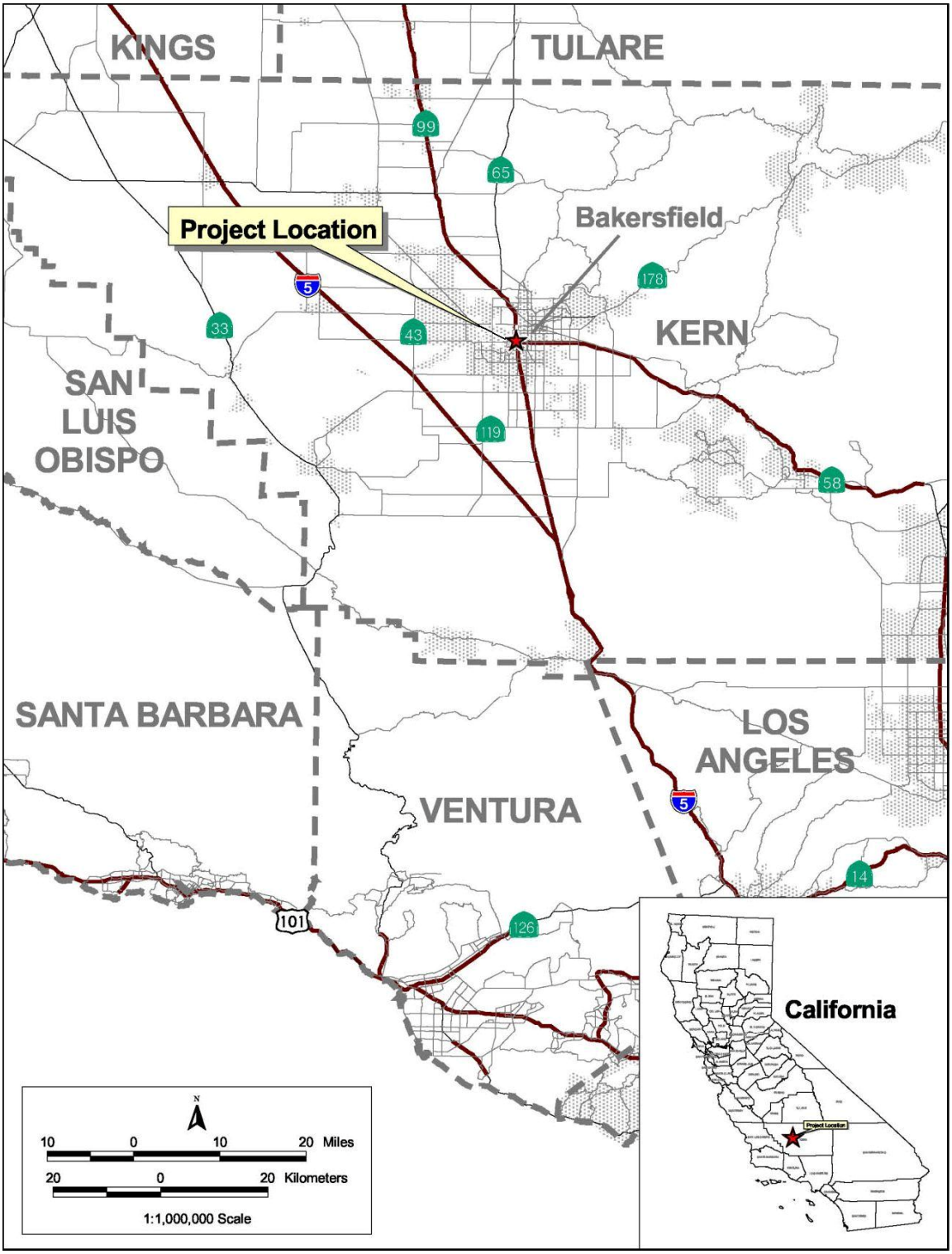
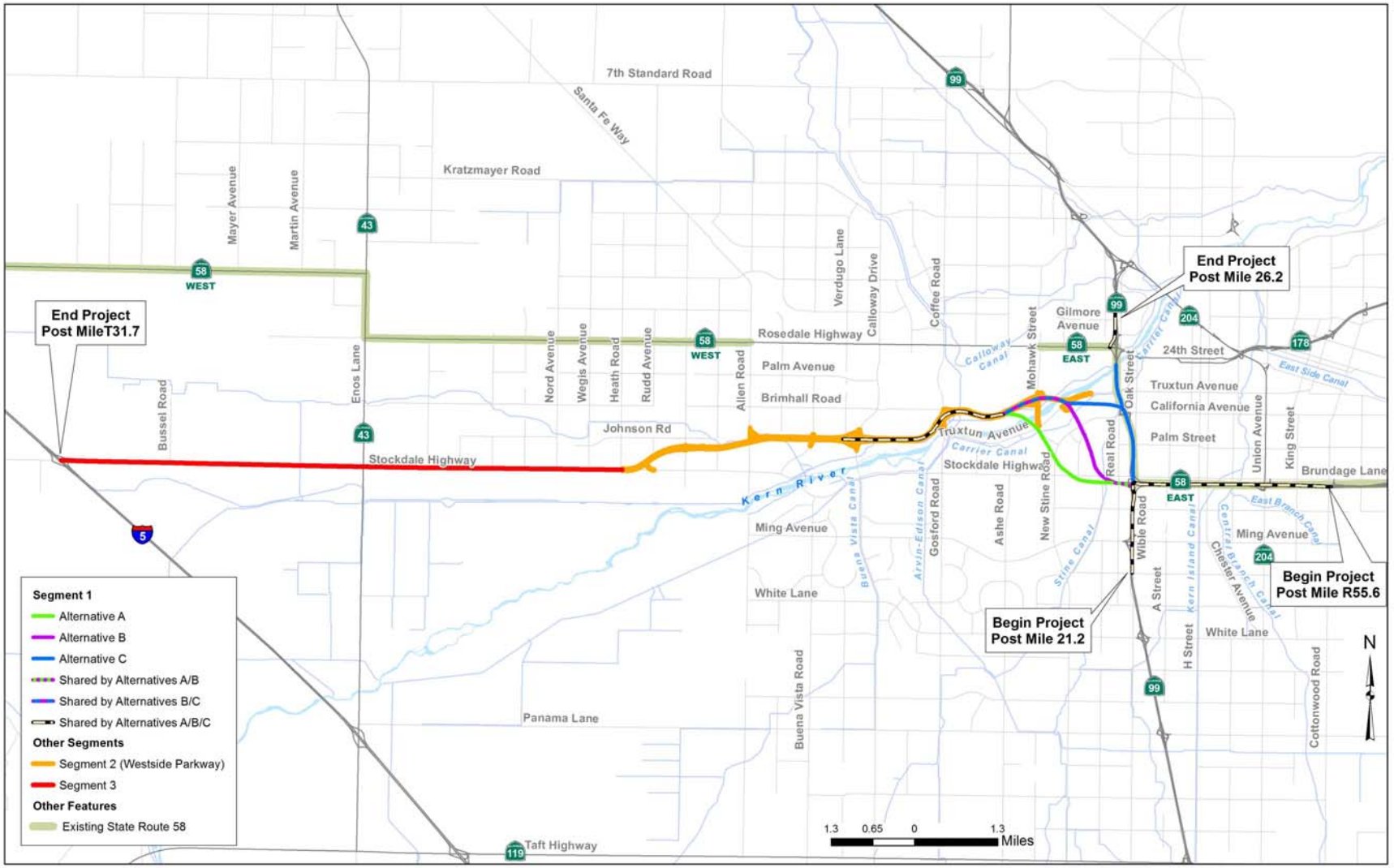


Figure 2-2. Centennial Corridor Segment Location Map



2.1. No-Build Alternative

No construction of Segment 1 would occur under the No-Build Alternative. In addition no improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange would be required. There would also be no improvements made to the Stockdale Highway/State Route 43 intersection. The No-Build Alternative would involve the following actions: (1) the Westside Parkway would be route adopted into the State Highway System; (2) the portion of Mohawk Street from the Westside Parkway to Rosedale Highway would be designated as part of State Route 58, which would provide a connection to State Route 99; (3) Stockdale Highway between Heath Road and Interstate 5 would serve as an interim alignment for State Route 58 until ultimate improvements are constructed; and (4) the portion of State Route 58 (West) from Allen Road to Interstate 5 would be relinquished) to the local jurisdictions as a local facility.

2.2. Build Alternatives

As shown in Figure 2-3, the three build alternatives (Alternatives A, B, and C) within Segment 1 propose new alignments that would extend from Cottonwood Road on the existing State Route 58 (East) and connect I-5 via the Westside Parkway. Alternatives A and B would be west of State Route 99, and Alternative C would parallel State Route 99 to the west. Under Alternative A, the eastern end of the Westside Parkway mainline would be realigned to conform to the Alternative A alignment, and ramp connections would be provided to the Mohawk Street interchange. Under Alternatives B and C, the alignments would connect to the Westside Parkway by extending the mainline lanes built as part of the Westside Parkway project. Detailed descriptions of the alternatives are provided on the following subsections.

Common Design Features of the Build Alternatives

The build alternatives would connect State Route 58 (East) to the east end of the Westside Parkway by means of a six-lane freeway. All the build alternatives would involve a route adoption to include the selected Segment 1 alignment and the Westside Parkway into the State Highway System as State Route 58. In Segment 3, there would be a temporary route adoption of Stockdale Highway as the interim State Route 58 connection to Interstate 5 until the ultimate alignment (the Cross Valley Canal alignment addressed in the 2001 EIS/EIR) is constructed, which would occur at a later date. Though the alignment and design characteristics vary by alternative, the three build alternatives have the following common design features:

Segment 1

All the alternatives would provide the following connections between State Route 58 and State Route 99 using high speed connection ramps:

- Northbound State Route 99 to westbound Centennial Corridor
- Northbound State Route 99 to eastbound State Route 58 (East)
- Southbound State Route 99 to eastbound State Route 58 (East)
- Eastbound Centennial Corridor to southbound State Route 99
- Westbound State Route 58 (East) to southbound and northbound State Route 99

Direct connector ramps from southbound State Route 99 to westbound State Route 58 are not being provided as part of this project. However, to accommodate this movement, the southbound State Route 99/Rosedale Highway off-ramp would have two lanes off the freeway and be widened to four lanes at the intersection with Rosedale Highway. Additionally, an auxiliary lane would be provided on State Route 99 from south of Gilmore Avenue to the State Route 58 (Rosedale Highway) off-ramp. Direct connector ramps from eastbound State Route 58 to northbound State Route 99 are not being provided as part of this project.

The project would require the widening of the South P Street Undercrossing and the westbound State Route 58 Grade Separation over State Route 99. In addition, the Stockdale Highway off-ramp from southbound State Route 99 and the Wible Road on- and off-ramps on State Route 99, located just south of the existing State Route 58/State Route 99 interchange, would be removed.

Segment 2

The Westside Parkway would be incorporated into the State Highway System with each of the Build Alternatives. Improvements to connect Centennial Corridor to the Westside Parkway would extend from where each build alternative connects at the eastern end of the Westside Parkway towards the west, ending at the Calloway Drive interchange. The proposed improvements would widen the Westside Parkway by constructing one additional lane in the median to provide auxiliary lanes. In the westbound direction, the median widening would extend from east of the Friant-Kern Canal through the Calloway Drive interchange. The limits of the added lane in the eastbound direction would differ between each alternative, as described in the Unique Design Features of the Build Alternatives section below. With each build alternative, modifications to the westbound diamond off-ramp to Calloway Drive and the eastbound loop on-ramp from Coffee Drive would be required.

Though the improvements described above are physically located in Segment 2, construction would be undertaken as part of Segment 1 construction to facilitate traffic operations between the Westside Parkway and the Centennial Corridor.

Segment 3

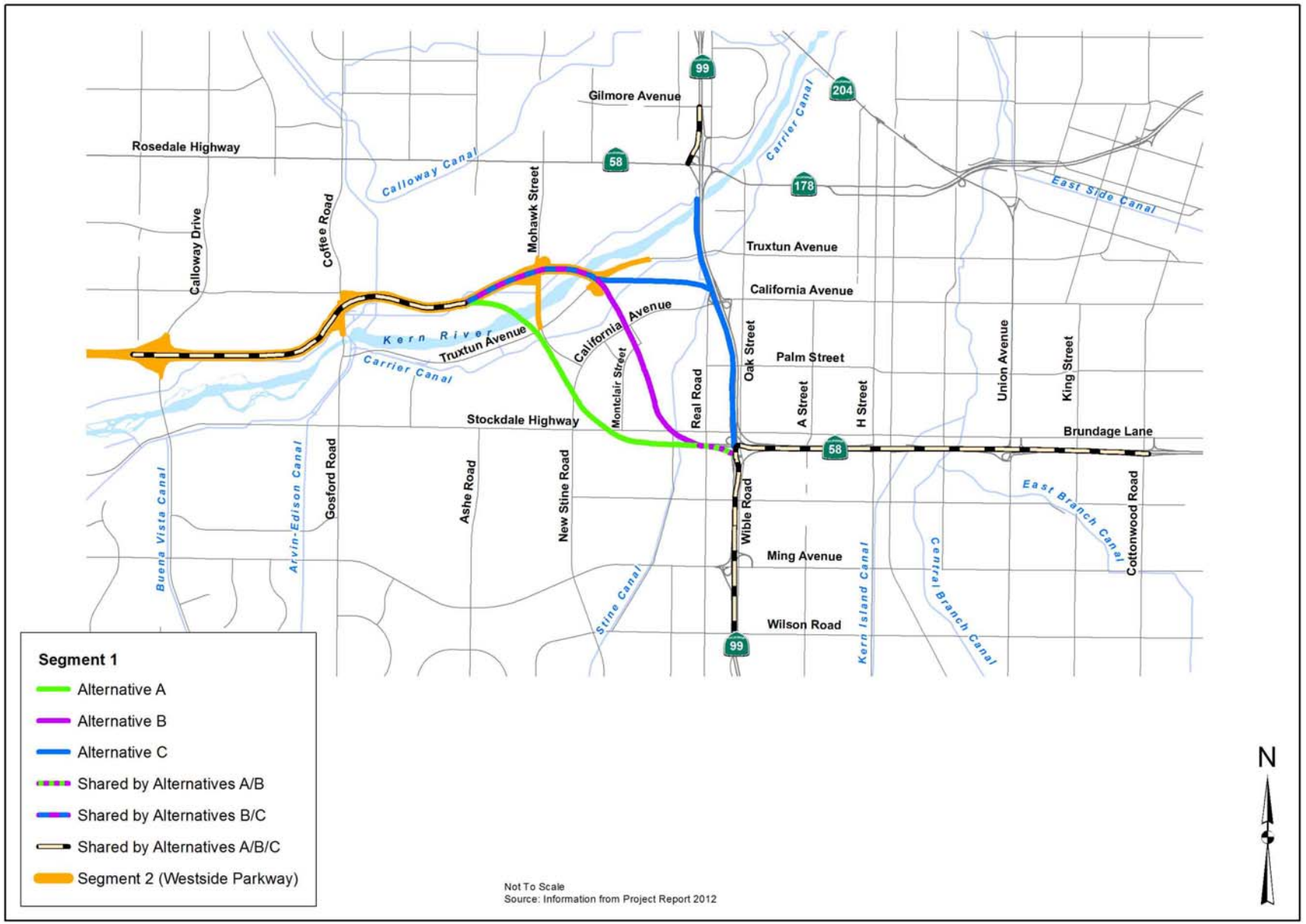
With each build alternative, the Stockdale Highway/State Route 43 intersection would be widened and traffic signals would be added to control the traffic movements. State Route 43 would be widened to add a dedicated left-turn lane in both directions. Stockdale Highway would be widened to add a dedicated left-turn lane and a shared through/right-turn lane in both directions. Though physically located in Segment 3, these improvements would be built as part of Segment 1 to ensure adequate traffic operations at this intersection.

Unique Design Features of the Build Alternatives

Alternative A

Alternative A would travel westerly from the existing State Route 58/State Route 99 interchange for about 1 mile south of Stockdale Highway, where it would turn northwesterly and span Stockdale Highway/Montclair Street, California Avenue/Lennox Avenue, Truxtun Avenue, and the Kern River before joining the eastern end of the Westside Parkway near the Mohawk Street interchange.

Figure 2-3. Segment 1 Build Alternatives



A link would be provided from northbound State Route 99 to westbound State Route 58 and from eastbound State Route 58 to southbound State Route 99 via high-speed connectors. No direct connector ramps would be built from southbound State Route 99 to westbound State Route 58 or from eastbound State Route 58 to northbound State Route 99. Southbound State Route 99 would be widened to accommodate the additional traffic from eastbound State Route 58 to the southbound State Route 99 connector. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would be realigned and would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The existing southbound State Route 99 to eastbound State Route 58 connector and northbound State Route 99 to eastbound State Route 58 would be preserved with some changes.

The limits of widening on State Route 99 would extend to the Wilson Road overcrossing. On northbound State Route 99, a three-lane exit would be provided just north of Wilson Road to carry the northbound State Route 99 to westbound State Route 58 traffic on two lanes and the Ming Avenue on- and off-ramp traffic on the third lane. All ramps in this area would have to be realigned to provide for the additional lanes. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange, which is in conflict with the Caltrans standards of interchange spacing, would have to be removed to accommodate this design. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, State Route 58 would also lose its link with Real Road. Also, Alternative A would provide an auxiliary lane on southbound State Route 99 from south of Gilmore Avenue to the Rosedale Highway off-ramp.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp.

Alternative B

Alternative B would run westerly from the existing State Route 58/State Route 99 interchange for about 1,000 feet, south of Stockdale Highway, where it would turn northwesterly and span Stockdale Highway/Stine Road, California Avenue, Commerce Drive, Truxtun Avenue, and the Kern River before joining the east end of Westside Parkway between the Mohawk Street and Coffee Road interchanges. This alignment would depress State Route 58 between California Avenue and Ford Avenue, minimizing visual impacts to the neighborhood. Overcrossings are proposed at Marella Way and La Mirada Drive to ease traffic circulation.

Alternative B proposes the same connections to State Route 99 that Alternative A proposes and would require similar improvements on State Route 99 and existing State Route 58.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp and

reconstruction of the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

Alternative C

Near the existing State Route 58/State Route 99 interchange, Alternative C would turn north and run parallel to the west of State Route 99 for about 1 mile. The freeway would turn west and span the BNSF Railway rail yard, Truxtun Avenue, and the Kern River. This alternative proposes undercrossings at Brundage Lane, Oak Street, State Route 99, Palm Avenue, and California Avenue.

Connections would be provided from eastbound State Route 58 to southbound State Route 99 and from northbound State Route 99 to westbound State Route 58. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The southbound State Route 99 Ming Avenue off-ramp would be relocated north of the eastbound State Route 58 to southbound State Route 99 connector to facilitate weaving between the Ming Avenue off-ramp and the eastbound State Route 58 to southbound State Route 99 connector traffic. A connector would be provided east of northbound State Route 99 from Brundage Lane to south of California Avenue to facilitate weaving between westbound State Route 58 to northbound State Route 99 traffic with northbound State Route 99 to westbound State Route 58 traffic.

Improvements on State Route 99 would extend from the Wilson Road overcrossing (south of the State Route 58/State Route 99 interchange) to the Gilmore Avenue overcrossing (north of the State Route 58/State Route 99 interchange). A collector-distributor (C-D) road system would provide access from westbound State Route 58 to northbound State Route 99, as well as from northbound State Route 99 to westbound State Route 58. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange would have to be removed to accommodate the northbound State Route 99 auxiliary lane. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, southbound State Route 99 would also lose its link with Real Road.

The median widening to provide an auxiliary lane along Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp, and reconstruction of the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

Chapter 3. Fundamentals of Traffic Noise

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, please refer to Caltrans' Technical Noise Supplement (TeNS) (Caltrans, 2009), a technical supplement to the Protocol, that is available on the Caltrans Web site (http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf).

3.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

3.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

3.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascal's (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 µPa. Because of this huge range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 µPa.

3.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an

SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

3.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz, and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an "A-weighted" sound level (expressed in units of dBA) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with highway-traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. Table 3-1 describes typical A-weighted noise levels for various noise sources.

3.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3 dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different than what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels, when exposed to steady, single-frequency ("pure-tone") signals in the mid-frequency (1,000 Hz–8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5 dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3 dB increase in sound, would generally be perceived as barely detectable by the average person.

Table 3-1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	**— 70 —**	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	**— 60 —**	
		Large business office
Quiet urban daytime	**— 50 —**	Dishwasher next room
Quiet urban nighttime	**— 40 —**	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	**— 0 —**	Lowest threshold of human hearing

Source: Caltrans, 2009.

3.7. Noise Descriptors

Noise in our daily environment fluctuates over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in traffic noise analysis:

- **Equivalent Sound Level (L_{eq}):** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level (L_{eq}[h]) is the energy average of A-weighted sound levels occurring during a one-hour period, and is the basis for noise abatement criteria (NAC) used by Caltrans and FHWA.

- **Percentile-Exceeded Sound Level (L_n):** L_n represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10% of the time, and L_{90} is the sound level exceeded 90% of the time).

- **Maximum Sound Level (L_{max}):** L_{max} is the highest instantaneous sound level measured during a specified period.

- **Day-Night Level (L_{dn}):** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

- **Community Noise Equivalent Level (CNEL):** Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m., and a 5 dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

3.8. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the following factors.

3.8.1. Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 decibels for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 decibels for each doubling of distance from a line source.

3.8.2. Ground Absorption

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water,), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 decibels per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 decibels per doubling of distance for a line source.

3.8.3. Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

3.8.4. Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and receiver is rarely effective in reducing noise because vegetation does not create a solid barrier.

Chapter 4. Federal Regulations and State Policies

This report focuses on the requirements of Title 23 CFR 772.

4.1. Federal Regulations

4.1.1. Title 23 CFR 772

Title 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under Title 23 CFR 772.7, projects are categorized as Type I, Type II, or Type III projects. FHWA defines a Type I project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment, or increases the number of through-traffic lanes. A Type II project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type III project is a federal or federal-aid highway project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

Type I projects include those that create a completely new noise source, as well as those that increase the volume or speed of traffic or move the traffic closer to a receiver. Type I projects include the addition of an interchange, high-occupancy vehicle (HOV) lane, high-occupancy toll (HOT) lane, ramp, or truck-climbing lane to an existing highway, or the addition of an auxiliary lane, except for when an auxiliary lane is a turning lane, or restriping existing pavement for the purpose of adding a through-traffic lane or auxiliary lane, or the addition of a new substantial alteration of a weigh station, rest stop, ride share lot, or toll plaza. Projects unrelated to increased noise levels, such as lighting, signing, and landscaping projects would be considered Type III.

Under Title 23 CFR 772.11, noise abatement must be considered for Type I projects if the project is predicted to result in a traffic noise impact. In such cases, Title 23 CFR 772 requires that the project sponsor "consider" noise abatement before adoption of the final NEPA document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in Title 23 CFR 772.5, occur when the predicted noise level in the design year approaches or exceeds the Noise Abatement Criteria (NAC) specified in Title 23 CFR 772, or a predicted noise level substantially exceeds the existing noise level (a "substantial" noise increase). Title 23 CFR 772 does not specifically define the terms "substantial increase" or "approach"; these criteria are defined in the Protocol, as described in the next subsection.

Table 4-1 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

Table 4-1. Activity Categories and Noise Abatement Criteria

Activity Category	Activity $L_{eq}[h]$[1]	Evaluation Location	Description of Activities
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67	Exterior	Residential.
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted (without building permits)

[1] The $L_{eq}(h)$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA).
[2] Includes undeveloped lands permitted for this activity category.

Source: 23 CFR Part 772, 2011

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. In situations where there are no exterior activity areas, or where the exterior activities occur far from the roadway or physically shielded in a manner that prevents an impact on exterior activities, the interior criterion (Activity Category D) is used as the basis for determining a noise impact.

4.2. State Regulations and Policies

4.2.1. Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects

The Protocol specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The NAC specified in the Protocol are the same as those specified in Title 23 CFR 772.

The Protocol defines a noise increase as substantial when the predicted noise levels with project implementation exceed existing noise levels by 12 dB. The Protocol also states that a sound level is considered to approach an NAC level when the sound level is within 1 dB of the NAC identified in Title 23 CFR 772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

The Technical Noise Supplement (TeNS) to the Protocol provides detailed technical guidance for the evaluation of highway traffic noise. This includes field measurement methods, noise modeling methods, and report preparation guidance.

4.2.2. Section 216 of the California Streets and Highways Code

Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed an $L_{eq}(h)$ of 52 dBA in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the "approach or exceed" NAC criterion for FHWA Activity Category C for classroom exteriors, but it is a requirement that must be addressed in addition to the requirements of Title 23 CFR 772.

If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below an $L_{eq}(h)$ of 52 dBA. If the noise levels generated from freeway and non-freeway sources exceed an $L_{eq}(h)$ of 52 dBA prior to the construction of the proposed freeway project, then noise abatement must be provided to reduce the noise to the level that existed prior to construction of the project.

Chapter 5. Study Methods and Procedures

5.1. Methods for Identifying Land Uses and Selecting Noise Measurement and Modeling Locations

Field investigation was conducted to identify frequent human outdoor use areas that could be subject to traffic noise impacts and to consider the physical setting of the freeway alignment relative to those areas. Land uses in the project area were categorized as defined in the Activity Category of Table 4-1. As stated in the Protocol, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common use areas at multi-family residences. Figures in Appendix A indicate the locations of relevant land use types within the study corridor.

Multiple outdoor noise measurements were taken throughout the project study corridor in order to evaluate existing noise levels and to calibrate the FHWA Traffic Noise Model (TNM) 2.5 computer noise model. Specific measurement sites were chosen to be representative of receiver sites with similar topography, orientation to the highway, exposure angles, etc, with respect to frequent outdoor use areas adjacent to SR-58 and SR-99 where applicable. Locations expected to receive the greatest traffic noise impacts, such as the first row of houses from the existing and proposed freeway, were chosen for noise measurement locations. In many locations of this project, second and third row houses became first row houses as a result of expanding the state right-of-way to accommodate new lanes.

Noise measurements were mainly conducted in frequent outdoor human-use areas (primarily backyards) along the project alignment. Where permits to enter were not obtained, short-term measurements were conducted on a nearby sidewalk or in an alley determined to be acoustically representative of the actual frequent use area. All short-term and long-term measurement sites were selected so that unusual noise from sources such as barking dogs, air-conditioners, or pool pumps would not affect the measurement.

5.2. Field Measurement Procedures

Noise measurements were conducted at selected locations to evaluate the existing noise environment. Noise measurements were conducted in conformance with the TeNS and with the guidelines outlined in the FHWA's "Measuring of Highway Related Noise," FHWA-DP-96-046. The following is a brief description of the measurement procedures used for this project:

- Microphones were primarily placed approximately 5 feet above the ground and were positioned more than 10 feet from any wall or building to prevent reflections or unrepresentative shielding of the noise.

- Sound level meters were calibrated before and after each set of measurements.

- Following the calibration of equipment, a windscreen was placed over the microphone.

- Frequency weighting was set on "A", and the slow detector response was selected.

- Results of the short-term noise measurements were recorded on data sheets in the field. Long-term measured data were downloaded to the computer for tabulation and graphing. This information is located in Appendix B.

- During the short-term noise measurements, any noise contaminations such as local traffic, barking dogs, etc. were noted.

- Traffic was counted for model calibration measurements. Vehicle types were separated into three vehicle groups: automobiles, medium trucks (2-axle with 6-wheels but not including dually pick-up trucks), and heavy trucks (3 or more axle vehicles). Average traffic speeds were measured using a radar gun. Traffic data is located in Appendix E.

- Wind speed, temperature, humidity, and sky conditions were observed and documented during the short-term noise measurements. This information is located in Appendix B.

Instruments used for the noise measurements included the following:

- Sound Level Meters – Larson Davis models 812, 820, 824, 831, and 870, as well as Brüel & Kjær models 2238 and 2250.

- Microphone Systems:

    - Larson Davis 812 and 820 System – Larson Davis model PRM 828 microphone preamps; Larson Davis model 2560, ½-inch pressure microphones.
    - Larson Davis 824 System – Larson Davis model PRM 902 microphone preamp; PCB model 377A02, ½-inch pressure microphone.
    - Larson Davis 831 System – Larson Davis model PRM 831 microphone preamp; ½-inch pressure microphone.
    - Larson Davis 870 System – Larson Davis model 900B microphone preamps; Larson Davis model 2559, ½-inch pressure microphones.
    - Brüel & Kjær 2238 System – Brüel & Kjær model ZC-0030 microphone preamp; Brüel & Kjær model 2188, ½-inch pressure microphone.
    - Brüel & Kjær 2250 System – Brüel & Kjær model ZC-0032 microphone preamp; Brüel & Kjær model 4189, ½-inch pressure microphone.

- Acoustic Field Calibrators – Larson Davis model CA250 and Brüel & Kjær 4231 constant pressure microphone calibrators.

- Microphone cables; 4-inch diameter windscreens; and tripods.
- Wind Monitor/Temperature and Humidity Gauge – Kestrel 3000 Pocket Weather Meter.
- Stationary Handheld Traffic Radar Detector – Kustom Signals, Inc. Falcon Radar Gun.

Instrumentation serial numbers, calibration data, noise measurement dates and times, noise measurement data, meteorological data, and measurement locations are noted on the noise measurement field forms located in Appendix B. Noise measurement instrumentation calibration records are included in Appendix C.

5.2.1. Short-Term Measurements

Short-term monitoring was conducted at 44 locations in October 2011 using Larson-Davis model 820 and Brüel & Kjær model 2250 Precision Type 1 sound level meters. Measurements were taken for 20 minutes at each site. Short-term monitoring was conducted at or adjacent to Activity Category B, C, D, and E land uses. The short-term measurement locations are identified in Appendix A, and addresses are listed in Table 6-1 of *Section 6.0 Existing Noise Environment*. Noise measurement field notes are in Appendix B and measurement site photographs are presented in Appendix D.

Field staff attended each meter during the 20-minute measurement period when dominant noise sources were observed, identified, and logged. Using this approach, other non-traffic noise sources such as local traffic and barking dogs, which potentially contributed significantly to measured noise levels, could be identified. The calibration of the meter was checked before and after the measurement using Larson-Davis Model CAL250 and Brüel & Kjær 4231 calibrators.

Temperature, wind speed, and humidity were recorded manually during the short-term monitoring session using a Kestrel 3000 portable weather station. During the short-term measurements, wind speeds typically ranged from 0 to 2 miles per hour (mph). Temperatures were 63 to 88°F with relative humidity of 18 to 64%.

5.2.2. Long-Term Measurements

Long-term monitoring was conducted at 28 locations in October of 2011 using Larson-Davis models 812, 820, 824, 870 and B&K model 2238 Type 1 sound level meters. Additional long-term monitoring was conducted twice by HNTB in January 2010. The purpose of these measurements was to identify variations in sound levels throughout the day. The long-term sound level data was collected for 24 to 47 hour periods. Long-term monitoring locations are shown in Appendix A, and addresses are listed in Table 6-2 of *Section 6.0 Existing Noise Environment*. Noise measurement field notes are in Appendix B and measurement site photographs are presented in Appendix D.

5.3. Prediction Methods

5.3.1. Traffic Noise Levels

The FHWA Traffic Noise Model Version 2.5 (TNM 2.5) was used for the noise computations (FHWA, 2004). TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). TNM 2.5 inputs are based on a three-dimensional grid created for the study area to be modeled. All roadway, barrier, terrain lines, and receiver points are defined by their x, y, and z coordinates. The x and y coordinates are obtained by digitizing line strings into a CAD layout map and later exported out into a spreadsheet. The z coordinates are determined by the topographic contours included in the CAD layout map and roadway profiles. The coordinates are then exported from the spreadsheet into TNM 2.5. Roadways, terrain lines, and barriers are coded into TNM 2.5 as line segments defined by their end points. Receivers, defined as single points, are typically located at frequent outdoor use areas such as residences, schools, and recreational areas. In general, receivers are modeled at a height of 5 feet above ground elevation. Appendix F lists the addresses of modeled noise receivers. TNM 2.5 files are contained on a CD located in Appendix G.

The TNM 2.5 computer program requires inputs of traffic volumes, speeds, and vehicle types to determine the noise levels generated by traffic. Three vehicle types were input into the model: cars, medium trucks, and heavy trucks. The propagation path between the source and receiver is modeled in TNM 2.5 by specifying special terrain features, rows of houses or building structures, and existing walls. Propagation of noise can be further specified by selecting ground types such as hard soil, loose soil, pavement, lawn, and field grass. The lawn option was chosen as the overall ground type for this study because the grounds between receivers and existing and proposed freeways are vegetated. Hard ground zones were used in one location to further define an area that contains roadway pavement. Several tree zones were also used to represent areas with dense vegetation. All other natural obstructions, such as cuts and fills that could affect the future predicted noise levels were also included in the input files.

Traffic noise is a function of traffic type, volume, and speed. Generally, noise increases with increased speed and with higher volumes of traffic. However, at much higher volumes, travel speed decreases (stop and go conditions), so the worst-case noise levels are experienced when there is an optimum balance between the volume and speed. For purposes of determining noise impacts, the worst-case traffic noise occurs when traffic is operating under level of service (LOS) C conditions. Under these conditions, traffic is heavy, but remains free flowing. Based on the results of the long-term noise measurements, typical peak noise hours for this project are between 5:00 and 8:00 am and 3:00 and 6:00 pm adjacent to existing freeways. The volume on any lane is a function of its traffic type (main lane and ramp) for LOS C conditions. Appendix E presents the future traffic volumes and traffic distribution per direction of travel for the future No-Build and project build conditions.

The LOS C volumes of general traffic lanes and auxiliary lanes were assumed to be 1,800 and 1,500 vehicles per hour (VPH)/lane, respectively. For modeled freeway ramps and connectors, traffic volumes were based on the forecasted 2038 volumes (Parsons, 2011)

or 1,000 VPH/lane for ramps and 1,500 VPH/lane for connectors, whichever was lower. Typically, heavy trucks do not travel in the inner or "fast" lanes; thus, heavy truck traffic volumes were modeled only in the outer lanes when the total number of lanes was greater than two lanes of traffic.

Truck percentages relative to the total traffic volume forecasted for 2038 were developed from a traffic model and provided in a table. Truck volumes were categorized by major interchange segments. The truck percentages used in this study are shown in Table 5-1. Heavy truck percentages on ramps, auxiliary lanes, exit lanes, and weaving lanes are assumed to be lower than the mainline percentages because it is assumed that only a portion of the heavy trucks will enter and exit the freeway in this area which is largely residential. The reduced heavy truck percentage used in this study for ramps, auxiliary lanes, exit lanes, and weaving lanes is 3.0 percent.

Table 5-1. Truck Percentages

Route / Segment	Medium Truck Percentage	Heavy Truck Percentage	Total Truck Percentage
Centennial Corridor (SR-58) West of SR-99	2.0	10.8	12.8
SR-58 East of SR-99	6.7	15.9	22.5
SR-99 North of SR-58	7.6	21.6	29.2
SR-99 South of SR-58	6.9	18.8	25.7

Source: Parsons

TNM 2.5 was used to compare measured traffic noise levels to modeled noise levels at field measurement locations to validate the accuracy of the model. Traffic volumes counted during each measurement period were normalized to 1-hour volumes. Appendix E contains traffic volumes counted for the model calibration. These normalized volumes were assigned to the corresponding project area roadways to simulate the noise source strength at the roadways during the actual measurement periods. Modeled and corresponding measured sound levels were then compared to determine the accuracy of the model and if additional calibration of the model was necessary.

5.4. Methods for Identifying Traffic Noise Impacts and Consideration of Abatement

Traffic noise impacts are considered to occur at receiver locations where predicted design-year traffic noise levels are at least 12 dB greater than existing noise levels, or where predicted design year traffic noise levels approach or exceed the NAC for the applicable activity category. Where traffic noise impacts are identified, noise abatement must be considered for reasonability and feasibility as required by Title 23 CFR 772 and the Protocol.

According to the Protocol, abatement measures are considered acoustically feasible if a minimum noise reduction of 5 dB at impacted receiver locations is predicted with implementation of the abatement measures. In addition, barriers should be designed to intercept the line-of-sight from the exhaust stack of a truck to the first tier of receivers, as

suggested by the Highway Design Manual, Chapter 1100. Other factors that affect feasibility include topography, access requirements for driveways and ramps, presence of local cross streets, utility conflicts, train crossings, and safety considerations. The overall reasonableness of noise abatement is determined by considering factors such as the noise reduction design goal; cost of noise abatement; viewpoints of benefitted receivers (including property owners and tenants); environmental impacts of abatement construction; input from the public and local agencies; and social, legal, and technological factors.

The Protocol also defines the procedure for applying an acoustical design goal to all noise abatement. Caltrans' acoustical design goal is that a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefitted receivers (i.e., receivers that receive at least 5 dB of noise reduction from a noise barrier). For a wall to be considered reasonable, the 7-dB design goal must be achieved at one or more benefitted receivers. This design goal applies to any receiver and is not limited to impacted receivers.

The Protocol further defines the procedure for assessing reasonableness of noise barriers from a cost perspective. The cost-per-residence allowance for each benefited receiver at the time of this study was $55,000. Total allowances for each soundwall are calculated by multiplying the cost-per-residence by the number of benefited residences.

Chapter 6. Existing Noise Environment

6.1. Existing Land Uses

A field investigation was conducted to identify land uses that could be subject to traffic noise impacts from the proposed project. Single-family residences and multi-family residences were identified as Activity Category B land uses. Stockdale Christian School, Centennial Park, Saunders Park, Central Bakersfield Community Center/Clinica Sierra Vista, Montessori Children's Center, and Camelot Park Family Fun Center were identified as Activity Category C land uses. Bakersfield Fire Station #6 was identified as an Activity Category C and D land use. Various hotels/motels as well as Outback Restaurant's outside dining area were identified as Activity Category E land uses. Six places of worship have been identified in the project area; however, because there are no outdoor use areas and/or facades with windows facing the freeway, they have not been categorized as either Activity Category C or D land uses.

As required by the Protocol, noise abatement is considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses primarily on locations with defined outdoor activity areas, such as residential backyards, common use areas at multi-family residences, parks, and pool areas of hotels/motels.

This noise study for the Centennial Corridor Project analyzes 32 distinct areas based on local interchanges, overcrossings, undercrossings, and direction of travel (westbound [WB], eastbound [EB], northbound [NB], and southbound [SB]), as well as which freeway the project follows (Centennial Corridor Alternative A [ALT A], Centennial Corridor Alternative B [ALT B], Centennial Corridor Alternative C [ALT C], existing segment of SR-58, or SR-99). These areas are shown in Figures 6-1 through 6-7.

CENTENNIAL CORRIDOR ALTERNATIVE A:

Alternative A, Area 1 – Truxtun Avenue to California Avenue along WB SR-58: Creekside Apartments at north of Mohawk Street is the only Category B land use in this area. The portions of the Green Tree Apartments in this area will be demolished as a result of the proposed project. There are also seven commercial establishments and office buildings in this area, three of which will be demolished. Along this area, the residences are at a lower elevation relative to proposed SR-58.

Alternative A, Area 2 – Truxtun Avenue to California Avenue along EB SR-58: This area is predominantly single-family and multi-family residences (Activity Category B) along with four commercial facilities and a Farmer Boys restaurant. Multiple multi-family buildings and two commercial buildings would be demolished as a result of the proposed project. Along this area, freeway elevation would be higher than the residences.

Alternative A, Area 3 – California Avenue to Stockdale Highway along WB SR-58: Along WB SR-58 between California Avenue and Stockdale Highway, the predominant Activity Category B land uses are multi-family residences with three single-family residences. Other land uses include a bank and five commercial establishments. One

multi-family residence and one commercial building would be demolished as a result of the proposed project. The residences in this area are on lower ground than the proposed freeway.

Alternative A, Area 4 – Stockdale Highway to SR-99 along WB SR-58: This area along WB SR-58 is bound by Stockdale Highway to the north and SR-99 to the east and is composed primarily of various commercial uses and Activity Category B single-family residences with some multi-family residences. Various single-family residences as well as a couple of multi-family residences and five commercial buildings would be demolished as a result of the proposed project. Along this area of SR-99, the residences are at a lower elevation relative to proposed SR-58.

Alternative A, Area 5 – Stockdale Highway to SR-99 along EB SR-58: The land use south of SR-58 consists primarily of single-family residences (Activity Category B), along with the outdoor dining area of the Outback Steakhouse (Activity Category E) and several commercial establishments on the far east and far west of this area. A large number of single-family residences as well as six commercial buildings would be demolished under Alternative A. Along this area, the freeway would be at a higher elevation compared to residences.

CENTENNIAL CORRIDOR ALTERNATIVE B:

Alternative B, Area 1 – California Avenue to Marella Way along WB SR-58: A mixture of single and multi-family residences (Activity Category B) along with one commercial establishment are in this area. Several single-family and multi-family residential buildings as well as the commercial building would be demolished under Alternative B. The freeway would be elevated at the west end and depressed at the east end in this area relative to residences.

Alternative B, Area 2 – California Avenue to Marella Way along EB SR-58: This area consists of single-family residences (Activity Category B). Multiple single-family residences would be demolished as a result of the proposed project. The freeway would be elevated at the west end and depressed at the east end compared to the residences.

Alternative B, Area 3 – Marella Way to Stockdale Highway along WB SR-58: The land use in this area consists primarily of single-family residences along with the Stockdale Gardens Apartment complex (Activity Category B). Multiple single-family residences would be demolished in this area. The highway is elevated at the east end and depressed at the west end of this area compared to the residences.

Alternative B, Area 4 – Marella Way to Stockdale Highway along EB SR-58: The land use in this area consists of single-family residences (Activity Category B). Multiple residences would be demolished as a result of the proposed project in this area. The highway is elevated at the east end and depressed at the west end of this area compared to the residences.

Alternative B, Area 5 – Stockdale Highway to SR-99 along EB SR-58: Single-family residences (Activity Category B), along with two commercial establishments to the far east and four to the far west, are in this area. Several of the residences would be

demolished as a result of the proposed project. The single-family residences are at a lower elevation than the freeway.

EXISTING STATE ROUTE 58:

SR-58, Area 1 – SR-99 to Hughes Lane along WB SR-58: This area is mixed between commercial facilities and Activity Category B single-family residences and two multi-family residences. Both of the multi-family residences and several commercial buildings at the west end of the area would be demolished under Alternative C only. There are no planned buildings to be demolished in this area for Alternatives A and B. The freeway is at the same grade as the residences at the western end but depressed at the eastern end relative to the residences.

SR-58, Area 2 – SR-99 to Hughes Lane along EB SR-58: In this area, Activity Category B land uses are mostly single-family residences with a multi-family complex called the Villas at Hughes Lane Apartments. For all three alternatives, no buildings would be demolished. Freeway elevation in this area is at grade to the west and at a lower elevation to the east compared to the residences.

SR-58, Area 3 – Hughes Lane to H Street along WB SR-58: In this area, the Activity Category B land uses are single-family and multi-family residences. Other land uses include a day care, which is a second row receiver, and six commercial establishments. No demolitions are planned under the three alternatives. The residences in this area are on higher ground than the existing freeway.

SR-58, Area 4 - Hughes Lane to H Street along EB SR-58: Single-family and multi-family residences (Activity Category B) as well as two buildings that comprise the Central Baptist Church are in this area. The Central Baptist Church is not considered an Activity Category C land use because there are no outdoor use areas, and not considered to be Activity Category D land use due to the lack of windows or doors that directly face the freeway. No demolitions are planned under the three alternatives. The residences in this area are at higher elevation relative to SR-58.

SR-58, Area 5 – H Street to Union Avenue along WB SR-58: The land use in this area consists of a mixture of Activity Category B single-family residences along with the Central Bakersfield Community Center/Clinica Sierra Vista and Bakersfield Fire Station #6 (Activity Categories C and D), the Emmanuel Temple Church, and several commercial establishments. The church is not considered an Activity Category C land use (no outdoor use areas) or an Activity Category D land use (no windows or doors face the freeway. No demolitions are planned under the three alternatives. The freeway is at a lower elevation at the east and west ends of the area but higher in the center relative to the adjacent land.

SR-58, Area 6 – H Street to Union Avenue along EB SR-58: A mixture of single and multi-family residences (Activity Category B), the Dayspring Christian Fellowship, commercial land use, and an office building are in this area. An outdoor use area is associated with the church (Activity Category C). The outdoor area; however, is protected by two buildings of the church complex and is approximately 650 feet from the nearest freeway lane, too far to considered for traffic noise analysis. Under all three

alternatives, a cluster of single-family residences between Haybert Court and Chester Avenue would be demolished to make way for a retention basin. The freeway is at a lower elevation at the east and west ends of the area but higher in the center relative to the adjacent land.

SR-58, Area 7 – Union Avenue to Cottonwood Road along WB SR-58: The land use in this area consists primarily of single-family residences along with some multi-family residences, including the Brundage Arms Apartments (Activity Category B). Three places of worship, including the St. James Baptist Church, and several commercial establishments are also in this area. The three churches have not been identified as Activity Categories C or D because there are no outdoor use areas and there are no windows facing SR-58. No demolitions are planned under the three alternatives. The freeway is depressed at the west end and elevated at the east end relative to the residences and churches.

SR-58, Area 8 – Union Avenue to Cottonwood Road along EB SR-58: This area consists primarily of single-family residences along with two multi-family residential buildings (Activity Category B) and two commercial buildings. No demolitions are planned under the three alternatives. The residences are at a lower elevation at the west end, transitioning to a higher elevation relative to the freeway.

STATE ROUTE 99:

SR-99, Area 1 – Wilson Road to Ming Avenue along NB SR-99: This area is largely commercial with four single-family residences (Activity Category B) exposed to the freeway and the Garden Suites Inn (Activity Category E). No buildings would be demolished in this area. The freeway is depressed in this area compared to the residences and motel.

SR-99, Area 2 – Wilson Road to Ming Avenue along SB SR-99: A mix of single-family residences along with the Casa Real Apartment complex (Activity Category B) and a K-Mart are in this area. An existing 10-foot 6-inch high soundwall within the right-of-way protects the residential land uses in this area. No demolitions are planned under the three alternatives. The highway is at a lower elevation relative to the residences.

SR-99, Area 3 – Ming Avenue to Belle Terrace along NB SR-99: The land use in this area consists primarily of commercial establishments as well as two single-family residences (Activity Category B), California Best Inn (Activity Category E), Ramada Inn, and the Knights Inn and Suites. The Ramada Inn and Knights Inn and Suites have not been considered Activity Category E because there are no outdoor use areas associated with these properties. An existing 10-foot high soundwall within the right-of-way is just north of Wood Lane ending at Belle Terrace. Two commercial buildings as well as the existing soundwall would be demolished as part of the proposed project under all three alternatives. The highway is depressed in this area compared to the residences and motels.

SR-99, Area 4 – Ming Avenue to Belle Terrace along SB SR-99: The Activity B land uses in this area consist of single-family and multi-family residences along with two commercial establishments. An existing 9-foot 6-inch to 11-foot 6-inch high soundwall in

the right-of-way provides traffic noise abatement for all the residential land uses in this area. Several of the single-family residences and the northern portion of the existing soundwall would be demolished as a result of the proposed project. The residences are at a higher elevation to the south and at a lower elevation at the north end of this area when compared to the freeway.

SR-99, Area 5 – Belle Terrace to SR-58 along NB SR-99: This area is mostly single-family residences with two multi-family residences (Activity Category B) and a few commercial establishments at the south end of the area. An existing 10-foot high soundwall in the right-of-way is in this area beginning at Belle Terrace and ends south of Terrel Court. Both multi-family residences and the gas station located at Wible Road and Belle Terrace would be demolished under all alternatives. The residences are at a higher elevation relative to SR-99 in this area.

SR-99, Area 6 – Belle Terrace to SR-58 along SB SR-99: This area is predominantly single-family residences (Activity Category B) and includes the Montessori Children's Center (Activity Category C). There is an existing 9-foot 6-inch high soundwall within the right-of-way that protects all the land uses in this area. All first row single-family buildings between Belle Terrace and Mona Way as well as the existing soundwall would be demolished under all three alternatives. Along this area, freeway elevation is depressed compared to the residences.

SR-99, Area 7/Alternative C, Area 1 – SR-58 to California Avenue along SB SR-99: The Activity Category B land uses in this area are single-family residences. Other land uses include Saunders Park (Activity Category C) and four commercial establishments at the north end. Two existing soundwalls are located in this area. Varying in height from 10 to 16 feet, the first soundwall extends from Stockdale Highway to Palm Street. At a height of 10 feet, the second soundwall begins at Palm Street and ends at the northern edge of Chester Lane. These soundwalls provide traffic noise abatement for the single-family residences as well as Saunders Park. The majority of first row buildings north of Verde Street, including single-family residences, commercial buildings, and both existing soundwalls, would be demolished under Alternative C. The residences in this area are on higher ground than the existing SR-99 but on lower ground than the proposed SR-58.

SR-99, Area 8/Alternative C, Area 2 – SR-58 to California Avenue along NB SR-99: The land use in this area consists of Activity Category B single-family and a few multi-family residences and the following Activity Category E uses: Econolodge, Best Value Inn, Travelodge, Hampton Inn, and several commercial establishments. The Econolodge, Travelodge, and Hampton Inn have pool areas; however, the Best Value Inn and Travelodge pool areas are shielded by the hotel buildings. Several commercial buildings would be demolished under Alternative C. SR-99 is at a lower elevation relative to the residences and hotels/motels.

SR-99, Area 9 – California Avenue to Rosedale Highway along SB SR-99: The majority of land uses in the area are commercial establishments along with a Motel 6, Hotel Rosedale, and Double Tree Hotel where each hotel/motel has an outdoor pool area (Activity Category E). Also in this area is the eastern end of Yokuts Park (Activity Category C). The Motel 6 would be demolished under Alternative C and pool areas of the other two hotels are encircled by each of the hotel buildings. A traffic noise analysis has

not been performed for this study since this area was already addressed by the 24th Street Improvement Project Noise Study (LSA, 2011). Several commercial buildings south of the railroad tracks would also be demolished as a result of the proposed project. The freeway is at a higher elevation when compared to the adjacent land.

SR-99, Area 10 – California Avenue to Rosedale Highway along NB SR-99: The land use in this area primarily consists of commercial buildings, an Extended Stay America, Beach Park (Activity Category C), and the Camelot Park Family Fun Center (Activity Category E). Additionally, two of the commercial buildings in this area have outdoor use areas (Activity Category E). The Extended Stay America would be demolished as a result of the proposed project. SR-99 is elevated compared to the adjacent land.

SR-99, Area 11 – Rosedale Highway to Gilmore Avenue along SB SR-99: This area consists of two single-family residences (Activity Category B), Clarion Hotel (Activity Category E), and several commercial buildings. The residences and hotel are at a lower elevation relative to the freeway.

SR-99, Area 12 – Rosedale Highway to Gilmore Avenue along NB SR-99: A Holiday Inn and its outdoor pool area is the only land use with a noise abatement criterion (Activity Category E). The Roadrunner Inn and Suites has no outdoor use area associated with this property. Commercial establishments make up the remaining land uses in this area. The hotels/motels and commercial buildings are at a lower elevation compared to the freeway.

Westside Parkway – Calloway Drive to Coffee Road along WB Westside Parkway: The Activity Category B land use in this area consists primarily of single-family residential and a multi-family residential development west of Coffee Road. The development is currently under construction with some units completed. Activity Category C land uses include Mondavi Park and the Columbia Elementary School and Columbia Extended Daycare facility which are located approximately midway between Calloway Drive and Coffee Road. The school and daycare facility properties are approximately 500 feet to the north of the right-of-way line. The freeway is depressed at the west end and elevated at the east end compared to the residences and school.

Westside Parkway – Calloway Drive to Coffee Road along EB Westside Parkway: The Glenwood Gardens Senior Living development (Activity Category B) is just east of Calloway Drive. The development includes multistory buildings for assisted living as well as several semi-detached units near its eastern end. Land east of Glenwood Gardens is vacant. The senior living development is at a higher elevation relative to the freeway.

Figure 6-1. Analysis Areas, Noise Monitoring and Analysis Positions – Alternative A

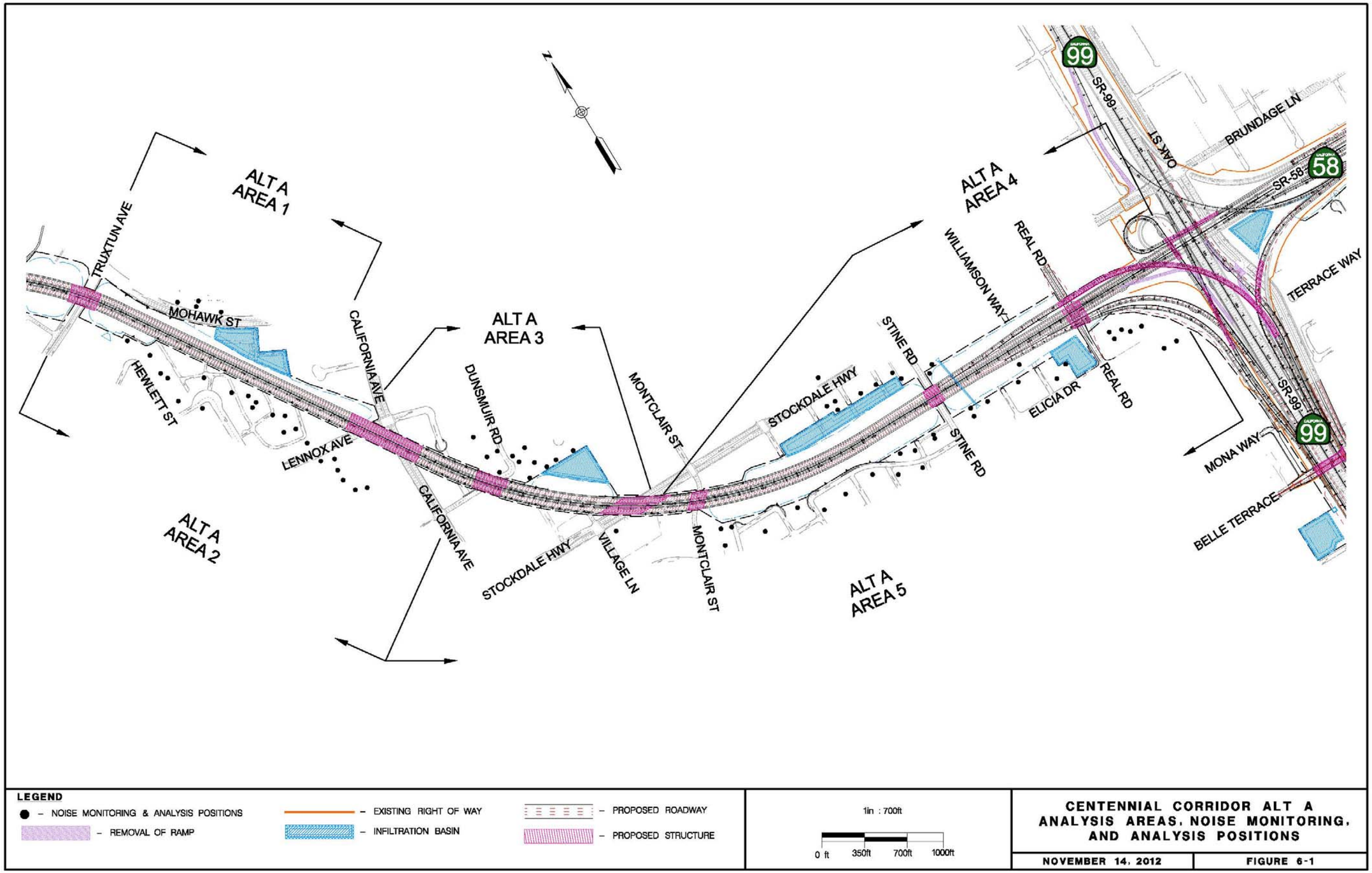


Figure 6-2. Analysis Areas, Noise Monitoring and Analysis Positions – Alternative B

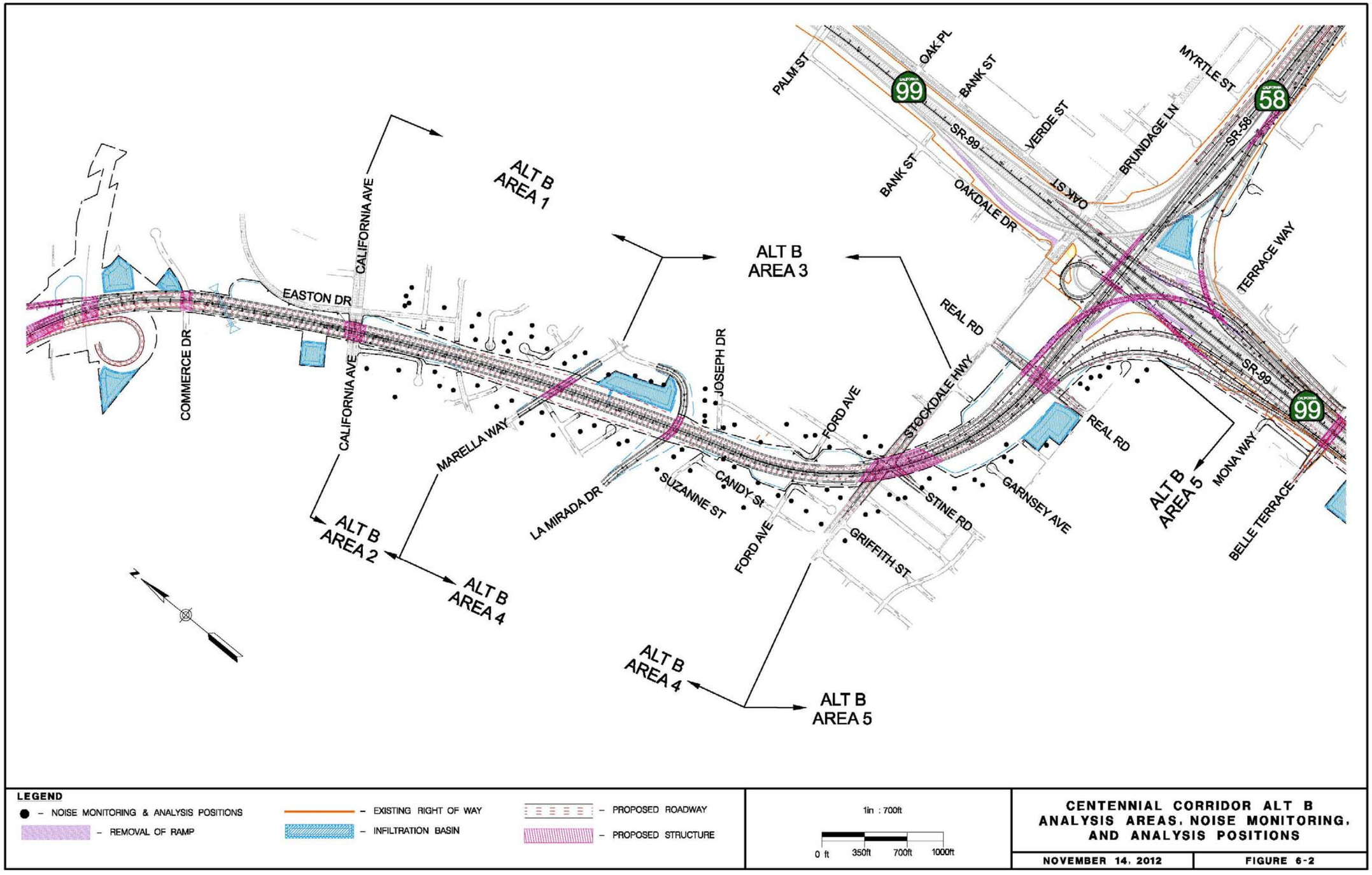


Figure 6-3. Analysis Areas, Noise Monitoring and Analysis Positions – State Route 58 West

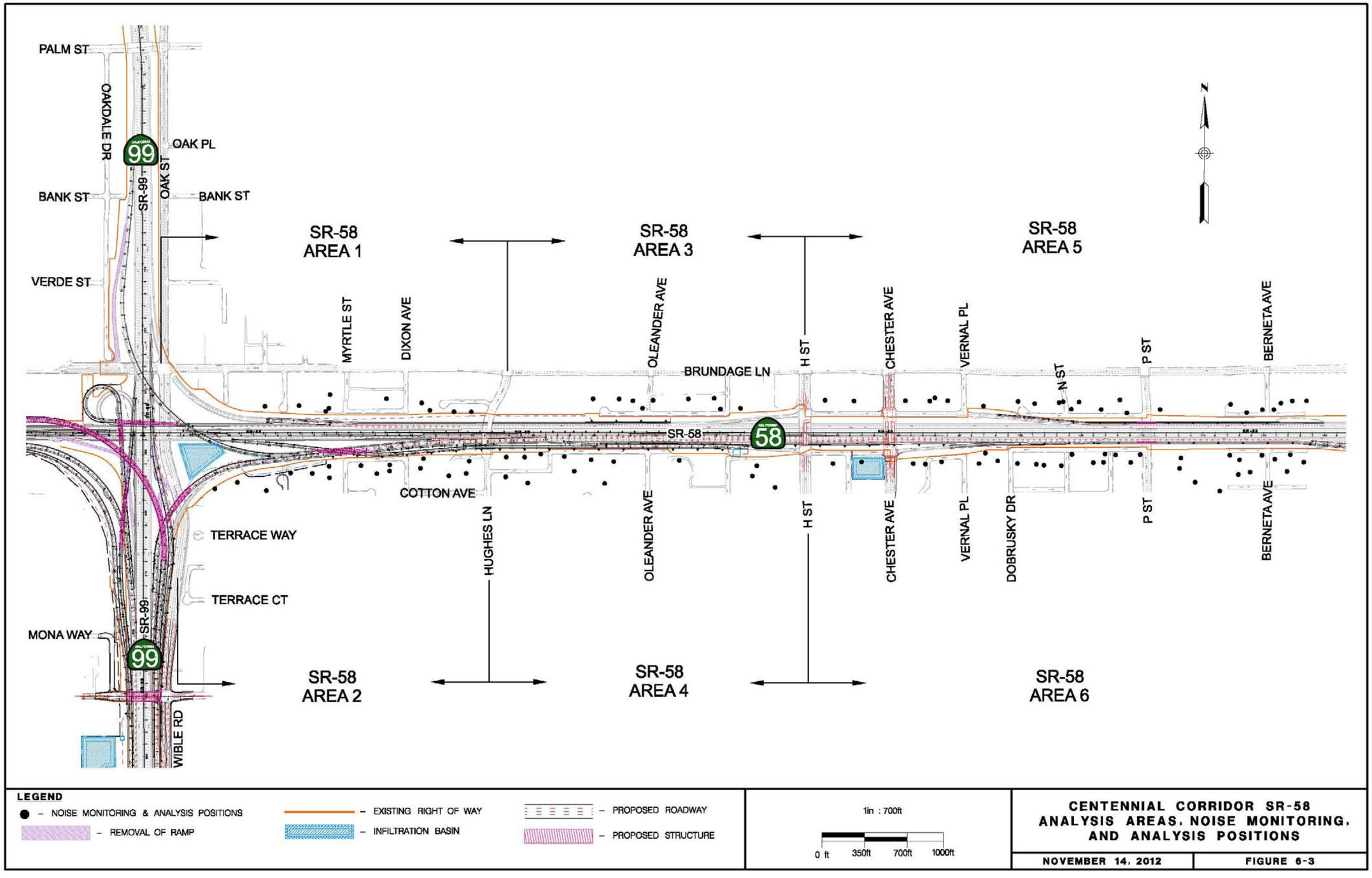


Figure 6-4. Analysis Areas, Noise Monitoring and Analysis Positions – State Route 58 East

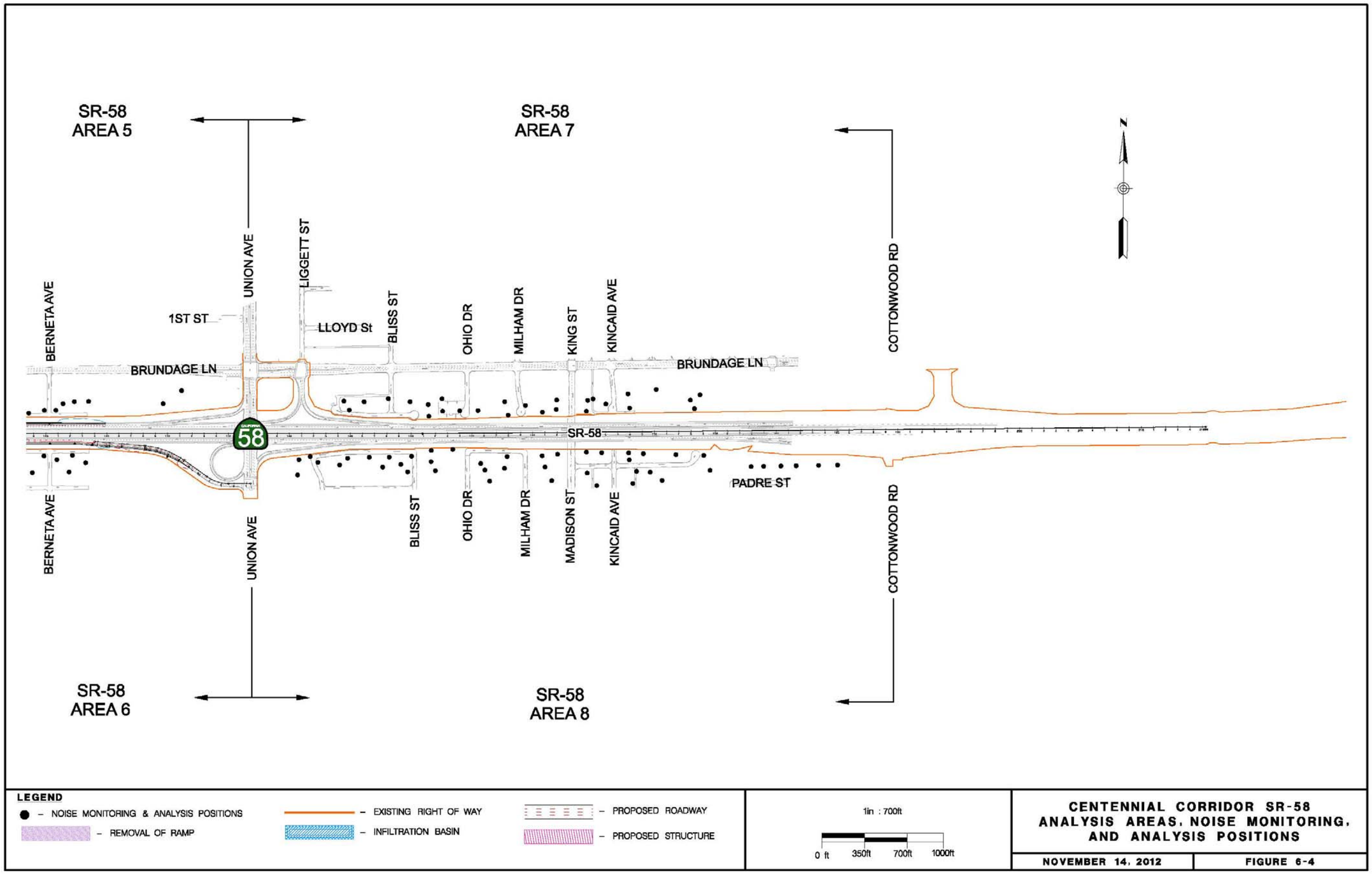


Figure 6-5. Analysis Areas, Noise Monitoring and Analysis Positions – State Route 99 South

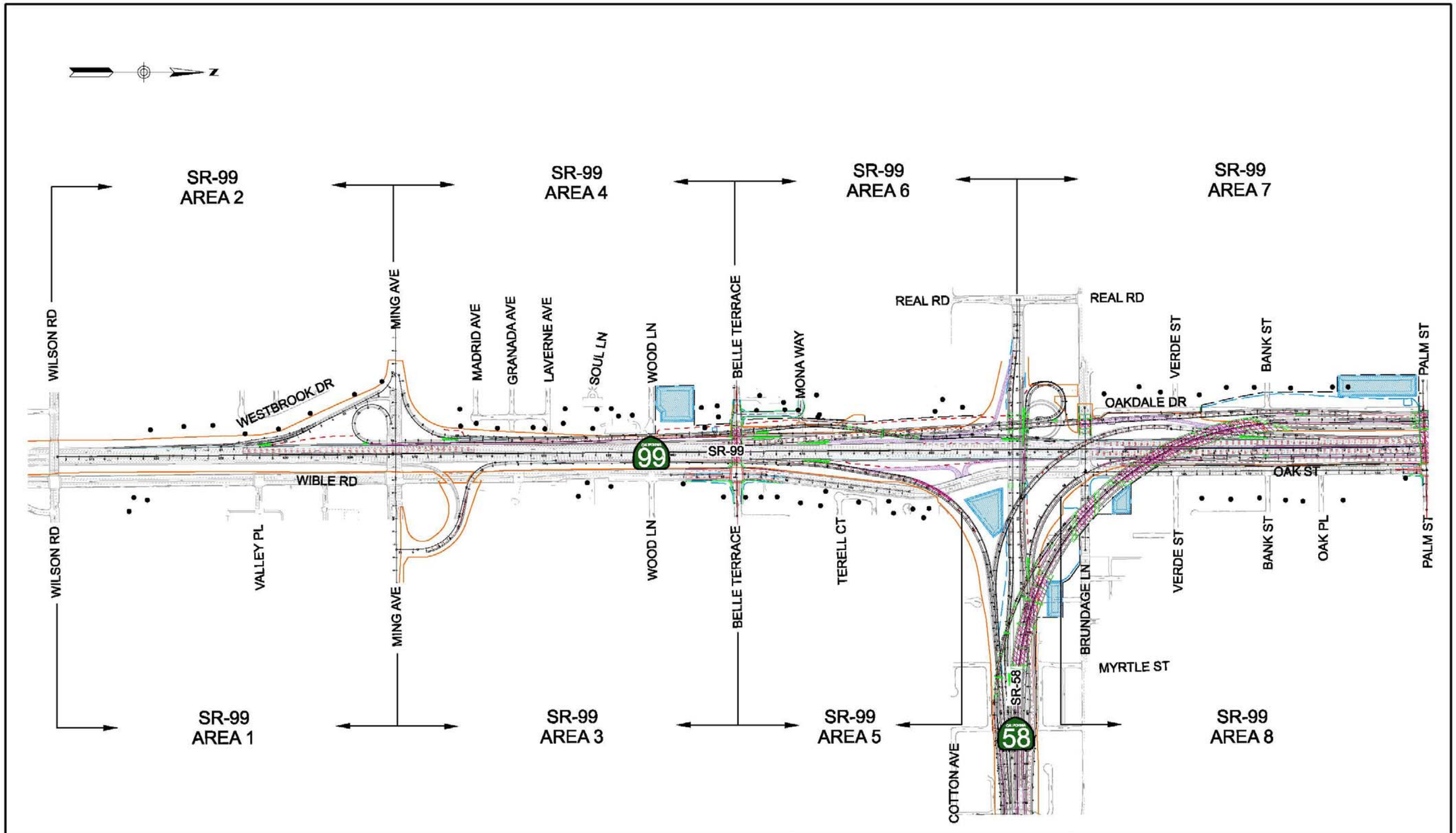


Figure 6-6. Analysis Areas, Noise Monitoring and Analysis Positions – State Route 99 North

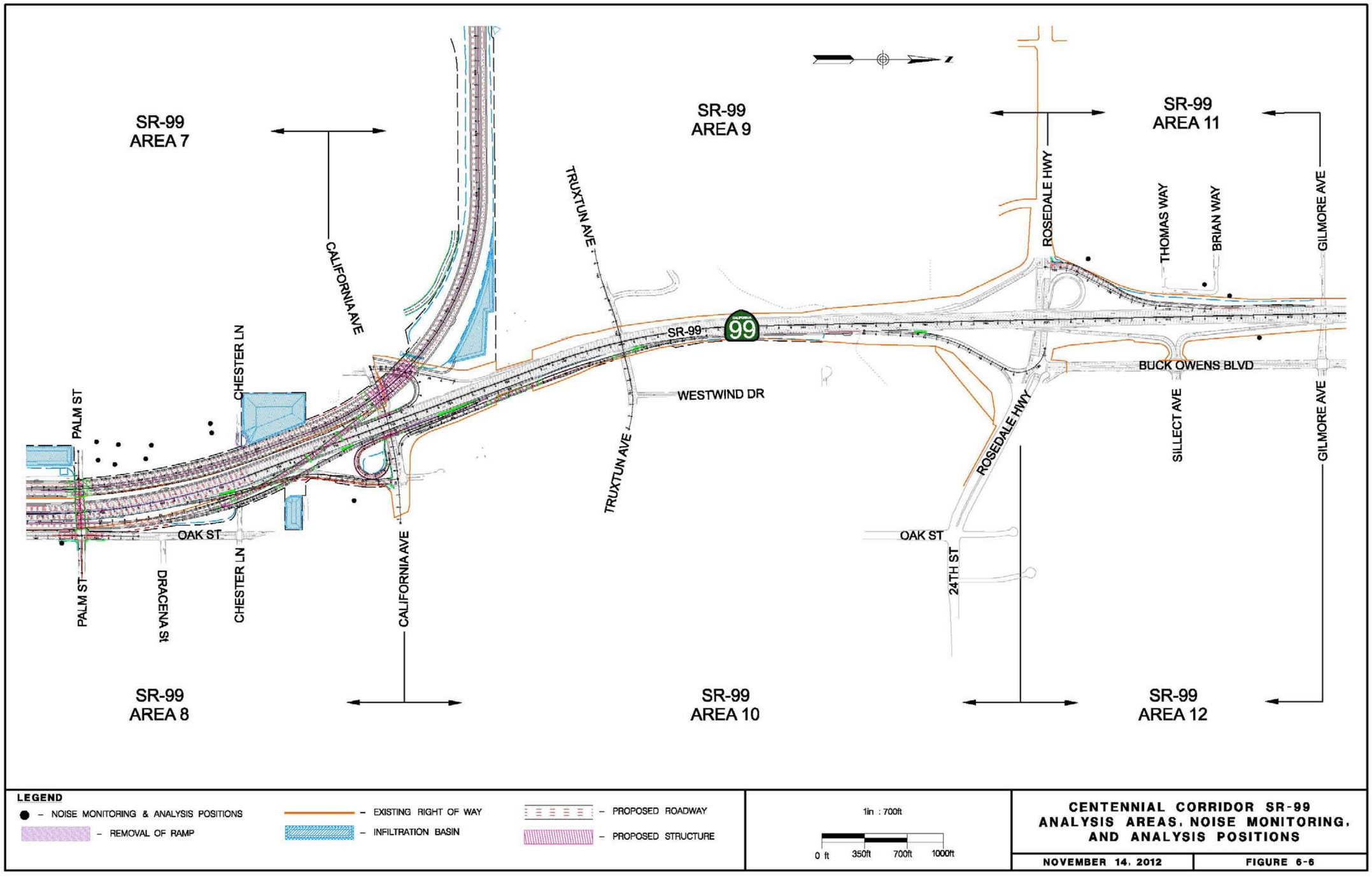
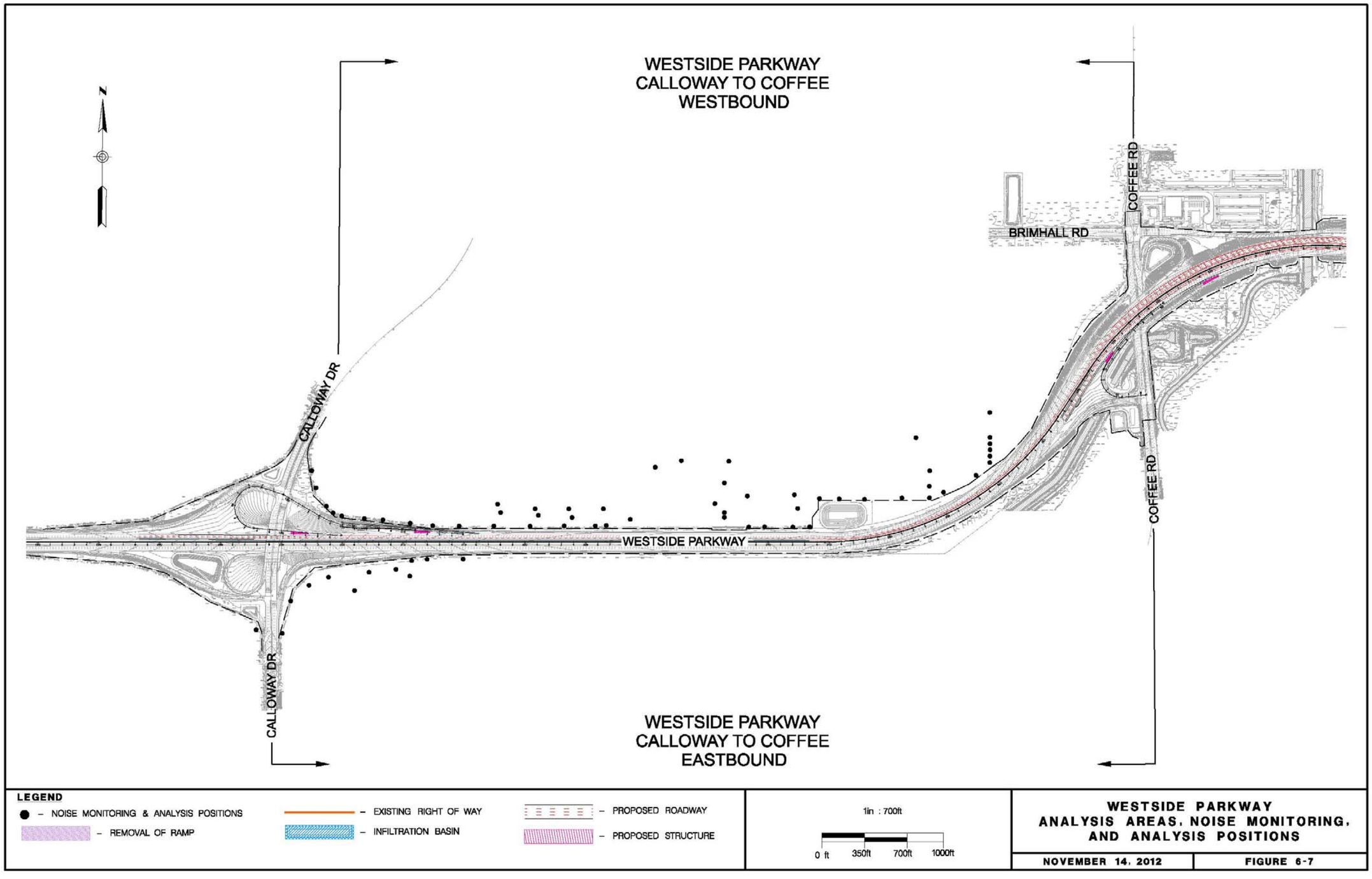


Figure 6-7. Analysis Areas, Noise Monitoring and Analysis Positions – Westside Parkway



6.2. Noise Measurement Results

The existing noise environment in the project area is characterized in the following sections based on short-term and long-term noise monitoring that was conducted.

6.2.1. Short-Term Monitoring

In October 2011, short-term (20 minutes) noise measurements were conducted at 44 sites. The primary objectives of the short-term noise measurements were to evaluate the existing noise environment. Table 6-1 summarizes the short-term noise measurement results. Also included in Table 6-1 are the land use types for each of the measurement sites. Figures in Appendix A present the measurement locations. Appendix B includes noise measurement data sheets recorded in the field and meteorological data. Appendix C contains equipment calibration records. Appendix D includes the noise measurement site photographs. Although most noise measurements were not conducted at frequent use areas, on sidewalks or cul-de-sacs, the data collected is representative of nearby frequent outdoor use areas. Measurement results presented in Table 6-1 indicate that traffic noise at many measurement sites along the project corridor adjacent to existing freeways already approach or exceed the NAC of 67 dBA.

Some of the measurements were not made when the highest hourly traffic noise levels occurred because taking short-term noise measurements at 44 locations during only the peak noise hours is not possible within a reasonable amount of time. The measured noise levels shown in Table 6-1 were taken at different times throughout the day, and they are not necessarily indicative of the existing peak hour noise levels. These measurements have been adjusted to reflect peak hourly noise levels using the results of the nearby long-term noise measurements. The peak noise hour was determined by a long-term noise measurement running simultaneously with each short-term noise measurement. The difference in noise levels between the hour in which the short-term level was recorded and the hour that the actual peak hour level occurred was then applied to each of the short-term levels to adjust it to the peak hour. This is one of the methods suggested by the TeNS to adjust measured noise levels taken at times other than the noisiest hour.

6.2.2. Long-Term Monitoring

In October 2011, long-term noise measurements were conducted at 28 locations for more than 24 hours using Larson-Davis model 812, 820, 824, and 870 and B&K model 2238 Type 1 sound level meters. Two additional long-term measurements were conducted in January 2010 by another consultant using Larson Davis model 831 Type 1 sound level meters. Those measurements were also used in this study. The long-term noise measurements were conducted to observe hourly noise distribution and identify the peak noise hours. Table 6-2 summarizes long-term monitoring results and shows addresses of the monitoring locations. Appendix B includes field survey sheets and hourly L_{eq} graphs, Appendix C contains equipment calibration records, and Appendix D includes the noise measurement site photographs.

Table 6-1. Short-Term Noise Measurement Results

Site No.	Street Address, City	Area	Land Use[1]	Meter Location	Meas. Date	Start Time	Duration, Min.	Meas. L_{eq}, dBA[2]	Adjusted Peak-Hour L_{eq}, dBA	Adjusted to Long-Term Site
ST1A	1000 Mohawk Avenue, Bakersfield	ALT A,1	REC	Pool	10/12/11	12:40	20	60	60	LT1
ST1	5301 Lennox Ave, Bakersfield	ALT A,2	MFR	Sidewalk	10/11/11	14:20	20	48	50	LT2
ST2	5401 Dunsmuir Drive, Bakersfield	ALT A,3	MFR	Sidewalk	10/11/11	13:40	20	56	59	LT3
ST3	5051 Stockdale Highway, Bakersfield	ALT A,5	RST	Sidewalk	10/11/11	14:20	20	67	71	LT4
ST4	4534 Frazier Avenue, Bakersfield	ALT A,5	SFR	Sidewalk	10/12/11	11:00	20	48	53	LT5
ST5	17 Jones Street, Bakersfield	ALT A,4	SFR	Sidewalk	10/12/11	11:00	20	56	59	LT4
ST6	3608 Peckham Avenue, Bakersfield	ALT A,5	SFR	Alley	10/12/11	11:40	20	51	56	LT5
ST7	16 Stine Road, Bakersfield	ALT A,4	SFR	Sidewalk	10/25/11	15:40	20	67	73	LT6
ST7A	16 Jones Street, Bakersfield	ALT A,4	SFR	Alley	10/25/11	15:40	20	57	63	LT6
ST8	6 Stine Road, Bakersfield	ALT B,3	SFR	Sidewalk	10/26/11	10:00	20	61	69	LT6
ST9	3120 Joseph Drive, Bakersfield	ALT B,3	SFR	Backyard	10/26/11	09:20	20	45	51	LT8
ST10	Centennial Park, Bakersfield	ALT B,4	REC	Open Area	10/26/11	08:40	20	53	53	LT7
ST11	4424 Charter Oaks Avenue, Bakersfield	ALT B,1	SFR	Alley	10/26/11	10:40	20	52	58	LT9
ST12	2220 South Real Road, Bakersfield	SR-99,2	REC	Playground	10/26/11	13:00	20	60	63	LT11
ST13	1800 Westbrook Drive, Bakersfield	SR-99,2	SFR	Backyard	10/25/11	14:20	20	53	55	LT11
ST14	3321 Laverne Avenue, Bakersfield	SR-99,4	SFR	Sidewalk	10/25/11	13:20	20	62	65	LT13
ST14A	3321 Seville Street, Bakersfield	SR-99,4	SFR	Sidewalk	10/26/11	14:20	20	61	63	LT13
ST15	830 Wible Road, Bakersfield	SR-99,3	MOT	Pool	10/26/11	15:40	20	66	69	LT12
ST16	607 South Olive Street, Bakersfield	SR-99,5	SFR	Backyard	10/26/11	19:00	20	55	56	LT12
ST17	3209 Mona Way, Bakersfield	SR-99,6	SFR	Sidewalk	10/26/11	15:00	20	56	58	LT13

Notes:

1. SFR – Single-family residential; MFR – Multi-family residential; REC – Recreational; RST – Restaurant; MOT – Hotel/Motel; HLT – Health center.
2. All short-term measured noise levels are 20-minutes L_{eq}.

Table 6-1. Short-Term Noise Measurement Results (Cont'd)

Site No.	Street Address, City	Area	Land Use[1]	Meter Location	Meas. Date	Start Time	Duration, Min.	Meas. L_{eq}, dBA[2]	Adjusted Peak-Hour L_{eq}, dBA	Adjusted to Long-Term Site
ST18	3330D Elicia Drive, Bakersfield	SR-99,6	MFR	Sidewalk	10/26/11	12:20	20	59	62	LT13
ST19	3112 Terrace Way, Bakersfield	SR-99,5	SFR	Sidewalk	10/26/11	16:20	20	67	69	LT14
ST20	314 Stephens Drive, Bakersfield	SR-58,2	SFR	Sidewalk	10/12/11	15:00	20	68	69	LT14
ST21	119 Myrtle Street, Bakersfield	SR-58,1	SFR	Alley	10/12/11	15:40	20	70	70	LT16
ST21A	2300 Brite Street, Bakersfield	SR-58,4	SFR	Backyard	10/11/11	10:40	20	66	68	LT15
ST22	1900 Roosevelt Street, Bakersfield	SR-58,3	SFR	Front yard	10/11/11	09:00	20	68	69	LT16
ST23	209 Brink Lane, Bakersfield	SR-58,6	SFR	Sidewalk	10/11/11	11:40	20	62	65	LT20
ST24	1624 Richland Avenue, Bakersfield	SR-58,5	MFR	Alley	10/11/11	16:00	20	60	62	LT19
ST25	1100 Dobrusky Drive, Bakersfield	SR-58,5	SFR	Sidewalk	10/11/11	16:00	20	65	67	LT19
ST26	123 P Street, Bakersfield	SR-58,5	SFR	Sidewalk	10/13/11	11:40	20	69	70	LT22
ST27	720 Terrace Way, Bakersfield	SR-58,6	MFR	Sidewalk	10/27/11	13:20	20	66	68	LT21
ST28	616 Fig Street, Bakersfield	SR-58,5	SFR	Sidewalk	10/13/11	13:40	20	70	71	LT22
ST29	301 Brundage Lane, Bakersfield	SR-58,5	HLT	Sidewalk	10/13/11	14:20	20	65	66	LT22
ST30	304 Legett Street, Bakersfield	SR-58,8	SFR	Sidewalk	10/13/11	15:20	20	70	70	LT24
ST31	329 Tollhouse Drive, Bakersfield	SR-58,8	SFR	Sidewalk	10/13/11	10:40	20	69	70	LT24
ST32	316 South Bliss Street, Bakersfield	SR-58,7	SFR	Sidewalk	10/14/11	09:20	20	61	62	LT23
ST33	1103 Derrell Avenue, Bakersfield	SR-58,8	SFR	Alley	10/14/11	10:00	20	64	65	LT24
ST34+	106 Kincaid Street, Bakersfield	SR-58,7	SFR	Sidewalk	10/14/11	10:40	20	63	64	LT23
ST35	931 Brundage Lane, Bakersfield	SR-58,7	MFR	Open Area	10/14/11	11:20	20	66	67	LT23
ST36A	203 Oakbank Road, Bakersfield	SR-99,8	SFR	Backyard	10/27/11	17:20	20	56	57	LT28

Notes:

1. SFR – Single-family residential; MFR – Multi-family residential; REC – Recreational; RST – Restaurant; MOT – Hotel/Motel; HLT – Health center.
2. All short-term measured noise levels are 20-minutes L_{eq}.

\+ Noise measurement level was determined to be suspiciously quiet and has not been included in noise abatement analysis.

Table 6-1. Short-Term Noise Measurement Results (Cont'd)

Site No.	Street Address, City	Area	Land Use[1]	Meter Location	Meas. Date	Start Time	Duration, Min.	Meas. L_{eq}, dBA[2]	Adjusted Peak-Hour L_{eq}, dBA	Adjusted to Long-Term Site
ST36	350 Oak Street, Bakersfield	SR-99,8	MOT	Pool	10/28/11	10:40	20	64	64	LT28
ST37	Saunders Park, Bakersfield	SR-99,7	REC	Playground	10/28/11	10:00	20	58	60	LT26
ST37B	1017 Oak Street, Bakersfield	SR-99,8	MOT	Pool	10/28/11	11:20	20	66	67	LT28
ST38	3540 Rosedale Highway, Bakersfield	SR-99,11	MOT	Pool	10/27/11	14:00	20	61	63	LT29

Notes:

1. SFR – Single-family residential; MFR – Multi-family residential; REC – Recreational; RST – Restaurant; MOT – Hotel/Motel; HLT – Health center.
2. All short-term measured noise levels are 20-minutes L_{eq}.

Table 6-2. Long-Term Noise Measurement Results

Site No.	Street Address, City	Area	Land Use[1]	Noise Abatement Category (Criterion)[2]	Meter Location	Meas. Dates	Start Time	Duration, No. of Hours	Peak Hour Time	Measured Peak Hour L_{eq}, dBA
LT1	1000 Mohawk Avenue, Bakersfield	ALT A,1	MFR	B (67)	Patio	10/11/11 – 10/12/11	09:57	27	8:00	73
LT2	900 Hewlett Street, Bakersfield	ALT A,2	SFR	B (67)	Backyard	10/10/11 – 10/11/11	14:26	25	13:00	52
LT3	4905 Durham Avenue, Bakersfield	ALT A,3	SFR	B (67)	Backyard	10/10/11 – 10/12/11	14:59	46	16:00	52
LT4	9 Griffith Street, Bakersfield	ALT A,4	SFR	B (67)	Backyard	10/12/11 – 10/14-11	10:33	46	11:00	63
LT5	209 Williamson Way, Bakersfield	ALT A,5	SFR	B (67)	Backyard	10/12/11 – 10/14/11	10:04	47	06:00	52
LT6	2 Candy Street, Bakersfield	ALT B,4	SFR	B (67)	Backyard	10/24/11 – 10/26/11	13:56	46	17:00	62
LT7	236 Candy Street, Bakersfield	ALT B,4	SFR	B (67)	Backyard	10/24/11 – 10/26/11	15:44	44	19:00	51
LT8	509 Malibu Court, Bakersfield	ALT B,1	SFR	B (67)	Backyard	10/24/11 – 10/26/11	14:55	44	07:00	53
LT9	805 Del Rey, Bakersfield	ALT B,2	SFR	B (67)	Backyard	10/25/11 – 10/27/11	16:39	40	07:00	52
LT10	2309 Christopher Court, Bakersfield	SR-99,1	SFR	B (67)	Backyard	10/25/11 – 10/26/11	09:08	32	15:00	59
LT11	2012 Westbrook Drive, Bakersfield	SR-99,2	SFR	B (67)	Backyard	10/25/11 – 10/26/11	09:55	32	08:00	63
LT12	1120 Wible Road, Bakersfield	SR-99,3	SFR	B (67)	Backyard	10/25/11 – 10/27-11	10:23	46	15:00	60
LT13	3227 Belle Terrace, Bakersfield	SR-99,4	SFR	B (67)	Backyard	10/25/11 – 10/26/11	11:14	31	06:00	66
LT14	228 South Olive Street, Bakersfield	SR-58,2	SFR	B (67)	Backyard	10/12/11 – 10/13/11	06:28	34	07:00	65
LT15	300 Dixon Avenue, Bakersfield	SR-58,2	SFR	B (67)	Backyard	10/12/11 – 10/13/11	08:47	24	07:00	66
LT16	2403 Robbin Road, Bakersfield	SR-58,1	SFR	B (67)	Backyard	10/11/11 – 10/12/11	17:26	24	15:00	65
LT17	2104 Roosevelt Street, Bakersfield	SR-58,3	SFR	B (67)	Backyard	10/10/11 – 10/11/11	12:56	28	07:00[3]	57[3]
LT18	204 Haybert Court, Bakersfield	SR-58,6	SFR	B (67)	Backyard	10/10/11 – 10/11/11	13:38	28	06:00	64
LT19	1330 Richland Street, Bakersfield	SR-58,5	SFR	B (67)	Backyard	10/10/11 – 10/11/11	16:31	25	17:00	61
LT20	1111 Snyder Lane, Bakersfield	SR-58,6	SFR	B (67)	Backyard	10/10/11 – 10/11/11	12:22	29	18:00	63

Notes:

1. SFR – Single-family residential; MFR – Multi-family residential.
2. According to Caltrans Traffic Noise Analysis Protocol.
3. Measurement did not capture a full 24 hour period of reliable data.

Table 6-2. Long-Term Noise Measurement Results (Cont.)

Site No.	Street Address, City	Area	Land Use[1]	Noise Abatement Category (Criterion)[2]	Meter Location	Meas. Dates	Start Time	Duration, No. of Hours	Peak Hour Time	Measured Peak Hour L_{eq}, dBA
LT21	1001 Snyder Lane, Bakersfield	SR-58,6	SFR	B (67)	Backyard	10/27/11 – 10/28/11	11:54	25	07:00	63
LT22	522 Fig Street, Bakersfield	SR-58,5	SFR	B (67)	Backyard	10/13/11 – 10/14/11	09:27	27	07:00	63
LT23	108 Milham Drive, Bakersfield	SR-58,7	SFR	B (67)	Backyard	10/13/11 – 10/14/11	08:36	28	16:00	72
LT24	125 Madison Street, Bakersfield	SR-58,8	SFR	B (67)	Backyard	10/13/11 – 10/14/11	08:53	27	07:00	69
LT26	28 Wetherley Drive, Bakersfield	SR-99,7	SFR	B (67)	Backyard	10/27/11 – 10/28/11	09:26	27	05:00	57
LT27	320 Wetherley Drive, Bakersfield	SR-99,7	SFR	B (67)	Backyard	10/27/11 – 10/28/11	09:56	26	07:00	59
LT28	3311 Chester Lane, Bakersfield	SR-99,7	SFR	B (67)	Backyard	10/27/11 – 10/28/11	10:36	26	07:00	60
LT29	3515 Brian Way, Bakersfield	SR-99,11	SFR	B (67)	Side Yard	10/27/11 – 10/28/11	11:23	27	07:00	68
HNTB-LT1	3152 Terrell Court, Bakersfield	SR-99,5	SFR	B (67)	Backyard	01/14/10 – 01/15/10	08:31	24	17:00	68
HNTB-LT3	307 South Oleander Avenue, Bakersfield	SR-58,4	SFR	B (67)	Backyard	01/11/10 – 01/12/10	10:18	24	06:00	63

Notes:

1. SFR – Single-family residential; MFR – Multi-family residential.
2. According to Caltrans Traffic Noise Analysis Protocol.

6.3. Traffic Noise Model Calibration

Noise measurements for the noise model calibration were conducted with simultaneous traffic counts at 14 locations by Parsons personnel in October of 2011 and at one location by another consultant in January of 2010. These measurements were additionally conducted to calibrate the TNM 2.5. Concurrent with the measurements, traffic volumes were recorded by video camera and/or by a manual count. Traffic speeds were recorded with a radar gun. Traffic counts were tabulated according to three vehicle types: automobiles, medium trucks (2-axle with 6-wheels but not pick-up trucks), and heavy trucks (3 or more axles). As a general rule, the noise model is considered calibrated if the measured noise levels versus the modeled noise levels (using field collected traffic data) agree within 2 dB. If differences are more than 2 dB, refinement of the noise model is performed until there is agreement between the two values. If after thorough re-evaluation, calibration still cannot be achieved because of complex topography or other unusual circumstances, then a calibration constant ("K" factor) is added such that the measured versus modeled values agree before any predictions can be made with the model.

Table 6-3 summarizes the calibration results of 15 short-term and long-term measurement locations. The traffic volumes used in the calibration process are in Appendix E. Out of the 15 measurement sites, six calibration factors, or "K" factors, have been applied to the noise model results for the areas acoustically represented by the six measurement sites. Tables H-1 through H-10 in Appendix H show the "K" factors applied and to which receivers. The following explains possible causes of the noise level differences at the six sites where "K" factors were applied:

- The calibration or "K" factor of -2.0 dB was applied to the areas that have similar acoustical and geometrical characteristics to measurement site LT11. This calibration factor is needed possibly due to the existing soundwall between the highway and the measurement site. The existing soundwall is potentially not as effective in the model as it is in the real world. This adjustment factor, labeled K4 in Appendix H, was applied to Receivers R99-7 through R99-10A.
- The calibration or "K" factor of -2.0 dB was applied to the areas that have similar acoustical and geometrical characteristics to measurement site LT12. The need for this calibration factor is most likely due to the traffic volumes used on Wible Road which were estimated because the traffic was not counted during the noise measurement. This adjustment factor, labeled K5 in Appendix H, was applied to Receivers R99-11 and R99-12.
- The calibration or "K" factor of +2.0 dB was applied to the areas that have similar acoustical and geometrical characteristics to measurement site LT13. This calibration factor is needed possibly due to the existing soundwall between the highway and the measurement site being more effective in the model compared to the real world. This adjustment factor, labeled K6 in Appendix H, was applied to Receivers R99-21 through R99-25.
- The calibration or "K" factor of -1.0 dB was applied to the areas that have similar acoustical and geometrical characteristics to measurement site LT20. This calibration

factor is needed in the noise model most likely due to the dense vegetation and canal located between the highway and the measurement site. This adjustment factor, labeled K1 in Appendix H, was applied to Receivers R58-74 and R58-76 through R58-79.

- A calibration or "K" factor of +2.0 dB was applied to the areas that have similar acoustical and geometrical characteristics to measurement site LT23. This calibration factor is needed to account for the elements that effect sound propagation not accounted for in the noise model due to unknown reasons. This adjustment factor, labeled as K2 in Appendix H, was applied to Receivers R58-111 through R58-116, R58-118, and R58-121.
- A calibration or "K" factor of -2.0 dB was applied to the residences that have similar acoustical and geometrical characteristics to measurement site ST31. This calibration factor is needed to account for the elements that effect sound propagation not accounted for in the noise model due to unknown reasons. This adjustment factor, labeled as K3 in Appendix H, was applied to Receivers R58-136, R58-137, R58-139 through R58-141, and R58-143.

Table 6-3. Noise Model Calibration Results

Measurement Site	Modeled Rec. No.	Date	Start Time	Noise Levels, $L_{eq(h)}$, dBA		Deviation, dB	Applied Adjustment, dB
				Measured	Modeled		
LT11	R99-7	10/25/11	11:40	59.8	61.4	1.6	-2.0
LT12	R99-11	10/25/11	13:20	58.6	60.8	2.2	-2.0
LT13	R99-24			63.1	61.0	-2.1	+2.0
ST14	R99-19A			61.5	61.7	0.2	0.0
LT15	R58-21	10/12/11	13:40	64.5	64.8	0.3	0.0
LT16	R58-10			63.8	63.8	0.0	0.0
ST21A	R58-36	10/11/11	10:40	65.7	66.3	0.6	0.0
LT19	R58-47	10/11/11	11:40	56.2	56.3	0.1	0.0
LT20	R58-79			59.7	61.2	1.5	-1.0
ST23	R58-72			62.4	63.4	1.0	0.0
LT22	R58-64	10/13/11	10:00	62.0	61.8	-0.2	0.0
LT23	R58-111	10/13/11	10:40	71.3	69.0	-2.3	+2.0
LT24	R58-147			68.4	68.4	0.0	0.0
ST31	R58-136			68.7	70.5	1.8	-2.0
HNTB-LT3	R58-39	01/11/10	10:29	58.1	59.0	0.9	0.0

Source: Parsons, HNTB

Chapter 7. Future Noise Environment, Impacts, and Considered Abatement

This noise study was conducted to determine future traffic noise impacts of the proposed project at frequent human use areas within the highway corridor. The future worst case traffic noise impact at frequent outdoor human use areas along the project corridor was modeled for the No-Build alternative and the three build alternatives, in order to determine appropriate abatement measures. This section discusses the future noise environment and feasible noise abatement measures for impacted locations.

7.1. Future Noise Environment and Impacts

Tables in Appendix H summarize traffic noise levels for the existing and design-year No-Build condition as well as for design-year Build Alternatives A, B, and C. Predicted design-year traffic noise levels with the project are compared to existing conditions and to the design-year no-project conditions. The comparison to existing conditions is included in the analysis to identify traffic noise impacts under Title 23 CFR 772. The comparison to no-project conditions indicates the direct effect of the project. Noise receivers that were not also noise measurement sites have been estimated. The estimated existing noise levels are calculated from the No-Build noise levels of that receiver based on the difference between the No-Build and near-by representative measured existing noise levels.

As stated in the TeNS, modeling results are rounded to the nearest decibel before comparisons are made. In some cases, this can result in relative changes that may not appear intuitive. An example would be a comparison between sound levels of 64.4 and 64.5 dBA. The difference between these two values is 0.1 dB. However, after rounding, the difference is reported as 1 dB.

Modeling results in Appendix H indicate that predicted traffic noise levels ($L_{eq[h]}$) for the design-year with-project conditions approach or exceed the NAC of 67 dBA for Activity Category B and C land uses at most of the residences and parks throughout the study corridor. Therefore, traffic noise impacts are predicted to occur at Activity Category B, C, and E land uses within the project area. Accordingly, noise abatement must be considered at those locations.

7.2. Preliminary Noise Abatement Analysis

In accordance with Title 23 CFR 772, noise abatement is considered where traffic noise impacts are predicted in areas of frequent human use that would benefit from a lowered noise level. Potential noise abatement measures identified in the Protocol include the following:

- Constructing noise barriers
- Using traffic management measures to regulate types of vehicles and speeds
- Avoiding the impact by using design alternatives, such as altering the horizontal and vertical alignment of the project
- Acquiring property to serve as a buffer zone
- Acoustically insulating public-use or nonprofit institutional structures.

These abatement options have been considered; however, because of the constrained configuration and suburban location of the project, abatement in the form of soundwalls is the only abatement measure considered to be feasible. Noise barrier analysis was conducted by placing soundwalls at the highway mainline shoulders, on/off-ramp shoulders, and right-of-way lines.

Each noise barrier has been evaluated for feasibility based on achievable noise reduction (5 dB or more). For each noise barrier determined to be acoustically feasible, reasonable cost allowances were calculated. Tables in Appendix H summarize the existing noise levels as well as predicted future noise levels at receiver locations for soundwalls with heights ranging from 8 to 16 feet.

The Caltrans acoustical design goal must be met for a noise barrier to be considered reasonable. The design goal is that a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefitted receivers. Also, the estimated cost to build the noise barrier should be equal to or less than the total cost allowance of benefited receivers calculated for the barrier to be considered reasonable from a cost perspective. The cost calculations of the noise barrier should include all items appropriate and necessary for construction of the barrier, such as traffic control, drainage modification, retaining walls, and other items. Construction cost estimates are not provided in this NSR, but are presented in the Noise Abatement Decision Report (NADR). The NADR is a design responsibility and is prepared to compile information from the NSR, other relevant environmental studies, and design considerations into a single, comprehensive document before public review of the project. The NADR is prepared by the project engineer after completion of the NSR and prior to publication of the draft environmental document. The NADR includes noise abatement construction cost estimates that have been prepared and signed by the project engineer based on site-specific conditions. Construction cost estimates are compared to reasonableness allowances in the NADR to identify which wall configurations are reasonable from a cost perspective.

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 location specific noise abatement will be made upon completion of the project design.

The analysis was conducted with barrier heights ranging from 8 to 16 feet. The barrier heights and locations were evaluated first to determine if a minimum 5 dB attenuation at the outdoor frequent use areas of the representative receivers could be achieved, then second, to determine if a minimum 7 dB attenuation at one of the benefitted receivers could be achieved. The reason for limiting the maximum soundwall height to 16 feet above the ground line is to comply with the suggestions set forth by the Highway Design Manual (Caltrans, 2007). The minimum barrier height required to cut the line-of-sight from each receiver to the exhaust stacks of heavy trucks has been calculated for all feasible barriers. These heights were evaluated through calculations performed by TNM 2.5.

Minimum heights and locations of the soundwalls that provide feasible abatement are shown in Appendix A.

The following discussion considers six general areas of the corridor where feasible abatement was considered:

- Centennial Corridor West of State Route 99 – Alternative A
- Centennial Corridor West of State Route 99 – Alternative B
- State Route 58 East of State Route 99 – Alternatives A, B, and C
- State Route 99 South of State Route 58 – Alternatives A, B, and C
- State Route 99 North of State Route 58 – Alternative C
- Westside Parkway – Calloway to Coffee

Tables 7-1 through 7-56 summarize the data used to assess the abatement cost allowances at each of the considered barrier heights. The following subsections present predicted future traffic noise levels at various receivers and abatement measures for the three alternatives. Predicted noise levels are shown in Appendix H, and tables showing top-of-wall heights and locations of feasible soundwalls are included in Appendix I. A summary of feasible soundwalls including protected receivers, type and number of benefitted receivers, barrier locations, height and length of barrier, and the reasonable cost allowance are presented in Appendix J.

7.2.1. Centennial Corridor West of State Route 99 – Alternative A

Alternative A would run from the existing SR-58/SR-99 interchange to join the east end of the Westside Parkway between the Mohawk Street and Coffee Road interchanges. No outdoor frequent use areas are located west of Truxtun Avenue; hence, the noise study for Alternative A of the Centennial Corridor stretches between Truxtun Avenue and SR-99. Existing noise levels in this area range from 50 to 73 dBA. The future predicted noise levels range from 59 to 75 dBA, which either approach or exceed the NAC for Category B or have noise increases of 12 dB or more at most of the locations; therefore, consideration of noise abatement is required. Traffic noise impacts are identified for 67 Category B receivers which represent 62 single-family residences, 114 multi-family residences, and the recreational area of two apartment complexes. Table J-1 in Appendix J presents the type and number of benefitted land uses, barrier locations and heights, and the total reasonable allowance for each feasible soundwall.

Soundwall S469: Soundwall S469 would be located at the edge of shoulder of the westbound Centennial Corridor just south of the intersection of Truxtun Avenue with Mohawk Street. Traffic noise impacts are predicted within the outdoor frequent use areas of eight multi-family residences at the Creekside Apartments represented by Receivers RA-1 and RA-4 and their common outdoor use area represented by Receivers RA-2 and RA-3. This soundwall would meet the feasibility requirement by providing 5 dB or more reduction at Receiver RA-3 that represents the common outdoor use area of the apartment complex but would not meet the design goal of a 7 dB traffic noise reduction. Eight multi-family residences represented by Receivers RA-1 and RA-4 would be located behind Soundwall S469; however, feasible noise abatement was not possible due to high traffic volume on Mohawk Street. Table 7-1 summarizes predicted

soundwall performance and associated cost allowance information. Figure 1 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement.

Table 7-1. Summary of Reasonableness Determination Data – Alternative A – Soundwall S469

Barrier I.D.: S469	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	N/A	1	1	1
Reasonable Allowance Per Benefited Receiver	N/A	N/A	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	N/A	$55,000	$55,000	$55,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S474: Soundwall S474 would be located at the edge of shoulder of the eastbound Centennial Corridor. This soundwall would tie into a solid 3-foot high safety barrier on the proposed eastbound Centennial Corridor overcrossing of Truxtun Avenue and ties into another solid 3-foot high safety barrier at the other end on the overcrossing of Lennox Avenue. The solid 3-foot high safety barriers along the shoulder are considered in the noise impact analysis and they must be kept for noise reduction in addition to the safety related issues. A substantial (12 dB increase in traffic noise level) noise increase would occur within the outdoor frequent use areas of seven single-family residences represented by Receivers RA-6 through RA-8, 66 multi-family residences represented by Receivers RA-11 through RA-24 and RA-27, and one recreational area represented by Receiver RA-25. This soundwall would provide 5 dB or more of traffic noise reduction to seven single-family, 62 multi-family residences as well as one recreational area behind it. Soundwall S474 would also meet the design goal by providing at least 7 dB in traffic noise reduction to Receivers RA-12 and RA-12A as well as Receivers RA-13A though RA-18A. Four multi-family residences represented by Receiver RA-27 would be located behind Soundwall S474; however, feasible noise abatement was not possible for these units. Raising Soundwall S474 to 16 feet would not provide 5 dB in traffic noise reduction for this receiver. Table 7-2 summarizes predicted soundwall performance and associated cost allowance information. Figure 1 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-2. Summary of Reasonableness Determination Data – Alternative A – Soundwall S474

Barrier I.D.: S474	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	25	64	72	72
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$1,375,000	$3,520,000	$3,960,000	$3,960,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S499: Soundwall S499 would be located at the edge of shoulder of the westbound Centennial Corridor just south of the intersection of California with Lennox Avenues. The western part of the soundwall would be located on top of the proposed retaining wall and would tie into a solid 3-foot high safety barrier on the proposed westbound Centennial Corridor

overcrossing of California Avenue. The solid 3-foot high safety barrier along the shoulder is considered in the noise impact analysis and it must be kept for noise reduction in addition to the safety related issues. Substantial (12 dB increase in traffic noise level) noise impacts are predicted within the outdoor frequent use areas of 37 multi-family residences represented by Receivers RA-28 through RA-32, RA-36, and RA-37 as well as three single-family residences represented by Receivers RA-38 and RA-39. This soundwall would provide 5 dB or more of traffic noise reduction at impacted receivers and would extend beyond the east end of the proposed Business Center Drive overcrossing to provide feasible traffic noise reduction to the outdoor frequent use areas of the single family residences represented by Receivers RA-38 and RA-39. Soundwall S499 would also meet the design goal by providing at least 7 dB in traffic noise reduction at several locations. Table 7-3 summarizes predicted soundwall performance and associated cost allowance information. Figure 2 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-3. Summary of Reasonableness Determination Data – Alternative A – Soundwall S499

Barrier I.D.: S499	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	9	30	47	54	54
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$495,000	$1,650,000	$2,585,000	$2,970,000	$2,970,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S526: Soundwall S526 would be located at the edge of shoulder of the eastbound Centennial Corridor just south of Stockdale Highway and then follows the right of way line near the connector to southbound SR-99 just east of the proposed eastbound overcrossing of the Centennial Corridor of Real Road then it proceeds west between the existing infiltration basin and residences it protects. A portion of this soundwall would be located on top of the proposed retaining wall and would tie into a solid 3-foot high safety barrier on the proposed retaining wall and Centennial Corridor overcrossing of California Avenue. This safety barrier also runs along the edge of the eastbound shoulder and ties into Soundwall S474. The solid 3-foot high safety barrier along the shoulder is considered in the noise impact analysis and must be kept for noise reduction in addition to the safety related issues. Traffic noise impacts are predicted within the outdoor frequent use areas of a single-family residence represented by Receiver RA-64 and a substantial (12 dB increase in traffic noise level) noise increase would occur within the outdoor frequent use area of 40 single family residences represented by Receivers RA-50, RA-51, RA-54, RA57 through RA-62, RA-66, RA-67 and RA-69 through RA-77, and at three multi-family residences represented by Receiver RA-65. This soundwall would meet the feasibility requirement by providing 5 dB or more of traffic noise reduction at impacted receivers except for Receiver RA-77. Raising Soundwall S526 to 16 feet would not provide 5 dB in traffic noise reduction for this receiver. Soundwall S526 would also meet the design goal by providing 7 dB in traffic noise reduction to five single-family residences. Table 7-4 summarizes predicted soundwall performance and associated cost allowance information. Figures 2, 3, and 4 in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-4. Summary of Reasonableness Determination Data – Alternative A – Soundwall S526

Barrier I.D.: S526	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	31	44	52	54
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$1,705,000	$2,420,000	$2,860,000	$2,970,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S531: Soundwall S531 would be placed at the edge of shoulder of the westbound Centennial Corridor just south of McDonald Way. Traffic noise impacts are predicted within the outdoor frequent use areas of 11 single-family residences represented by Receivers RA-41 through RA-47 and RA-49. This soundwall would provide 5 dB or more of traffic noise reduction at 11 impacted receivers. Soundwall S531 would also meet the design goal by providing at least 7 dB in traffic noise reduction to Receiver RA-44. Table 7-5 summarizes predicted soundwall performance and associated cost allowance information. Figure 3 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and to meet the design goal.

Table 7-5. Summary of Reasonableness Determination Data – Alternative A – Soundwall S531

Barrier I.D.: S531	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	1	7	11	11	11
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$55,000	$385,000	$605,000	$605,000	$605,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Areas without Noise Abatement

7.2.2. Centennial Corridor West of State Route 99 – Alternative B

Alternative B would run from the existing SR-58/SR-99 interchange to join the east end of the Westside Parkway between the Mohawk Street and Coffee Road interchanges. No outdoor frequent use areas are located west of California Avenue; hence, the noise study for Alternative B of Centennial Corridor stretches between California Avenue and SR-99. Existing noise levels in this area range from 51 to 73 dBA. The future predicted noise levels ranges from 60 to 77 dBA, which in most cases either approach or exceed the NAC for Categories B and C or have noise increases of 12 dB or more; therefore, consideration of noise abatement is required. Traffic noise impacts are identified for 60 Category B and C receivers which represent 113 single-family residences, 15 multi-family residences and a park. Table J-2 in Appendix J presents the type and number of benefitted land uses, barrier locations and heights, and the total reasonable allowance for each feasible soundwall.

Areas with Noise Abatement

Soundwalls S509 and S519: Soundwall S509 would be placed at the edge of shoulder of the southbound Centennial Corridor at the north end of the proposed structure of California Avenue, whereas Soundwall S519 would follow the right-of-way line between Marella Way and Montclair Street where it would overlap with Soundwall S509. A portion of Soundwall S509 would be located on top of the proposed retaining wall and the overcrossing of California Avenue and would tie into a solid 3-foot high safety barrier that runs along the edge of shoulder of the southbound Centennial Corridor between California Avenue and Commerce Drive. The solid 3-foot high safety barrier along the shoulder is considered in the noise impact analysis and must be kept for noise reduction in addition to the safety related issues. Substantial (12 dB increase in traffic noise level) traffic noise impacts are predicted within the outdoor frequent use areas of 15 multi-family residences and 14 single-family residences represented by Receivers RB-36, RB-37, RB-39 through RB-42, and RB-44. Soundwalls S509 and S519, as a system, would meet the feasibility requirement by providing 5 dB or more of traffic noise reduction at impacted receivers in addition to Stockdale Christian School which is not impacted. Soundwalls S509 and S519 would also meet the design goal by providing more than 7 dB in traffic noise reduction at several locations. Table 7-6 summarizes predicted soundwall performance and associated cost allowance information. Figures 1 and 2 in Appendix A show the minimum length and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-6. Summary of Reasonableness Determination Data – Alternative B – Soundwalls S509 and S519

Barrier I.D.: S509 & S519	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	6	15	28	29	29
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$330,000	$825,000	$1,540,000	$1,595,000	$1,595,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S518: Soundwall S518 would be located at the edge of shoulder of the northbound Centennial Corridor just south of California Avenue then follows the right-of-way line between Montclair Avenue and Marella Way. Substantial (12 dB increase in traffic noise level) traffic noise impacts are predicted within the outdoor frequent use areas of 11 single-family residences represented by Receivers RB-5, RB-7, RB-8, RB-10, RB-11, RB-15 and RB-16. This soundwall would meet the feasibility requirement by providing 5 dB or more reduction to impacted receivers except for two single-family residences represented by Receiver RB-16 where feasible noise abatement was not possible. Soundwall analysis summarized in Table H-2 demonstrates that increasing the height of the Soundwall S518 would not provide 5 dB of feasible noise reduction at these impacted residences. Failure to achieve a 5 dB in noise reduction at Receiver RB-16 is attributed to the absence of abatement at the Marella Way overcrossing, exposing the receiver to Centennial Corridor traffic. Soundwall S518 would also meet the design goal by providing at least 7 dB reduction at several locations. Table 7-7 summarizes predicted soundwall performance and associated cost allowance information. Figures 1 and 2 in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-7. Summary of Reasonableness Determination Data – Alternative B – Soundwall S518

Barrier I.D.: S518	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	8	10	18	19
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$440,000	$550,000	$990,000	$1,045,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S529: Soundwall S529 would follow the right-of-way line along the southbound side of the Centennial Corridor between Marella Way and La Mirada Drive where it ties into the overcrossing embankment. Centennial Park and the outdoor frequent use areas of three single - family residences that are located behind this soundwall would be substantially impacted; however, Soundwall S529 would meet the feasibility requirement by providing 5 dB in traffic noise reduction to three single-family residence represented by Receivers RB-49 and RB-50 but would not meet the design goal of providing 7 dB or more in traffic noise reduction to any receiver. Raising Soundwall S529 along the right-of-way line between the two overcrossings would not provide 5 dB or more of traffic noise reduction at Receiver RB-46 that represents the park. The failure to achieve a 5 dB noise reduction at Receiver RB-46 is attributed to the absence of abatement at the Marella Way overcrossing, which causes exposure of the receiver to the Corridor traffic. Table 7-8 summarizes predicted soundwall performance and associated cost allowance information. Figure 2 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement.

Table 7-8. Summary of Reasonableness Determination Data – Alternative B – Soundwall S529

Barrier I.D.: S529	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	2	3	3	3
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$110,000	$165,000	$165,000	$165,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S530: Soundwall S530 would follow the right-of-way line along the northbound side of the Centennial Corridor between Marella Way and the La Mirada Drive overcrossings. This soundwall would meet the feasibility requirement by providing 5 dB or more reduction to impacted Receivers RB-19, RB-19A, and RB-20 that represent the frequent outdoor use area of eight single-family residences. Soundwall S530 would also meet the design goal by providing 7 dB in traffic noise reduction at Receiver RB-20. Table 7-9 summarizes predicted soundwall performance and associated cost allowance information. Figure 2 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement.

Table 7-9. Summary of Reasonableness Determination Data – Alternative B – Soundwall S530

Barrier I.D.: S530	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	5	8	8	8
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$275,000	$440,000	$440,000	$440,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwalls S536, S544, and S552: Soundwalls S536, S544, and S552 would act as a system. S536 would be located along the right-of-way line while S544 and S552 at the edge of shoulder along the northbound side of the Centennial Corridor. Substantial (12 dB increase in traffic noise level) traffic noise impacts are predicted within the outdoor frequent use areas of 19 single-family residences represented by Receivers RB-22 through RB-24 and RB-26 through RB-32. Soundwall S536 would tie into the berm at the La Mirada Drive overcrossing providing at least 5 dB in traffic noise abatement to four single-family residences represented by Receivers R-B22 through RB-24 and would overlap with Soundwall S544 located on the shoulder. Soundwall S544, together with Soundwall S552 that is located on the retaining wall at the edge of shoulder of the northbound Centennial Corridor, would provide at least 5 dB in traffic noise reduction to 15 single-family residences. The solid 3-foot high safety barrier on the edge of the structure is considered in the noise impact analysis and must be kept for noise reduction in addition to the safety related issues. Soundwall system S536, S544, and S552 would meet the design goal by providing at least 7 dB in traffic noise reduction at several locations. Table 7-10 summarizes predicted soundwall performance and associated cost allowance information. Figures 2 and 3 in Appendix A show the minimum length and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-10. Summary of Reasonableness Determination Data – Alternative B – Soundwalls S536, S544, and S552

Barrier I.D.: S536, S544, & S552	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	4	12	16	22	22
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$220,000	$660,000	$880,000	$1,210,000	$1,210,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwalls S537 and S555: Soundwalls S537 and S555 which work as a system would be located at the southbound side of the Centennial Corridor on the right-of-way line and the edge of shoulder then it proceeds west between the existing infiltration basin and residences it protects. Soundwall S537 would tie into the berm at the La Mirada overpass and continues following the right-of-way to overlap with Soundwall S555. Traffic noise impacts are predicted within the outdoor frequent use areas of 19 single-family residences represented by Receivers RB-61, RB-64, RB-65, RB-67, RB-69 through RB-71, RB-73, and RB-74 where traffic noise impacts would approach or exceed NAC. Substantial (12 dB increase in traffic noise level) traffic noise impacts are predicted within the outdoor frequent use areas of 38 single-family

residences represented by Receivers RB-53 through RB-55, RB-57, RB-59 through RB-60, RB-75 through RB-77, RB-79 through RB-82, RB-84 through RB-87. Soundwalls S537 and S555 would meet the feasibility requirement by providing 5 dB or more of traffic noise reduction at impacted residences except for six single-family residences represented by Receivers RB-65, RB-67, and RB-69. Soundwall S555 on the edge of shoulder would not provide 5 dB or more of traffic noise reduction at these receivers. The failure to achieve a 5 dB noise reduction at those receivers is attributed to their exposure to the high traffic volume on Stockdale Highway which hinders the efficiency of the shoulder soundwall. Soundwalls S537 and S555 would also meet the design goal by providing more than 7 dB in traffic noise reduction at several locations. Table 7-11 summarizes predicted soundwall performance and associated cost allowance information. Figures 2, 3, and 4 in Appendix A show the minimum length and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-11. Summary of Reasonableness Determination Data – Alternative B – Soundwalls S537 and S555

Barrier I.D.: S537 & S555	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	14	31	47	52	58
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$770,000	$1,705,000	$2,585,000	$2,860,000	$3,190,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Areas without Noise Abatement

Receivers RB-34 and RB-35: Traffic noise impacts would occur at the frequent outdoor use areas of four first row single-family residences along the northbound side of the Centennial Corridor just north of Stockdale Highway. These impacts would occur despite the addition of new Soundwalls S544 and S552 along the northbound shoulder of the Centennial Corridor and the shoulder of the connector to northbound SR-99. Soundwall system S544 and S552 would not provide 5 dB or more of traffic noise reduction at these residences because of the high traffic volume on Stockdale Highway. Figure 3 in Appendix A shows these receivers.

7.2.3. State Route 58 East of State Route 99 – Alternatives A, B, and C

The future predicted traffic noise levels in this segment range from 57 to 79 dBA, which contains values that exceed the NAC for Categories B and C at most of the receiver locations; therefore, consideration of noise abatement is required for all impacted receivers. None of the Category C receivers were impacted by traffic noise levels in this area. However, a total of 293 Category B receivers were impacted by traffic noise levels for Alternatives A and B. A total of 289 Category B receivers were impacted by traffic noise levels for Alternative C. Traffic noise impacts for single-family residences are identified for 219 frequent outdoor use areas for Alternatives A and B; however, 220 single-family residences were impacted by traffic noise levels under Alternative C. For Alternatives A and B, 50 multi-family residential units were impacted by traffic noise levels while 45 multi-family residential units were impacted by Alternative C. All three alternatives exhibited traffic noise levels that would impact 22 mobile homes. Tables J-3, J-4, and J-5 in Appendix J present the type and number of benefitted land uses, barrier locations and heights, and the total reasonable allowance for each feasible soundwall for Alternatives A, B, and C, respectively.

Stationing and barrier identifications are identical between Alternatives A and B with the exception of one barrier location. Although Alternative C uses a separate stationing convention, several soundwalls under this alternative fall into an identical placement with Alternatives A and B. These cases will be specifically noted where applicable.

Areas with Noise Abatement

Soundwall S45 (Alternatives A and B): Soundwall S45 would be located on the right-of-way line along the westbound lanes of SR-58 between Hughes Lane and SR-99. This soundwall would meet the feasibility requirement by providing 5 dB or more of traffic noise reduction to impacted receivers. Five multi-family and 17 single-family residences represented by Receivers R58-1 through R58-10 would benefit from this soundwall. Soundwall S45 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Due to major design differences between Alternatives A and B versus Alternative C, Soundwall S45 and Receivers R58-1 and R58-2 are not present in Alternative C. For Alternative C, Soundwalls S103 and S109 protect the remaining impacted receivers representing residences that would not be demolished. Tables 7-12 and 7-13 summarize the predicted soundwall performance and associated cost allowance information for Alternatives A and B, respectively. Figures 4 and 5 in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-12. Summary of Reasonableness Determination Data – Alternative A – Soundwall S45

Barrier I.D.: S45	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	13	19	22	22	22
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$715,000	$1,045,000	$1,210,000	$1,210,000	$1,210,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-13. Summary of Reasonableness Determination Data – Alternative B – Soundwall S45

Barrier I.D.: S45	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	8	19	20	22	22
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$440,000	$1,045,000	$1,100,000	$1,210,000	$1,210,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S103 and Soundwall S109 (Alternative C): Under Alternative C, Receivers R58-1 and R58-2 represent residences that would be demolished and therefore are not included in the future build traffic noise analysis. Soundwalls S103 and S109 act together as a system and are required to provide feasible traffic noise abatement to 14 single-family houses represented by

Receivers R58-4 and R58-6 through R58-10. Receiver R58-5, representing the frequent outdoor use areas of two single-family residences, was not able to achieve a reduction in traffic noise levels of at least 5 dB for soundwall configurations along the right-of-way and/or roadway shoulder. This is most likely because of traffic noise contributions due to the position of the elevated structure of the proposed Centennial Corridor lanes. Figure 4 in Appendix A shows this receiver. Soundwall S103 would be located at the top of the retaining wall structure near the right-of-way line starting approximately 300 feet west of Myrtle Street and extending to Dixon Avenue. Soundwall S109 would be located on the right-of-way line between Dixon Avenue and Hughes Lane. Both soundwalls follow stationing of the westbound SR-58 connector to northbound SR-99. These soundwalls would meet feasibility requirements by providing 5 dB or more of traffic noise reduction. In addition, the design goal of 7 dB would also be met by these soundwalls. Table 7-14 summarizes the predicted soundwall performance and associated cost allowance information. Figures 4 and 5 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-14. Summary of Reasonableness Determination Data – Alternative C – Soundwalls S103 and S109

Barrier I.D.: S103 & S109	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	12	13	13	14	14
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$660,000	$715,000	$715,000	$770,000	$770,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S88 (Alternative A), Soundwall S194 (Alternative B), and Soundwall S90 (Alternative C): Soundwalls S88 and S194 would follow the shoulder along the northbound SR-99 to eastbound SR-58 connector from the Wible Road overcrossing to the eastbound SR-58 H Street off-ramp overcrossing. Soundwalls S88 and S194 would meet feasibility requirements by providing 5 dB or more of traffic noise reduction to 12 single-family residences represented by Receivers R58-11 through R58-13 and R58-15 through R58-17. For Alternative C, design differences in the grading and the profile of the northbound SR-99 to eastbound SR-58 connector allow for Soundwall S90 to transition from the edge of shoulder to the right-of-way line toward the east end of the soundwall. Furthermore, although a gap exists between Soundwalls S90 and S106, there is a 5 to 15-foot high retaining wall in addition to the safety barrier along the shoulder of the Centennial Corridor H Street exit ramp, which blocks traffic noise. Soundwall S90 would provide feasible abatement to 13 impacted single-family residences, represented by Receivers R58-11 through R58-13 and R58-15 through R58-18, by providing at least a 5 dB reduction in traffic noise levels. Additionally, the design goal of a 7 dB reduction of traffic noise levels would also be met at several receivers by each of the three soundwalls. Tables 7-15, 7-16, and 7-17 summarize the predicted soundwall performance and associated cost allowance information for Alternatives A, B, and C, respectively. Figures 4 and 5 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-15. Summary of Reasonableness Determination Data – Alternative A – Soundwall S88

Barrier I.D.: S88	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	3	12	12	12
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$165,000	$660,000	$660,000	$660,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-16. Summary of Reasonableness Determination Data – Alternative B – Soundwall S194

Barrier I.D.: S194	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	7	12	12	12
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$385,000	$660,000	$660,000	$660,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-17. Summary of Reasonableness Determination Data – Alternative C – Soundwall S90

Barrier I.D.: S90	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	4	9	13	13
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$220,000	$495,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S106 (Alternatives A and B): Soundwall S106 would be located on the right-of-way line along the eastbound lanes of SR-58 between Myrtle Street and Hughes Lane. For Alternative A, this soundwall would meet the feasibility requirement by providing 5 dB or more traffic noise reduction to eight single-family residences and the pool of The Villas at Hughes Lane Apartments. The benefitted receivers for Alternative A are represented by Receivers R58-18, R58-20 through R58- 22, and R58-24A. Likewise for Alternative B, Soundwall S106 would also meet the feasibility requirement; however, differences between vertical geometries allow for non-impacted Receiver R58-19 to be benefitted by the soundwall; therefore, for Alternative B, seven additional single-family residences will be counted as benefitted receivers. For Alternative B, Soundwall S106 would provide feasible traffic noise abatement to 15 single-family residences as well as the pool of The Villas at Hughes Lane Apartments represented by Receivers R58-18 through R58- 22 and R58-24A. Soundwall S106 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Due to major design differences between Alternatives A and B versus Alternative C, Soundwall S106 is not present in Alternative

C. For Alternative C, Soundwall S610 protects impacted Receivers R58-21 through R58-24A. Tables 7-18 and 7-19 summarize the predicted soundwall performance and associated cost allowance information for Alternatives A and B, respectively. Figure 5 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-18. Summary of Reasonableness Determination Data – Alternative A – Soundwall S106

Barrier I.D.: S106	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	8	8	16	16	16
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$440,000	$440,000	$880,000	$880,000	$880,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-19. Summary of Reasonableness Determination Data – Alternative B – Soundwall S106

Barrier I.D.: S106	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	7	7	15	16	16
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$385,000	$385,000	$825,000	$880,000	$880,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S610 (Alternative C): Soundwall S610 would be located on the right-of-way line along the eastbound lanes of SR-58 between Dixon Avenue and Hughes Lane. This soundwall would meet the feasibility requirement by providing 5 dB or more traffic noise reduction to three impacted single-family residences and the pool of The Villas at Hughes Lane Apartments represented by Receivers R58-21 and R58-24A. Soundwall S610 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels to Receiver R58-21. Table 7-20 summarizes the predicted soundwall performance and associated cost allowance information for Alternative C. Figure 5 in Appendix A shows the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal.

Table 7-20. Summary of Reasonableness Determination Data – Alternative C – Soundwall S610

Barrier I.D.: S610	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	2	4	4	4	4
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$110,000	$220,000	$220,000	$220,000	$220,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S71 (Alternatives A and B) and Soundwall S629 (Alternative C): Soundwalls S71 and S629 would be located on the right-of-way line along the westbound lanes of SR-58 between Hughes Lane and H Street. Three single-family residences with outdoor use areas in front yards would be impacted with the proposed project and are represented by Receivers R58-28 and R58-33. The remaining receivers in this area represent frequent outdoor use areas that are backyards. These soundwalls would meet the feasibility requirement by providing 5 dB or more traffic noise reduction for the three impacted single-family residences. Soundwalls S71and S629 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at impacted Receiver R58-33. Tables 7-21, 7-22, and 7-23 summarize the predicted soundwall performance and associated cost allowance information for Alternatives A and B. Figures 5 and 6 in Appendix A show the minimum length and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S629 (Alternative C) will be labeled as Soundwall S71 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-21. Summary of Reasonableness Determination Data – Alternative A – Soundwall S71

Barrier I.D.: S71	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	3	10	13	13	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$165,000	$550,000	$715,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-22. Summary of Reasonableness Determination Data – Alternative B – Soundwall S71

Barrier I.D.: S71	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	3	10	10	13	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$165,000	$550,000	$550,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-23. Summary of Reasonableness Determination Data – Alternative C – Soundwall S629

Barrier I.D.: S629	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	3	10	13	13	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$165,000	$550,000	$715,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S68 (Alternatives A and B) and Soundwall S624 (Alternative C): Although there are roadway design differences between future build alternatives, Soundwalls S68 and S624 fall into the same footprint and would be located on the right-of-way line along the eastbound lanes of SR-58 between Hughes Lane and H Street. For the three future build alternatives, frequent outdoor use areas of 10 single-family residences and four multi-family residential units would be impacted with the proposed project. These soundwalls would each meet the feasibility requirement by providing 5 dB or more of traffic noise reduction for 15 frequent outdoor use areas that include 11 single-family residences and four multi-family residential units. The benefitted receivers are represented by Receivers R58-34 through R58-36, R58-37A and R58-37B, and R58-39 through R58-41. In addition, Soundwalls S68 and S624 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Tables 7-24, 7-25, and 7-26 summarize the predicted soundwall performance and associated cost allowance information for Soundwalls S68 and S624 under Alternatives A, B, and C, respectively. Figures 5 and 6 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S624 (Alternative C) will be labeled as Soundwall S68 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-24. Summary of Reasonableness Determination Data – Alternative A – Soundwall S68

Barrier I.D.: S68	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	15	15	16	16	16
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$825,000	$825,000	$880,000	$880,000	$880,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-25. Summary of Reasonableness Determination Data – Alternative B – Soundwall S68

Barrier I.D.: S68	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	15	15	15	16	16
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$825,000	$825,000	$825,000	$880,000	$880,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-26. Summary of Reasonableness Determination Data – Alternative C – Soundwall S624

Barrier I.D.: S624	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	14	15	15	16	16
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$770,000	$825,000	$825,000	$880,000	$880,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S93 (Alternatives A and B) and Soundwall S649 (Alternative C): For all future build alternatives, traffic noise impacts with the proposed project were identified for five single-family residences represented by Receivers R58-46 and R58-48. Soundwalls S93 and S649 would be located along the shoulder of the westbound SR-58 South Chester Avenue off-ramp between the ramp and the outer freeway lanes. These soundwalls would each meet the feasibility requirement by providing 5 dB or more of traffic noise reduction for seven residential frequent outdoor use areas. Soundwalls S93 and S649 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at one receiver; furthermore, it should be noted that although a shorter soundwall would achieve feasibility, the soundwall had to be raised significantly to achieve the design goal. Tables 7-27 and 7-28 summarize the predicted soundwall performance and associated cost allowance information for Soundwall S93 under Alternatives A and B and Soundwall S649 for Alternative C, respectively. Figure 6 in Appendix A shows the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S649 (Alternative C) will be labeled as Soundwall S93 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-27. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S93

Barrier I.D.: S93	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	2	5	7	7
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$110,000	$275,000	$385,000	$385,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-28. Summary of Reasonableness Determination Data – Alternative C – Soundwall S649

Barrier I.D.: S649	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	2	5	7	7
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$110,000	$275,000	$385,000	$385,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S108 (Alternatives A and B) and Soundwall S664 (Alternative C): Although there are differences in roadway elevations between future build alternatives, Soundwalls S108 and S664 both follow the edge of shoulder along the eastbound lanes of SR-58 between Chester Avenue and Union Avenue. Represented by Receivers R58-71 through R58-81 and R58-84 through R58-100, the frequent outdoor use areas of 34 single-family and 24 multi-family residences would be impacted with the proposed project for Alternatives A and B; however, under Alternative C, two single-family residences represented by Receiver R58-86 would not be impacted. Soundwall S108 would provide feasible abatement by reducing future Build Alternative A and B traffic noise levels by 5 dB or more for 34 single-family and 24 multi-family residences. Feasible abatement provided by Soundwall S664 would benefit frequent outdoor use areas of 30 single-family and 24 multi-family residences. For the three build alternatives, traffic noise impacts would occur at the frequent outdoor use area of one single-family residence along eastbound SR-58 represented by Receiver R58-71. Soundwalls S108 or S664 would not provide 5 dB or more traffic noise reduction at this residence due to an existing property wall and noise contributions from the local traffic on the frontage road between H Street and South Chester Avenue. Figure 6 in Appendix A shows this receiver. Soundwalls S108 and S664 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Tables 7-29 and 7-30 summarize the predicted soundwall performance and associated cost allowance information for Soundwall S108 under Alternatives A and B and Soundwall S664 for Alternative C, respectively. Figures 6 and 7 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S664 (Alternative C) will be labeled as Soundwall S108 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-29. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S108

Barrier I.D.: S108	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	16	49	57	58	58
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$880,000	$2,695,000	$3,135,000	$3,190,000	$3,190,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-30. Summary of Reasonableness Determination Data – Alternative C – Soundwall S664

Barrier I.D.: S664	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	17	45	57	58	58
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$935,000	$2,475,000	$3,135,000	$3,190,000	$3,190,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S107 (Alternatives A and B) and Soundwall S663 (Alternative C): Soundwalls S107 and S663 for all build alternatives would be located at the edge of shoulder and right-of-way line along the westbound lanes of SR-58. Under Alternatives A and B, the proposed project would widen the existing westbound lanes to accommodate the addition of an exit lane between Union and South Chester Avenues. Since this portion of SR-58 is elevated with respect to the receivers along westbound SR-58, a retaining wall must be added to replace portions of the existing fill slope; consequently, a safety barrier is added where a retaining wall is present. A portion of proposed Soundwall S107 would be located at the edge of shoulder where the safety barrier is placed. However, since no lane is being added to the westbound lanes of SR-58 for Alternative C, Soundwall S644 follows the existing edge of shoulder where a retaining wall and safety barrier are not needed. In the area between South Chester and Union Avenues, the residential land use north of SR-58 is broken into two distinct areas by a large commercial property and a community service center. For Alternatives A and B, Soundwall S107 would meet with Soundwall S119, but each soundwall would protect their own residential areas and receivers; likewise for Alternative C, Soundwall S663 would join with Soundwall S677 in the same manner.

For Alternatives A and B, Soundwall S107 would provide feasible abatement of at least 5 dB reduction in traffic noise levels for 18 single-family residences represented by Receivers R58-49 through R58-52, R58-54 through R58-57, and R58-59. Soundwall S663 would provide feasible abatement to the frequent outdoor use areas of 20 single-family residences represented by Receivers R58-49 through R58-52 as well as R58-54 through R58-59. The design goal will be met by Soundwalls S107 and S663 by providing at least a 7 dB reduction in traffic noise levels at several receiver locations. Table 7-31 summarizes the predicted soundwall performance and associated cost allowance information for Alternatives A and B. Table 7-32 summarizes the

predicted soundwall performance and associated cost allowance information for Alternative C. Figures 6 and 7 in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S663 (Alternative C) will be labeled as Soundwall S107 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-31. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S107

Barrier I.D.: S107	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	6	15	20	20	20
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$330,000	$825,000	$1,100,000	$1,100,000	$1,100,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-32. Summary of Reasonableness Determination Data – Alternative C – Soundwall S663

Barrier I.D.: S663	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	18	20	20	20
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$990,000	$1,100,000	$1,100,000	$1,100,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S119 (Alternatives A and B) and Soundwall S677 (Alternative C): Soundwalls S119 and S677 for all build alternatives would be placed at the edge of shoulder along the westbound lanes of SR-58. Under Alternatives A and B, the proposed project would widen the existing westbound lanes to accommodate the addition of an exit lane between Union Avenue and South Chester Avenue. Since this portion of SR-58 is elevated with respect to the receivers along westbound SR-58, a retaining wall must be added to replace portions of the existing fill slope; consequently, a safety barrier is added where a retaining wall is present. A portion of proposed Soundwall S119 would be located at the edge of shoulder where the safety barrier is placed. However, since no lane is being added to the westbound lanes of SR-58 for Alternative C, Soundwall S644 follows the existing edge of shoulder where a retaining wall and safety barrier are not needed. In the area between South Chester and Union Avenues, the residential land use north of SR-58 is broken into two distinct areas by a large commercial property. For Alternatives A and B, Soundwall S119 would meet with Soundwall S107, but each soundwall would protect their own residential areas and receivers; likewise for Alternative C, Soundwall S677 would join with Soundwall S661 in the same manner.

For Alternatives A and B as well as Alternative C, Soundwalls S119 and S677 would provide feasible abatement of at least 5 dB reduction in traffic noise levels for 12 single-family residences represented by Receivers R58-60 through R58-63, R58-65, and R58-66. The design

goal will be met by Soundwalls S119 and S677 by providing at least a 7 dB reduction in traffic noise levels at one receiver location. Soundwall S119 for both Alternatives A and B stop short of a local church because the church does not fall under either Activity Categories C or D since there are no windows directly facing the freeway. Soundwall S677 in Alternative C inadvertently protects the church to provide feasible abatement at nearby residences. Table 7-33 summarizes the predicted soundwall performance and associated cost allowance information for Alternatives A and B. Table 7-34 summarizes the predicted soundwall performance and associated cost allowance information for Alternative C. Figure 7 in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S677 (Alternative C) will be labeled as Soundwall S119 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-33. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S119

Barrier I.D.: S119	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	4	12	12	12	12
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$220,000	$660,000	$660,000	$660,000	$660,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-34. Summary of Reasonableness Determination Data – Alternative C – Soundwall S677

Barrier I.D.: S677	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	2	9	12	12	12
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$110,000	$495,000	$660,000	$660,000	$660,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwalls S147 and S165 (Alternatives A and B) and Soundwalls S703 and S721 (Alternative C): Although stationing between build alternatives varies, Soundwall S147 versus S703 as well as Soundwall S165 versus S721 fall into the same footprints. Soundwalls S147 and S703 would be located at the right-of-way line between Union Avenue and Ohio Drive along the westbound lanes of SR-58 while Soundwalls S165 and S721 would be placed at the edge of shoulder of the westbound lanes of SR-58 between Bliss Street and Cottonwood Road. With respect to their alternatives, Soundwalls S147 and S165 as well as Soundwalls S703 and S721 act together as systems in order to provide feasible abatement.

For all future build alternatives, traffic noise impacts with the proposed project were identified for 31 single-family, 10 multi-family residential units, and 22 mobile homes represented by Receivers R58-101, R58-102, R58-104, and R58-106 through R58-127. Soundwall systems S147 and S165 as well as S703 and S721 would meet the feasibility requirement by providing 5 dB or

more of traffic noise reduction for 63 impacted residential frequent outdoor use areas. These soundwalls would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Soundwalls S165 and S721 stop short of protecting St. John Baptist Church because the church does not fall under either Activity Categories C or D. Predicted soundwall performance and associated cost allowance information for Soundwalls S147 and S165 for Alternatives A and B are presented in Table 7-35. Table 7-36 summarizes the predicted soundwall performance and associated cost allowance information for Soundwalls S703 and S721 under Alternative C. Figures 8 and 9 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwalls S703 and S721 (Alternative C) will be labeled as Soundwalls S147 and S165 respectively in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-35. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S147 and S165

Barrier I.D.: S147 & S165	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	18	46	67	67	69
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$990,000	$2,530,000	$3,685,000	$3,685,000	$3,795,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-36. Summary of Reasonableness Determination Data – Alternative C – Soundwall S703 and S721

Barrier I.D.: S703 & S721	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	18	46	67	69	69
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$990,000	$2,530,000	$3,685,000	$3,795,000	$3,795,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S144 (Alternatives A and B) and Soundwall S702 (Alternative C): Although stationing between build alternatives varies, Soundwalls S144 and S702 fall into the same footprint and would be located on the right-of-way line along the eastbound lanes of SR-58. For all future build alternatives, eight single-family residences would be impacted with the proposed project and are represented by Receivers R58-128, R58-131, R58-133, R58-134, R58-136, R58-138, and R58-139. These soundwalls would meet the feasibility requirement by providing 5 dB or more of traffic noise reduction for the impacted eight single-family residences. Soundwalls S144 and S702 would also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at several locations. Receivers along Bliss Street would get 5 dB noise reduction only if Soundwalls S164 for Alternatives A and B and Soundwall S722 for Alternative C are constructed. Tables 7-37 and 7-38 summarize the predicted soundwall performance and associated cost allowance information for Soundwall S144 under Alternatives A and B and

Soundwall S702 for Alternative C, respectively. Figure 8 in Appendix A shows the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwall S702 (Alternative C) will be labeled as Soundwall S144 in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-37. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S144

Barrier I.D.: S144	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	5	8	18	18
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$275,000	$440,000	$990,000	$990,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-38. Summary of Reasonableness Determination Data – Alternative C – Soundwall S702

Barrier I.D.: S702	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	5	8	18	18
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$275,000	$440,000	$990,000	$990,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwalls S164 and S184 (Alternatives A and B) and Soundwalls S722 and S742 (Alternative C): Stationing between build alternatives varies but Soundwall S164 versus S722 as well as Soundwall S184 versus S742 fall into the same footprints. These soundwalls would be located at the edge of shoulder of the eastbound lanes of SR-58 between Union Avenue and Cottonwood Road. With respect to their alternatives, Soundwalls S164 and S184 as well as Soundwalls S722 and S742 act together as systems in order to provide feasible abatement. For all future build alternatives, the frequent outdoor use areas of 67 single-family residences and four multi-family residential units would be impacted. These soundwall pairs would meet the feasibility requirement by providing 5 dB or more traffic noise reduction for 71 impacted residences represented by Receivers R58-140 through R58-172; in addition, both soundwall pairs also meet the design goal by providing at least a 7 dB reduction in traffic noise levels at many locations. Receivers along Bliss Street would only receive a 5 dB noise reduction if Soundwall S144 for Alternatives A and B and Soundwall S702 for Alternative C are also constructed. Tables 7-39 and 7-40 summarize the predicted soundwall performance and associated cost allowance information for Soundwall S144 under Alternatives A and B and Soundwall S702 for Alternative C, respectively. Figures 8 and 9 in Appendix A show the minimum lengths and heights required for these soundwalls to provide feasible traffic noise abatement and meet the design goal. Note that to facilitate the general public, Soundwalls S722 and S742 (Alternative C) will be labeled as Soundwalls S164 and S184 respectively in the environmental document (EIR/EIS) similar to Alternatives A and B.

Table 7-39. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwalls S164 and S184

Barrier I.D.: S164 & S184	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	14	39	71	71	71
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$770,000	$2,145,000	$3,905,000	$3,905,000	$3,905,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-40. Summary of Reasonableness Determination Data – Alternative C – Soundwall S722 and S742

Barrier I.D.: S722 & S742	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	14	39	71	71	71
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$770,000	$2,145,000	$3,905,000	$3,905,000	$3,905,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Areas without Noise Abatement

Receivers R58-43 and R58-44: For all build alternatives, traffic noise impacts would occur at the frequent outdoor use areas of one single-family residence and two multi-family residential units along westbound SR-58. A soundwall placed at the right-of way would not provide 5 dB or more traffic noise reduction at these residences because of local traffic contributions from the frontage road between South Chester Avenue and H Street. Figure 6 in Appendix A shows these receivers.

Receiver R58-69: For all build alternatives, traffic noise impacts would occur at the frequent outdoor use areas of one single-family residence along eastbound SR-58. A soundwall placed at the right-of way would not provide 5 dB or more traffic noise reduction at this residence because of local traffic noise contributions from the frontage road between H Street and South Chester Avenue. Figure 6 in Appendix A shows this receiver.

7.2.4. State Route 99 South of State Route 58 – Alternatives A, B, and C

Existing noise levels at the outdoor frequent use areas along SR-99 between Wilson Road and SR-58 range from 56 to 71 dBA for Receivers R99-1 through R99-43B and R99-69 to R99-71. The predicted future build traffic noise levels in this segment range from 58 to 75 dBA under Alternatives A and B and from 58 to 77 dBA under Alternative C. Much of this range approaches or exceeds the NAC for Categories B, C, and E; therefore, consideration of noise abatement is required. Under Alternative A, traffic noise impacts are identified for 28 Category B receivers, one Category C receiver, and two Category E receivers. These impacted receivers represent outdoor use areas associated with 44 single-family residences, 15 multi-family residential units, one shared multi-family recreation facility, one daycare facility, and two

motels. Relative to Alternative A, impacts are identified at one fewer single-family residence (Category B) under Alternative B. Under Alternative C, traffic noise impacts are identified for 31 Category B receivers and two Category E receivers. Outdoor use areas associated with 43 single-family residences, 22 multi-family residential units, one shared multi-family recreation facility, and two motels are represented by these receivers. Tables J-6, J-7, and J-8 in Appendix J present the type and number of benefitted land uses, barrier locations and heights, and the total reasonable allowance for each feasible soundwall for Alternatives A, B, and C, respectively.

Areas with Noise Abatement

Soundwall S656: Soundwall S656 considered under Alternatives A and B would not provide feasible traffic noise abatement for the impacted frequent outdoor use area under Alternative C. This soundwall would be located along the west side of Wible Road on the northbound side of SR-99. The soundwall would extend just north of the egress point of the westbound Centennial Corridor connector from the SR-99 mainline northward to connect with the replace-in-kind Soundwall SW3. Traffic noise impacts are predicted within the outdoor frequent use areas of two single-family residences and one motel represented by Receivers R99-11 to R99-13.This soundwall would meet the feasibility requirements by providing 5 dB or more reduction at all three receivers but would not meet the design goal of 7 dB traffic noise reduction. Table 7-41 summarizes predicted soundwall performance and associated cost allowance information. Figures 10 and 11 for Alternatives A and B in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement.

Table 7-41. Summary of Reasonableness Determination Data – Alternatives A and B – Soundwall S656

Barrier I.D.: S656	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	2	3	3	3	3
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$110,000	$165,000	$165,000	$165,000	$165,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S661: Soundwall S661 along the southbound side of SR-99 is considered under all alternatives. The horizontal alignments under the three alternatives are similar though they differ in detail. In each case, Soundwall S661 would begin at the northern terminus of the replace-in-kind portion of SW2 at Wood Lane and veer westward to avoid the top of cut before extending northward toward its terminus at Belle Terrace.

Under Alternatives A and B, traffic noise impacts are predicted within the outdoor frequent use areas of two single-family residences represented by Receivers R99-23 and R99-25. For Alternative C, Receiver R99-25A is considered rather than Receiver R99-25 because the residence associated with the latter would be demolished under this alternative. Receiver R99-25A represents a different portion of the same residential property represented by Receiver R99-23. Accordingly, under Alternative C, traffic noise impacts are predicted within the outdoor frequent use area of only one single-family residence behind Soundwall S661.

Under all alternatives, Soundwall S661 would meet the feasibility requirements by providing 5 dB or more reduction at represented residences. However, it would not meet the design goal of 7 dB traffic noise reduction for at least one residence under any alternative. Tables 7-42 through 7-44 summarize predicted soundwall performance and associated cost allowance information. Figure 10 for each alternative in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement.

Table 7-42. Summary of Reasonableness Determination Data – Alternative A – Soundwall S661

Barrier I.D.: S661	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	N/A	2	2	2
Reasonable Allowance Per Benefited Receiver	N/A	N/A	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	N/A	$110,000	$110,000	$110,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-43. Summary of Reasonableness Determination Data – Alternative B – Soundwall S661

Barrier I.D.: S661	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	1	1	2	2
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$55,000	$55,000	$110,000	$110,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-44. Summary of Reasonableness Determination Data – Alternative C – Soundwall S661

Barrier I.D.: S661	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	N/A	N/A	1	1	1
Reasonable Allowance Per Benefited Receiver	N/A	N/A	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	N/A	$55,000	$55,000	$55,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S669: This soundwall, considered under all three alternatives, would extend north along the southbound SR-99 right-of-way line from Belle Terrace to the southern edge of the existing retention basin north of Mona Way. The barrier would then run westward along a portion of the retention basin's southern edge. Under Alternative A, traffic noise impacts are predicted within the outdoor frequent use areas of four single-family residences and one daycare facility represented by Receivers R99-40 to R99-43A. The location associated with Receiver R99-43 would be part of a partial property acquisition under Alternative B; under this alternative, the outdoor use area of the remaining residential property is represented by Receiver

R99-43C. Alternative C would require the acquisition of the daycare facility represented by Receiver R99-40 and a single-family residence represented by Receiver R99-41. This would remove two outdoor use areas but would expose the outdoor use areas of two adjacent single-family residences to increased noise exposure. Because only a portion of the property represented by Receiver R99-43 will be acquired under Alternative C; therefore, Receiver R99-43B has been used to represent the remaining outdoor use area of this property.

Soundwall S669 would meet feasibility requirements. Under Alternatives A and B, the soundwall would provide 5 dB or more reduction at impacted receivers. Soundwall S669 would provide benefit at three of the four impacted outdoor use areas under Alternative C. The soundwall would also meet the design goal of 7 dB traffic noise reduction for at least one receiver under each of the three alternatives. Tables 7-45 to 7-47 summarize predicted soundwall performance and associated cost allowance information under Alternatives A through C, respectively. Figure 10 for all three alternatives in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-45. Summary of Reasonableness Determination Data – Alternative A – Soundwall S669

Barrier I.D.: S669	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	1	2	4	4	5
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$55,000	$110,000	$220,000	$220,000	$275,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-46. Summary of Reasonableness Determination Data – Alternative B – Soundwall S669

Barrier I.D.: S669	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	4	5	5	5	5
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$220,000	$275,000	$275,000	$275,000	$275,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-47. Summary of Reasonableness Determination Data – Alternative C – Soundwall S669

Barrier I.D.: S669	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	1	1	2	3	3
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$55,000	$55,000	$110,000	$165,000	$165,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S676: Soundwall S676 is considered under all three alternatives. This soundwall would be along the east side of Wible Road. It would extend northward from south of the cul-de-sac on Terrel Court to west of the western terminus of Doresta Drive. Under Alternatives A and C, traffic noise impacts are predicted within the outdoor frequent use areas of 13 single-family residences represented by Receivers R99-31 to R99-37. Traffic noise impacts are predicted within the outdoor frequent use areas of nine single-family residences represented by Receivers R99-31 to R99-33, R99-36, and R99-37 under Alternative B. Soundwall S676 would meet the feasibility requirements by providing 5 dB or more reduction at represented receivers experiencing traffic noise impacts. The soundwall would also meet the design goal of 7 dB traffic noise reduction for at least one receiver under each alternative. Tables 7-48 to 7-50 summarize predicted soundwall performance and associated cost allowance information. Figures 10 and 4 in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-48. Summary of Reasonableness Determination Data – Alternative A – Soundwall S676

Barrier I.D.: S676	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	9	13	13	13	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$495,000	$715,000	$715,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-49. Summary of Reasonableness Determination Data – Alternative B – Soundwall S676

Barrier I.D.: S676	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	7	7	7	9	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$385,000	$385,000	$385,000	$495,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Table 7-50. Summary of Reasonableness Determination Data – Alternative C – Soundwall S676

Barrier I.D.: S676	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	11	13	13	13	13
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$605,000	$715,000	$715,000	$715,000	$715,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S683: Soundwall S683 is considered only under Alternative C because protected receivers would be demolished under the other two alternatives. The soundwall would extend eastward from the northeast boundary of a retention basin, then northward along the right-of-way line to the Payless Mini Storage property. Under Alternative C, traffic noise impacts are

predicted within the outdoor frequent use areas of one single-family residence and seven multi-family residences represented by Receivers R99-69 to R99-71. Soundwall S683 would meet feasibility requirements by providing 5 dB or more reduction at all represented receivers experiencing traffic noise impacts and would meet the design goal of 7 dB traffic noise reduction for at least one receiver under each alternative. Table 7-51 summarizes predicted soundwall performance and associated cost allowance information. Figure 4 for Alternative C in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-51. Summary of Reasonableness Determination Data – Alternative C – Soundwall S683

Barrier I.D.: S683	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	5	5	5	5	8
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$275,000	$275,000	$275,000	$275,000	$440,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall SW2: Most of existing Soundwall SW2 would be demolished under all three alternatives because of widening along the southbound side of SR-99. A portion of this soundwall would be rebuilt on top of a proposed retaining wall and can be considered as a replacement in kind. However, the northern portion of the wall demolition would accommodate a substantial widening of the existing cut. As a result, houses now protected by the existing soundwall would be demolished. Therefore, an in-kind replacement soundwall cannot be considered for this area. Accordingly, a new soundwall has been analyzed in this area. The portion of Soundwall SW2 that would be replaced in-kind extends from Laverne Avenue (Alternative A) or north of Laverne Avenue (Alternatives B and C) to Wood Lane. Traffic noise impacts are predicted within the outdoor frequent use areas of three single family residences behind the segment of Soundwall SW2 to be replaced in-kind. However, raising this soundwall beyond the in-kind replacement height would not provide an additional 5 dB or more of traffic noise reduction at any of the impacted outdoor frequent use areas. Figures 10 and 11 in Appendix A show the location and height of Soundwall SW2 under Alternatives A, B, and C.

Soundwall SW3: Soundwall SW3 would be an in-kind replacement for an existing soundwall to be demolished under Alternatives A and B because of widening along the northbound side of SR-99. The existing soundwall would remain under Alternative C. As with the existing soundwall, replacement Soundwall SW3 would be located along the west side of Wible Road south of Belle Terrace. Traffic noise impacts are predicted within the outdoor frequent use areas of one single-family residence and one motel behind Soundwall SW3. However, raising this soundwall beyond the in-kind replacement height would not provide an additional 5 dB or more of traffic noise reduction at either of the impacted outdoor frequent use areas. Figure 10 in Appendix A shows the location and height of Soundwall SW3 under Alternatives A and B.

Soundwall SW5: Soundwall SW5 would be an in-kind replacement for an existing soundwall to be demolished under Alternatives A and B because of widening along the northbound side of SR-99. The existing soundwall would remain under Alternative C. As with the existing soundwall, replacement Soundwall SW5 would be located along the west side of Wible Road

north of Belle Terrace. Traffic noise impacts are predicted within the outdoor frequent use areas of six single-family residences behind Soundwall SW5. However, raising this soundwall beyond the in-kind replacement height would not provide an additional 5 dB or more of traffic noise reduction at any of the impacted outdoor frequent use areas. The original intent of Soundwall SW5 was to provide traffic noise abatement for two multi-family buildings along Wible Road that would be demolished under all the alternatives. Figure 10 in Appendix A shows the location and height of Soundwall SW5 under Alternatives A and B.

Areas without Noise Abatement

Receiver R99-2, all Alternatives: Under all three alternatives, traffic noise impacts would occur at an outdoor use area associated with one single-family residence along the northbound side of SR-99 north of Wilson Road. The soundwall analysis summarized in Tables H-6 to H-8 demonstrates that a soundwall along the right-of-way line would not provide feasible traffic noise abatement. Feasible noise abatement cannot be achieved because a prospective soundwall could not provide at least 5 dB additional noise reduction beyond that already provided by the top of cut along the northbound side of the freeway. Figure 12 for Alternatives A, B, and C in Appendix A shows this receiver.

Receivers R99-4 through R99-8, all Alternatives: Under all three alternatives, traffic noise impacts would occur at outdoor use areas associated with eight single-family residences, 14 multi-family units, and one shared recreation area within the same multi-family development along the southbound side of SR-99 between Wilson Road and Ming Avenue. The soundwall analysis summarized in Tables H-6 to H-8 demonstrate that raising the height of the existing soundwall in this area would not provide an additional 5 dB or more of noise reduction at any of the affected receivers; accordingly, a heightened soundwall would not provide feasible noise abatement. Feasible noise abatement cannot be attained because the existing soundwall already achieves much of the noise reduction potential of a soundwall. Figures 11 and 12 for Alternatives A, B, and C in Appendix A show these receivers.

Receivers R99-11 through R99-13, Alternative C: Traffic noise impacts would occur at outdoor use areas associated with two single-family residences and one motel along northbound SR-99 between Ming Avenue and Belle Terrace represented by Receivers R99-11 through R99-13. The soundwall analysis summarized in Tables H-6 to H-8 demonstrate that a soundwall located at the right-of-way line would provide feasible traffic noise abatement under Alternatives A and B but not under Alternative C. The most likely reason why feasible noise abatement is not achievable under Alternative C is that Alternative C would result in negligible changes to the path of sound propagation between the traffic noise source and the receivers, whereas Alternatives A and B would substantially change that path in a manner that allows a soundwall to be more effective. Figure 10 for Alternative C in Appendix A shows these receivers.

Receivers R99-17 through R99-19, all Alternatives: Under all three alternatives, traffic noise impacts would occur at outdoor use areas associated with five single-family residences along southbound SR-99 north of Ming Avenue represented by Receivers R99-17 through R99-19. The portion of existing Soundwall SW2 in front of these residences would remain under all three build alternatives. The soundwall analysis summarized in Tables H-6 to H-8 demonstrates that raising the height of the existing soundwall in this area would not provide an additional 5 dB or more of noise reduction at any of the affected receivers; accordingly, a heightened soundwall would not provide feasible noise abatement. Feasible noise abatement cannot be attained because

the existing wall already achieves much of the noise reduction potential of a soundwall. Figure 11 for Alternatives A, B, and C in Appendix A shows these receivers.

7.2.5. State Route 99 North of State Route 58 – Alternative C

Centennial Corridor extends parallel to SR-99 north of SR-58 only under Alternative C; therefore, this portion of the SR-99 corridor is only considered under Alternative C. Furthermore, the recent 24th Street Improvement Project Noise Study Report (24th Street NSR) has already evaluated noise impacts and abatement along the portion of the SR-99 corridor between California Avenue and Rosedale Highway (LSA, 2011). California Avenue is where eastbound Centennial Corridor approaches and westbound Centennial Corridor diverges from SR-99 under Alternative C. Between California Avenue and the BNSF rail yard, Alternative C would require the acquisition of a Motel 6 that contains the only existing outdoor areas of frequent human use along this portion of the project corridor. From the rail yard to Rosedale Highway, the current project would introduce relatively minor modifications to the future freeway geometry considered in the 24th Street NSR and would not alter facility capacity or other operational characteristics in this area. Accordingly, this study does not address the segment of the project corridor between California Avenue and Rosedale Highway.

Existing noise levels for Receivers R99-44 to R99-68 and R99-72 to R99-75 - representing frequent use areas along SR-99 between SR-58 and California Avenue and between Rosedale Highway and Gilmore Avenue - range from 56 to 70 dBA. The predicted future build traffic noise levels at the same receivers range from 63 to 75 dBA under Alternative C. Much of this range approaches or exceeds the NAC for Categories B, C, or E; therefore, consideration of noise abatement is required. Under Alternative C, traffic noise impacts are identified for 18 Category B receivers, three Category C receivers, and two Category E receivers. These receivers represent outdoor use areas associated with 37 single-family residences, four multi-family residential units, Saunders Park (three distinct use areas), as well as the Econolodge and Holiday Inn pool areas.

Areas with Noise Abatement

Soundwall S561: This soundwall would be located along the shoulder of the west side of the eastbound Centennial Corridor to the southbound SR-99 connector and along an adjacent segment of the Centennial Corridor mainline. The soundwall would extend southward from just north of Chester Lane to the northern terminus of in-kind replacement Soundwall SW6. Traffic noise impacts are predicted within the outdoor frequent use areas of 23 single-family residences, four multi-family residences, and Saunders Park (containing three distinct outdoor use areas) represented by Receivers R99-44 to R99-57. This soundwall would meet the feasibility requirements by providing 5 dB or more reduction at all but one of the impacted outdoor use areas (all but two of the residences represented by Receiver R99-57) and would meet the design goal of 7 dB traffic noise reduction. Table 7-52 summarizes predicted soundwall performance and associated cost allowance information. Figures 2 and 3 for Alternative C in Appendix A show the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-52. Summary of Reasonableness Determination Data – Alternative C - Soundwall S561

Barrier I.D.: S561	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	0	13	22	22	28
Reasonable Allowance Per Benefited Receiver	N/A	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	N/A	$715,000	$1,210,000	$1,210,000	$1,540,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S815: Soundwall S815 would be located along the southbound SR-99 off-ramp at Rosedale Highway and an adjacent portion of the SR-99 mainline. This soundwall would extend along the ramp/freeway shoulder from just north of Thomas Way northward to a point east of the southern portion of the RTC Resources property's eastern boundary north of Brian Way. Traffic noise impacts are predicted within the outdoor frequent use areas of two single-family residences represented by Receivers R99-73 and R99-74. Soundwall S815 would meet the feasibility requirements by providing 5 dB or more reduction at both receivers. It would also meet the design goal of 7 dB traffic noise reduction at one residence. Table 7-53 summarizes predicted soundwall performance and associated cost allowance information. Figure 14 for Alternative C in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-53. Summary of Reasonableness Determination Data – Alternative C - Soundwall S815

Barrier I.D.: S815	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	2	2	2	2	2
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$110,000	$110,000	$110,000	$110,000	$110,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall S818: Soundwall S818 would be located along the northbound SR-99 on-ramp at Buck Owens Boulevard. This soundwall would extend along the ramp shoulder from south of the Holiday Inn property northward to a point south of Gilmore Avenue. Traffic noise impacts are predicted at the Holiday Inn pool area frequent outdoor use area represented by Receiver R99-75. Soundwall S818 would meet the feasibility requirements by providing 5 dB or more reduction at this receiver. It would also meet the design goal of 7 dB traffic noise reduction. Table 7-54 summarizes predicted soundwall performance and associated cost allowance information. Figure 14 for Alternative C in Appendix A shows the minimum length and heights required for this soundwall to provide feasible traffic noise abatement and meet the design goal.

Table 7-54. Summary of Reasonableness Determination Data – Alternative C - Soundwall S818

Barrier I.D.: S818	8-Foot Barrier	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
Number of Benefited Receivers	1	1	1	1	1
Reasonable Allowance Per Benefited Receiver	$55,000	$55,000	$55,000	$55,000	$55,000
Total Reasonable Allowance	$55,000	$55,000	$55,000	$55,000	$55,000

Note: N/A-Not applicable. Barrier does not provide 5 dB of noise reduction.

[a] A NADR will be prepared that will identify noise barrier construction cost information and the noise barriers that are reasonable from a cost perspective.

Soundwall SW6: Soundwall SW6 would be an in-kind replacement for an existing soundwall to be demolished under Alternative C because of encroachment by the eastbound Centennial Corridor to the southbound SR-99 connector and construction of a retaining wall. Replacement Soundwall SW6 would follow the top of the retaining wall from the cul-de-sac at the south end of Oakdale Drive northward to just south of Verde Street. Traffic noise impacts are predicted within the outdoor frequent use areas of five single-family residences represented by Receiver R99-58. However, raising this soundwall beyond the in-kind replacement height would not provide an additional 5 dB or more of traffic noise reduction within the impacted outdoor frequent use areas. Figures 3 and 4 for Alternative C in Appendix A show the location and height of replacement Soundwall SW6.

Areas without Noise Abatement

Receiver R99-62 to R99-66 and R99-68, Alternative C: Traffic noise impacts would occur at outdoor use areas associated with seven single-family residences and one motel along the northbound side of SR-99 between Verde and Palm Streets. The Econolodge and various commercial properties along the east side of Oak Street depend on vehicular access and visibility from that street. Accordingly, the only potential location for a soundwall would be along the retaining wall proposed west of Oak Street under Alternative C. The soundwall analysis summarized in Table H-9 demonstrates that a soundwall would not provide feasible traffic noise abatement primarily because of the unabated influence of noise from Oak Street traffic even with the considered soundwall. Figure 3 for Alternative C in Appendix A shows these receivers.

7.2.6. Segment 2, Westside Parkway

A detailed noise study was conducted for Segment 2 of the Centennial Corridor Project (Westside Parkway) in 2009 and a Noise Study Report was prepared (Parsons, 2010). At the time of the traffic noise study analysis for Segment 1 of the Centennial Corridor Project, Segment 2 was under construction.

Traffic noise impact analysis for Westside Parkway was conducted using level-of-service C traffic volumes for each lane to predict the worst case traffic noise impacts. In anticipation of the Centennial Corridor project, truck percentages from the Centennial Corridor project were used when conducting the traffic noise impact analysis for Westside Parkway. Furthermore, to account for the possibility of adding more traffic lanes due to the proposed Centennial Corridor alignment, which could result in slightly higher traffic noise levels, soundwalls recommended for the Westside Parkway project have been built at least 2 feet higher than required by the traffic noise analysis; however, at locations where soundwalls were already 16-foot high, they were

kept at 16 feet in height. Soundwalls were also extended in a two areas to cover additional residences which were not impacted by traffic noise levels under the Westside Parkway Project due to existing property walls.

The following changes were implemented to the feasible Soundwall S335 identified in the Westside Parkway Noise Study Report:

- Portions of the soundwall that were 10 or 12-foot high were raised to 14 feet.
- Portions of the soundwall that were 14-foot high were raised to 16 feet.
- No changes were done to the portions of the wall that were 16-foot high.
- Soundwall was extended by 330 feet on the west end along the right of way line with 10 to 12 feet height.

The following changes were implemented to the feasible Soundwall S314 identified in the Westside Parkway Noise Study Report:

- Soundwall height was raised from 14 feet to 16 feet.
- Soundwall was extended by 1,357 feet on the west end along the right of way line with 8 to 12 feet height.

The Westside Parkway traffic noise analysis was conducted using three general lanes in the westbound direction from Coffee Road to Callaway Drive. As part of the Centennial Corridor Project, an auxiliary lane will be added to the westbound travel lanes of Westside Parkway from Coffee Road to Callaway Drive. Because soundwalls in this area are constructed at least 2 feet higher than what was needed to provide feasible abatement for the three general lanes, they would be also effective in providing abatement when an auxiliary lane is added as part of the Centennial Corridor Project. Figures 1 through 4 in Appendix A-Westside Parkway show the area between Coffee Road to Callaway Drive where a new auxiliary lane will be added and soundwalls that are being constructed as part of the Westside Parkway project.

7.2.7. Segment 3

At the time of this noise study, the Segment 3 alignment was not known. The Centennial Corridor project will not cover Segment 3 with the exception of modifications to one intersection. Therefore, traffic noise impacts were not evaluated for Segment 3. The Centennial Corridor project is proposing to widen and signalize the Enos Lane and Stockdale Highway intersection. Besides five single-family residences along Stockdale Highway east of Enos Lane, surrounding areas of this intersection consist of farmlands and open spaces. The proposed changes to the Stockdale Highway in front of these five single-family homes would be minimal, and there would not be any noticeable change to the traffic noise levels at the frequent outdoor use areas associated with these houses.

Chapter 8. Construction Noise and Vibration

During the construction phases of the project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Table 8-1 summarizes noise levels produced by construction equipment commonly used on roadway construction projects. As indicated, equipment involved in construction is expected to generate noise levels ranging from 80 to 89 dBA at a distance of 50 feet. Noise produced by construction equipment would be reduced over distance at a rate of about 6 dB per doubling of distance.

Table 8-1. Construction Equipment Noise

Equipment	Maximum Noise Level (dBA at 50 feet)
Scrapers	89
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Concrete Pump	82

Source: Federal Transit Administration, 2006

Construction noise varies greatly depending on the construction process, type and condition of equipment used, as well as layout of the construction site. Many of these factors are traditionally left to the contractor's discretion, which makes it difficult to accurately estimate levels of construction noise. Construction noise estimates are approximate because of the lack of specific information available at the time of the assessment. Temporary construction noise impacts would be unavoidable at areas located immediately adjacent to the proposed project alignment.

The noise level requirement specified herein shall apply to the equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor.

Sound control shall conform to the provisions in Section 14-8.02, "Noise Control," of the Standard Specifications and 14-8.02 “Noise Control” of the Standard Special Provisions. According to requirements of these specifications, construction noise cannot exceed 86 dBA at 50 feet from the job site activities from 9 p.m. to 6 a.m.

There are a number of measures that can be taken to minimize noise intrusion without placing unreasonable constraints on the construction process or substantially increasing costs. These include noise monitoring to ensure that contractors take all reasonable steps to minimize impacts when near sensitive areas; noise testing and inspection of equipment to ensure that all equipment on the site is in good condition and effectively muffled; and an active community liaison program. A community liaison program would keep residents informed about construction plans so they can plan around periods of particularly high noise or vibration levels and would provide a conduit for residents to express any concerns or complaints.

The following are possible control measures that can be implemented to minimize noise disturbances at sensitive areas during construction:

- All equipment shall have sound-control devices no less effective than those provided on the original equipment. Each internal combustion engine used for any purpose on the job or related to the job shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine should be operated on the job site without an appropriate muffler.

- Construction methods or equipment that will provide the lowest level of noise impact (for example, avoid impact pile driving near residences and consider alternative methods that are also suitable for the soil condition) should be used.

- Idling equipment shall be turned off.

- Truck loading, unloading, and hauling operations shall be restricted so that noise and vibration are kept to a minimum through residential neighborhoods to the greatest possible extent.

- Construction activities shall be coordinated to build recommended permanent soundwalls during the first phase of construction to protect sensitive receivers from subsequent construction noise, dust, light, glare, and other impacts, to the extent feasible.

- Temporary noise barriers shall be used and relocated, as needed, to protect sensitive receptors against excessive noise from construction activities involving large equipment and by small items such as compressors, generators, pneumatic tools, and jackhammers. Noise barriers can be made of heavy plywood, moveable insulated sound blankets, or other best available control techniques.

- Newer equipment with improved noise muffling shall be used, and all equipment items shall have the manufacturers' recommended noise-abatement measures (such as mufflers, engine covers, and engine vibration isolators) intact and operational. Newer equipment will generally be quieter in operation than older equipment. All construction equipment shall be inspected at periodic intervals to ensure proper maintenance and presence of noise-control devices (such as mufflers and shrouding).

- Construction activities shall be minimized in residential areas during evening, nighttime, weekend, and holiday periods. Noise impacts are typically minimized when construction activities are performed during daytime hours. However, nighttime construction may be desirable (such as in commercial areas where businesses may be disrupted during daytime hours) or necessary to avoid major traffic disruption. Coordination with the City or County shall occur before construction can be performed in noise-sensitive areas between 9:00 in the evening and 6:00 in the morning.

- Construction lay-down or staging areas shall be selected in industrially zoned districts. If industrially zoned areas are not available, commercially zoned areas may be used, or locations that are at least 100 feet from any noise-sensitive land use (such as residences, hotels, and motels).

- Contractor shall prepare a Noise and Vibration Monitoring and Mitigation Plan by a qualified Acoustical Engineer and submit it for approval. The Plan must outline noise and vibration monitoring procedures at predetermined noise and vibration sensitive sites as well as historic properties. Plan also must included calculated noise and vibration levels for various construction phases and mitigation measures that may need to meet the project specifications. The contractor shall not start any construction work or operate any noise generating construction equipment at the construction site before approval of the Plan. Plan must be updated every three months or sooner if there are any changes to the construction activities.

The contractor shall be required to adhere to the following administrative noise control measures:

- Once details of the construction activities become available, the contractor shall work with local authorities to develop an acceptable approach to minimize interference with the business and residential communities, traffic disruptions, and the total duration of the construction.
- Good public relations shall be maintained with the community to minimize objections to unavoidable construction impacts. Frequent activity updates of all construction activities shall be provided. A construction noise monitoring program to track sound levels and limit the impacts shall be implemented.
- In case of construction noise complaints by the public, the Resident Engineer shall coordinate with the construction manager, and the specific noise-producing activity may be changed, altered, or temporarily suspended, if necessary.

It is possible that certain construction activities could cause intermittent localized concern from vibration in the Project Area. During certain construction phases, processes such as earth moving with bulldozers, the use of vibratory compaction rollers, impact pile driving, demolitions, or pavement braking may cause construction related vibration impacts such as human annoyance or, in some cases, building damages. There are cases where it may be necessary to use this type of equipment in close proximity to residential buildings. The following are some procedures that can be used to minimize the potential impacts from construction vibration:

- Restrict the hours of vibration-intensive equipment or activities such as vibratory rollers so that impacts to residents are minimal (e.g., weekdays during daytime hours only when as many residents as possible are away from home.
- The owner of a building close enough to a construction vibration source that damage to that structure due to vibration is possible would be entitled to a pre-construction building inspection to document the pre-construction condition of that structure.

- Conduct vibration monitoring during vibration-intensive activities.

A combination of the mitigation techniques for equipment vibration control as well as administrative measures, when properly implemented, can be selected to provide the most effective means to minimize the effects of construction activity. Application of the mitigation measures will reduce the construction impacts; however, temporary increases in vibration would likely occur at some locations.

Chapter 9. References

23 CFR Part 772, 2011. Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 Codes of Federal Regulations, Part 772, July.

Caltrans, 2009. Technical Noise Supplement, October. Sacramento, CA: Environmental Program, Noise, Air Quality, and Hazardous Waste Management Office. Sacramento, CA. Available: (http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf).

Caltrans, 2011. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects. May. Sacramento, CA.

Caltrans, 2007. Highway Design Manual, Chapter 1100 Highway Traffic Noise

FHWA. 1998a. FHWA Traffic Noise Model, Version 1.0 User's Guide. January. FHWA-PD-96-009. Washington D.C.

FHWA, 1998b. FHWA Traffic Noise Model, Version 1.0. February. FHWA-PD-96-010. Washington D.C.

FHWA, 2004. U.S. Department of Transportation, FHWA Traffic Noise Model, TNM 2.5, Report No. FHWA–PD–96–010, Revision No. 1, April 14.

FTA, 2006. *Transit noise and vibration impact assessment.* (DOT-T-95-16.) Office of Planning, Washington, DC. Prepared by Harris Miller Miller & Hanson, Inc. Burlington, MA.

LSA, 2011. 24th Street Improvement Project Noise Study Report, March.

Parsons, 2010. Westside Parkway Noise Study Report, July.

Parsons, 2011. Traffic Study Report for the Centennial Corridor Project on Route 58 in Bakersfield, Chapters 1 through 3, November.

Chapter 10. List of Preparers

Greg J Berg, Senior Environmental Noise Scientist. Bachelor of Arts, Acoustics, Columbia College Chicago, Chicago, IL; 7 years of experience in environmental noise and vibration analysis. Contribution: Performed noise analysis and prepared the Noise Study Report.

Martin Meyer, Senior Environmental Noise Scientist. Master of Science, Physics, University of New Orleans, New Orleans, LA; 13 years experience in environmental noise and vibration analysis. Contribution: Performed noise analysis and assisted in preparing the Noise Study Report.

Bryan M Jarjoura, Noise Control Specialist. Master of Science, Mechanical Engineering, University of Southern California, 4 years of experience in noise control analysis and mitigation. Contribution: Traffic noise analysis, sound barrier design and quality assurance/quality control.

Areg Gharabegian, Principal Project Manager. Master of Science, Energy, Resources, and Environment, George Washington University, Washington, D.C.; 33 years experience in environmental and transportation noise and vibration analysis. Contribution: Task Manager, provided technical direction for the traffic noise analysis and conducted review and quality control for the Noise Study Report, and the NADR.

Ruben E. Urenda, Senior Noise Control Tech. Associate of Science, Computer Aided Drafting, ITT Technical Institute, West Covina, CA; 8 years experience in CAD Noise and Vibration Drafting. Contribution: Performed all technical and drafting support required for the Noise Study Report.

Jason Ogden, Environmental Noise Specialist. Bachelor of Arts, Acoustics, Columbia College Chicago, Chicago, IL; 5 years of experience in environmental noise and vibration analysis. Contribution: Traffic noise analysis, sound barrier design and quality assurance/quality control.

Michael Weber, Senior Noise & Air Quality Specialist. Bachelor of Science, Physiology, University of California, Davis; 21 years experience in environmental noise and air quality analysis. Contribution: Contributed to noise analysis and preparation of the Noise Study Report.