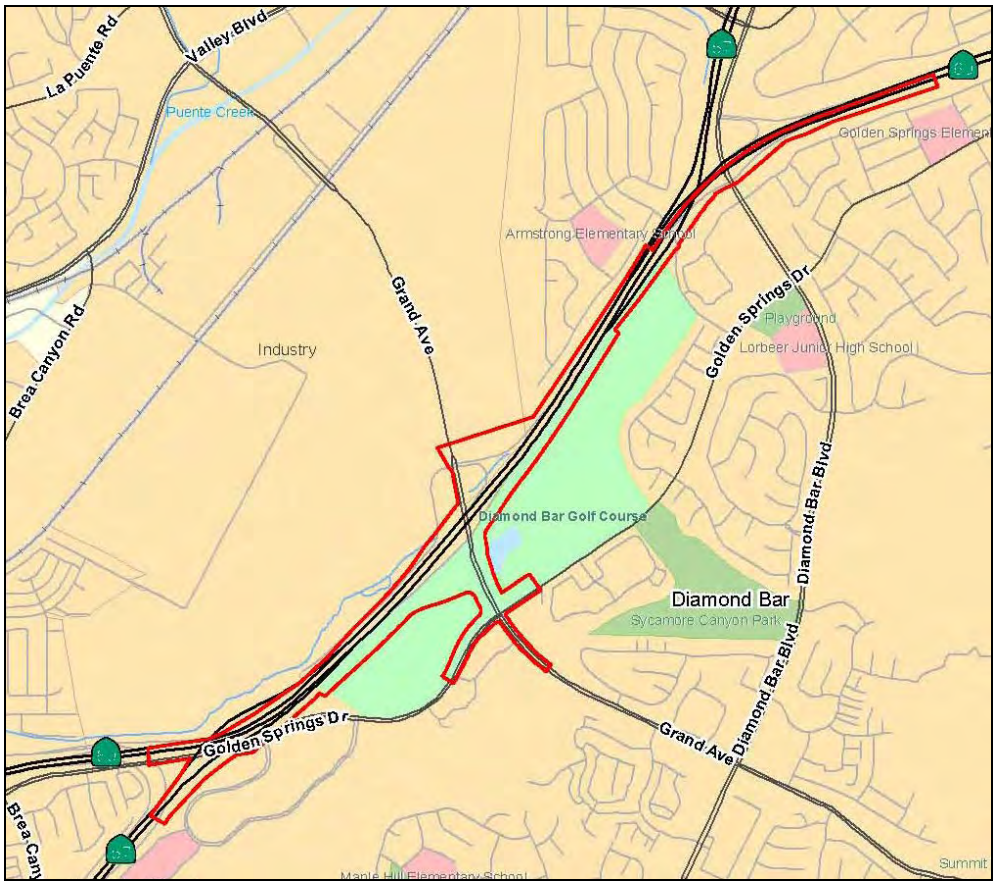
State Route 57/State Route 60 Confluence Project



Noise Study Report

City of Industry and City of Diamond Bar, California

07-LA-57-PM-R4.3/R4.5 and R4.5/R4.8
07-LA-60-PM-R23.7/R26.5

EA Number: 279100

May 2012

Caltrans

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Summary

This noise study report discusses potential noise impacts and related noise abatement measures associated with construction and operation of improvements to the State Route (SR) 57/SR-60 confluence. This report has been prepared to comply with Title 23, Part 772, of the Code of Federal Regulations, "Procedures for Abatement of Highway Traffic Noise and Construction Noise," and California Department of Transportation noise analysis policy, as described in the *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects* (Protocol).

Improvements to the SR-57/SR-60 confluence are needed to address operational deficiencies at the Grand Avenue interchange. The objectives of the project include increasing capacity to accommodate forecast traffic growth and improving safety and traffic operations on the freeway mainline and at the Grand Avenue interchange.

The Protocol defines single-family and multifamily homes as Activity Category B land uses. Diamond Bar Golf Course is categorized as an Activity Category C land use. Outdoor areas associated with commercial use, including hotels in the project area, are defined in the Protocol as Activity Category E uses. Residences, hotels, and the Diamond Bar Golf Course are located adjacent to the SR-57/SR-60 confluence. Many of these locations are nearly at grade and have a direct line-of-sight view of the confluence. Several residences along Rock River Road lie on an elevated section of land that overlooks the confluence. An existing noise barrier, with a nominal height of 12 feet, and a line of privacy fences, with a nominal height of 4 feet, are located along the southbound SR-57/SR-60 frontage, adjacent to the residences along Rock River Road. Another existing noise barrier with a nominal height of 8 feet is located along eastbound SR-60 frontage, adjacent to the residences along Palomino Drive.

A field noise investigation was conducted to describe and document existing noise conditions. The Federal Highway Administration's Traffic Noise Model, version 2.5, was used in this analysis to evaluate traffic noise under existing and design-year (2037) conditions.

As stated in the Protocol, noise abatement is considered only where frequent human use occurs and where a reduced noise level would be beneficial. In general, an area of frequent human use is an area where people are exposed to traffic noise for an extended period of time on a regular basis. As an extension of this concept, impacts are assessed in detail only at locations where frequent human use occurs and where a reduced noise level would be beneficial. Accordingly, an impact assessment focuses on locations with defined outdoor activity areas, such as residential backyards, common-use areas at multifamily residences, or active sporting areas.

Existing traffic noise levels at first-row residences, expressed in terms of the 1-hour A-weighted equivalent sound level (dBA L_{eq}[h]), were found to range from 56 to 79 dBA L_{eq}(h). Future with-project traffic noise levels were in the range of 58 to 82 dBA L_{eq}(h). Therefore, traffic noise impacts were predicted to occur, and noise abatement was evaluated.

As stated above, a residential subdivision on Rock River Road has existing masonry walls along the SR-57/SR-60 frontage. However, under future with-project conditions, traffic noise levels would approach or exceed the noise abatement criterion for residential land uses in the subdivision.

Of the seven noise barriers evaluated in this noise analysis, five were found to be feasible from an acoustical perspective.

Noise Barrier A-2: North of SR-60, east of Diamond Bar Boulevard

Noise Barrier A-2 would benefit affected residences along Decorah Road. The barrier would have an estimated total length of 2,440 feet. Barrier heights in the range of 6 to 16 feet were evaluated. Noise Barrier A-2 was found to meet the noise abatement design goal of 7 decibels of noise reduction at a barrier height of 6 feet. A maximum of 41 homes would benefit from raising the barrier height to 16 feet (total cost allowance: $2,255,000).

Noise Barrier C: North of SR-57/SR-60, from Grand Avenue to North Prospectors Road

Noise Barrier C would benefit affected residences along Rock River Road. It would have an estimated total length of 2,300 feet. Noise Barrier C would replace an existing 4-foot-high privacy wall at residences situated above the SR-57/SR-60 confluence. Barrier heights in the range of 6 to 16 feet were evaluated. Noise Barrier C was found to meet the noise abatement design goal of 7 decibels of noise reduction at a barrier height of 12 feet. A maximum of 35 homes would benefit from raising the barrier height to 16 feet (total cost allowance: $1,925,000). Increasing the height of the existing 12-foot-high barrier at Rock River Road was also considered, but this approach would not provide additional acoustical benefits for residences along the SR-57/SR-60 frontage.

Noise Barrier C-2: North of SR-57/SR-60, from North Prospectors Road to Rock River Drive

Noise Barrier C-2 would benefit affected residences along Beaverhead Drive and Rock River Drive. It would have an estimated total length of 1,280 feet. Barrier heights in the range of 6 to 16 feet were evaluated. Noise Barrier C-2 was found to meet the noise abatement design goal of 7 decibels of noise reduction at a barrier height of 6 feet. A maximum of 16 homes would benefit from a barrier height of 16 feet (total cost allowance: $888,000).

Noise Barriers G-1 and G-2: South of SR-57/SR-60, between Golden Springs Drive and South Prospectors Road (Diamond Bar Golf Course)

Noise Barriers G-1 and G-2 would be located along the SR-57/SR-60 frontage of Diamond Bar Golf Course. The barriers would have lengths of 2,220 feet (west of Grand Avenue) and 2,970 feet (east of Grand Avenue). The barriers would benefit Diamond Bar Golf Course. Barrier heights in the range of 6 to 16 feet were evaluated. Noise Barrier G-1, the barrier evaluated for the course east of Grand Avenue, was found to meet the noise abatement design goal of 7 decibels of noise reduction at a barrier height of 8 feet. A maximum of seven outdoor use areas would benefit from a 12-foot-high barrier (total cost allowance: $385,000). Noise Barrier G-2, the barrier evaluated for the course west of Grand Avenue, was found to meet the noise abatement design goal of 7 decibels of noise reduction at a barrier height of 12 feet. A maximum of one outdoor use area would benefit from a 12-foot-high barrier (total cost allowance: $55,000).

A preliminary noise abatement design for each barrier and a range of barrier heights have been evaluated for feasibility, as described in the Protocol. The design for the noise barriers presented in this report is only preliminary. It allows an appropriate level of environmental review but is not intended for final project design.

Table of Contents

List of Tables and Figures

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
dBA	A-weighted sound level
dBA $L_{eq}(h)$	1-hour A-weighted equivalent sound level
F&E	Freeway and Expressway System
FHWA	Federal Highway Administration
HOV	high-occupancy vehicle
Hz	Hertz
I	Interstate
kHz	kilohertz
L_{dn}	day-night level
L_{eq}	equivalent sound level
$L_{eq}(h)$	1-hour equivalent sound level
L_{max}	maximum sound level
L_{xx}	percentile-exceeded sound level
mPa	micro-Pascals
NAC	noise abatement criteria
NEPA	National Environmental Policy Act
NHS	National Highway System
NSR	noise study report
Protocol	*Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction, Retrofit Barrier Projects*
SCAG	Southern California Association of Governments
SPL	sound pressure level
SR	State Route
TeNS	Technical Noise Supplement
TNM 2.5	FHWA Traffic Noise Model Version 2.5

Chapter 1 Introduction

1.1 Purpose of the Noise Study Report

The California Department of Transportation (Caltrans) proposes to construct improvements to the interchange at the confluence of State Route (SR) 57/SR-60 in the City of Industry and the City of Diamond Bar (see Figures 1 and 2). The purpose of this noise study report (NSR) is to evaluate noise impacts and abatement procedures under the requirements of Title 23, Part 772, of the Code of Federal Regulations (CFR), "Procedures for Abatement of Highway Traffic Noise and Construction Noise," which provides guidance for preparing construction and operational noise studies and evaluating noise abatement procedures considered for federal and federal-aid highway projects. According to 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 *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects* (Protocol), dated May 2011, provides Caltrans' policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing an NSR. Noise impacts associated with this project under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) will be evaluated in the project's environmental assessment and environmental impact report, respectively.

1.2 Project Purpose and Need

1.2.1 Project Purpose

Improvements to the SR-57/SR-60 confluence are needed to correct safety and operational deficiencies at the Grand Avenue interchange. The five primary objectives are presented below.

- Reduce congestion and delays on Grand Avenue from Golden Springs Drive to the interchange at SR-60.
- Reduce congestion and delays at the Grand Avenue interchange.
- Reduce congestion and delays on the SR-57/SR-60 freeway mainline.
- Reduce weaving within the SR-57/SR-60 confluence.
- Improve safety by reducing weaving movements and increasing weaving distances along the SR-57/SR-60 confluence.

These primary objectives address the need to improve the operational deficiencies of the freeways at the Grand Avenue interchange.

1.2.2 Project Need

Forecast regional population and employment growth between 2008 and 2035[1] is expected to result in more traffic, with volumes 10% to 25% higher than existing volumes along the SR-60 mainline and in the recently constructed high-occupancy vehicle (HOV) lanes, according to the traffic forecast from the Southern California Association of Governments (SCAG) model.

Traffic conditions on most roadway facilities are analyzed by using the principles or the specific analysis methods contained in the *Highway Capacity Manual, 2000 Edition* (HCM), a publication of the Transportation Research Board, an agency that is associated with the federal government. Level of service (LOS) is the report-card scale used in the HCM. LOS, which ranges from A to F, describes the varying conditions on a roadway during a specific time interval. Brief definitions of LOS are found in Table 1.

Forecast traffic in 2035 would result in further deterioration of freeway operations and an estimated LOS of F on the mainline of the SR-57/SR-60 confluence in both the westbound and eastbound direction. Therefore, improvements are proposed at the SR-57/SR-60 confluence to accommodate expected traffic volumes.

Table 1. Level of Service Descriptions

Level of Service	Traffic Description
A	Excellent, Light Traffic
B	Good, Light to Moderate Traffic
C	Moderate Traffic, with Insignificant Delay
D	Heavy Traffic, with Significant Delay
E	Severe Congestion and Delay
F	Failed; Indicated Levels Cannot Be Handled

Source: Transportation Research Board, 2000.

[1] Note that 2035 is the horizon year of the most recently adopted regional transportation plan (RTP) (2008 RTP). The proposed project is included in the list of projects that make up the 2008 RTP.

Figure 1
Regional Vicinity Map
State Route 57/State Route 60 Confluence at Grand Avenue Project

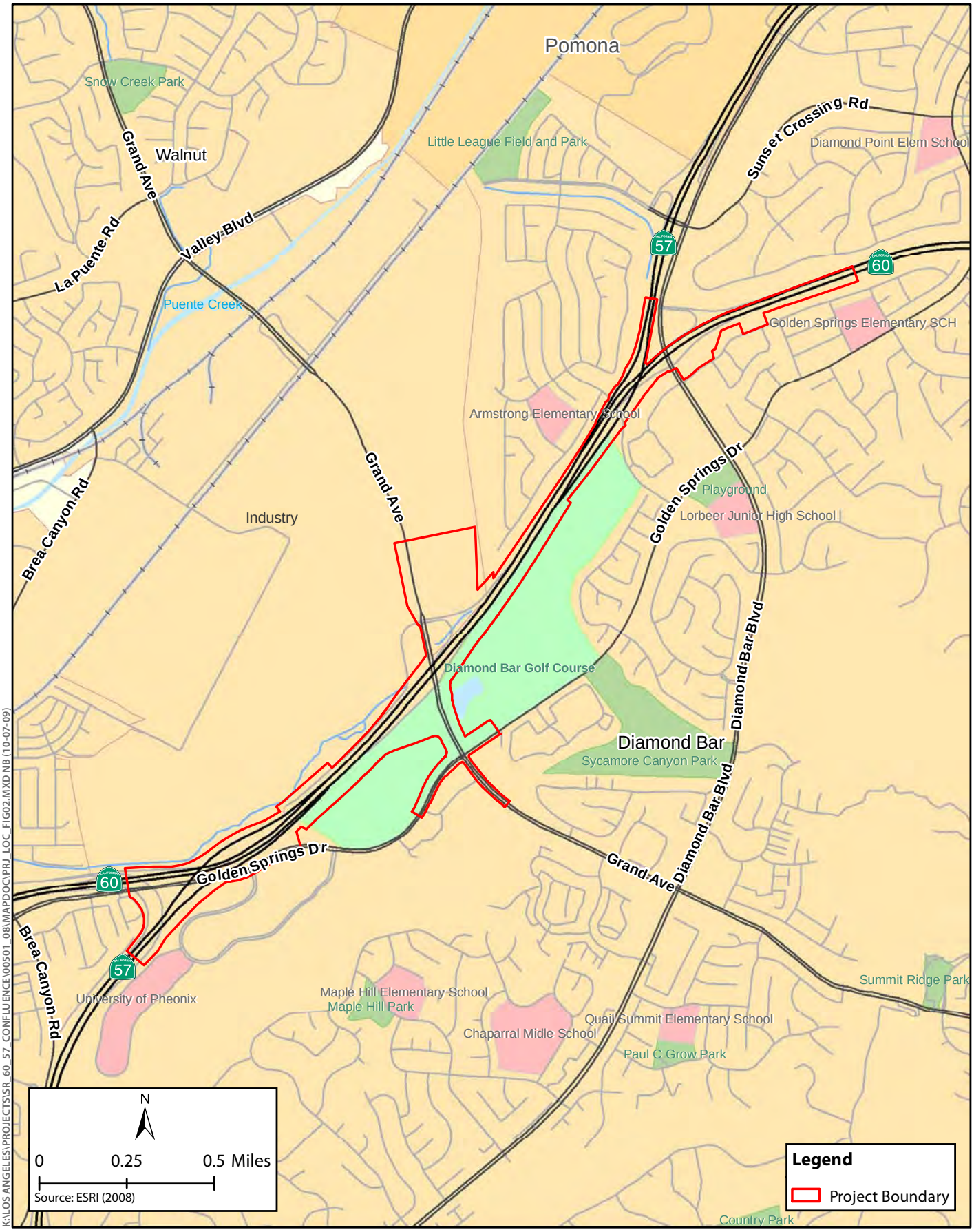


Figure 2
Project Location Map
State Route 57/State Route 60 Confluence at Grand Avenue Project

Chapter 2 Proposed Project

2.1 Introduction

The City of Industry, in cooperation with Caltrans, is proposing freeway improvements to the SR-57/SR-60 confluence at the Grand Avenue interchange in Los Angeles County. The proposed project would be subject to both CEQA and NEPA. Caltrans would be the lead agency under both CEQA and NEPA.

Figure 1 and Figure 2 show the regional location and project vicinity, respectively.

SR-57 is a major north/south freeway, serving the cities and communities of the Greater Los Angeles area, and is part of the National Highway System and the State Freeway and Expressway System. The freeway's northern terminus is at its junction with Interstate (I) 210 in the City of Glendora, and its southern terminus is at its junction with I-5 and SR-22 in the City of Orange. The portion of SR-57 within the project area is located in the Pomona Valley.

SR-60 is a major east/west freeway that also serves the cities and communities of the Greater Los Angeles area. The freeway is also part of the National Highway System and the State Freeway and Expressway System. SR-60 begins near the Los Angeles River in the City of Los Angeles and continues eastward to Riverside County, serving the cities and communities on the east side of the Los Angeles metropolitan area and on the south side of the San Gabriel Valley. The western terminus of the freeway is at the East Los Angeles interchange with I-10, I-5, and U.S. 101; the eastern terminus is at its junction with I-10 in the City of Beaumont.

There is a gap in SR-57 at its junction with SR-60. SR-57 terminates at the west end of the confluence with SR-60. SR-60, which carries traffic from both freeways, maintains six lanes in each direction under Grand Avenue. SR-57 resumes at the split with SR-60 at the east end of the confluence near Diamond Bar Boulevard.

The primary purpose of the proposed project is to improve traffic operations and safety on SR-57 and SR-60 at the Grand Avenue interchange.

2.2 Project Description

The proposed project would reconfigure the approximately 2-mile confluence of SR-57 and SR-60, which would entail the addition of auxiliary lanes and associated on-ramp/off-ramp reconfigurations. SR-57 and SR-60 are major inter-regional freeways that link cities in the San Gabriel Valley and the Inland Empire with Los Angeles and Orange counties.

2.3 Alternative 1, No-Build Alternative

The No-Build (or No-Action) Alternative would result in no structural or physical changes to SR-57, SR-60, or the Grand Avenue interchange. Existing deficient capacity and congestion conditions due to short weaving distances on SR-57, SR-60, and Grand Avenue would not change under this alternative.

2.4 Build Alternatives

The two build alternatives being considered (i.e., Alternative 2: Combination Cloverleaf/ Diamond Interchange Configuration and Alternative 3: Partial Cloverleaf Interchange Configuration) are described below and shown in Figures 3 and 4, respectively. Under both build alternatives, a new bypass off-ramp is proposed for eastbound SR-60 west of the southern/ western SR-57/SR-60 junction. The bypass off-ramp would be barrier separated from SR-57/SR-60 traffic until passing the SR-57 diverge to the Grand Avenue off-ramp. Northbound SR-57 traffic would exit to Grand Avenue by using an optional exit from the third SR-57 lane. The off-ramp lane would add to the one-lane eastbound SR-60 bypass off-ramp. The off-ramp would widen to three lanes at the final approach to the intersection at Grand Avenue.

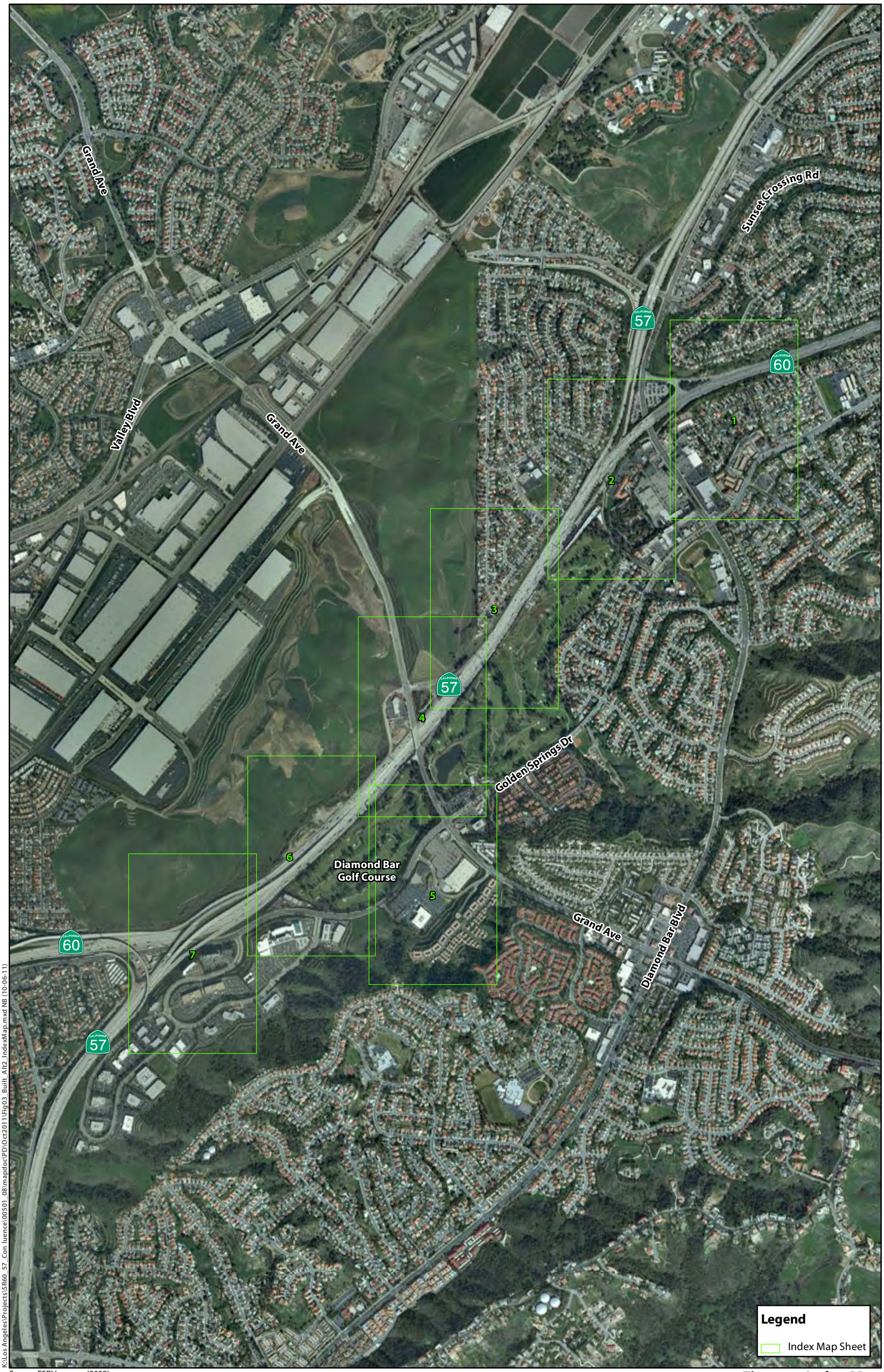
Currently, the third lane on SR-57 ends at the Grand Avenue off-ramp, and begins again 4,200 feet to the east. The build alternatives would both add this lane between the Grand Avenue off-ramp and the additional lane near the SR-57 diverge at the east end. An auxiliary lane would be added adjacent to the added through lane to serve traffic entering from Grand Avenue.

At the east end of the confluence, a bypass connector would be built to connect the Grand Avenue eastbound on-ramp auxiliary lane with eastbound SR-60. This connector would require new overcrossing structure at Prospector Road and Diamond Bar Boulevard as well as realignment of the Diamond Bar Boulevard on-ramp.

In the westbound direction, the dropped southbound SR-57 lane would be extended 2,500 feet to the realigned westbound SR-60 off-ramp to Grand Avenue, creating a two-lane exit ramp. The exit ramp would expand to five lanes at the intersection.

Operational improvements along Grand Avenue include widening the roadway to four through lanes in each direction under both build alternatives. Grand Avenue would be widened easterly, encroaching on the existing westbound loop on-ramp. Grand Avenue would be realigned approximately 50 feet east of the existing centerline to avoid a right-of-way acquisition from a vacant automobile dealership on Grand Avenue north of SR-60. The centerline shift of Grand Avenue would require the westbound off-ramp to be relocated approximately 100 feet north of the existing intersection on Grand Avenue. The intersection relocation would also require realignment of the two-lane westbound loop on-ramp as well as Old Brea Canyon Road (to be renamed Grand Crossing Parkway).

The existing Grand Avenue overcrossing does not have sufficient length to accommodate an added northbound SR-57 through lane or sufficient vertical clearance over SR-60 to allow for widening. Therefore, it would be replaced. The replacement bridge would be longer and deeper, resulting in a raised profile along Grand Avenue.



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Source: ESRI Imagery (2008)

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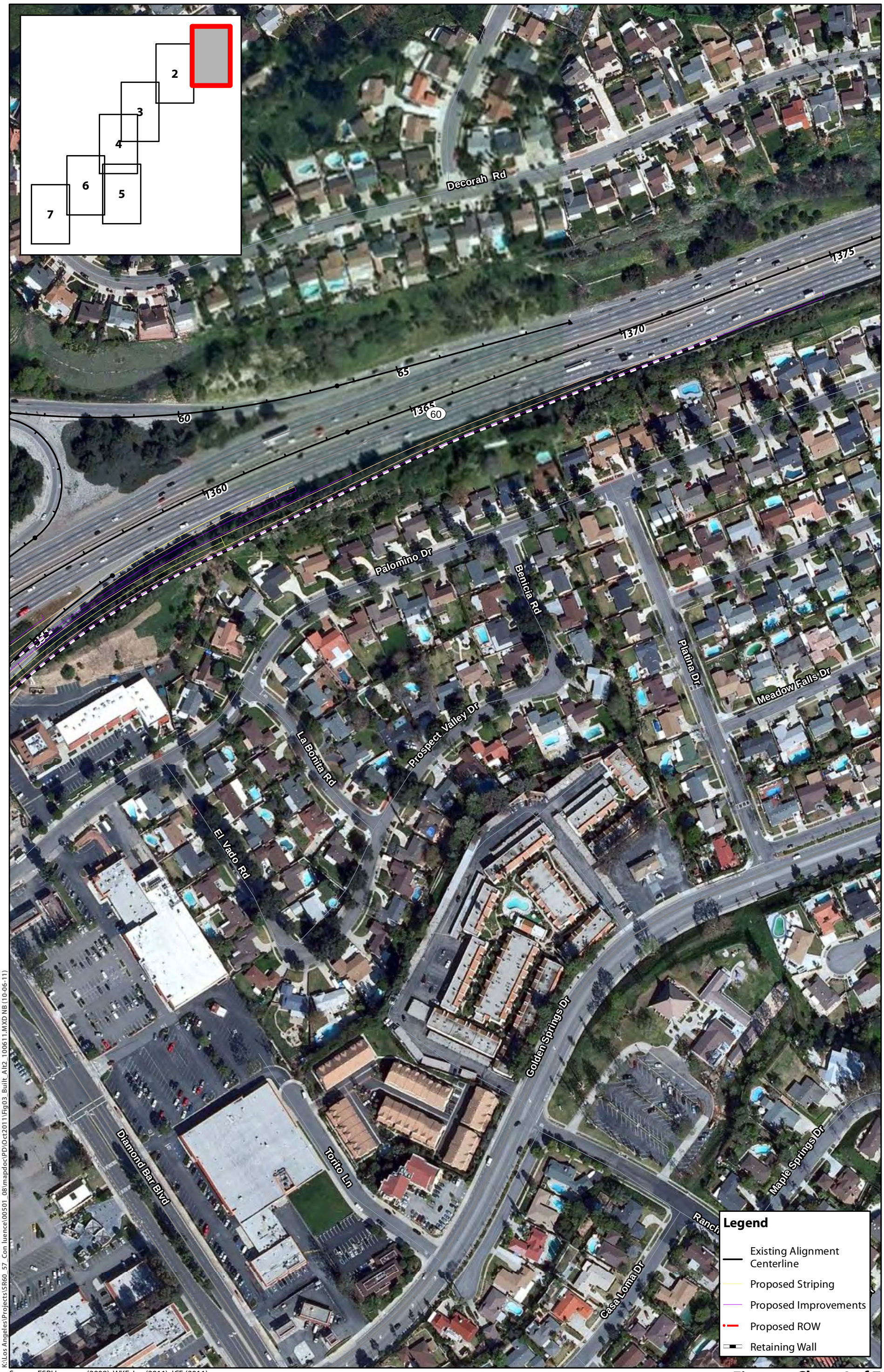
Figure 3-Index Map
Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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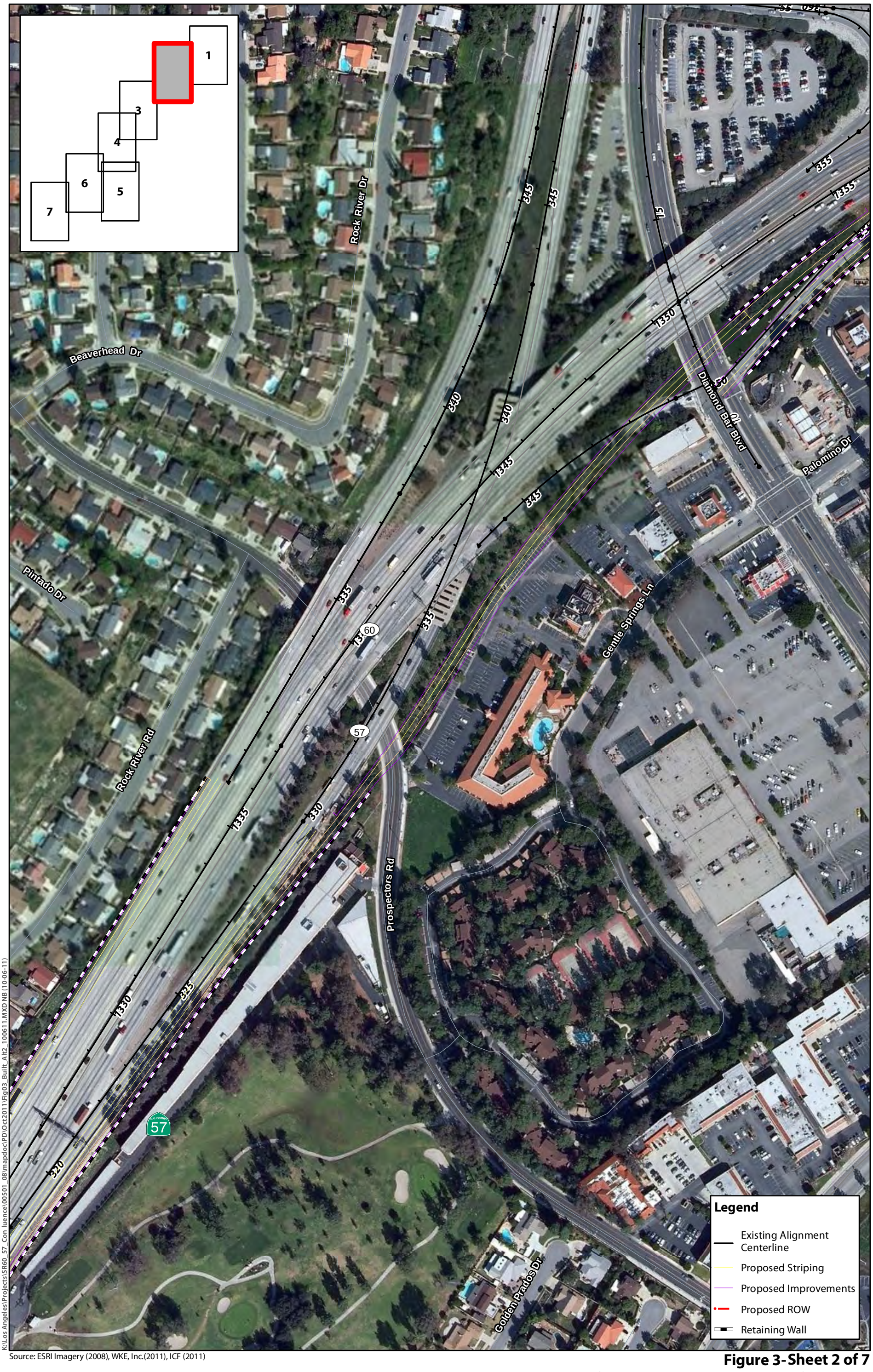
Figure 3-Sheet 1 of 7
Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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Figure 3-Sheet 2 of 7

Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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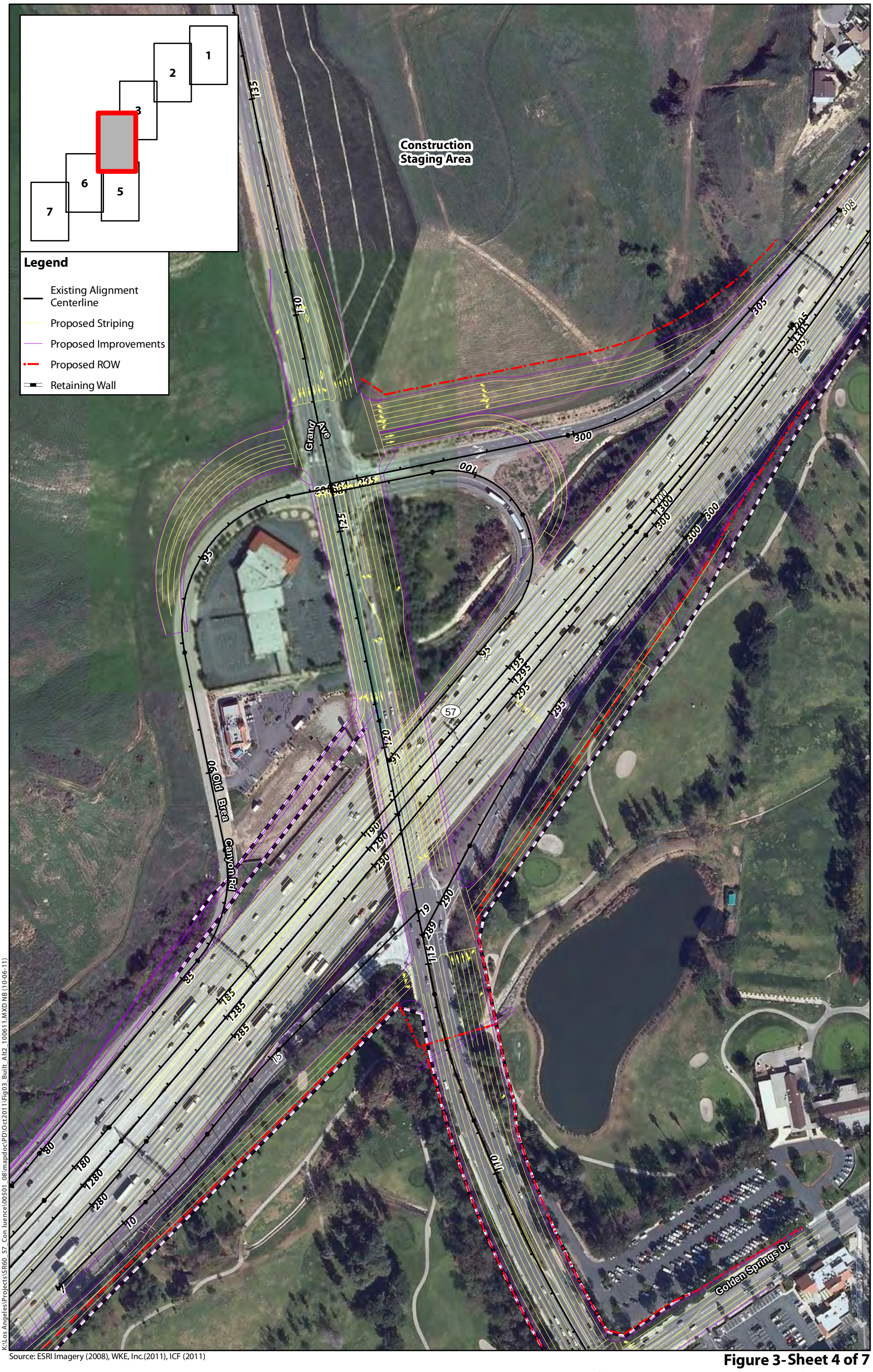
Figure 3-Sheet 3 of 7
Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

Figure 3- Sheet 4 of 7
Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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Figure 3-Sheet 5 of 7
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State Route 57/State Route 60 Confluence at Grand Avenue Project

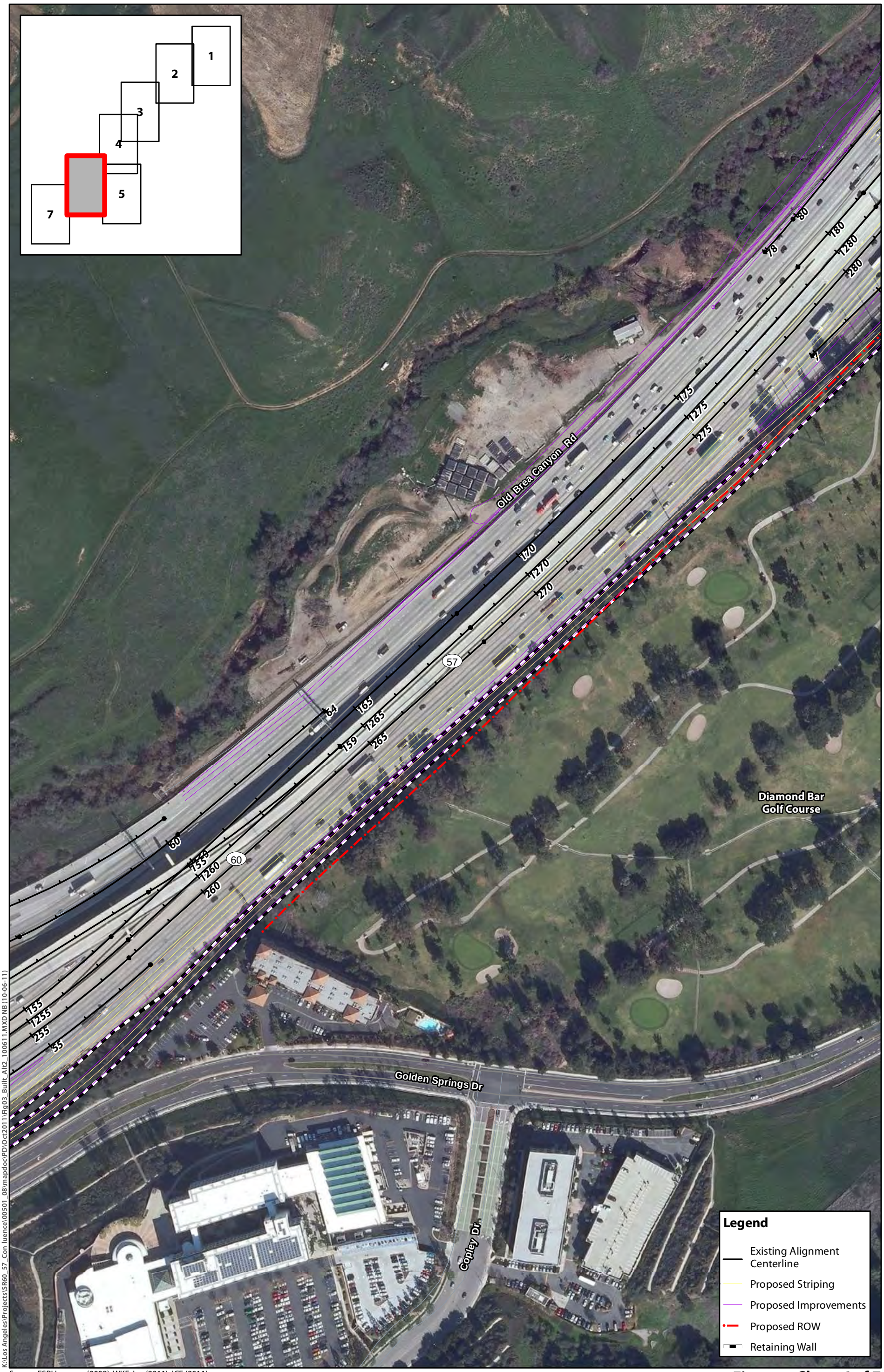

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Figure 3-Sheet 6 of 7

Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

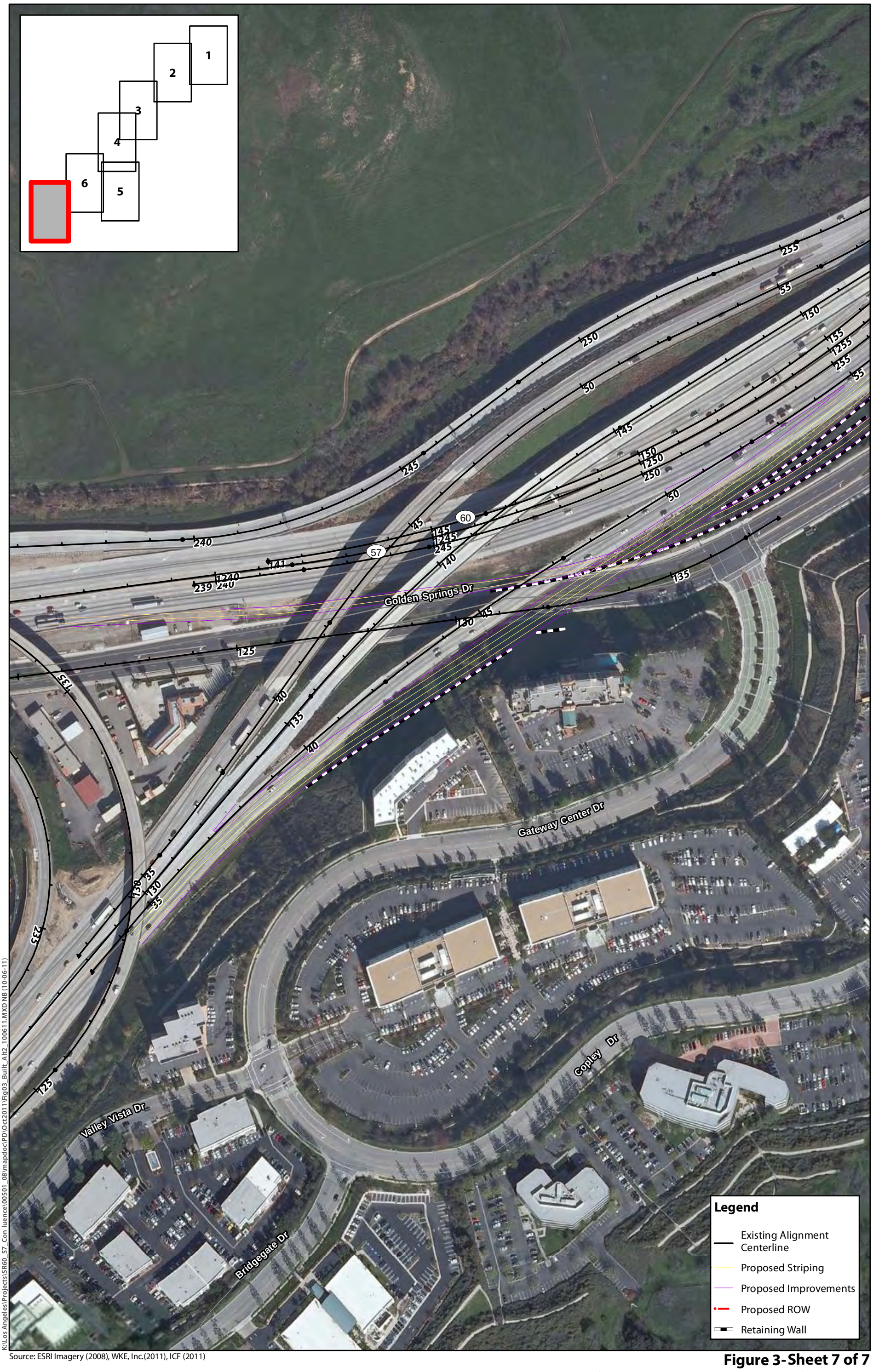

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Figure 3-Sheet 7 of 7
Alternative 2, Combination Cloverleaf / Diamond Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

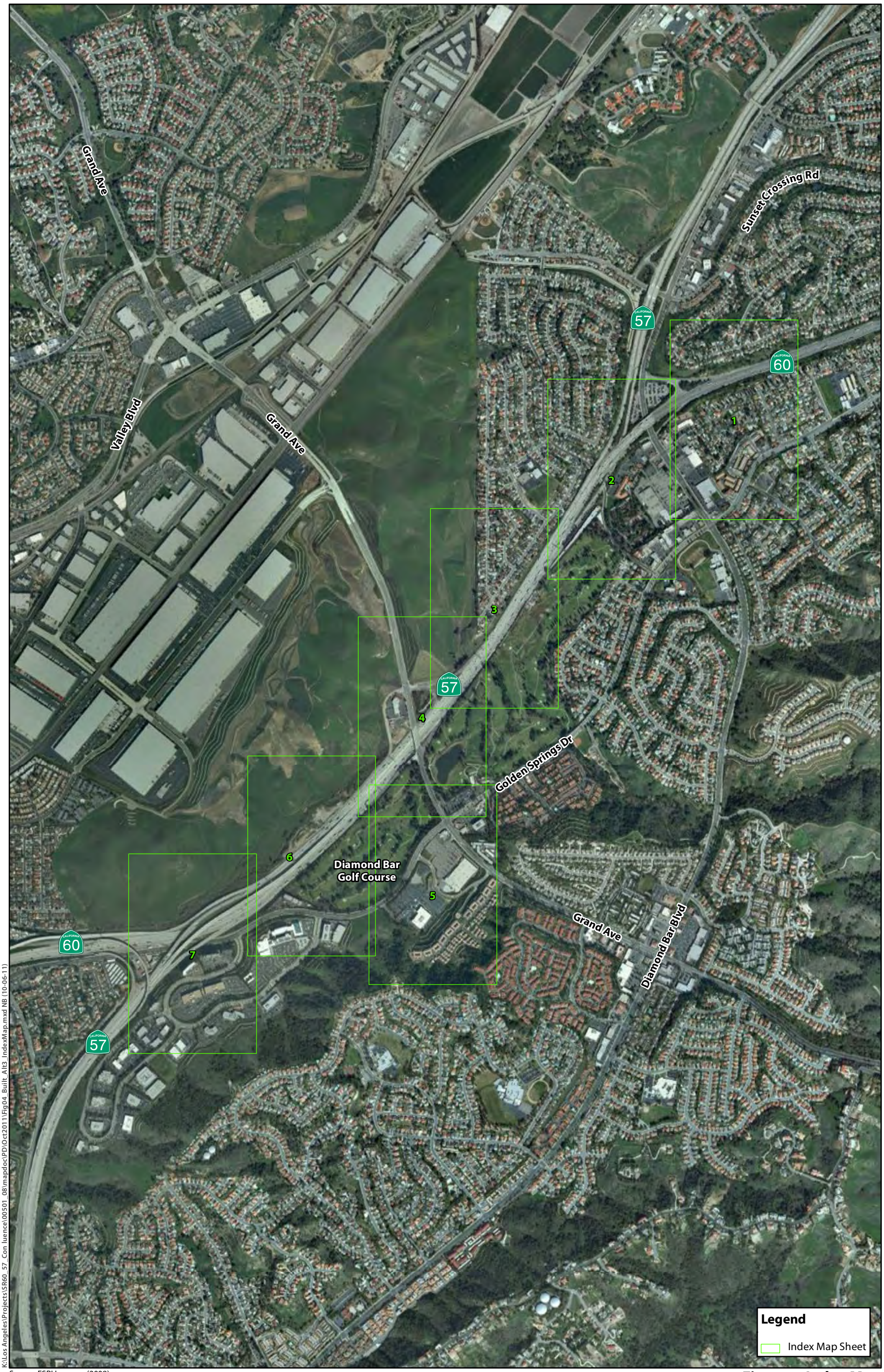

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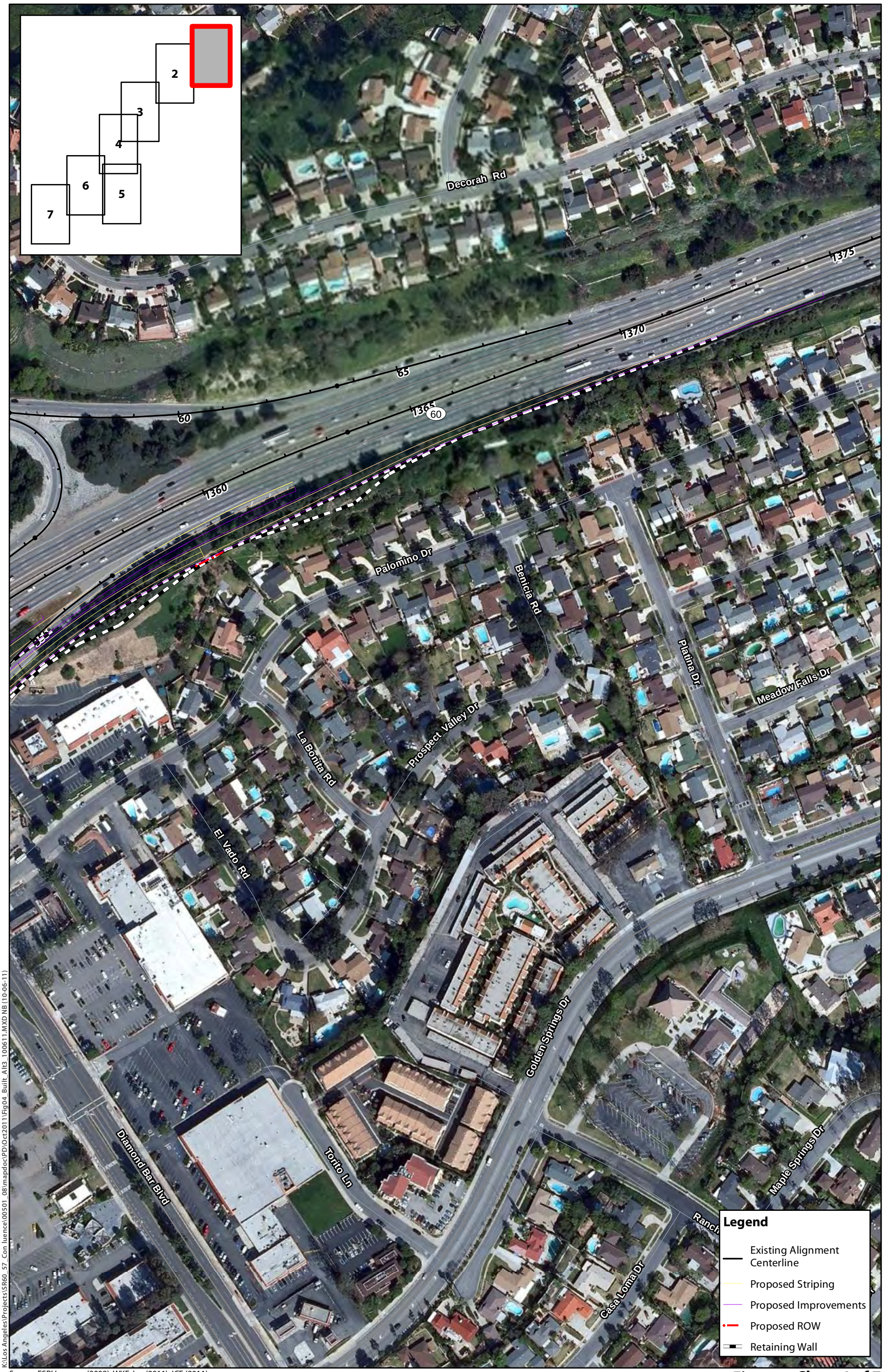
Figure 4-Index Map
Alternative 3, Partial Cloverleaf Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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Figure 4-Sheet 1 of 7
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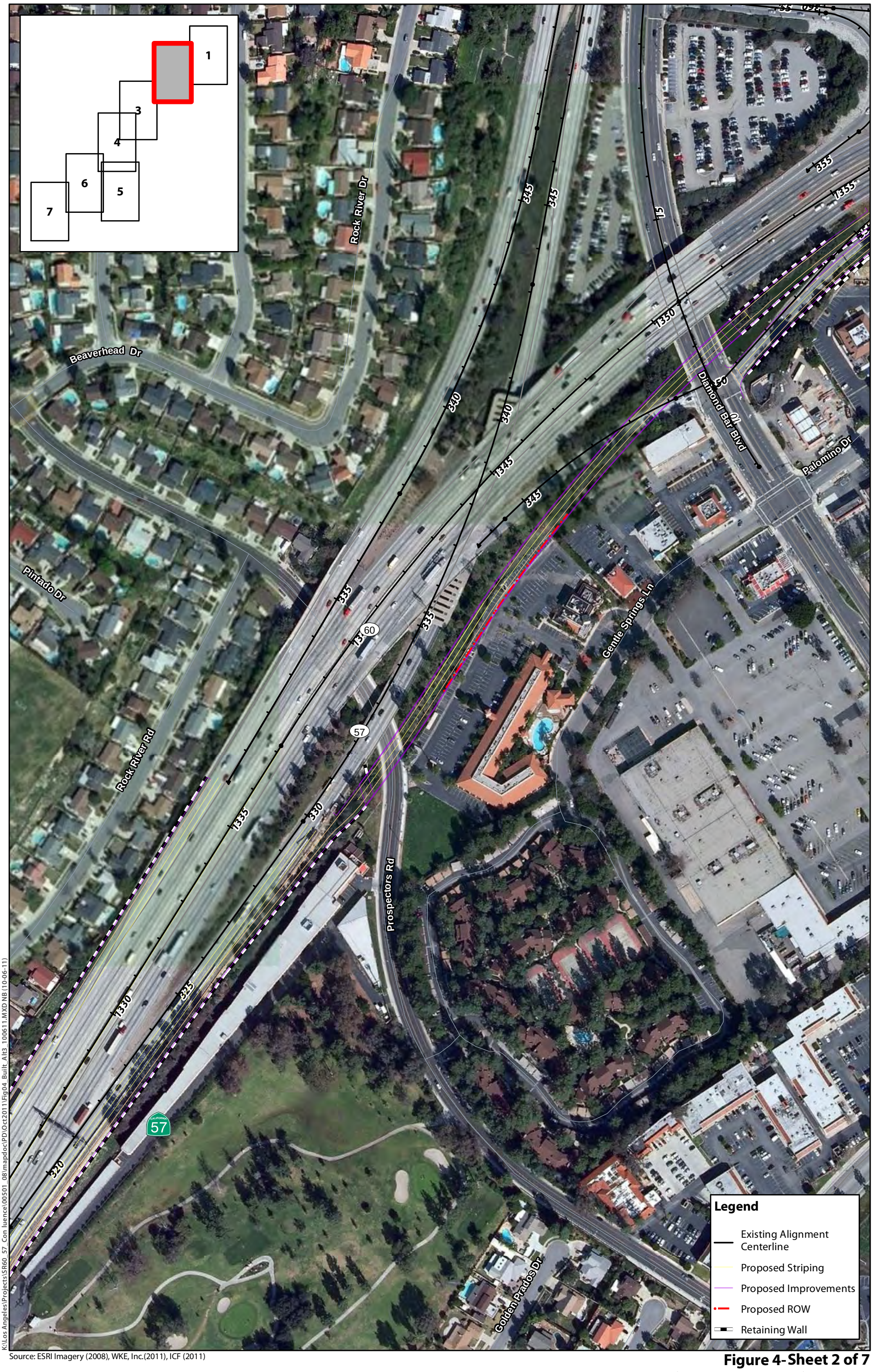
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

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Figure 4-Sheet 2 of 7
Alternative 3, Partial Cloverleaf Interchange Configuration
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Figure 4-Sheet 3 of 7
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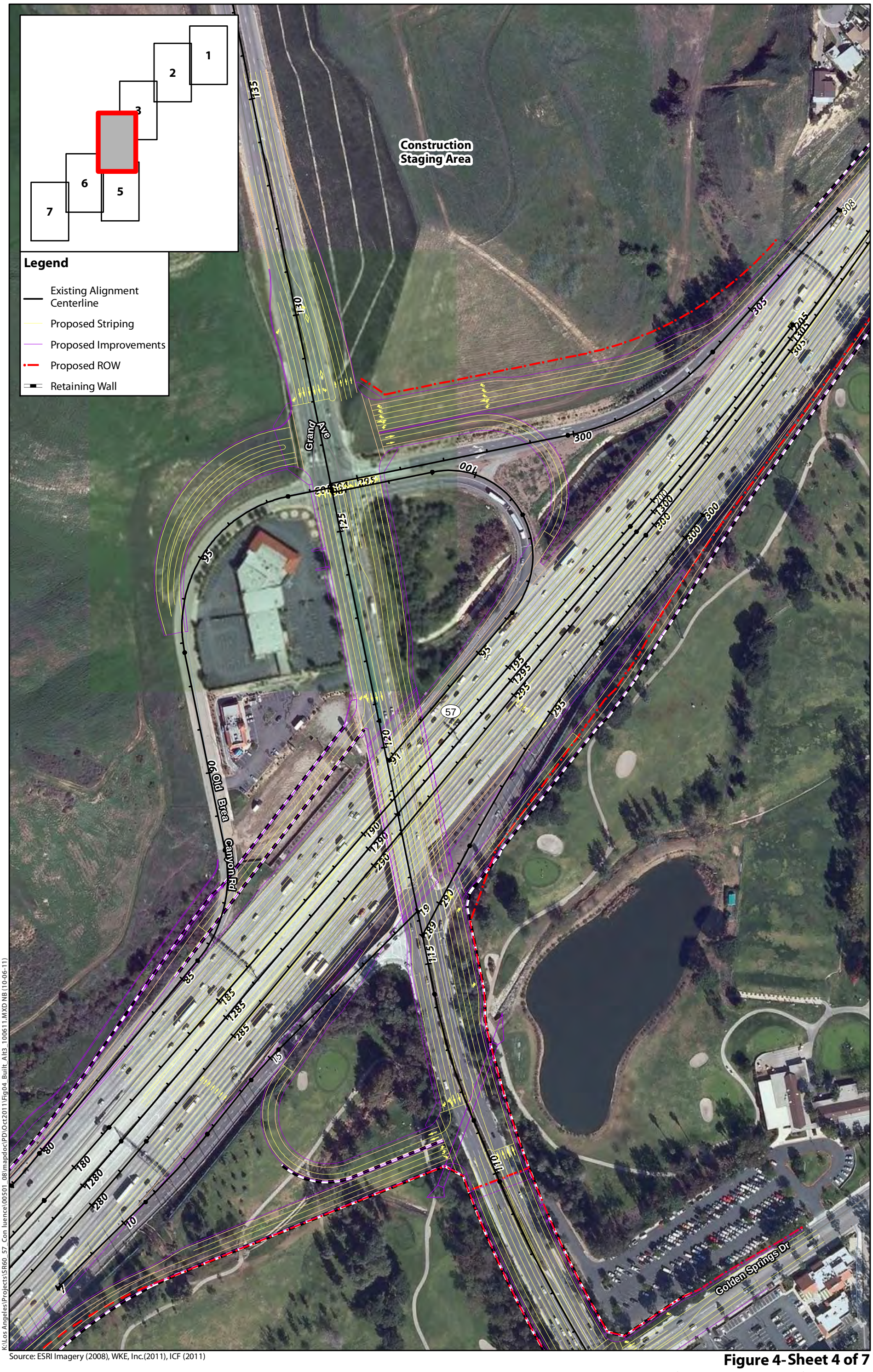

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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

Figure 4- Sheet 4 of 7
Alternative 3, Partial Cloverleaf Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

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Figure 4- Sheet 5 of 7
Alternative 3, Partial Cloverleaf Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

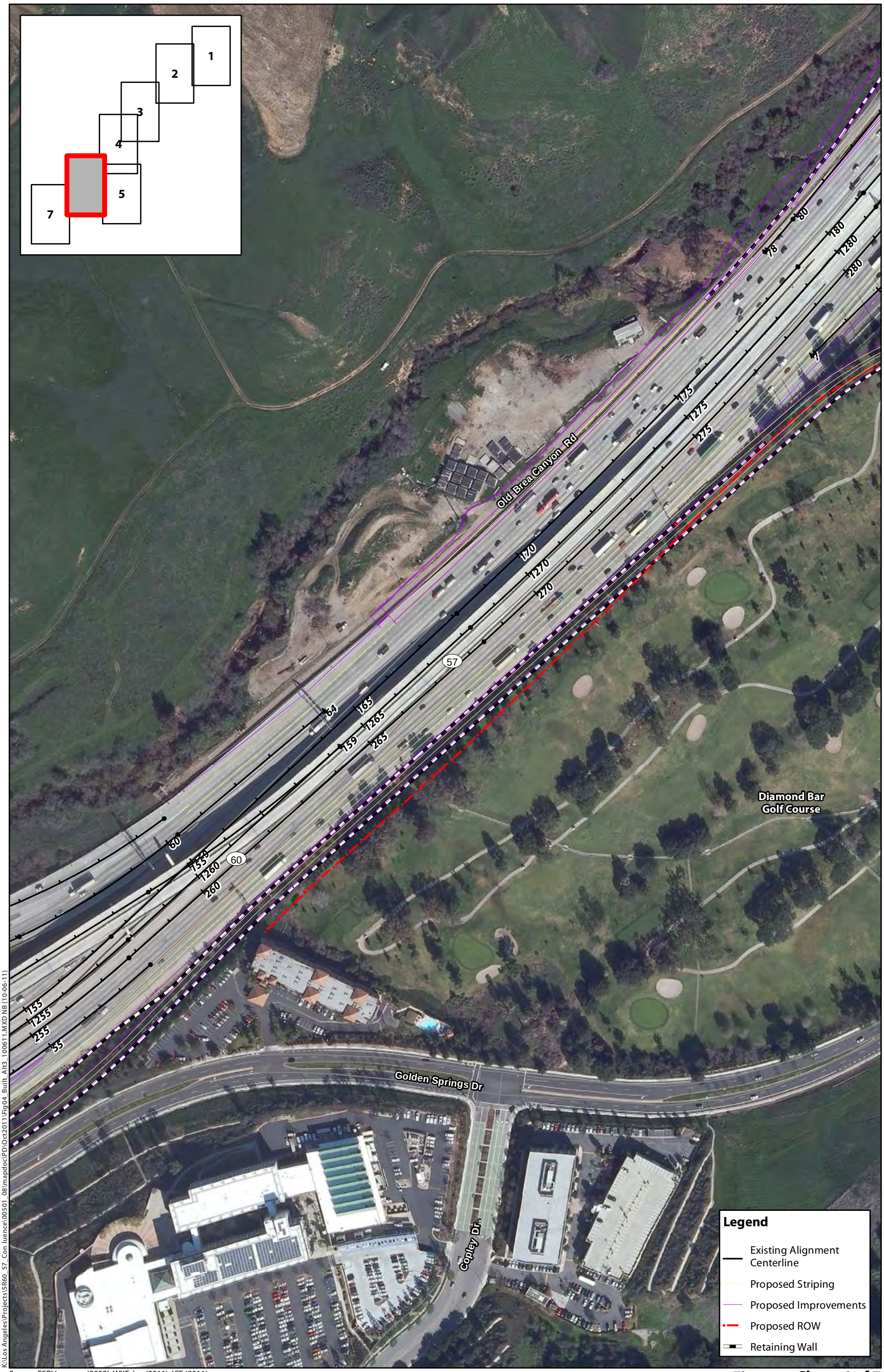

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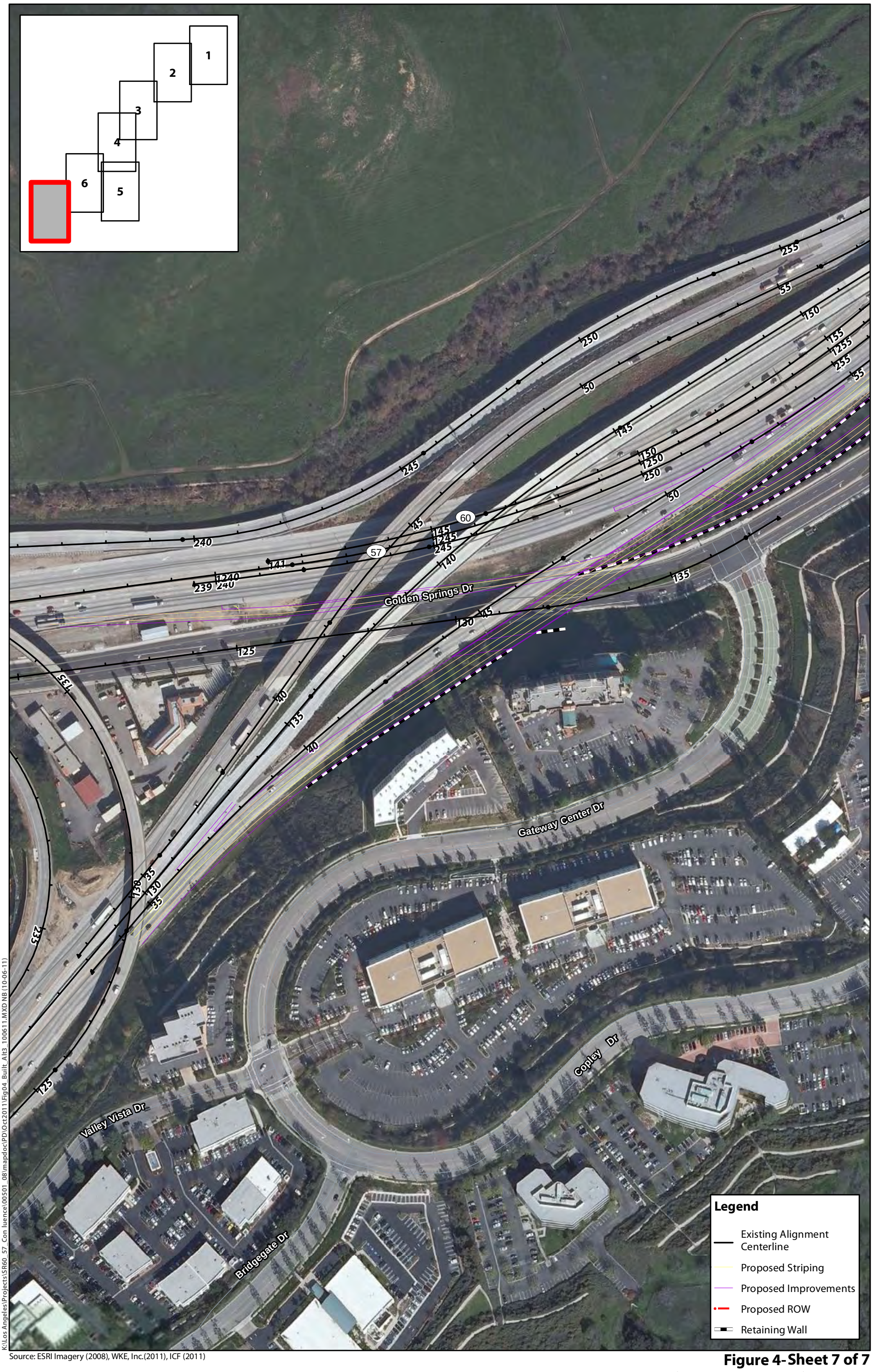
Figure 4-Sheet 6 of 7
Alternative 3, Partial Cloverleaf Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project



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Source: ESRI Imagery (2008), WKE, Inc.(2011), ICF (2011)

Figure 4-Sheet 7 of 7
Alternative 3, Partial Cloverleaf Interchange Configuration
State Route 57/State Route 60 Confluence at Grand Avenue Project

The widening of Grand Avenue would continue south to Golden Springs Drive. Golden Springs Drive would be widened to allow additional through lanes, double left-turn lanes, and one right-turn lane on three legs of the intersection of Grand Avenue and Golden Springs Drive. One right-turn lane would be provided on Grand Avenue at the northbound approach to Golden Springs Drive. Street widening would occur on the north, east and west legs of the intersection. Approximately 600 feet of northbound Grand Avenue south of the intersection at Golden Springs Drive would be restriped to three lanes.

A continuous pedestrian walkway is currently provided on the west side of Grand Avenue between Golden Springs Drive and Old Brea Canyon Road. However, on the east side of Grand Avenue, no pedestrian walkway is provided north of the overcrossing. Under both alternatives, 8-foot-wide walkways on both sides of Grand Avenue would be constructed from Golden Springs Drive to Old Brea Canyon Road. Construction of build the alternatives would not affect pedestrian walkways on other local roads.

New rights-of-way and easements would be required to accommodate the improvements proposed under both build alternatives. It is anticipated that all right-of-way acquisitions would be partial acquisitions. Both alternatives would require property from Diamond Bar Golf Course.

Reconstruction of the northbound SR-57 connector to eastbound SR-60 would require partial acquisition of undevelopable slopes on three parcels. Construction of the new eastbound bypass connector would require aerial easements from three commercial parcels with a hotel and restaurants. Within two of the easements, the potential exists for a few parking stalls to be eliminated to accommodate bridge columns and foundations. The eliminated parking would not be replaced. In addition, a sliver of landscaping area would need to be acquired from a local shopping mall on Grand Avenue near the intersection with Golden Springs Drive. On the north side of the project area, undeveloped land in the City of Industry would need to be acquired to reconstruct the westbound SR-60 off-ramp to Grand Avenue.

Alternative 2 would require 7.1 acres of property from Diamond Bar Golf Course. This would require realigning four fairways within the remaining property. Alternative 3 would require 10.1 acres from the golf course. This would require relocating six fairways within the remaining property and minor improvements to 12 fairways. Both alternatives would also require reconfiguration of a secondary clubhouse driveway to Grand Avenue, with no change to the parking configuration.

With respect to right-of-way acquisitions, retaining walls are proposed in lieu of slopes to limit the amount of land acquired from businesses as well as the golf course. Temporary construction easements (TCEs), ranging from 10 to 15 feet, would be needed along the proposed right-of-way to construct the retaining walls. In addition, permanent maintenance or footing easements would be needed.

Under both alternatives, two utility easements would need to be relocated. A Los Angeles County Sanitation District easement in the slope of the Ayres Hotel would require relocation, and a Southern California Edison distribution line that runs parallel to eastbound SR-60, north of Grand Avenue, would be relocated southward (within the golf course and four commercial parcels).

Alternative 2 would require 173,702 square feet (3.99 acres) of TCEs, and Alternative 3 would require 192,447 square feet (4.42 acres) of TCEs.

2.4.1 Alternative 2 – Combination Cloverleaf/Diamond Configuration Interchange

Alternative 2 would maintain the existing interchange configuration (compact diamond) for the eastbound SR-60 on- and off-ramps. The interchange configuration at Grand Avenue for Alternative 2 would remain a combination partial cloverleaf for the westbound SR-60 on- and off-ramps. An auxiliary lane would be added, connecting the new three-lane on-ramp at Grand Avenue to the new connector, which would bypasses the north/east SR-57/SR-60 interchange.

The existing Grand Avenue overcrossing does not have sufficient length to accommodate an added northbound SR-57 through lane or sufficient vertical clearance over SR-60 to allow for widening. Therefore, it would be replaced. Under Alternative 2, the existing Grand Avenue overcrossing would be replaced by a 10-lane, 148-foot-wide structure over SR-60. The longer span would require a deeper structure, raising the Grand Avenue profile by about 4 feet. The bridge would contain eight through lanes and two 450-foot-long double left-turn lanes from southbound Grand Avenue to the eastbound on-ramp.

2.4.2 Alternative 3 – Partial Cloverleaf Interchange Configuration

The main difference between Alternative 2 and Alternative 3 is the configuration of the eastbound SR-60 interchange at Grand Avenue. Under Alternative 3, the existing eastbound on- and off-ramps at Grand Avenue, which form a compact diamond interchange, would be reconfigured to form a partial cloverleaf interchange. The new intersection at Grand Avenue and the new eastbound on- and off-ramps would be located approximately 500 feet south of the existing intersection (i.e., midway between the freeway and Golden Springs Drive). The new eastbound on-ramp from southbound Grand Avenue would be a loop on-ramp that would join SR-60 as a new eastbound auxiliary lane. The existing eastbound on-ramp would be realigned to accommodate the widened Grand Avenue and merge into the eastbound auxiliary lane created by the new loop on-ramp from southbound Grand Avenue to eastbound SR-60. The auxiliary lane would connect to the new connector that bypasses the north/east SR-57/SR-60 interchange.

The existing Grand Avenue overcrossing would be replaced by a new structure over SR-60. However, unlike Alternative 2, a double left-turn lane from southbound Grand Avenue to the eastbound on-ramp would not be required because vehicles traveling southbound on Grand Avenue would access northbound SR-57 and eastbound SR-60 by way of the new loop on-ramp on the west side of Grand Avenue. The new Grand Avenue overcrossing would be widened to accommodate eight through lanes and a center divider/median (a total width of 136 feet). A longer span would be required to accommodate the third SR-57 through lane and the loop on-ramp auxiliary lane. The longer span would require a deeper structure, raising the Grand Avenue profile by about 4 feet.

2.4.3 Construction Activities and Staging

The construction scenarios would be similar for both Alternative 2 and Alternative 3. The construction phase of the proposed project is anticipated to begin in the fall of 2014 and end by the fall of 2017. The proposed project would involve clearing, excavation, grading, and other site preparation activities prior to structural work and paving. On-site construction staging would occur just north of the westbound SR-60/southbound SR-57 Grand Avenue on- and off-ramps. This area, which is east of Grand Avenue, is owned by the City of Industry.

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, which is available on 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 determine 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, Sound Pressure Levels, and Decibels

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 (20 kHz).

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (mPa). One mPa is approximately one hundred-billionth (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 mPa. Because of this huge range of values, sound is rarely expressed in terms of mPa. Instead, a logarithmic scale is used to describe the sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 mPa.

3.3 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.

3.4 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 human sensitivity to those frequencies. An "A-weighted" sound level (expressed in units of dBA) can then 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 judge the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound 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-scale sound levels), 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 2 describes typical A-weighted noise levels for various noise sources.

3.5 Human Response to Changes in Noise Levels

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

Under controlled conditions in an acoustical laboratory, a 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 midfrequency range (1,000 Hz–8,000 Hz). 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. Furthermore, 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), which would result in a 3 dB increase in sound, would generally be perceived as barely detectable.

Table 2. Typical A-weighted Noise Levels

Common Outdoor Sources	Noise Level (dBA)	Common Indoor Sources
	—110—	Rock band
Jet flyover at 1,000 feet		
	—100—	
Gas lawnmower 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 lawnmower at 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 area (daytime)	—50—	Dishwasher (next room)
Quiet urban area (nighttime)	—40—	Theater, large conference room (background)
Quiet suburban area (nighttime)		
	—30—	Library
Quiet rural area (nighttime)		Bedroom at night, concert
	—20—	
		Broadcast/recording studio
	—10—	
Lowest threshold of human hearing	—0—	Lowest threshold of human hearing

Source: Caltrans, 2009.

3.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. Listed below are the noise descriptors most commonly used in traffic noise analysis.

- **Equivalent Sound Level (L_{eq}):** Leq 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 1-hour period and the basis for noise abatement criteria (NAC) used by Caltrans and FHWA.

- **Percentile-Exceeded Sound Level (L_{xx}):** L_{xx} 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 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 and 10 p.m.

3.7 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 factors discussed below.

3.7.1 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 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and, therefore, 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 dB for each doubling of distance from a line source.

3.7.2 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, excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually 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 dB per doubling of distance is normally assumed. When added to cylindrical spreading, excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

3.7.3 Atmospheric Effects

Receptors located downwind from a source may experience higher noise levels, relative to calm conditions, whereas upwind locations may experience lower noise levels. In addition, sound levels may be higher at a considerable distance from a highway (e.g., more than 500 feet) because of atmospheric temperature inversions (i.e., temperature increases with elevation). Factors such as air temperature, humidity, and turbulence can also have significant effects.

3.7.4 Shielding by Natural or Human-made Features

A large object or barrier 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 of the noise source. Natural terrain features (e.g., hills, dense woods) and human-made features (e.g., buildings, walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver for the specific purpose of reducing 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 a highway and a receiver is rarely effective with respect to reducing noise because it does not create a solid barrier.

Chapter 4 Federal Regulations and State Policies

NEPA and CEQA provide the broad basis for analyzing highway traffic noise effects. The intent of these laws is to promote the general welfare and foster a healthy environment.

4.1 Federal Regulations

Federal guidelines for assessing traffic noise are contained in 23 CFR 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." These regulations constitute the federal noise standard. Projects complying with this standard are also in compliance with the requirements of NEPA.

4.1.1 23 CFR 772

For highway transportation projects with FHWA involvement, the Federal-aid Highway Act of 1970 and the associated implementing regulations (23 CFR 772) govern the analysis and abatement of traffic noise impacts. Specifically, 23 CFR 772 provides procedures for preparing construction and operational noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23 CFR 772, 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 that constructs a highway at a new location or physically alters an existing highway, thereby significantly changing either the horizontal or vertical alignment or increasing 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. Type III projects do not require a noise analysis. If a project is determined to be a Type I project under the FHWA definition, the entire project area, as defined in the environmental document, is a Type I project. Projects such as striping, lighting, signing, and landscaping projects are not considered Type I projects. A Type III project is a project that does not meet the classifications of a Type I or Type II project.

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

Traffic noise impacts, as defined under 23 CFR 772, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23 CFR 772 or a predicted noise level substantially exceeds the existing noise level (a "substantial" noise increase). However, 23 CFR 772 does not specifically define the terms "substantial increase" or "approach." These criteria are defined in the Protocol, as described below.

Table 3 summarizes the NAC and the corresponding land use activity categories identified in the Protocol. Activity categories and related traffic noise impacts are based on actual land uses in a given area.

Table 3. Activity Categories and Noise Abatement Criteria

Activity Category	NAC, Hourly A-weighted Noise Level (dBA L_{eq}[h])	Description of Activities
A	57 exterior	Land where serenity and quiet are of extraordinary significance and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67 exterior	Residential
C	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 Activity Categories A through D or F
F	—	Agricultural areas; airports; bus yards; shipyards; utility infrastructure (e.g., water resources, water treatment facilities, electrical power plants); and emergency service, industrial, logging, maintenance, manufacturing, mining, rail yard, warehouse, and retail facilities
G	—	Undeveloped lands that are not permitted

In determining traffic noise impacts for the activity categories listed above, primary consideration is given to exterior areas where frequent human use occurs (i.e., areas that would benefit from a lower noise level). There are no NAC for Activity Category F or G land uses; however, noise levels are still modeled at these locations for reporting purposes.

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 that are to be used by agencies that sponsor federal or federal-aid highway projects involving new construction or reconstruction. The NAC specified in the Protocol are the same as those specified in 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 dBA. 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 23 CFR 772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

TeNS 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 52 dBA $L_{eq}(h)$ in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or other spaces. This requirement does not replace the "approach or exceed" NAC criterion under FHWA Activity Category D for classroom interiors, but it is a requirement that must be addressed in addition to the requirements of 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 at or below 52 dBA $L_{eq}(h)$. If noise levels exceed 52 dBA $L_{eq}(h)$ prior to construction of a proposed freeway project, then noise abatement must be provided to reduce 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 Receiver Locations

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the proposed project. As stated in the Protocol, noise abatement is considered only for areas of frequent human use that would benefit from a lower noise level. Although all developed land uses were evaluated in this analysis, the focus was on locations of frequent human use. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas. The geometry of the proposed project relative to nearby existing and planned land uses was also identified.

5.2 Field Measurement Procedures

A field noise study was conducted in accordance with the recommended procedures in TeNS. Two long-term measurement sites were selected to capture the diurnal noise level pattern from traffic in the project area near the SR-57/SR-60 interchange. Short-term measurement locations, representing each major land use in the project area, were also selected.

The following is a summary of the procedures used to collect long- and short-term sound level data. Figure 5 shows the long- and short-term monitoring locations.

5.2.1 Long-term Measurements

Long-term monitoring was conducted at two locations (marked LT-1 and LT-2 in Figure 5) to quantify daily noise level trends and identify the peak noise hour, or "loudest" hour, for traffic. The results of this monitoring were used to describe variations in sound levels throughout the day rather than absolute sound levels at a specific receptor of concern. The long-term sound level data were collected over 24-hour periods, March 15 and 16, 2010 (LT-1), and January 26, 2012 (LT-2), using a Rion NL-22 Type 2 sound level meter.

5.2.2 Short-term Measurements

Short-term monitoring was conducted at seven locations on Tuesday, March 16, 2010, using a Larson Davis LD812 Precision Type 1 sound level meter. The short-term monitoring locations are shown in Figure 5.

During the short-term measurements, field staff attended each meter. At all locations, noise levels were measured at a height of 5 feet above the ground and at least 10 feet from structures. The selected sites were affected primarily by traffic noise from the SR-57/SR-60 confluence. At each measurement site, one or more 10-minute noise measurements were taken. The loudest hourly traffic condition for each short-term measurement site was calculated according to the correlation between long- and short-term measurement results. L_{eq}, L_{10}, L_{50}, and L_{90} values

collected during the measurement period were logged, and dominant noise sources observed during each measurement period were also identified and logged. The calibration of the meter was checked before and after the measurement.

Traffic on SR-57/SR-60 was classified and counted by direction, concurrent with short-term noise measurements. Vehicles were classified as automobiles, medium-duty trucks, heavy-duty trucks, buses, or motorcycles. An automobile was defined as a vehicle with two axles and four tires, designed primarily to carry passengers. Small vans and light trucks were included in this category. Medium-duty trucks included all cargo vehicles with two axles and six tires. Heavy-duty trucks included all vehicles with three or more axles.

5.3 Traffic Noise Levels Prediction Methods

Traffic noise levels were predicted using FHWA's Traffic Noise Model, version 2.5 (TNM 2.5). TNM 2.5 is based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a; FHWA 1998b). Three-dimensional representations of roadways, shielding features (e.g., topography, buildings), noise barriers, ground types, and receivers were developed using CAD drawings, aerials, and the topographic contours provided by the project engineer and then entered into the traffic noise model.

Traffic noise was evaluated under existing conditions (2009), design-year (2037) no-project conditions, and design-year (2037) with-project conditions under Build Alternative 2 or Build Alternative 3. Loudest-hour traffic volumes, vehicle classification percentages, and traffic speeds under existing and design-year conditions were taken from the Traffic Operations Analysis Report (KOA Corporation 2011) and entered into the traffic noise model. The highest average traffic volumes on SR-57/SR-60 were predicted to occur during PM hours; therefore, PM peak-hour traffic volumes were used in the model. Each through lane was assumed to have a maximum capacity of 1,950 vehicles per hour so that the loudest-hour level-of-service condition would not be exceeded. The tables in Appendix A (Traffic Data) summarize the traffic volumes and assumptions used for modeling the existing and design-year conditions with and without the build alternatives.

To validate the accuracy of the model, TNM 2.5 was used to compare measured traffic noise levels with modeled noise levels at field measurement locations. For each receiver, traffic volumes measured during the short-term measurement periods were normalized to 1-hour volumes. These normalized volumes were assigned to the corresponding project area roadways to simulate the strength of the noise source at the roadways during the actual measurement period. To adjust measured levels to loudest-hour conditions, the appropriate factor was derived from the 24-hour noise monitoring data and added to the measured level. The loudest-hour noise level was also used to adjust predicted traffic noise levels during the PM peak hour. Once adjusted to loudest-hour conditions, modeled and measured sound levels were then compared to determine the accuracy of the model and recalibrated if necessary.

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Figure 5
Noise Monitoring Locations and Existing Noise Barriers

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

According to the Protocol, noise abatement must be predicted to reduce noise by at least 5 dB at an affected receptor to be considered feasible from an acoustical perspective. Factors that affect feasibility include topography, access requirements for driveways and ramps, the presence of local cross streets, utility conflicts, other noise sources in the area, and safety considerations. The determination of the reasonableness of noise abatement is more subjective than the determination of its feasibility. Reasonableness is the combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

The overall reasonableness of noise abatement is determined by considering the following three factors:

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

Caltrans' acoustical design goal states that a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefited receptors. This design goal applies to any receptor and is not limited to receptors exposed to traffic noise impacts. Barriers should be designed to intercept the line of sight from the exhaust stack of a truck to the first tier of receivers, as stated in the *Highway Design Manual* (California Department of Transportation 2001).

Cost considerations for determining noise abatement reasonableness are evaluated by comparing reasonableness allowances and projected abatement costs. Cost considerations in the reasonableness determination of noise abatement are based on a 2011 allowance per benefited receptor of $55,000. A benefited receptor is a dwelling unit that is predicted to receive a noise reduction of at least 5 dBA from the proposed noise abatement measure. A receptor can be a benefited receptor even if it is not subject to a traffic noise impact. Total allowances for a given noise abatement measure are calculated by multiplying the cost allowance per residence by the number of residences benefited by that abatement measure.

The viewpoints of benefited receptors are determined by the survey process identified in the Protocol. This survey is conducted after completion of the noise study report.

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 and construction noise impacts resulting from the proposed project. Single-family and multifamily residences were identified as Activity Category B land uses in the project area. Outdoor recreational uses in the project area, including Diamond Bar Golf Course, were identified as Activity Category C land uses. Hotel outdoor areas were identified as Activity Category E land uses. Commercial uses (Activity Category F) and undeveloped uses (Activity Category G) were also identified but are not subject to noise impacts, as discussed in Chapter 4.

Although all land uses were evaluated in this analysis, as required by the Protocol, noise abatement was considered only for areas of frequent human use that would benefit from a lower noise level. Accordingly, the impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common use areas at multifamily residences.

Land uses in the project area have been grouped into a series of lettered analysis areas, which are shown in Figure 5.

- **Area A: Areas east of South Diamond Bar Boulevard.** This area includes all locations in the study area east of Diamond Bar Boulevard, where SR-57 and SR-60 diverge. In this area, SR-60 is a 10-lane roadway (including one HOV lane in each direction) with paved shoulders. The SR-60 eastbound on-ramp extends along the southeast quadrant of the interchange. Land uses in this area consist of single-family residences (Activity Category B) and commercial uses (Activity Category F). Outdoor areas considered areas of frequent human use include the private yards associated with the residences.
- **Area B: South of SR-60, South Prospectors Road to South Diamond Bar Boulevard.** This area is near the eastern convergence of SR-57 and SR-60. In this area, northbound SR-57 runs through a tunnel under SR-60, which is a 10-lane roadway (including one HOV lane in each direction) with paved shoulders. Land uses in this area consist of multifamily residences (Activity Category B), a hotel (Activity Category E), and commercial uses (Activity Category F). Outdoor areas considered areas of frequent human use include the tennis courts and swimming pool within the multifamily residential development. The hotel includes a swimming pool, which would be considered an area of frequent outdoor use.
- **Area C: North of SR-57/SR-60, Grand Avenue to Rock River Drive.** This area is north of the SR-57/SR-60 confluence. In this area, SR-57/SR-60 is 14-lane roadway (including one HOV lane in each direction) with paved shoulders, transitioning to eight lanes on SR-57 at the divergence from SR-60. Land uses in this area consist of single-family residences (Activity Category B) and Armstrong Elementary School (Activity Category C). Outdoor areas of frequent human use include the private yards associated with the residences and the school playground. This area also includes commercial use (Activity Category F) and undeveloped use (Activity Category G) adjacent to Grand Avenue.

- **Area D: South of SR-57/SR-60, project western terminus to the intersection of Golden Springs Drive and Copley Drive.** This area is south of the SR-57/SR-60 confluence. In this area, SR-57/SR-60 transitions from a 14-lane roadway (including one HOV lane in each direction) to a roadway with a varying number of lanes as ramps for SR-57 and SR-60 separate from the confluence at the western end of the project area. Land uses in this area consist of hotels with outdoor swimming pools (Activity Category E), which are considered outdoor areas of frequent human use. There is also an outdoor use area associated with a day care facility (Activity Category C). The hotel properties with outdoor swimming pools and the day care facility are located on elevated terrain that faces the SR-57/SR-60 confluence.
- **Area G: South of SR-57/SR-60, between Golden Springs Drive and South Prospectors Road.** Diamond Bar Golf Course is considered an outdoor area of frequent human use and therefore evaluated as an Activity Category C land use. Area G also contains a residential neighborhood adjacent to the golf course (Activity Category B).

6.2 Noise Measurement Results

The existing noise environment in the project area is characterized below according to the short- and long-term noise monitoring that was conducted.

6.2.1 Short-term Monitoring

Table 4 summarizes the results of the short-term noise monitoring conducted in the project area. The short-term monitoring sites are shown in Figure 5. One measurement, ST-8, was conducted to document other sources that contribute to noise levels in the project area. Residences in the project area are generally on elevated terrain, relative to the confluence; therefore, background noise levels measured at site ST-8 are considered representative of the other residential neighborhoods that surround the project area. The dominant source of noise levels in the community other than traffic on SR-57/SR-60 was observed to be local traffic, measured at a sound level of 50.1 dBA L_{eq}. This level is lower than noise levels on SR-57/SR-60 by a factor of more than 10 dB, therefore existing community noise levels do not significantly contribute to noise levels at noise sensitive receivers evaluated for this project.

Table 4. Summary of Short-term Measurements

Location	Address	Area	Shielding	Start Time	Duration (minutes)	Measured L_{eq}
ST-1	Residence, 23619 Palomino Drive	A	20-foot berm	9:00 a.m.	10	61.2
ST-2	Best Western Hotel, South Gentle Springs Lane	B	hotel building	9:40 a.m.	10	57.3
ST-3	First-row residence, 300 South Rock River Road	C	4-foot privacy wall	1:10 p.m.	10	73.9
ST-4	Second-row residence, 293 South Rock River Road	C	4-foot privacy wall	1:40 p.m.	10	58.6
ST-5	Residence, 465 Golden Prados Drive	G	none	10:40 a.m.	10	59.1

Location	Address	Area	Shielding	Start Time	Duration (minutes)	Measured L_{eq}
ST-6	Diamond Bar Golf Course, 75 feet from SR-57/SR-60	G	none	11:30 a.m.	10	78.2
ST-7	Holiday Inn Select, Gateway Center Drive	D	6-foot privacy wall	2:40 p.m.	10	71.5
ST-8 (background measurement)	23617 Meadcliff Place	A	none	12:00 p.m.	10	50.1

6.2.2 Long-term Monitoring

Long-term monitoring location LT-1 is located in the backyard of a residence on the north side of SR-57/SR-60 (408 Rock River Road), approximately 100 feet from the westbound lanes. A microphone was placed at a height of about 3 feet above the surrounding ground. Noise levels were monitored for a 24-hour period on March 15 and 16, 2010. Hourly average noise levels ranged from a minimum of 75.5 dBA $L_{eq}(h)$ during the 2 a.m. hour to a maximum of 81.0 dBA $L_{eq}(h)$ during the 2 p.m. hour. A graph summarizing the results of the long-term monitoring is provided in Figure 6A.

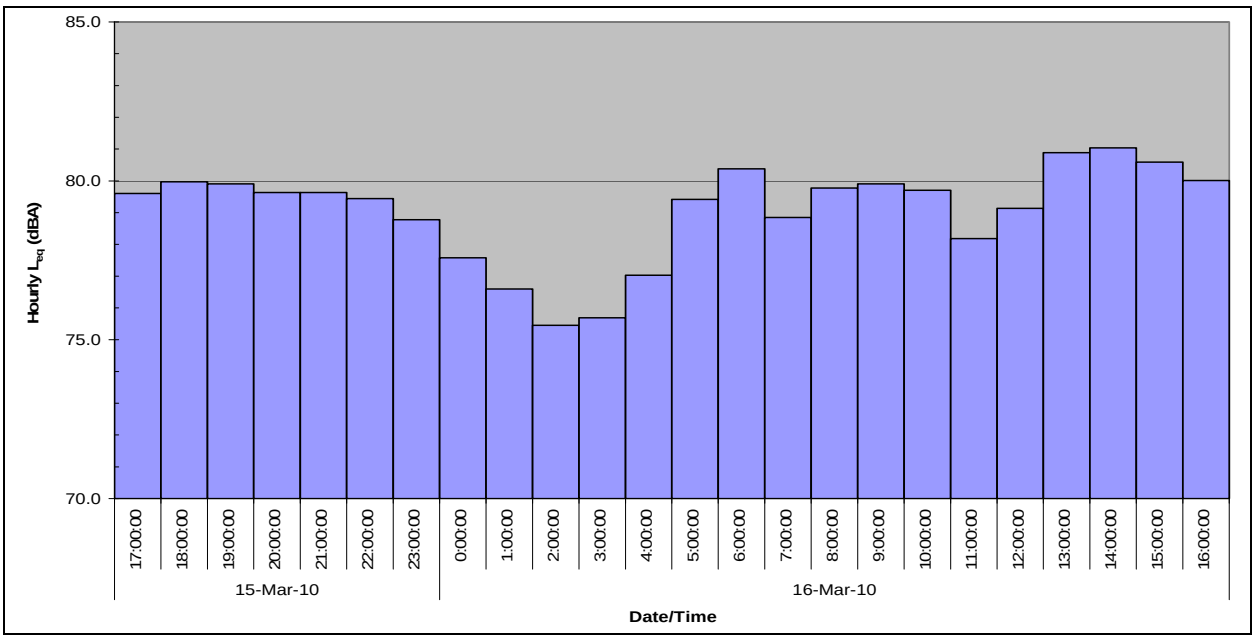

Figure 6A: Long-term Noise Monitoring, Site LT-1, March 15–16, 2010

Long-term monitoring location LT-2 is located in the backyard of a residence on the south side of SR-60 (23603 Palomino Drive), approximately 100 feet from the eastbound lanes. A microphone was placed at a height of about 3 feet above the surrounding ground. Noise levels were monitored for a 24-hour period on January 26, 2012. Hourly average noise levels ranged from a minimum of 52.1 dBA $L_{eq}(h)$ during the 1 a.m. hour to a maximum of 59.3 dBA $L_{eq}(h)$ during the 7 p.m. hour. A graph summarizing the results of the long-term monitoring is provided in Figure 6B.

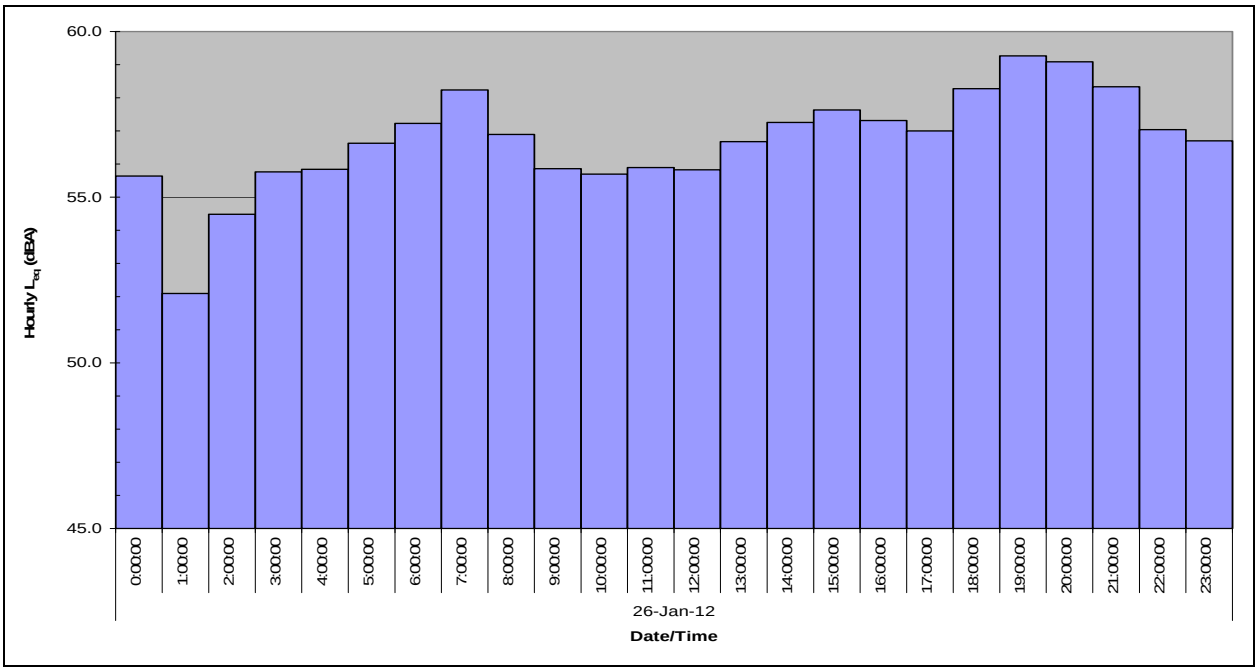

Figure 6B: Long-term Noise Monitoring, Site LT-2, January 26, 2012

6.3 Noise Model Calibration

TNM 2.5 was used to compare measured traffic noise levels with modeled noise levels at field measurement locations (see Table 5). The digitized roadway, barrier, receiver, and building row locations were entered into the traffic noise model for calibration. Traffic counts conducted simultaneously with noise measurements were normalized to 1-hour traffic volumes. These hourly traffic volumes were also entered into the model for calibration. Traffic volumes were classified into three vehicle types: light-duty automobiles and trucks, medium-duty trucks (typically trucks with two axles and more than four wheels), and heavy-duty trucks (typically trucks with more than two axles).

In general, modeled sound level predictions that use counted traffic are considered to be in reasonable agreement if they are within +/- 1 dB of measured sound levels. As shown in Table 5, predicted sound levels at short-term measurement sites were found to overpredict measured sound levels by up to 3.1 dB. The predicted sound level at one site was 0.7 dB lower than the measured level (ST-7), which falls within a reasonable range of agreement with the measured sound level.

As discussed in Section 5.3, traffic data were provided for the PM peak hour. However, according to 24-hour monitoring data, the loudest hour of the day is 2 p.m. at Site LT-1 and 7 p.m. at Site LT-2. Traffic noise levels during the PM peak period were found to differ from the loudest hour of the day by 1.2 dB and 1.8 dB respectively. Therefore, additional adjustments were made to account for loudest-hour conditions at noise prediction sites in the TNM.

Table 5. Comparison of Measured Sound Levels with Predicted Sound Levels in the TNM for Short-term Measurement Sites

Location	Area	Measured Sound Level (dBA)	Predicted Sound Level (dBA)	Predicted minus Measured (dB)
ST-1	A	61.2	64.2	+ 3.0
ST-2	B	57.3	59.1	+ 1.8
ST-3	C	73.9	75.0	+ 1.1
ST-4	C	58.6	61.1	+ 2.5
ST-5	G	59.1	62.2	+ 3.1
ST-6	G	78.2	78.8	+ 0.6
ST-7	D	71.5	70.5	-1.0

The calibration factors shown in Table 6 provide reasonable agreement between measured and predicted sound levels when adjusted for loudest-hour conditions. The calibration factors were applied to the predicted traffic noise levels in the model. The results of the traffic noise modeling analysis are shown in Table B-1 in Appendix B.

Table 6. Derivation of Calibration Factors Used in TNM

Location	Area	Location	Predicted minus Measured (dB)	Measured loudest hour	Adjustment for Loudest-hour Conditions (average PM peak hour minus loudest hour) (dB)	Adjustment for Calibration of Noise Model (loudest-hour conditions) (dB)	Predicted minus Measured after Adjustments (dB)
ST-1	A	First row	+ 3.0	7:00 p.m. (LT-2)	- 1.8	**- 1.0**	+ 0.2
ST-2	B	Second row	+ 1.8	2:00 p.m. (LT-1)	- 1.2	**0.0**	+ 0.6
ST-3	C	First row	+ 1.1	2:00 p.m. (LT-1)	- 1.2	**0.0**	- 0.1
ST-4	C	Second row	+ 2.5	2:00 p.m. (LT-1)	- 1.2	**0.0**	+ 1.3
ST-5	G	> 500 ft from SR-57/SR-60	+ 3.1	2:00 p.m. (LT-1)	- 1.2	**- 1.0**	+ 0.9
ST-6	G	60 ft from SR-57/SR-60	+ 0.6	2:00 p.m. (LT-1)	- 1.2	**0.0**	- 0.6
ST-7	D	200 ft from SR-57/SR-60	- 1.0	2:00 p.m. (LT-1)	- 1.2	**+ 2.0**	- 0.2

Chapter 7 Future Noise Environment, Impacts, and Considered Abatement

7.1 Future Noise Environment and Impacts

Table B-1 in Appendix B summarizes the traffic noise modeling results for existing conditions and design-year conditions with and without the project. Predicted design-year traffic noise levels with the project are compared with existing conditions as well as design-year no-project conditions. The comparison with existing conditions is included in the analysis to identify traffic noise impacts under 23 CFR 772. The comparison with no-project conditions indicates the direct effect of the proposed project.

Modeling results in Table B-1 indicate that predicted traffic noise levels for the design-year with-project conditions approach or exceed the NAC of 67 dBA $L_{eq}(h)$ for Activity Category B and C land uses at residences and outdoor use areas in the project area. The results in Table B-1 also indicate that predicted traffic noise levels under design-year with-project conditions would not approach or exceed the NAC of 72 dBA $L_{eq}(h)$ for Activity Category E land uses in the project area. A substantial increase in noise levels, as defined in the Protocol, is not predicted for any land uses in the project area. Because noise levels approach or exceed the NAC for Activity Category B and C land uses, traffic noise impacts are predicted to occur. Therefore, noise abatement must be considered.

Future predicted noise levels at noise-sensitive receiver locations are considered to be equal under the two build alternatives. From an acoustical perspective, the only significant difference between the geometry of the two build alternatives is the ramp configuration in the southwest quadrant of the Grand Avenue interchange at SR-57/SR-60. However, noise from traffic using the ramp would be overshadowed by noise from through traffic on SR-57/SR-60. Therefore, the two build alternatives are considered equal for noise analysis purposes. The traffic noise modeling focused on Alternative 3.

7.2 Preliminary Noise Abatement Analysis

In accordance with 23 CFR 772, noise abatement is considered only for areas of frequent human use that would benefit from a lower noise level. A detailed evaluation of noise barriers is provided for affected Activity Category B and C land uses.

According to 23 CFR 772(13)(c), federal funding may be used for the following abatement measures:

- Construction of noise barriers, including the acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement measure.
- Traffic management measures, including traffic control devices and signing to prohibit certain vehicle types, time/use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.

- Alteration of horizontal and vertical alignments.
- Acquisition of real property or interests therein (predominantly unimproved property) to create a buffer zone and preempt development that would be adversely affected by traffic noise. This measure may be included in Type I projects only.
- Noise insulation for the Activity Category D land use facilities listed in Table 3. Post-installation maintenance and operational costs for noise insulation are not eligible for federal-aid funding.

Each noise barrier was evaluated for feasibility according to its achievable noise reduction. For each noise barrier found to be acoustically feasible, reasonable cost allowances were calculated.

For any noise barrier considered reasonable from a cost perspective, the estimated cost of the noise barrier should be equal to or less than the total cost allowance calculated for the barrier. The cost calculations of the noise barrier should include all items considered appropriate and necessary for construction of the barrier, such as traffic control devices, drainage modifications, and retaining walls. The design of noise barriers presented in this report is preliminary. It has been conducted at a level appropriate for environmental review but not for final design of the project.

Preliminary information regarding the physical location, length, and height of evaluated noise barriers is provided in this report. If pertinent parameters change substantially during final project design, preliminary noise barrier designs may be modified or eliminated from the final project. A final decision regarding construction of the noise abatement measure will be made upon completion of the project design.

The following is a discussion of noise abatement considered for each evaluation area within the project area. Evaluation areas and noise prediction locations are shown in Figures 7-1 to 7-4.

7.2.1 Area A

Noise modeling results shown in Table B-1 indicate that residences located along Palomino Drive would approach or exceed the Activity Category B NAC of 67 dBA $L_{eq}(h)$ under design-year conditions. Traffic noise impacts are predicted to occur at two residences in this area. A noise barrier was designed for the eastbound SR-60 on-ramp and evaluated with respect to feasibility and benefit to residences along Palomino Drive.

Detailed modeling analysis for this section of Area A indicates that a barrier up to 24 feet high would not meet the design goal (i.e., a 7 dB noise reduction) at noise-sensitive first-row receiver locations. An existing berm adjacent to the on-ramp provides acoustical shielding and breaks the line of sight to SR-60 from residences along Palomino Drive. As a result, a noise barrier would provide limited acoustical benefit. Therefore, Noise Barrier A is not feasible from an acoustical perspective. (The analysis for Noise Barrier A is provided in Table C-1 of Appendix C.)

Acoustical shielding is provided by an existing noise barrier along the eastbound side of SR-60 for several residential receivers located on Palomino Drive. Predicted noise levels at residences located behind the existing barrier do not approach the NAC. It is recommended that this existing noise barrier be maintained.

Legend

- Noise Measurement Sites
- Existing Noise Barrier
- Prediction site, residential (Activity Category B)
- Prediction site, outdoor use area (Activity Category C)
- Prediction site, hotel use area (Activity Category E)
- Prediction site, commercial/undeveloped area (Activity Category F/G)
- Project Area

Source: Google Inc. 2010. Google Earth Pro. Version 5.2. Mountain View, CA. Accessed: 10/18/2010.

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Figure 7-1
Noise Prediction Locations
(Sheet 1 of 4)

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Figure 7-2
Noise Prediction Locations
(Sheet 2 of 4)

Graphics... 00501.08 (02-12) SS

Figure 7-3
Noise Prediction Locations
(Sheet 3 of 4)

Graphics... 00501.08 (02-12) SS

Figure 7-4
Noise Prediction Locations
(Sheet 4 of 4)

Noise modeling results in Table B-1 indicate that residences along Decorah Road would be exposed to traffic noise levels in the range of 58 to 73 dBA L_{eq}(h) under design-year build conditions. Therefore, traffic noise levels at these residences are predicted to approach or exceed the NAC of 67 dBA L_{eq}(h) for Activity Category B under design-year conditions. Traffic noise impacts are predicted to occur at 43 residences in this area. A noise barrier was designed for the westbound SR-60 off-ramp, and evaluated with respect to feasibility and benefit to residences along Decorah Road.

Noise Barrier A-2 was evaluated for wall heights in the range of 6 to 16 feet, with an estimated total length of 2,440 feet. Noise barrier analysis locations and predicted traffic noise levels for Noise Barrier A-2 are provided in Appendix C (Table C-2). The barrier evaluation is summarized in Table 7. The location of Noise Barrier A-2 is shown in Figure 8.

Table 7. Summary of Reasonableness Determination Data—Noise Barrier A-2

Predicted Sound Level without Barrier	
Design-year loudest-hour noise level (dBA L_{eq}[h])	73
Design-year noise level minus existing noise level (maximum) (dB)	1

Design Year with Barrier	H = 6 ft	H = 8 ft	H = 10 ft	H = 12 ft	H = 14 ft	H = 16 ft
Maximum barrier noise reduction (dB)	8	10	12	13	14	15
Design goal of 7 dB met?	Yes	Yes	Yes	Yes	Yes	Yes
Number of benefited residences	36	36	36	36	36	41
Reasonable allowance per benefited residence	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Total reasonable allowance	1,980,000	$1,980,000	$1,980,000	$1,980,000	$1,980,000	$2,255,000

7.2.2 Area B

Traffic noise modeling results in Table B-1 indicate that traffic noise levels at the hotel swimming pool in Area B would be 58 dBA L_{eq}(h) under worst-hour conditions. Outdoor use areas such as the pool, tennis courts, and balconies at the Fall Creek condominium apartments on South Prospectors Drive are located toward the center of the complex, with the buildings providing acoustical shielding at these locations. Worst-hour noise levels are predicted to be 58 to 62 dBA L_{eq}(h). Therefore, traffic noise impacts are not predicted to occur in Area B, and no noise abatement is considered.

7.2.3 Area C

Noise modeling results in Table B-1 indicate that residences in Area C would be exposed to traffic noise levels in the range of 61 to 77 dBA L_{eq}(h) under design-year build conditions. Therefore, traffic noise levels in Area C are predicted to approach or exceed the NAC of 67 dBA L_{eq}(h) for Activity Category B and C under design-year conditions. Traffic noise impacts are predicted to occur at 60 residences and the outdoor area at Armstrong Elementary School.

Within Area C, there are several existing residential noise barriers, which are made of concrete and/or masonry materials. The barriers were modeled under existing and design-year conditions at a nominal height, ranging from 4 to 12 feet. The 12-foot-high sections are located near the edge of SR-57/SR-60 along River Rock Road, south of North Prospectors Road, where the freeway is elevated relative to the ground elevation of the residences. The 4-foot-high sections are located further to the south where the residences are elevated above the ground elevation of the freeway. Noise Barrier C was designed in the model to follow the line of the existing 4-foot-high privacy wall that fronts the first-row residences located along Rock River Road, south of North Prospectors Road. The barrier would have a total length of approximately 2,300 feet. Increasing the height of the existing 12-foot-high barrier was also evaluated, but it was found that this approach would not provide additional acoustical benefit for residences along the SR-57/SR-60 frontage.

Noise Barrier C was evaluated at wall heights in the range of 6 to 16 feet. Noise barrier analysis locations and predicted traffic noise levels for the analyzed noise barrier are provided in Appendix C (Table C-3). The barrier evaluation is summarized in Table 8. The location of Noise Barrier C is shown in Figure 9.

Table 8. Summary of Reasonableness Determination Data—Noise Barrier C

Predicted Sound Level without Barrier	
Design-year loudest-hour noise level (dBA L_{eq}[h])	77
Design-year noise level minus existing noise level (maximum) (dB)	2

Design Year with Barrier	H = 6 ft	H = 8 ft	H = 10 ft	H = 12 ft	H = 14 ft	H = 16 ft
Maximum barrier noise reduction (dB)	4	5	6	7	8	9
Design goal of 7 dB met?	No	No	No	Yes	Yes	Yes
Number of benefited residences	0	0	0	33	35	35
Reasonable allowance per benefited residence	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Total reasonable allowance	$0	$0	$0	$1,815,000	$1,925,000	$1,925,000

Noise Barrier C-2 was evaluated for residences located along Rock River Road, north of North Prospectors Road, with wall heights in the range of 6 to 16 feet and an estimated total length of 1,280 feet. Noise barrier analysis locations as well as the predicted traffic noise levels for Noise Barrier C-2 are provided in Appendix C (Table C-4). The barrier evaluation is summarized in Table 9, and the location of Noise Barrier C-2 is shown in Figure 9.

Figure 8
Future Noise Barrier A-2

Figure 9
Evaluated Future Noise Barrier C

Table 9. Summary of Reasonableness Determination Data—Noise Barrier C-2

Predicted Sound Level without Barrier	
Design-year loudest-hour noise level (dBA L_{eq}[h])	79
Design-year noise level minus existing noise level (maximum) (dB)	2

Design Year with Barrier	H = 6 ft	H = 8 ft	H = 10 ft	H = 12 ft	H = 14 ft	H = 16 ft
Maximum barrier noise reduction (dB)	8	10	12	13	14	15
Design goal of 7 dB met?	Yes	Yes	Yes	Yes	Yes	Yes
Number of benefited residences	16	16	16	16	16	16
Reasonable allowance per benefited residence	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Total reasonable allowance	$880,000	$880,000	$880,000	$880,000	$880,000	$880,000

7.2.4 Area D

Noise modeling results in Table B-1 indicate that hotel (Activity Category E) outdoor areas with frequent human use in Area D would be exposed to traffic noise levels in the range of 68 to 75 dBA L_{eq}(h) under design-year build conditions. Traffic noise levels are therefore predicted to approach or exceed the Activity Category E NAC of 72 dBA L_{eq}(h) under design-year conditions at one hotel, a Holiday Inn on Gateway Center Drive. The noise barrier analysis for the hotel indicates that a barrier up to 24 feet high would not meet the design goal (i.e., a 7 dB noise reduction) at noise-sensitive first-row receiver locations, most likely because the elevation of the pool is significantly higher than that of the highway and the footings for the potential noise barrier. Therefore, Noise Barrier D is not feasible from an acoustical perspective. The noise barrier analysis for Noise Barrier D is provided in Table C-5 in Appendix C.

7.2.5 Area G

Noise modeling results in Table B-1 indicate that outdoor areas of frequent human use at Diamond Bar Golf Course would be exposed to traffic noise levels in the range of 61 to 81 dBA L_{eq}(h) under design-year build conditions. Therefore, traffic noise levels are predicted to approach or exceed the Activity Category C NAC of 67 dBA L_{eq}(h) for active sporting areas. As defined in the Protocol, one receptor must be placed at each hole of the golf course in an area (e.g., tee box, fairway, green) with the highest expected traffic noise level for that hole. If other outdoor activity areas exist within the course (e.g., practice areas, picnic facilities, outdoor restaurant areas), each formalized activity area must be evaluated with a separate receptor. Please note that the golf course receptors in the model are based on the TEE and Green complexes of the new golf course layout from the Dec 7, 2010 golf course design by Casey O'Callaghan.

Noise Barrier G would consist of two barriers, G-1 and G-2, each with evaluated wall heights of 6 to 16 feet. Noise barrier G-1 is proposed as part of the project. The barriers would have lengths of 2,220 feet (west of Grand Avenue) and 2,970 feet (east of Grand Avenue). Predicted traffic noise levels for the analyzed noise barriers are provided in Appendix C (Table C-6). The barrier evaluations are summarized in Tables 10 and 11. The locations of Noise Barriers G-1 and G-2 are shown in Figure 10.

Table 10. Summary of Reasonableness Determination Data—Noise Barrier G-1

Predicted Sound Level without Barrier	
Design-year loudest-hour noise level (dBA L_{eq}[h])	81
Design-year noise level minus existing noise level (maximum) (dB)	5

Design Year with Barrier	H = 6 ft	H = 8 ft	H = 10 ft	H = 12 ft	H = 14 ft	H = 16 ft
Maximum barrier noise reduction (dB)	6	8	9	10	11	12
Design goal of 7 dB met?	No	Yes	Yes	Yes	Yes	Yes
Number of benefited outdoor use areas	0	2	5	7	7	7
Reasonable allowance per benefited outdoor use areas	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Total reasonable allowance	$0	$110,000	$275,000	$385,000	$385,000	$385,000

Table 11. Summary of Reasonableness Determination Data—Noise Barrier G-2

Predicted Sound Level without Barrier	
Design-year loudest-hour noise level (dBA L_{eq}[h])	75
Design-year noise level minus existing noise level (maximum) (dB)	5

Design Year with Barrier	H = 6 ft	H = 8 ft	H = 10 ft	H = 12 ft	H = 14 ft	H = 16 ft
Maximum barrier noise reduction (dB)	1	2	4	6	7	8
Design goal of 7 dB met?	No	No	No	No	Yes	Yes
Number of benefited outdoor use areas	0	0	0	0	1	1
Reasonable allowance per benefited outdoor use areas	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Total reasonable allowance	$0	$0	$0	$0	$55,000	$55,000

Figure 10
Evaluated Future Noise Barriers G-1 and G-2

Chapter 8 Construction Noise

During construction of the proposed project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Construction noise is regulated by Caltrans' provisions in Section 14-8.02, "Noise Control," of the *Draft 2010 Standard Specifications and Special Provisions*.

Table 12 summarizes the noise levels produced by the types of construction equipment that are commonly used on roadway construction projects. Construction equipment is expected to generate noise levels ranging from 70 to 90 dB 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 12. 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.

Pile driving, if necessary, generates sounds that are unique in terms of noise level, audibility characteristics, and time pattern. The louder impact sounds are heard very briefly (e.g., a "bang" or "clang") and typically concentrated over a 10- to 30-minute period when an individual pile is being driven. These types of impact sounds attenuate with distance in the same manner as regular construction noise such that the maximum levels would be 99 dBA at 100 feet, 93 dBA at 200 feet, 87 dBA at 400 feet, etc.

Support machinery associated with pile driving produces lower noise levels and corresponds to the regular construction activity described above. The discussion above pertains to both impact-type pile driving and vibratory pile driving, although, depending on the pile type being driven, vibratory pile driving can be noticeably quieter. Measurements taken for a pilot project indicate that vibratory pile driving can be as much as 15 dBA quieter than the impact method when driving H-piles (URS Corporation 2002). Vibratory methods are not always suitable for the soil conditions, however, and thus may not be a feasible alternative. A potential alternative to pile driving is the use of drilled, cast-in-place columns.

Sound control shall conform to the provisions in Section 14-8.02, "Noise Control," of Caltrans' *Draft 2010 Standard Specifications and Special Provisions*:

> Do not exceed 86 dBA at 50 feet from the job site activities from 9 p.m. to 6 a.m. Use an alternative warning method instead of a sound signal unless required by safety laws. Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

This requirement in no way relieves the contractor from responsibility for complying with local ordinances that regulate noise levels. The noise level requirement shall apply to equipment on the job or related to the job, including trucks, transit mixers, or transient equipment that may or may not be owned by the contractor. The use of loud signals shall be avoided in favor of light warnings, except those required by safety laws for the protection of personnel. Full compensation for conforming to the requirements of this section shall be considered as included in the prices for the various contract items of the work involved, and no additional compensation will be allowed.

No adverse noise impacts from construction are anticipated because construction would be conducted in accordance with applicable local noise standards and Caltrans' provisions in Section 14-8.02, "Noise Control," of the *Draft 2010 Standard Specifications and Special Provisions.*

Construction noise would be short-term, intermittent, and overshadowed by local traffic noise. Furthermore, implementing the measures below would further minimize temporary noise impacts from construction.

- As directed by Caltrans, the contractor will implement appropriate additional noise mitigation measures, including changing the location of stationary construction equipment, turning off idling equipment, rescheduling construction activity, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources.
- Where practicable, sound-attenuating shrouds shall be installed and used around the hammer/pile impact area of pile driver equipment during pile driving. Pile holes shall be pre-drilled where practical. To the extent practical, the contractor shall limit pile-driving noise to a maximum sound level of 95 dBA at a distance of 50 feet.

Chapter 9 References

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APPENDICES

Appendix A Traffic Data

Volumes - *traffic data from KOA Corporation traffic report, September 2011*

	SR 57 S NB [1]	SR 57 S SB [2]	SR 60 S NB [3]	SR 60 S SB [4]	SR 57/60 NB [5]	SR 57/60 SB [6]	SR 57 N NB [7]	SR 57 N SB [8]
Existing	4,431	4,862	5,374	4,871	9,415	8,867	4,444	4,873
No Build	4,600	6,100	7,700	7,600	11,300	11,400	6,000	6,000
Build	4,600	6,100	7,700	7,600	11,300	11,400	6,000	6,000

	Grand Ave NB	Grand Ave SB	Diamond Bar NB	Diamond Bar SB	Ramp NB 1 off	Ramp SB 2 on	Ramp SB 3 off	Ramp NB 4 on
Existing	1,198	1,663	702	1,227	390	866	647	1,333
No Build	2,600	4,330	1,110	1,620	990	790	1,250	1,470
Build	2,600	4,330	1,110	1,620	990	790	1,250	1,470

	Golden Sp W	Golden Sp E	Build Ramp	Build Ramp	Build Ramp
Existing	2,612	1,929	--	--	--
No Build	3,940	2,730	--	--	--
Build	3,940	2,730	1,170	880	620

Model Classification - *Truck Count data from Caltrans web site*

	SR 57 S NB	SR 57 S SB	SR 60 S NB	SR 60 S SB	SR 57/60 NB	SR 57/60 SB	SR 57 N NB	SR 57 N SB
Autos	89.9%	89.9%	89.9%	89.9%	89.9%	89.9%	89.9%	89.9%
Medium	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
Heavy	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%

Speed

	SR 57/60 NB	SR 57/60 SB	Arterials EB	Arterials WB	
Autos	65	65	45	45	mph
Medium	65	65	45	45	mph
Heavy	55	55	45	45	mph

Calibration - *Traffic volumes normalized to one hour from 15-minute counts*

	ST-1 NB	ST-1 SB	ST-2 NB	ST-2 SB	ST-3 NB	ST-3 SB	ST-4 NB	ST-4 SB
Autos	5,910	6,552	5,514	6,444	4,854	6,006	5,712	5,916
Medium	240	294	330	288	306	372	348	306
Heavy	942	948	948	1,008	888	810	1,278	906

	ST-5 NB	ST-5 SB	ST-6 NB	ST-6 SB	ST-7 NB	ST-7 SB
Autos	6,822	6,528	6,588	6,642	6,588	6,642

Appendix B Predicted Future Noise Levels and Impacts

Table B-1. Predicted Future Traffic Noise Levels

Receiver	Area	Activity Category	Approach NAC Noise Levels dBA Leq(h)	Noise Modeling Adjustment Factor (1) dB	Existing Conditions Year 2009 (2) dBA Leq(h)	Future No-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future No-project minus Existing dB	Future With-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future With-project minus Existing dB	Increase Future With-project minus Future No-Project dB	Approach or Exceed The NAC?	Substantial Increase over Existing levels?	Barrier Evaluated
A1	A	B	66	- 1	61	62	+ 1	64	+ 3	+ 2	No	No	Noise Barrier A
A2	A	B	66	- 1	61	62	+ 1	67	+ 6	+ 5	Yes	No	Noise Barrier A
ST1	A	B	66	- 1	61	62	+ 1	67	+ 6	+ 5	Yes	No	Noise Barrier A
A3	A	B	66	- 1	61	62	+ 1	65	+ 4	+ 3	No	No	Noise Barrier A
A4	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	Noise Barrier A
A5	A	C	66	- 1	62	63	+ 1	63	+ 1	0	No	No	Noise Barrier A
A6	A	B	66	- 1	62	63	+ 1	64	+ 2	+ 1	No	No	Noise Barrier A
A7	A	B	66	- 1	64	65	+ 1	64	0	- 1	No	No	Noise Barrier A
A8	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	Noise Barrier A
A09	A	B	66	- 1	64	64	0	64	0	0	No	No	No
A10	A	B	66	- 1	63	64	+ 1	64	+ 1	0	No	No	No
A11	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A12	A	B	66	- 1	61	62	+ 1	63	+ 2	+ 1	No	No	No
A13	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A14	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A15	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A16	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A17	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A18	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A19	A	B	66	- 1	62	63	+ 1	63	+ 1	0	No	No	No
A20	A	B	66	- 1	65	66	+ 1	66	+ 1	0	Yes	No	Noise Barrier A-2
A21	A	B	66	- 1	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier A-2
A22	A	B	66	- 1	68	69	+ 1	69	+ 1	0	Yes	No	Noise Barrier A-2
A23	A	B	66	- 1	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier A-2
A24	A	B	66	- 1	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier A-2
A25	A	B	66	- 1	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier A-2
A26	A	B	66	- 1	71	71	0	71	0	0	Yes	No	Noise Barrier A-2
A27	A	B	66	- 1	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier A-2
A28	A	B	66	- 1	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier A-2
A29	A	B	66	- 1	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier A-2
A30	A	B	66	- 1	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier A-2
A31	A	B	66	- 1	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier A-2
A32	A	B	66	- 1	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier A-2
A33	A	B	66	- 1	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier A-2
A34	A	B	66	- 1	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier A-2
A35	A	B	66	- 1	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier A-2
A36	A	B	66	- 1	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier A-2
A43	A	B	66	- 1	63	65	+ 2	64	+ 1	- 1	No	No	Noise Barrier A-2
A44	A	B	66	- 1	65	66	+ 1	66	+ 1	0	Yes	No	Noise Barrier A-2
A45	A	B	66	- 1	63	64	+ 1	63	0	- 1	No	No	Noise Barrier A-2
A46	A	B	66	- 1	57	58	+ 1	58	+ 1	0	No	No	Noise Barrier A-2
A47	A	B	66	- 1	60	61	+ 1	61	+ 1	0	No	No	Noise Barrier A-2
B1	B	E	71	0	58	59	+ 1	58	0	- 1	No	No	No
ST2	B	E	71	0	59	60	+ 1	60	+ 1	0	No	No	No
B2	B	B	66	0	59	60	+ 1	60	+ 1	0	No	No	No
B3	B	B	66	0	59	60	+ 1	60	+ 1	0	No	No	No

(1) Accounted for in noise levels shown.
(2) Modeled noise levels adjusted to the loudest hour of the day.
(3) Noise levels are included for Activity Category F and G land uses for reporting purposes, as required under the Protocol (rev. 2011)

Table B-1. Predicted Future Traffic Noise Levels

Receiver	Area	Activity Category	Approach NAC Noise Levels dBA Leq(h)	Noise Modeling Adjustment Factor (1) dB	Existing Conditions Year 2009 (2) dBA Leq(h)	Future No-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future No-project minus Existing dB	Future With-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future With-project minus Existing dB	Increase Future With-project minus Future No-Project dB	Approach or Exceed The NAC?	Substantial Increase over Existing levels?	Barrier Evaluated
B4	B	B	66	0	61	62	+ 1	62	+ 1	0	No	No	No
B5	B	B	66	0	56	58	+ 2	58	+ 2	0	No	No	No
C1	C	B	66	0	67	68	+ 1	68	+ 1	0	Yes	No	Noise Barrier C
C2	C	B	66	0	66	67	+ 1	67	+ 1	0	Yes	No	Noise Barrier C
C3	C	B	66	0	67	68	+ 1	68	+ 1	0	Yes	No	Noise Barrier C
C4	C	B	66	0	68	70	+ 2	69	+ 1	- 1	Yes	No	Noise Barrier C
C5	C	B	66	0	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier C
C6	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C
C7	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C
C8	C	B	66	0	69	71	+ 2	70	+ 1	- 1	Yes	No	Noise Barrier C
C9	C	B	66	0	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier C
C10	C	B	66	0	73	74	+ 1	74	+ 1	0	Yes	No	Noise Barrier C
ST3	C	B	66	0	76	77	+ 1	77	+ 1	0	Yes	No	Noise Barrier C
C11	C	B	66	0	75	77	+ 2	77	+ 2	0	Yes	No	Noise Barrier C
C12	C	B	66	0	75	76	+ 1	76	+ 1	0	Yes	No	Noise Barrier C
C13	C	B	66	0	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier C
C14	C	B	66	0	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier C
C15	C	B	66	0	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier C
C16	C	B	66	0	73	74	+ 1	74	+ 1	0	Yes	No	Noise Barrier C
C17	C	B	66	0	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier C
C18	C	B	66	0	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier C
C19	C	B	66	0	71	72	+ 1	73	+ 2	+ 1	Yes	No	Noise Barrier C
C20	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C
C21	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C
LT1	C	B	66	0	68	69	+ 1	70	+ 2	+ 1	Yes	No	Noise Barrier C
C22	C	B	66	0	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier C
C23	C	B	66	0	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier C
C24	C	B	66	0	69	70	+ 1	70	+ 1	0	Yes	No	Noise Barrier C
C25	C	B	66	0	68	69	+ 1	70	+ 2	+ 1	Yes	No	Noise Barrier C
C26	C	B	66	0	68	69	+ 1	69	+ 1	0	Yes	No	Noise Barrier C
C27	C	B	66	0	68	69	+ 1	69	+ 1	0	Yes	No	Noise Barrier C
C28	C	B	66	0	68	69	+ 1	69	+ 1	0	Yes	No	Noise Barrier C
C29	C	B	66	0	68	69	+ 1	69	+ 1	0	Yes	No	Noise Barrier C
C30	C	B	66	0	60	61	+ 1	61	+ 1	0	No	No	Noise Barrier C
C31	C	B	66	0	61	62	+ 1	62	+ 1	0	No	No	Noise Barrier C
C32	C	B	66	0	62	63	+ 1	63	+ 1	0	No	No	Noise Barrier C
C33	C	B	66	0	64	65	+ 1	65	+ 1	0	No	No	Noise Barrier C
C34	C	B	66	0	64	66	+ 2	66	+ 2	0	Yes	No	Noise Barrier C
C35	C	B	66	0	64	65	+ 1	65	+ 1	0	No	No	Noise Barrier C
C36	C	B	66	0	64	65	+ 1	65	+ 1	0	No	No	Noise Barrier C
C37	C	B	66	0	65	66	+ 1	66	+ 1	0	Yes	No	Noise Barrier C
ST4	C	B	66	0	61	62	+ 1	62	+ 1	0	No	No	Noise Barrier C
C38	C	C	66	0	70	72	+ 2	71	+ 1	- 1	Yes	No	Noise Barrier C
C39	C	G (3)	--	0	73	74	+ 1	74	+ 1	0	No	No	No
C40	C	F (3)	--	0	73	74	+ 1	74	+ 1	0	No	No	No
C41	C	G (3)	--	0	71	72	+ 1	72	+ 1	0	No	No	No

(1) Accounted for in noise levels shown.
(2) Modeled noise levels adjusted to the loudest hour of the day.
(3) Noise levels are included for Activity Category F and G land uses for reporting purposes, as required under the Protocol (rev. 2011)

Table B-1. Predicted Future Traffic Noise Levels

Receiver	Area	Activity Category	Approach NAC Noise Levels dBA Leq(h)	Noise Modeling Adjustment Factor (1) dB	Existing Conditions Year 2009 (2) dBA Leq(h)	Future No-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future No-project minus Existing dB	Future With-project Conditions Year 2037 (2) dBA Leq(h)	Increase Future With-project minus Existing dB	Increase Future With-project minus Future No-Project dB	Approach or Exceed The NAC?	Substantial Increase over Existing levels?	Barrier Evaluated
C42	C	B	66	0	65	66	+ 1	66	+ 1	0	Yes	No	Noise Barrier C-2
C43	C	B	66	0	78	80	+ 2	79	+ 1	- 1	Yes	No	Noise Barrier C-2
C44	C	B	66	0	78	80	+ 2	79	+ 1	- 1	Yes	No	Noise Barrier C-2
C45	C	B	66	0	75	76	+ 1	76	+ 1	0	Yes	No	Noise Barrier C-2
C46	C	B	66	0	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier C-2
C47	C	B	66	0	72	73	+ 1	73	+ 1	0	Yes	No	Noise Barrier C-2
C48	C	B	66	0	71	72	+ 1	72	+ 1	0	Yes	No	Noise Barrier C-2
C49	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C-2
C50	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C-2
C60	C	B	66	0	64	65	+ 1	65	+ 1	0	No	No	Noise Barrier C-2
C61	C	B	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier C-2
D1	D	E	71	+ 2	65	67	+ 2	68	+ 3	+ 1	No	No	No
D2	D	E	71	+ 2	67	68	+ 1	68	+ 1	0	No	No	Noise Barrier D
ST7	D	E	71	+ 2	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier D
D3	D	C	66	+ 2	59	60	+ 1	60	+ 1	0	No	No	No
G1	G	C	66	0	74	75	+ 1	75	+ 1	0	Yes	No	Noise Barrier G
G2	G	C	66	0	67	69	+ 2	68	+ 1	- 1	Yes	No	Noise Barrier G
G3	G	C	66	- 1	64	65	+ 1	66	+ 2	+ 1	Yes	No	Noise Barrier G
G4	G	C	66	- 1	62	63	+ 1	67	+ 5	+ 4	Yes	No	Noise Barrier G
G5	G	C	66	- 1	62	64	+ 2	64	+ 2	0	No	No	Noise Barrier G
G6	G	C	66	0	71	72	+ 1	63	- 8	- 9	No	No	Noise Barrier G
G7	G	C	66	0	79	80	+ 1	81	+ 2	+ 1	Yes	No	Noise Barrier G
G8	G	C	66	- 1	62	63	+ 1	66	+ 4	+ 3	Yes	No	Noise Barrier G
G9	G	C	66	- 1	62	64	+ 2	66	+ 4	+ 2	Yes	No	Noise Barrier G
G10	G	C	66	- 1	60	62	+ 2	64	+ 4	+ 2	No	No	Noise Barrier G
G11	G	C	66	- 1	60	62	+ 2	64	+ 4	+ 2	No	No	Noise Barrier G
G12	G	C	66	0	75	76	+ 1	76	+ 1	0	Yes	No	Noise Barrier G
G13	G	C	66	0	78	79	+ 1	77	- 1	- 2	Yes	No	Noise Barrier G
G14	G	C	66	0	69	70	+ 1	72	+ 3	+ 2	Yes	No	Noise Barrier G
G15	G	C	66	- 1	60	61	+ 1	65	+ 5	+ 4	No	No	Noise Barrier G
G16	G	C	66	- 1	61	62	+ 1	64	+ 3	+ 2	No	No	Noise Barrier G
G17	G	C	66	0	70	71	+ 1	71	+ 1	0	Yes	No	Noise Barrier G
G18	G	C	66	0	73	75	+ 2	76	+ 3	+ 1	Yes	No	Noise Barrier G
G19	G	C	66	0	75	76	+ 1	77	+ 2	+ 1	Yes	No	Noise Barrier G
G20	G	C	66	- 1	63	64	+ 1	67	+ 4	+ 3	Yes	No	Noise Barrier G
ST6	G	C	66	0	79	80	+ 1	82	+ 3	+ 2	Yes	No	Noise Barrier G
G21	G	B	66	- 1	62	64	+ 2	68	+ 6	+ 4	Yes	No	No
ST5	G	B	66	- 1	63	64	+ 1	68	+ 5	+ 4	Yes	No	No

(1) Accounted for in noise levels shown.
(2) Modeled noise levels adjusted to the loudest hour of the day.
(3) Noise levels are included for Activity Category F and G land uses for reporting purposes, as required under the Protocol (rev. 2011)

Appendix C Barrier Analysis

Table C-1. SR57/60 Confluence Barrier Analysis - Noise Barrier A

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])									
					6	8	10	12	14	16	18	20	22	24
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
A	A1	61	64	+ 3	64	63	63	63	63	62	62	62	62	62
	A2	61	67	+ 6	66	65	65	64	63	63	63	62	62	62
	ST1	61	67	+ 6	66	65	64	64	63	63	63	62	62	62
	A3	61	65	+ 4	64	64	64	63	63	62	62	62	62	61
	A4	62	63	+ 1	63	63	63	63	63	63	63	62	62	62
	A5	62	63	+ 1	63	63	63	63	63	63	63	63	63	62
	A6	62	64	+ 2	63	63	63	63	63	62	62	62	62	62
	A7	64	64	0	64	64	64	64	64	64	64	64	64	64
	A8	62	63	+ 1	63	63	62	62	62	62	62	62	62	62

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction									
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
A	A1	61	64	2	0	1	1	1	1	2	2	2	2	2
	A2	61	67	1	1	2	2	3	4	4	4	5	5	5
	ST1	61	67	0	1	2	3	3	4	4	4	5	5	5
	A3	61	65	2	1	1	1	2	2	3	3	3	3	4
	A4	62	63	2	0	0	0	0	0	0	0	1	1	1
	A5	62	63	1	0	0	0	0	0	0	0	0	0	1
	A6	62	64	4	1	1	1	1	1	2	2	2	2	2
	A7	64	64	3	0	0	0	0	0	0	0	0	0	0
	A8	62	63	9	0	0	1	1	1	1	1	1	1	1

Number of Benefited Receivers									
6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
0	0	0	0	0	0	0	1	1	1

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Table C-2. SR57/60 Confluence Barrier Analysis - Noise Barrier A-2

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
A-2	A20	65	66	+ 1	65	65	65	64	64	64
	A21	69	70	+ 1	65	64	64	63	63	63
	A22	68	69	+ 1	63	63	62	61	61	61
	A23	69	70	+ 1	65	64	63	61	60	60
	A24	69	70	+ 1	64	63	62	61	60	59
	A25	70	71	+ 1	64	62	61	60	59	59
	A26	71	71	0	63	62	61	60	59	59
	A27	71	72	+ 1	64	63	62	61	60	59
	A28	71	72	+ 1	64	62	61	60	59	59
	A29	71	72	+ 1	64	62	61	61	60	59
	A30	72	73	+ 1	64	63	62	61	60	59
	A31	72	73	+ 1	64	63	62	61	60	59
	A32	72	73	+ 1	66	64	63	62	61	60
	A33	72	73	+ 1	67	66	64	63	61	60
	A34	72	73	+ 1	65	63	61	60	59	58
	A35	71	72	+ 1	65	63	61	60	59	58
	A36	70	71	+ 1	64	62	61	60	59	58
	A43	63	64	+ 1	59	59	58	58	57	57
	A44	65	66	+ 1	64	64	63	63	62	61
	A45	63	63	0	63	63	62	62	61	60
	A46	57	58	+ 1	57	57	56	56	56	56
	A47	60	61	+ 1	60	60	60	60	60	60

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
A-2	A20	65	66	2	1	1	1	2	2	2
	A21	69	70	2	5	6	6	7	7	7
	A22	68	69	2	6	6	7	8	8	8
	A23	69	70	2	5	6	7	9	10	10
	A24	69	70	2	6	7	8	9	10	11
	A25	70	71	2	7	9	10	11	12	12
	A26	71	71	2	8	9	10	11	12	12
	A27	71	72	2	8	9	10	11	12	13
	A28	71	72	2	8	10	11	12	13	13
	A29	71	72	2	8	10	11	11	12	13
	A30	72	73	2	9	10	11	12	13	14
	A31	72	73	2	9	10	11	12	13	14
	A32	72	73	2	7	9	10	11	12	13
	A33	72	73	2	6	7	9	10	12	13
	A34	72	73	2	8	10	12	13	14	15
	A35	71	72	2	7	9	11	12	13	14
	A36	70	71	2	7	9	10	11	12	13
	A43	63	64	4	5	5	6	6	7	7
	A44	65	66	5	2	2	3	3	4	5
	A45	63	63	5	0	0	1	1	2	3
	A46	57	58	6	1	1	2	2	2	2
	A47	60	61	11	1	1	1	1	1	1

Number of Benefited Receivers					
6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
36	**36**	**36**	**36**	**36**	**41**

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Table C-3. SR57/60 Confluence Barrier Analysis - Noise Barrier C

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
C	C1	67	68	+ 1	68	68	68	68	67	67
	C2	66	67	+ 1	67	67	67	67	67	66
	C3	67	68	+ 1	68	68	68	68	67	66
	C4	68	69	+ 1	69	69	69	69	68	68
	C5	69	70	+ 1	70	70	70	70	69	68
	C6	70	71	+ 1	71	71	71	71	69	68
	C7	70	71	+ 1	71	71	71	71	70	69
	C8	69	70	+ 1	70	70	70	70	69	68
	C9	69	70	+ 1	70	70	70	70	69	67
	C10	73	74	+ 1	72	71	70	70	68	67
	ST3	76	77	+ 1	74	72	72	71	70	70
	C11	75	77	+ 2	73	72	71	70	69	69
	C12	75	76	+ 1	73	71	70	69	68	67
	C13	74	75	+ 1	72	70	69	68	67	66
	C14	74	75	+ 1	72	70	69	68	67	66
	C15	74	75	+ 1	72	71	69	68	67	66
	C16	73	74	+ 1	71	70	69	67	66	65
	C17	72	73	+ 1	71	70	69	67	66	65
	C18	71	72	+ 1	70	69	68	66	66	64
	C19	71	73	+ 2	70	69	68	67	66	65
	C20	70	71	+ 1	69	68	67	66	65	64
	C21	70	71	+ 1	69	68	67	65	65	64
	LT1	68	70	+ 2	68	67	66	66	65	64
	C22	69	70	+ 1	69	67	66	65	64	64
	C23	69	70	+ 1	68	67	66	65	64	63
	C24	69	70	+ 1	68	67	66	65	64	63
	C25	68	70	+ 2	68	67	66	64	64	63
	C26	68	69	+ 1	68	67	66	64	64	63
	C27	68	69	+ 1	68	67	65	64	64	63
	C28	68	69	+ 1	68	66	65	64	64	62
	C29	68	69	+ 1	68	66	65	64	64	63
	C30	60	61	+ 1	61	61	60	60	60	59
	C31	61	62	+ 1	62	61	61	61	60	60
	C32	62	63	+ 1	63	63	62	62	62	61
	C33	64	65	+ 1	64	64	63	63	62	62
	C34	64	66	+ 2	65	65	65	64	63	63
	C35	64	65	+ 1	65	65	65	65	64	63
	C36	64	65	+ 1	65	65	65	65	65	64
	C37	65	66	+ 1	66	66	66	66	65	65
	C38	70	71	+ 1	71	71	71	71	70	69
	ST4	61	62	+ 1	62	62	62	62	60	60

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
C	C1	67	68	2	0	0	0	0	1	1
	C2	66	67	2	0	0	0	0	0	1
	C3	67	68	2	0	0	0	0	1	2
	C4	68	69	1	0	0	0	0	1	1
	C5	69	70	2	0	0	0	0	1	2
	C6	70	71	1	0	0	0	0	2	3
	C7	70	71	1	0	0	0	0	1	2
	C8	69	70	1	0	0	0	0	1	2
	C9	69	70	1	0	0	0	0	1	3
	C10	73	74	2	2	3	4	4	6	7
	ST3	76	77	0	3	5	5	6	7	7
	C11	75	77	2	4	5	6	7	8	8
	C12	75	76	1	3	5	6	7	8	9
	C13	74	75	2	3	5	6	7	8	9
	C14	74	75	1	3	5	6	7	8	9
	C15	74	75	1	3	4	6	7	8	9
	C16	73	74	1	3	4	5	7	8	9
	C17	72	73	2	2	3	4	6	7	8
	C18	71	72	2	2	3	4	6	6	8
	C19	71	73	2	3	4	5	6	7	8
	C20	70	71	2	2	3	4	5	6	7
	C21	70	71	2	2	3	4	6	6	7
	LT1	68	70	0	2	3	4	4	5	6
	C22	69	70	2	1	3	4	5	6	6
	C23	69	70	2	2	3	4	5	6	7
	C24	69	70	2	2	3	4	5	6	7
	C25	68	70	2	2	3	4	6	6	7
	C26	68	69	2	1	2	3	5	5	6
	C27	68	69	2	1	2	4	5	5	6
	C28	68	69	2	1	3	4	5	5	7
	C29	68	69	1	1	3	4	5	5	6
	C30	60	61	4	0	0	1	1	1	2
	C31	61	62	4	0	1	1	1	2	2
	C32	62	63	3	0	0	1	1	1	2
	C33	64	65	6	1	1	2	2	3	3
	C34	64	66	6	1	1	1	2	3	3
	C35	64	65	6	0	0	0	0	1	2
	C36	64	65	5	0	0	0	0	0	1
	C37	65	66	5	0	0	0	0	1	1
	C38	70	71	1	0	0	0	0	1	2
	ST4	61	62	0	0	0	0	0	2	2

Number of Benefited Receivers					
6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
0	6	10	33	35	35

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Table C-4. SR57/60 Confluence Barrier Analysis - Noise Barrier C-2

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
C-2	C42	65	66	+ 1	65	64	63	63	63	62
	C43	78	79	+ 1	73	71	70	69	68	67
	C44	78	79	+ 1	71	69	67	66	65	64
	C45	75	76	+ 1	70	68	67	66	65	65
	C46	74	75	+ 1	69	68	66	66	65	64
	C47	72	73	+ 1	68	67	66	65	64	64
	C48	71	72	+ 1	67	66	65	64	63	63
	C49	70	71	+ 1	66	65	64	63	63	62
	C50	70	71	+ 1	66	65	64	64	63	63
	C60	64	65	+ 1	63	62	62	62	61	61
	C61	70	71	+ 1	69	69	69	69	68	68

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
C-2	C42	65	66	2	1	2	3	3	3	4
	C43	78	79	2	6	8	9	10	11	12
	C44	78	79	2	8	10	12	13	14	15
	C45	75	76	2	6	8	9	10	11	11
	C46	74	75	2	6	7	9	9	10	11
	C47	72	73	2	5	6	7	8	9	9
	C48	71	72	2	5	6	7	8	9	9
	C49	70	71	2	5	6	7	8	8	9
	C50	70	71	2	5	6	7	7	8	8
	C60	64	65	12	2	3	3	3	4	4
	C61	70	71	2	2	2	2	2	3	3

Number of Benefited Receivers					
6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
16	16	16	16	16	16

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Table C-5. SR57/60 Confluence Barrier Analysis - Noise Barrier D

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])									
					6	8	10	12	14	16	18	20	22	24
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
D	D2	67	68	+ 1	68	68	68	68	68	68	68	68	68	67
	ST7	74	75	+ 1	75	75	75	75	75	75	75	75	74	74

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction									
					6	8	10	12	14	16	18	20	22	24
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
D	D2	67	68	1	0	0	0	0	0	0	0	0	0	1
	ST7	74	75	0	0	0	0	0	0	0	0	0	1	1

Number of Benefited Receivers									
6	8	10	12	14	16	18	20	22	24
6 foot	8 foot	10 foot	12 foot	14 foot	16 foot	18 foot	20 foot	22 foot	24 foot
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Table C-6. SR57/60 Confluence Barrier Analysis, Noise Barrier G

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Design Year with Project minus Existing dB	Design Year with Project Traffic Noise Level with Noise Barrier (dBA-Leq[h])					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
G-2	G1	74	75	+ 1	74	73	71	69	68	67
	G2	67	68	+ 1	67	66	66	65	65	64
	G3	64	66	+ 2	66	65	65	65	64	64
	G4	62	67	+ 5	67	67	67	66	66	65
	G5	62	64	+ 2	64	64	64	64	64	63
G-1	G6	71	63	- 8	63	63	63	63	63	63
	G7	79	81	+ 2	81	79	75	72	70	69
	G8	62	66	+ 4	65	65	65	65	65	65
	G9	62	66	+ 4	66	66	66	65	65	65
	G10	60	64	+ 4	64	64	64	64	63	63
	G11	60	64	+ 4	64	64	64	63	63	63
	G12	75	76	+ 1	73	71	70	68	67	66
	G13	78	78	0	72	70	69	68	67	66
	G14	69	72	+ 3	69	69	68	66	65	64
	G15	60	65	+ 5	64	64	64	63	63	62
	G16	61	64	+ 3	64	64	64	64	64	63
	G17	70	71	+ 1	69	68	67	66	65	64
	G18	73	76	+ 3	73	72	70	69	68	67
	G19	75	77	+ 2	73	73	71	70	68	67
	G20	63	67	+ 4	66	66	66	66	66	66

Barrier ID	Receiver Position	Existing Traffic Noise Level dBA-Leq[h]	Design Year with Project Traffic Noise Level dBA-Leq[h]	Number of Units Represented	Barrier Noise Reduction					
					6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
G-2	G1	74	75	1	1	2	4	6	7	8
	G2	67	68	1	1	2	2	3	3	4
	G3	64	66	1	0	1	1	1	2	2
	G4	62	67	1	0	0	0	1	1	2
	G5	62	64	1	0	0	0	0	0	1
G-1	G6	71	63	1	0	0	0	0	0	0
	G7	79	81	1	0	2	6	9	11	12
	G8	62	66	1	1	1	1	1	1	1
	G9	62	66	1	0	0	0	1	1	1
	G10	60	64	1	0	0	0	0	1	1
	G11	60	64	1	0	0	0	1	1	1
	G12	75	76	1	3	5	6	8	9	10
	G13	78	78	1	6	8	9	10	11	12
	G14	69	72	1	3	3	4	6	7	8
	G15	60	65	1	1	1	1	2	2	3
	G16	61	64	1	0	0	0	0	0	1
	G17	70	71	1	2	3	4	5	6	7
	G18	73	76	1	3	4	6	7	8	9
	G19	75	77	1	4	4	6	7	9	10
	G20	63	67	1	1	1	1	1	1	1

	Number of Benefited Receivers					
	6 foot	8 foot	10 foot	12 foot	14 foot	16 foot
G-2	**0**	**0**	**0**	**1**	**1**	**1**
G-1	**1**	**2**	**5**	**7**	**7**	**7**

Notes:
Orange cells indicate a traffic noise level that approaches or exceeds the NAC (refer to Table B-1).
Yellow cells indicate a barrier noise reduction of at least 5 dB.

Appendix D Field Data Sheets

FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: LT-1 OBSERVER(S): Peter Hardie
ADDRESS: 908 S ROLK RIVER RD
START DATE / TIME: 7-15 5:00 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 78 °F HUMIDITY: %R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 1-2 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: (SUNNY) CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: RION NL-22 TYPE: 1 (2) SERIAL #:
CALIBRATOR: LD 812 SERIAL #: 6649
CALIBRATION CHECK: PRE-TEST 93.9 dBA SPL POST-TEST dBA SPL WINDSCREEN ✓

SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL (RANDOM) (ANSI) OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
LT-1	5:00										

COMMENTS: LT-1 POSITION ELEVATED APPROX 30' ABOVE SR.57. CLEAR VIEW OF FREEWAY. 50 LOCK HOUR IS TAIMED START AT 6PM. LOCAL INT

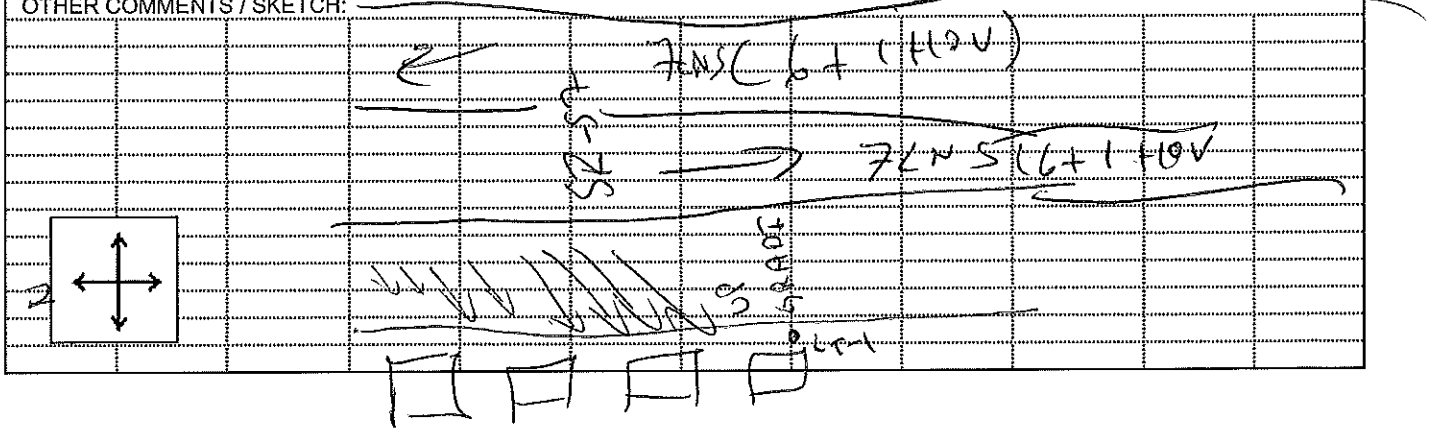
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL (AMBIENT) OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: -MIN SPEED #2 COUNT SPEED

	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **SR-57/SR-60 confluence** PROJ. #

SITE IDENTIFICATION: LT-2 OBSERVER(S): Peter Hardie
ADDRESS: 23603 PALOMINO DR
START DATE / TIME: 1/24/12 10:15 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 65 °F HUMIDITY: 42 %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: 0 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: RION NL-21 TYPE: 1 2 SERIAL #:
CALIBRATOR: LD CAL 200 SERIAL #: 6645
CALIBRATION CHECK: PRE-TEST 114 dBA SPL POST-TEST dBA SPL WINDSCREEN ✓

SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
LT-2	10:15										

COMMENTS: THERE IS A LARGE HILL BETWEEN METER SR-60 IS MAIN NOISE SOURCE.

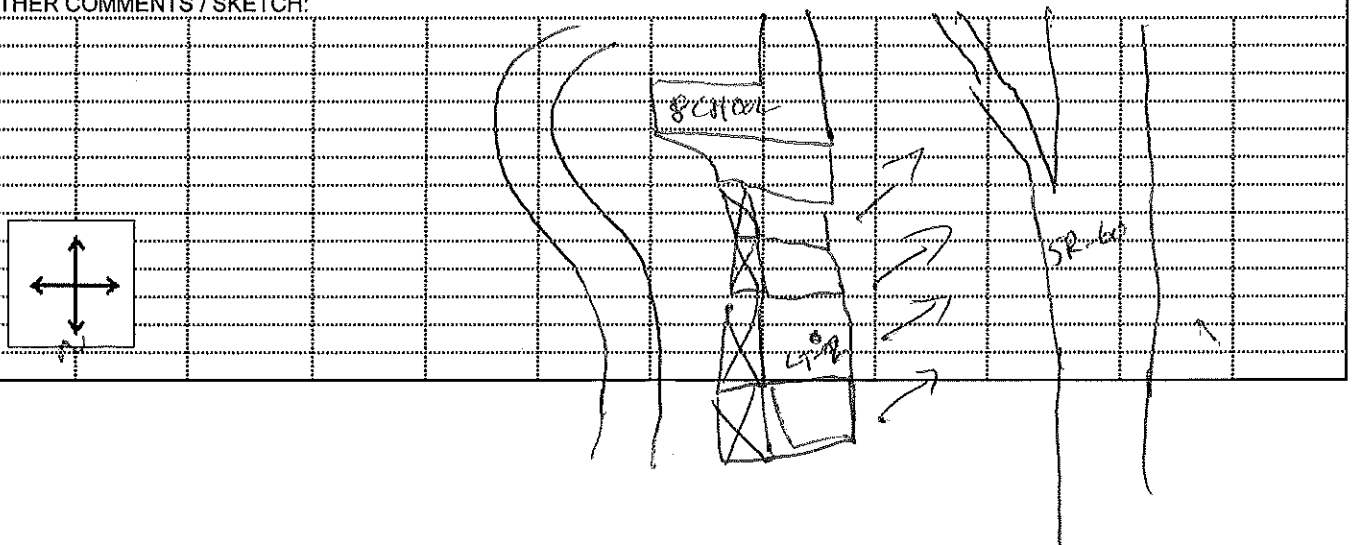
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: ~~TRAFFIC~~ AIRCRAFT RAIL INDUSTRIAL ~~AMBIENT~~ OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ____-MIN SPEED #2 COUNT SPEED

	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: ~~DIST. AIRCRAFT~~ / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-1 OBSERVER(S): Peter Hardie
ADDRESS: 23619 PALOMINO DR
START DATE / TIME: 3-16-10 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 68 °F HUMIDITY: 29 %R.H. WIND: (CALM) LIGHT MODERATE VARIABLE
WINDSPEED: MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: (SUNNY) (CLEAR) OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 812 TYPE: (1) 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 6644
CALIBRATION CHECK: PRE-TEST 93.9 dBA SPL POST-TEST 94.0 dBA SPL WINDSCREEN ✓

SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL (RANDOM) (ANSI) OTHER:

	REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
A	ST-1	9:00	9:10	61.2	65.2	58.4	59.6	60.8	62.8			
B		9:17	9:27	61.7	66.1	57.6	60.1	61.4	63.1			

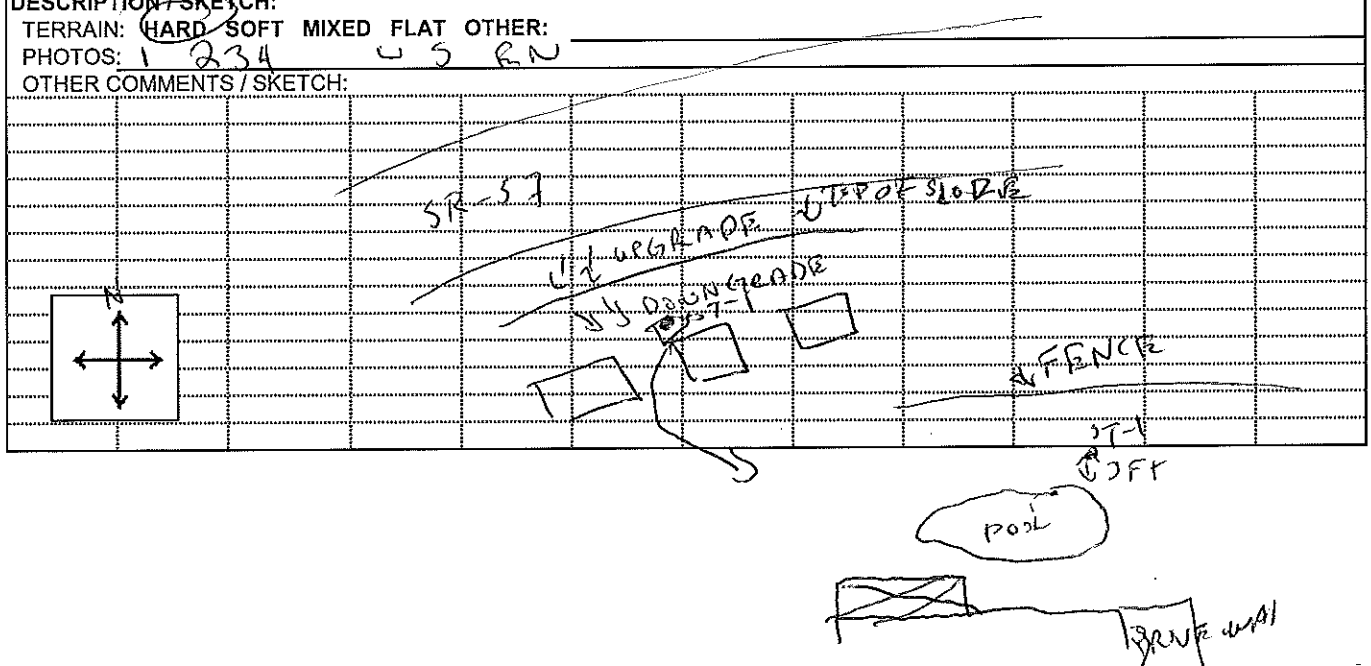
COMMENTS: SR-57 IS SHIELDED BY A LARGE BURM WHICH IS 30' AT ITS HIGH POINT.

SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL (AMBIENT) OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ____-MIN SPEED #2 COUNT SPEED

	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / (BIRDS) / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:
PHOTOS: 1 2 3 4 U S EN
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-2 OBSERVER(S): Peter Hardie
ADDRESS: 259 PALOMINO BEST WESTERN
START DATE / TIME: 9:40 7-16 PM END DATE / TIME:

METEROLOGICAL CONDITIONS:

TEMP: 70 °F HUMIDITY: 29 %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: ~~SUNNY~~ CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:

INSTRUMENT: LD 812 TYPE: 1 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 6614
CALIBRATION CHECK: PRE-TEST 94 dBA SPL POST-TEST 94 dBA SPL WINDSCREEN ✓

SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-2	9:40	9:50	57.3	72.2	54.5	55.6	56.6	57.9			
	9:50	10:00	56.3	62.9	54.6	55.4	56.2	57.1			

COMMENTS: SR-57 NOISE IS BACK GROUND. POOL HAS CONSIDER ABLE SHIELDING FROM SR-57, LG TRUCK ON PALOMINO SET L MAX.

SOURCE INFO AND TRAFFIC COUNTS:

PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: -MIN SPEED #2 COUNT SPEED

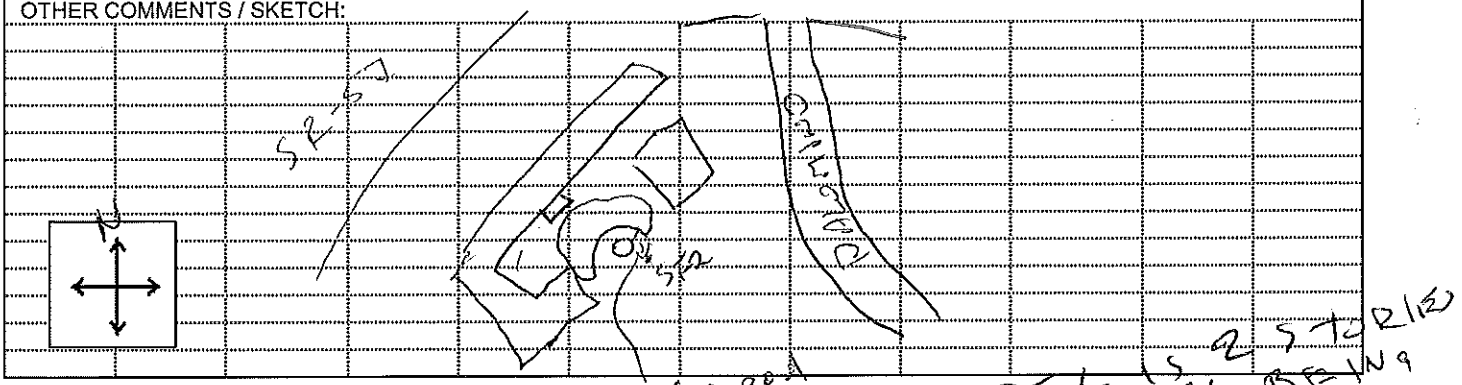
	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:

TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHOTOS: 5 6 7 8 N NW SE
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-1 OBSERVER(S): Peter Hardie
ADDRESS: 465 GOLDEN PRADO
START DATE / TIME: 10:40 3-16-10 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 60 °F HUMIDITY: 17 %R.H. WIND: (CALM) LIGHT MODERATE VARIABLE
WINDSPEED: 3-5 MPH DIR: N NE E SE S SW (W) NW STEADY GUSTY
SKY: (SUNNY) (CLEAR) OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 824 TYPE: (1) 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 6644
CALIBRATION CHECK: PRE-TEST 94 dBA SPL POST-TEST 94.1 dBA SPL WINDSCREEN Y

SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL (RANDOM) (ANSI) OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-1	10:40	10:50	59.1	71.7	54.9	56.8	58.6	60.6			
	10:50	11:00	59.8	63.7	56.6	58.1	59.7	61.1			

COMMENTS:

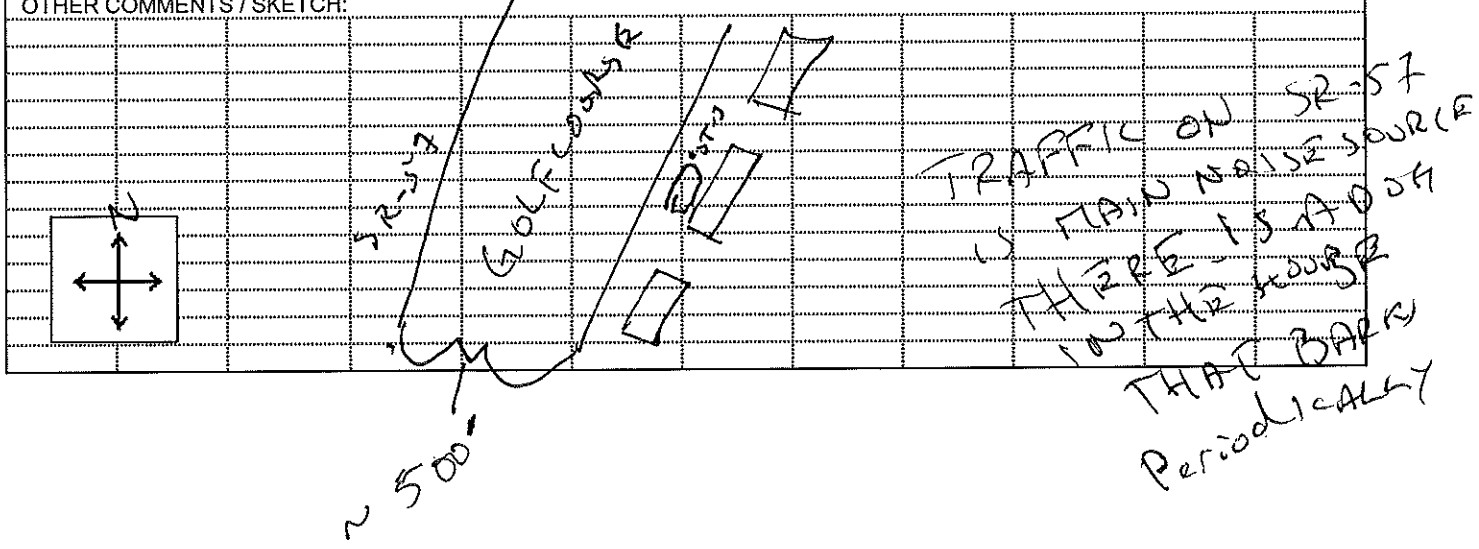
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL (AMBIENT) OTHER:
ROADWAY TYPE:

TRAFFIC COUNT DURATION: ___-MIN	NB / EB	SB / WB	SPEED NB / EB	SPEED SB / WB	#2 COUNT NB / EB	#2 COUNT SB / WB	SPEED NB / EB	SPEED SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:
PHOTOS: 9 10 11 12 NW SE
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-4 OBSERVER(S): Peter Hardie
ADDRESS: 182 OF 2ND GREEN
START DATE / TIME: 11:30 END DATE / TIME:

METEROLOGICAL CONDITIONS:

TEMP: 83 °F HUMIDITY: 17 %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: 3-5 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:

INSTRUMENT: LD 812 TYPE: 1 2 SERIAL #: 0432
CALIBRATOR: CAL200 SERIAL #: 6144
CALIBRATION CHECK: PRE-TEST 94 dBA SPL POST-TEST 94 dBA SPL WINDSCREEN ✓

SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-4	11:30	11:40	78.2	82.9	73.5	76.2	78.1	79.7			
	11:40	11:50	77.9	81.5	73.7	75.8	77.8	79.2			

COMMENTS: TRAFFIC FROM SR-57 DOMINATES NOISE ENV

SOURCE INFO AND TRAFFIC COUNTS:

PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ____-MIN SPEED #2 COUNT SPEED

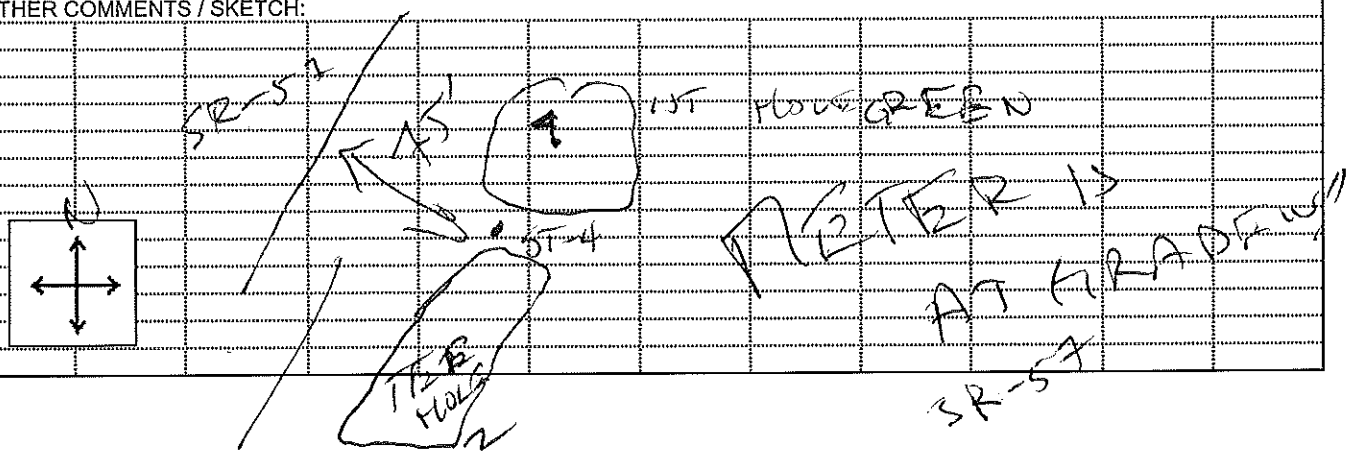
	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB	NB / EB	SB / WB
AUTOS:								
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:

TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHOTOS: 13, 14, 15, 16 ETC N E S W
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-5 OBSERVER(S): Peter Hardie
ADDRESS: 300 S RIVER ROAD RD
START DATE / TIME: 11:10 3-16-10 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 85 °F HUMIDITY: 12 %R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 3-5 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: (SUNNY) (CLEAR) OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 812 TYPE (1) 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 6649
CALIBRATION CHECK: PRE-TEST 94 dBA SPL POST-TEST 94.1 dBA SPL WINDSCREEN
SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL (RANDOM) (ANSI) OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-5	11:10	12:20	~~73.9~~ 74.0	~~78.8~~ 81.5	~~70.7~~ 70.5	~~72.4~~ 72.4	~~73.8~~ 73.8	~~75.1~~ 75.1			
	12:20	1:30									

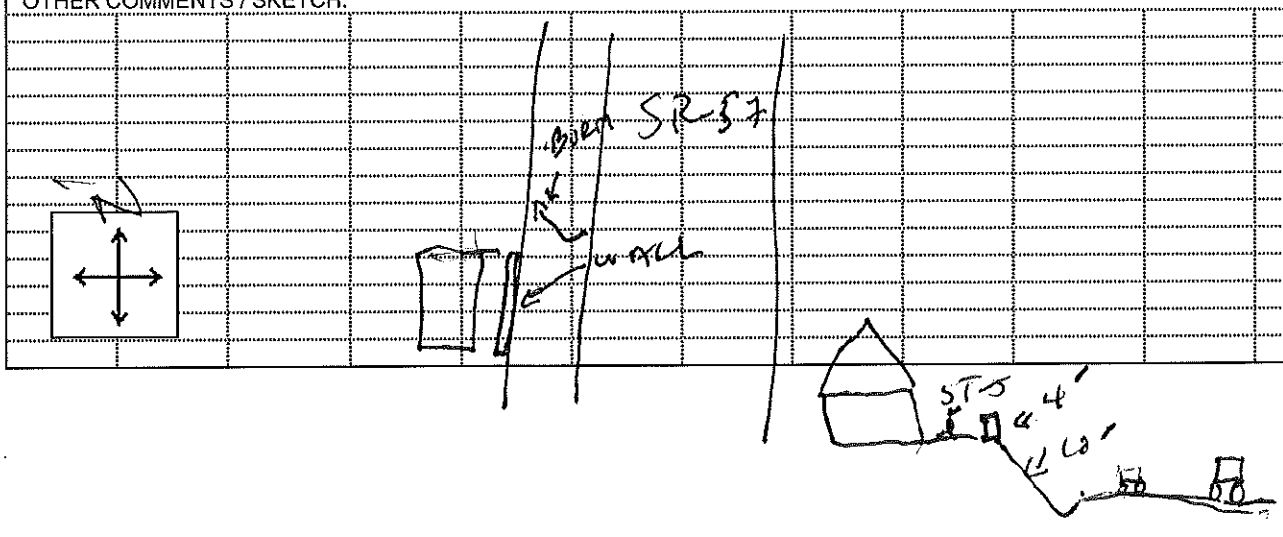
COMMENTS: NOISE IS TRAFFIC ALONG SR-57. DOG INSIDE IS BARKING BUT NOT AFFECTING METER

SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL (AMBIENT) OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ____-MIN

	SPEED NB / EB	SPEED SB / WB	#2 COUNT NB / EB	#2 COUNT SB / WB	SPEED NB / EB	SPEED SB / WB
AUTOS:						
MED. TRUCKS:						
HVY TRUCKS:						
BUSES:						
MOTORCYCLES:						

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:
PHOTOS: 19 20 21 22 23 N E S W ROAD
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **Grand Ave I-57/60 Fwy On-ramp Modification** PROJ. # **00028.09**

SITE IDENTIFICATION: ST-6 2ND ROW OBSERVER(S): Peter Hardie
ADDRESS: 293 S Rock River RD
START DATE / TIME: 140 3-16-10 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 87 °F HUMIDITY: 9.4 %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: 4-7 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 812 TYPE: 1 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 66414
CALIBRATION CHECK: PRE-TEST 94.1 dBA SPL POST-TEST 94.1 dBA SPL WINDSCREEN Y

SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-6	140	150	58.6	71.1	56.0	56.6	57.8	59.3			
	150	160	58.0	68.2	56.2	56.8	58.6	59.4			
			57.7	67.2		57.9					

COMMENTS: TRAFFIC ON SR-57 IS AUDIBLE PERIODIC DOG BARKING WATERFALL IN POOL IS SOOTHING LOUD

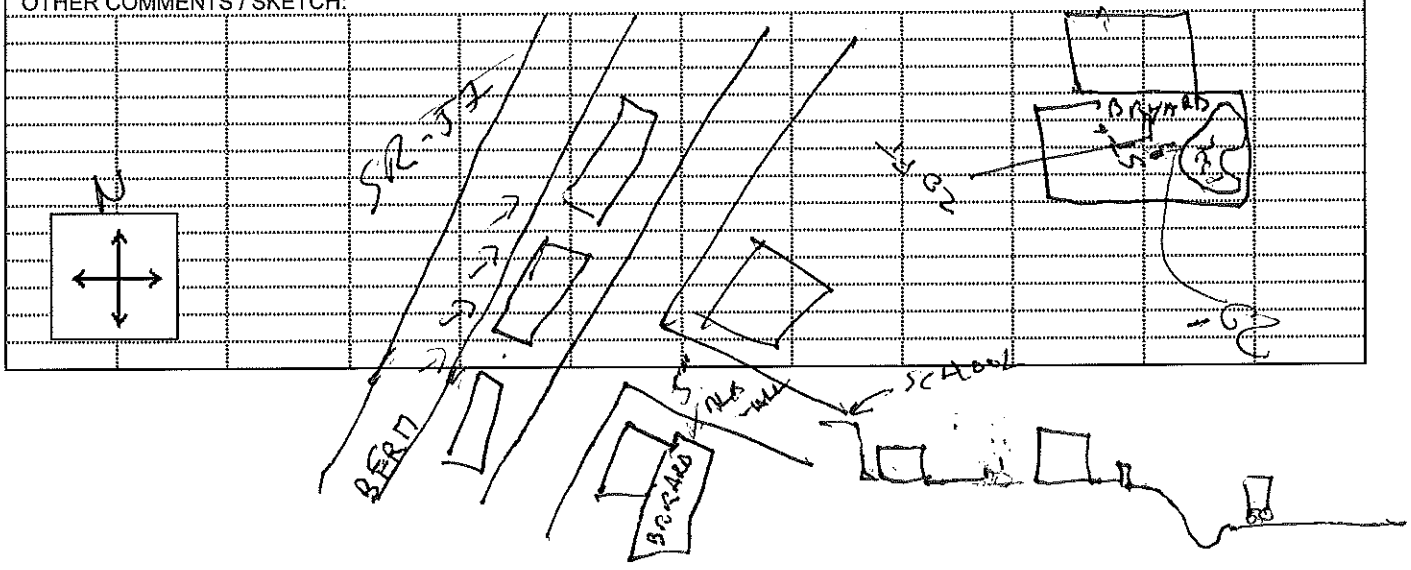
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER: WATERFALL POOL
ROADWAY TYPE:
TRAFFIC COUNT DURATION: 10 -MIN

	NB EB	SB / WB	SPEED NB / EB	SPEED SB / WB	#2 COUNT NB / EB	#2 COUNT SB / WB	SPEED NB / EB	SPEED SB / WB
AUTOS:	111							
MED. TRUCKS:								
HVY TRUCKS:								
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHOTOS: 24 25 26 NOW
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: Grand Ave I-57/60 Fwy On-ramp Modification PROJ. # 00028.09

SITE IDENTIFICATION: ST-7 OBSERVER(S): Peter Hardie
ADDRESS: HOLIDAY INN
START DATE / TIME: 2:40 3-16-10 END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 85 °F HUMIDITY: 6 %R.H. WIND: CALM LIGHT MODERATE VARIABLE
WINDSPEED: 4-7 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 812 TYPE 1 2 SERIAL #: 0432
CALIBRATOR: CAL200 SERIAL #: 6644
CALIBRATION CHECK: PRE-TEST 94.1 dBA SPL POST-TEST 94.1 dBA SPL WINDSCREEN ✓

SETTINGS: A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
ST-7	2:40	3:10	71.5	75.3	69.2	70.4	71.6	72.3			
	3:10	3:20	70.5	73.6	67.1	68.9	70.3	71.4			

COMMENTS: TRAFFIC IS SLOWING UP ON SIDEROAD W/ GRAND TRAFFIC, SPEEDS MAY BE AN ESTIMATED 40 MPH

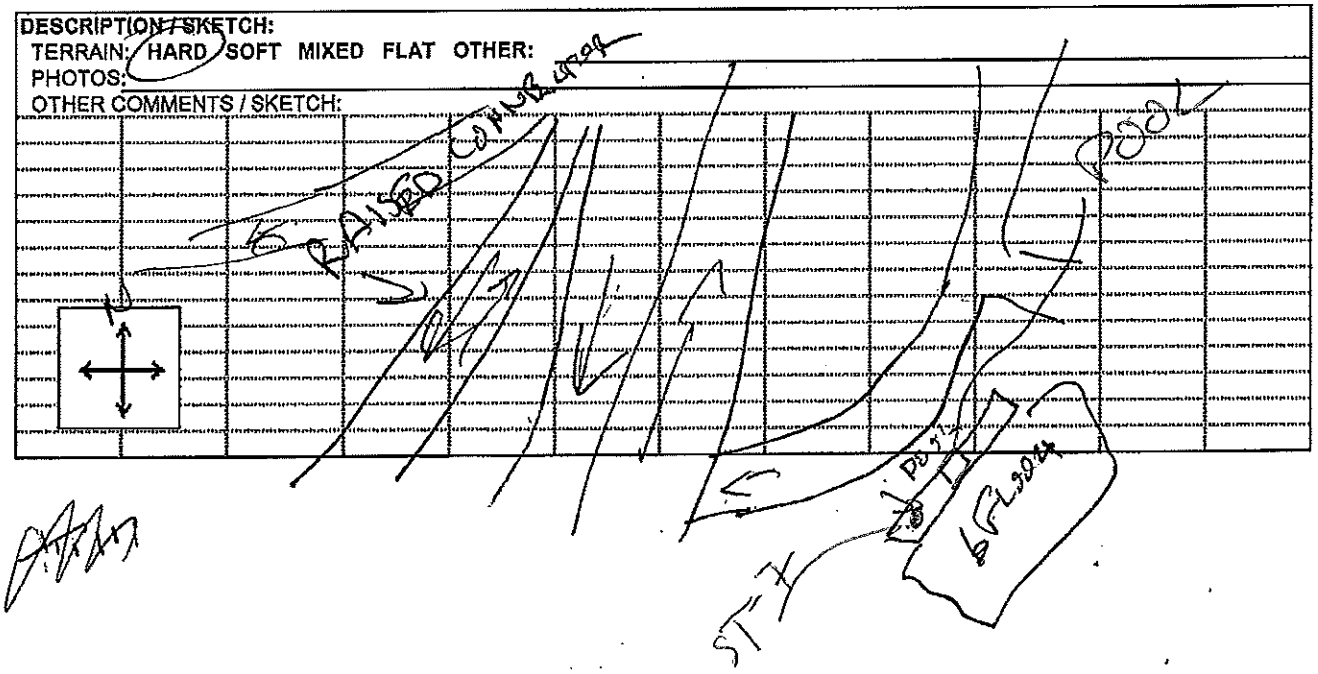
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
ROADWAY TYPE:
TRAFFIC COUNT DURATION: -MIN

	SPEED NB / EB	SPEED SB / WB	#2 COUNT NB / EB	#2 COUNT SB / WB	SPEED NB / EB	SPEED SB / WB
AUTOS:						
MED. TRUCKS:						
HVY TRUCKS:						
BUSES:						
MOTORCYCLES:						

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: HARD SOFT MIXED FLAT OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

Jones & Stokes

PROJECT: **SR-57/SR-60 confluence** PROJ. #

SITE IDENTIFICATION: ST-8 BACKGROUND OBSERVER(S): Peter Hardie
ADDRESS: R3617 MEAD CLIFF PL
START DATE / TIME: END DATE / TIME:

METEROLOGICAL CONDITIONS:
TEMP: 67 °F HUMIDITY: 52 %R.H. WIND: (CALM) LIGHT MODERATE VARIABLE
WINDSPEED: 0 MPH DIR: N NE E SE S SW W NW STEADY GUSTY
SKY: (SUNNY) (CLEAR) OVRCST PRTLY CLOUDY FOG RAIN OTHER:

ACOUSTIC MEASUREMENTS:
INSTRUMENT: LD 812 TYPE (1) 2 SERIAL #: 0432
CALIBRATOR: CAL 200 SERIAL #: 6644
CALIBRATION CHECK: PRE-TEST 114.1 dBA SPL POST-TEST dBA SPL WINDSCREEN ✓

SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL (RANDOM) (ANSI) OTHER:

REC #	START	END	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	OTHER:	(TYPE?)	
BKGND ST-8	11:15	11:30	48.4	67.7	43.0	44.1	45.4	48.0			

COMMENTS:

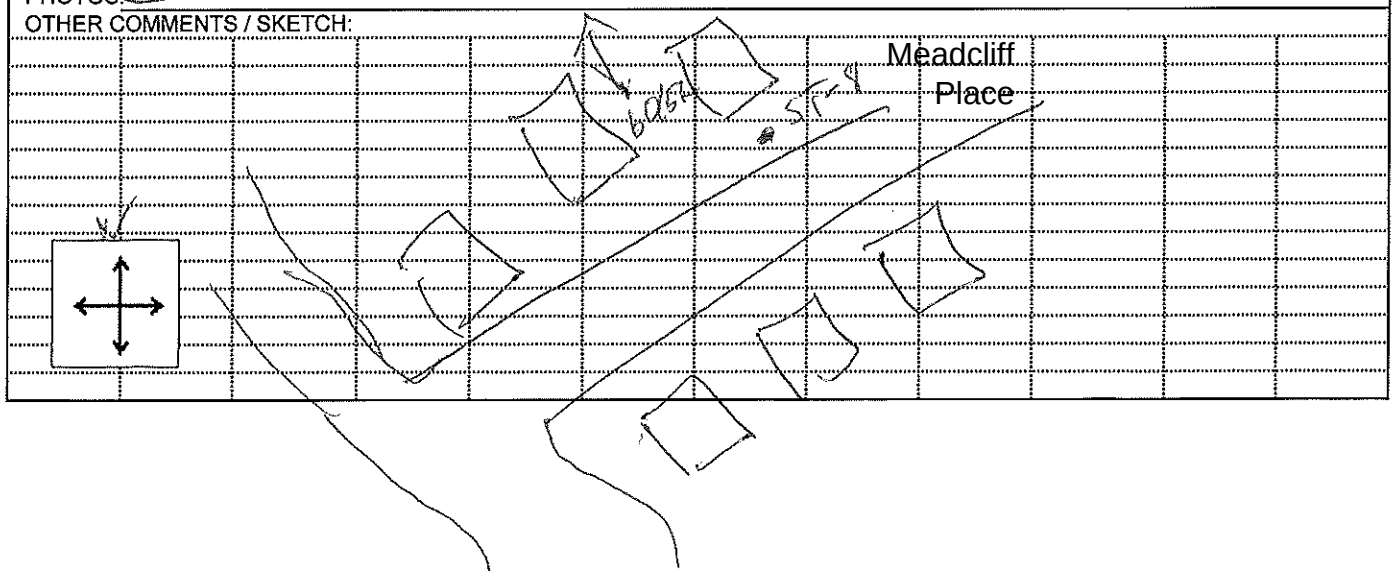
SOURCE INFO AND TRAFFIC COUNTS:
PRIMARY NOISE SOURCE: (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL (AMBIENT) (OTHER: MENTAL KING)
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ____-MIN

	SPEED NB / EB	SPEED SB / WB	#2 COUNT NB / EB	#2 COUNT SB / WB	SPEED NB / EB	SPEED SB / WB
AUTOS:	2					
MED. TRUCKS:						
HVY TRUCKS:						
BUSES:						
MOTORCYCLES:						

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / (BIRDS) / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

DESCRIPTION / SKETCH:
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



Appendix E TNM Modeling Results
[provided on CD]