
# Noise Study Report

South of Barton Road to North of Barton Road

Cities of Grand Terrace and Colton

08-SBD-215 PM 0.58/1.66

EA No. 08-0J0700

(PN 0800000282)

**February 2012**

Caltrans

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*I-215/Barton Road Interchange Improvement Project*

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# Executive Summary

The San Bernardino Associated Governments (SANBAG), in cooperation with the California Department of Transportation (the Department), City of Grand Terrace, City of Colton, and Riverside County Transportation Commission (RCTC), proposes to improve the Interstate 215 (I-215)/Barton Road interchange. The proposed project is located in the City of Grand Terrace and partially in the City of Colton in the County of San Bernardino (County). On Barton Road, the project limits extend from approximately 0.3 mile (mi) west of I-215 to 0.4 mi east of I-215. The project limits on I-215 extend from approximately 0.8 mi south of Barton Road to 0.4 mi north of Barton Road.

The purpose of the proposed project is to reconstruct and improve the interchange in order to improve operation, increase capacity, and reduce congestion at the I-215/ Barton Road interchange and facilities served by the interchange. The proposed project is needed to increase capacity, improve operations, and reduce congestion at the I-215/Barton Road interchange.

Three Build Alternatives and a No Build Alternative are being evaluated. The three Build Alternatives involve different ramp configurations and each of them would require reconstruction of the Barton Road overcrossing. The alternatives are Alternative 1 (No Build), Alternative 3 (Partial Cloverleaf Interchange), Alternative 6 (Modified Cloverleaf), and Alternative 7 Modified Cloverleaf/Diamond) (Locally Preferred Alternative).

The proposed project is considered a Type 1 project because it would use federal aid to improve the existing I-215/Barton Road interchange by adding a through lane on Barton Road and substantially altering the vertical and horizontal alignment of the Barton Road interchange. A noise analysis is required for all Type 1 projects.

Existing land uses in the project area include single-family and multifamily residences; two mobile home parks; a recreational vehicle (RV) park; a fast-food restaurant with an outdoor eating area; a school; a utility facility; office, commercial, and light industrial uses; and vacant land. The primary source of noise in the project area is traffic on I-215.

The terrain within the project area can be separated into three areas: Area 1 is located south of Barton Road; Area 2 is located between Barton Road and Newport Avenue;

and Area 3 is located north of Newport Avenue. Land uses located in Area 1 are located up to 20 feet (ft) higher in elevation than I-215. Land uses located in Area 2 are located approximately 20 ft higher in elevation than I-215. Lastly, land uses located in Area 3 are located between 20 and 50 ft higher in elevation than I-215.

Twelve short-term noise level measurements and one exterior/interior noise level measurement were conducted at representative locations to document the existing noise environment. All 12 short-term noise level measurements were used to calibrate the noise prediction model with concurrent traffic counts and measured vehicle speeds. A total of 144 representative existing sensitive receivers were modeled and evaluated for potential noise impacts resulting from traffic noise. The results of the modeled noise levels for existing, future No Build, and Alternatives 3, 6, and 7 are shown in Table 12.

Two long-term 24-hour noise level measurements were conducted within the project area. The first long-term 24-hour noise level measurement was conducted to identify the peak traffic noise hour and to adjust existing noise levels to the worst hour. The second long-term 24-hour noise level measurement was conducted to obtain the community background noise level measurement to capture nonvehicular traffic noise sources, such as train noise from Union Pacific Railroad (UPRR), because the ambient noise level is also dominated by existing rail operations. The community background noise level of 58 equivalent continuous sound level measured in A-weighted decibels (dBA $L_{eq}$) was incorporated into the noise level results for Receivers R-60 through R-130 because they are located in the vicinity of rail operations and the community background noise level measurement. In addition, the 24-hour community background noise level was incorporated into the modeling of sound barriers to ensure that barriers can provide a noise level reduction goal of 5 dBA with the consideration of the community background noise and that the modeled sound barriers do not reduce noise levels below the background noise level.

When traffic noise impacts have been identified, noise abatement measures must be considered. Traffic noise impacts result from one or more of the following occurrences: (1) an increase of 12 dBA or more over their corresponding existing noise levels, or (2) predicted noise levels approach or exceed the Noise Abatement Criteria (NAC).

Implementation of the proposed project would result in potential short-term noise impacts during construction and long-term noise impacts from use of the completed

project. No substantial noise increase of 12 dBA or more over the corresponding existing noise level would result under all three Build Alternatives. Of the 144 modeled receivers, 16, 20, and 22 of those receivers would approach or exceed the 67 dBA $L_{eq}$ NAC under Alternatives 3, 6, and 7, respectively.

The potential interior noise impact was evaluated for Grand Terrace Elementary School, which is located on the east side of I-215, north of Barton Road. The predicted future classroom interior noise level would approach or exceed the 52 dBA $L_{eq}$ NAC under Activity Category D under Alternatives 3, 6, and 7. SB Nos. 2a & 2b, 12a & 12b, and 17a & 17b were analyzed to shield classroom buildings closest to I-215.

Noise abatement measures were evaluated for receivers located within the project limits that would be or would continue to be exposed to traffic noise levels approaching or exceeding the NAC. A total of 16 sound barriers were evaluated. Twelve sound barriers were evaluated along the State right-of-way (ROW) or the edge of shoulder, and four sound barriers were evaluated along the residential property lines. The results of the sound barrier modeling along the State ROW or the edge of shoulder are shown in Tables 14, 15, and 16 for Alternatives 3, 6, and 7, respectively. Also, the results of the sound barrier modeling along residential property lines are shown in Tables 17, 18, and 19 for Alternatives 3, 6, and 7, respectively.

Of the 16 sound barriers evaluated, 14 sound barriers were capable of reducing noise levels by 5 dBA or more, as required to be considered feasible. Sound Barrier (SB) Nos. 4 and 18 were determined to be not feasible because the barriers would not reduce noise levels by 5 dBA or more. Table 21 provides the following information regarding the feasible sound barriers: height, approximate length, noise attenuation range, number of benefited units, location of sound barriers, reasonable allowance per residence, and total reasonable allowance.

The effects of parallel barriers were considered in areas where sound barriers are located on both sides of the roadway because reflective noise would have the potential to increase noise levels and degrade the performance of the modeled sound barriers (i.e., parallel barrier degradation). Parallel barrier configurations that have a roadway width to sound barrier height ratio of 15:1 or less (width/height) would degrade the performance of sound barriers. Parallel barriers within the project area are located along I-215, north of Barton Road. The minimum parallel barrier ratio along the I-215 north of Barton Road would be 11:1. Therefore, to avoid this effect,

the Department's standard practice would require sound barriers along I-215 north of Barton Road to be provided with an acoustically absorptive surface with a noise reduction coefficient (NRC) of 0.80 or greater.

A Noise Abatement Decision Report (NADR) will be prepared for this project. The NADR is a design responsibility and is prepared to compile information from the Noise Study Report (NSR), other relevant environmental studies, and design considerations into a single, comprehensive document before public review of the project. The NADR is prepared after completion of the NSR and prior to publication of the draft environmental document. The NADR includes noise abatement construction cost estimates that have been prepared and signed by the project engineer based on site-specific conditions. Construction cost estimates are compared to reasonable allowances in the NADR to identify which sound barrier configurations are reasonable from a cost perspective. The reasonableness determination of the feasible sound barriers shown in Table 21 will be reported in the NADR for the proposed project.

The design of sound barriers presented in this report is preliminary and has been conducted at a level appropriate for environmental review and not for final design of the project. If pertinent parameters change substantially during the final project design, preliminary sound barrier designs may be modified or eliminated from the final project. A final decision on the construction of the noise abatement will be made upon completion of the public involvement process during the final project design process.

The closest sensitive receivers are located within 50 ft from project construction areas. Therefore, these receiver locations may be subject to short-term noise higher than 95 dBA maximum instantaneous noise level ($L_{max}$) generated by construction activities along the project alignment. Compliance with the construction hours specified in the City of Grand Terrace Municipal Code, the City of Colton's Bid and Contract template, and the Department's Standard Special Provisions (SSP) will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by the Department's Standard Specifications in Section 14-8.02, "Noise Control," and also by SSP S5-310, "Noise Control." Noise control shall conform to the provisions in Section 14-8.02 and the SSP in S5-310. The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dBA $L_{max}$ at a distance of 50 ft. The Contractor should use an alternative warning method instead of a sound signal unless

required by safety laws. In addition, the Contractor shall equip all internal combustion engines with the manufacturer-recommended muffler and shall not operate any internal combustion engine on the job site without the appropriate muffler.

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# List of Abbreviated Terms

| | |
|---|---|
| °F | degrees Fahrenheit |
| µPa | micro-Pascals |
| 23 CFR 772 | Title 23, Part 772 of the Code of Federal Regulations |
| ADT | average daily traffic |
| BNSF | Burlington Northern Santa Fe |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| CNEL | Community Noise Equivalent Level |
| County | County of San Bernardino |
| dB | decibels |
| dBA | A-weighted decibels |
| Department | California Department of Transportation |
| EW | Existing Wall |
| FHWA | Federal Highway Administration |
| ft | foot/feet |
| GPS | Global Positioning System |
| HOT | high-occupancy toll |
| HOV | high-occupancy vehicle |
| Hz | Hertz |
| I.L. | Insertion Loss |
| I-15 | Interstate 15 |
| I-215 | Interstate 215 |
| kHz | kilohertz |
| $L_{dn}$ | day-night level |
| $L_{eq}$ | equivalent continuous sound level |
| $L_{eq}(h)$ | 1-hour A-weighted equivalent sound level |
| $L_{max}$ | maximum instantaneous sound level |
| LOS | level(s) of service |
| $L_{xx}$ | percentile-exceeded sound level |
| mi | miles/miles |
| mph | miles per hour |
| NAC | Noise Abatement Criteria |

| | |
|---|---|
| NADR | Noise Abatement Decision Report |
| NEPA | National Environmental Policy Act |
| NRC | Noise Reduction Coefficient |
| NSR | Noise Study Report |
| PDT | Project Development Team |
| PM | Post Mile |
| Protocol | Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects |
| RCTC | Riverside County Transportation Commission |
| ROW | right-of-way |
| RTP | Regional Transportation Plan |
| RV | recreational vehicle |
| SANBAG | San Bernardino Associated Governments |
| SB | Sound Barrier |
| SCAG | Southern California Association of Governments |
| SPL | sound pressure level |
| SSP | Standard Special Provisions |
| STA | Station |
| STAA | Surface Transportation Assistance Act |
| TeNS | Department Technical Noise Supplement |
| TNM | Traffic Noise Model |
| UPRR | Union Pacific Railroad |
| vplph | vehicles per lane per hour |

# Chapter 1. Introduction

The San Bernardino Associated Governments (SANBAG), in cooperation with the California Department of Transportation (the Department), City of Grand Terrace, City of Colton, and Riverside County Transportation Commission (RCTC), proposes to improve the Interstate 215 (I-215)/Barton Road interchange. The proposed project is located in the City of Grand Terrace and partially in the City of Colton in the County of San Bernardino (County). On Barton Road, the project limits extend from approximately 0.3 mile (mi) west of I-215 to 0.4 mi east of I-215. The project limits on I-215 extend from approximately 0.8 mi south of Barton Road to 0.4 mi north of Barton Road. Figure 1 shows project location and vicinity maps.

I-215 is a major north-south freeway facility that begins at the southern junction of Interstate 15 (I-15) in the City of Murrieta in Riverside County and terminates at the northern junction with I-15, near Devore in San Bernardino County. It is an alternative route of I-15. The portion of I-215 within the project limits currently provides three through lanes in each direction and a paved median.

The existing I-215/Barton Road interchange is a compact diamond interchange with single-lane entrance and exit ramps. Both of the exit ramp approaches expand to two lanes to accommodate turning traffic. The existing northbound ramp intersection and southbound ramp intersection are spaced approximately 350 feet (ft) apart. The existing overcrossing is a single lane in each direction with back-to-back left-turn pockets for the entrance ramps.

Barton Road is an east-west primary arterial in the County of San Bernardino. It extends from La Cadena Drive in the City of Colton to east of San Mateo Street in the City of Redlands. Within the project limits, Barton Road is a two-lane roadway west of I-215. East of I-215, Barton Road is a four-lane facility with turn lanes at various intersections. Within the project limits, there are several intersections:

- Grand Terrace Road (unsignalized T-intersection)
- Southbound ramps and La Crosse Avenue intersection (signalized)
- Northbound ramps intersection (signalized)
- Michigan Avenue intersection (signalized T-intersection)
- Vivienda Avenue intersection (unsignalized T-intersection)

## 1.1. Purpose of the Noise Study Report

The purpose of 23 Code of Federal Regulations (CFR) 772, "Procedures for Abatement of Highway Traffic Noise," is to provide procedures to help protect public health and welfare, supply Noise Abatement Criteria (NAC), and establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to 23 CFR 772.1. As such, 23 CFR 772 provides procedures for preparing operational and construction noise impact studies and evaluating noise abatement 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 Department Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) (Department 2011) provides Department policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing Noise Study Reports (NSRs). The purpose of this NSR is to evaluate noise impacts and noise abatement consistent with the requirements of 23 CFR 772.

## 1.2. Project Purpose and Need

### 1.2.1. Purpose

The purpose of the proposed project is to reconstruct and improve the interchange in order to improve operation, increase capacity, and reduce congestion at the I-215/ Barton Road interchange and facilities served by the interchange.

### 1.2.2. Need

The proposed project is needed to increase capacity, improve operations, and reduce congestion at the I-215/Barton Road interchange. Based on traffic projections and the existing and future land uses in the vicinity, the facility is forecast to degrade to level of service (LOS) F (breakdown condition) by 2040 without improvements. Due to its nonstandard design, the existing interchange restricts large truck movements as well as pedestrian and bicyclist access to local streets.

### Capacity and Transportation Demand

The study area intersections currently operate at LOS B or C during the a.m. and p.m. peak hours. Without improvements, in 2016, the Barton Road/Grand Terrace Road intersection would operate at LOS F during the a.m. peak hour and LOS E during the p.m. peak hour. Because of the projected demand, without improvements, by 2040 all seven study area intersections would operate at LOS F during both the a.m. and p.m. peak hours, with the exception of Barton Road/La Cadena Drive during the a.m. peak hour, which would operate at LOS C.

The demand for interchange access is also represented in traffic volumes. Traffic projections for 2040 show that the average daily traffic (ADT) volumes on I-215 will increase by more than 200 percent. The 2009 Barton Road interchange ramp volumes are forecast to double by 2040. Additional capacity is needed to accommodate projected traffic volumes and improve LOS.

### Roadway Deficiencies

The existing I-215 southbound off-ramp at Barton Road is nonstandard per the Highway Design Manual (Sixth Edition) because it intersects with a local street (La Crosse Avenue) before reaching Barton Road. The southbound off-ramp at Barton Road is a five-legged intersection with a two-way frontage road adjacent to the southbound on-ramp. The existing interchange does not have adequate space for Surface Transportation Assistance Act (STAA) truck-turning movements, a sidewalk on the south side, or bicycle lanes. Therefore, the existing interchange restricts large truck movements and pedestrian and bicyclist access to local streets. Reconstruction of the interchange is needed to improve access to the freeway and local streets.

In the existing condition, the left-turn lane on westbound Barton Road at the I-215 southbound on-ramp does not have sufficient vehicle capacity during the a.m. and p.m. peak hours. This prevents left-turning and through traffic from moving through the interchange. Queue lengths are forecasted to increase substantially by 2040 without interchange improvements. Additional turn-pocket capacity is needed in order to reduce delays at the interchange.

### Social Demand and Economic Development

The I-215/Barton Road interchange is the primary regional access for the City of Grand Terrace. It also serves the southwestern portion of the City of Colton and provides direct access to the City of Loma Linda. The western region of the City of Grand Terrace and eastern region of the City of Colton are projected to experience

substantial population growth through 2035 according to the Southern California Association of Governments (SCAG) 2008 Adopted Regional Transportation Plan (RTP) Growth Forecasts. The build out of the area in accordance with the City of Grand Terrace General Plan and the Barton Road Specific Plan will result in increased traffic congestion on the freeway and the local street networks leading to the interchange. Reconstruction of the interchange is needed to relieve additional congestion.

# Chapter 2. Project Description

This chapter describes the proposed action and the design alternatives that were developed to meet the identified need through accomplishing the defined purposes while avoiding or minimizing environmental impacts. The alternatives are Alternative 1 (No Build), Alternative 3 (Partial Cloverleaf Interchange), Alternative 6 (Modified Cloverleaf), and Alternative 7 (Modified Cloverleaf/Diamond). The proposed project is located in the City of Grand Terrace and partially in the City of Colton in San Bernardino County, California. Within the limits of the proposed project, Interstate 215 (I-215) currently provides three lanes in each direction. Barton Road is a two-lane roadway west of I-215 and a four-lane facility with turn lanes at various intersections east of I-215. Barton Road provides four ramps that connect to I-215: southbound on- and off-ramps, and northbound on- and off-ramps. The project location map is shown in Figure 1.

The purpose of the proposed project is to reconstruct and improve the interchange in order to improve operation, increase capacity, and reduce congestion at the I-215/ Barton Road interchange. The existing interchange has a nonstandard southbound off-ramp, and the existing interchange restricts large truck movements and pedestrian and bicyclist access. Without the interchange improvement, the operation of this facility will deteriorate over time to reach unacceptable levels of service (LOS) in the future.

The project area for the I-215/Barton Road Interchange Improvement Project overlaps the project area with the I-215 Bi-County High-Occupancy Vehicle (HOV) Lane Gap Closure Project at the Burlington Northern Santa Fe Railroad (BNSF) two-track underpass (bridge over the freeway) and the Union Pacific Railroad (UPRR) single-track underpass between the Iowa Avenue/La Cadena Drive interchange and the Barton Road interchange. Both projects would require the reconstruction of these two structures. For the I-215/Barton Road Interchange Improvement Project, the reconstruction is needed to accommodate an auxiliary lane that is proposed between the northbound La Cadena entrance ramp and the proposed Barton Road exit ramp. The underpass replacements are required for I-215/Barton Road interchange Alternatives 3, 6, and 7. For the I-215 Bi-County HOV Lane Gap Closure Project, the reconstruction is necessary due to inadequate horizontal clearance between the existing structure supports and the proposed HOV lane addition. The reconstructed bridges would be raised to provide adequate vertical clearance with the freeway.

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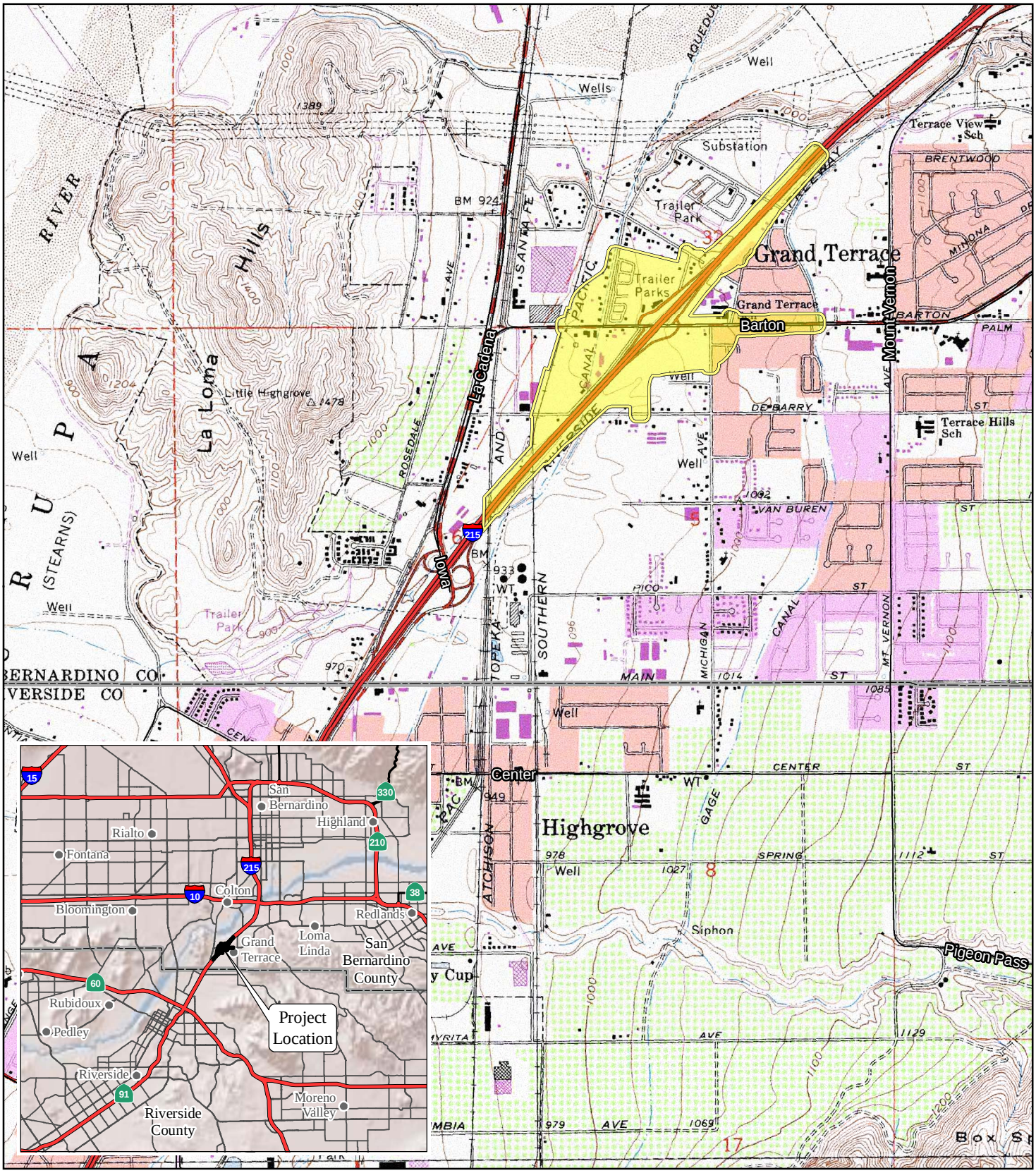


LEGEND

Project Area

FIGURE 1

0 1000 2000

FEET

SOURCE: USGS 7.5 min. quad. (San Bernardino South, 1980)

I:\SBA330\Barton_I-215\GIS\ProjectVicinity.mxd (5/26/2011)

*I-215/Barton Road Interchange Improvement Project*

Project Location

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Because the I-215 Bi-County HOV Lane Gap Closure Project analyzed the environmental impacts of reconstruction of the two railroad structures, as well as construction of temporary railroad bridges to be utilized during reconstruction of the existing structures (railroad shooflies), and this project was approved in April 2011, these impacts are not evaluated as part of this document.

## 2.1. Alternative 1 (No Build Alternative)

Under Alternative 1, no interchange reconstruction would occur. This alternative would not improve operations, increase highway capacity, or reduce highway congestion at the I-215/Barton Road interchange.

## 2.2. Alternative 3 (Partial Cloverleaf Interchange)

Alternative 3 would reconstruct and improve the existing interchange in a cloverleaf design. This alternative would widen the Barton Road overcrossing from one to three lanes in each direction, allowing for additional turning lanes onto the southbound and northbound loop on-ramps. The existing freeway overcrossing would be replaced with a new structure comprising four through lanes and two turn lanes. The conceptual design for Alternative 3 is described in the following sections.

### 2.2.1. Interchange Components

Alternative 3 includes the components listed below:

- A new southbound off-ramp, southbound loop on-ramp, northbound loop on-ramp, and northbound off-ramp.
- The southbound off-ramp would make a new connection at Barton Road with one right-turn lane, one shared right-/left-turn lane, and one left-turn lane. La Crosse Avenue north of Barton Road would be removed.
- The southbound loop on-ramp would provide three lanes at Barton Road.
- The northbound off-ramp would accommodate three lanes (two right-turn lanes and one left-turn lane) at the Barton Road intersection.
- The northbound loop on-ramp would provide three lanes at Barton Road.
- Modified drainage facilities consistent with other project improvements.
- Standard sidewalks and a Class II bicycle lane would be provided on both sides of the Barton Road overcrossing.

- Storm water treatment devices as needed to address storm water runoff in the project limits.
- Replacement landscaping consistent with the 215/91 Corridor Master Plan Conceptual Interchange design.
- Potential sound barriers in the vicinity of new on- and off-ramps.
- In-place utility relocation or protection during construction.
- Design exceptions for interchange spacing, superelevation design on the southbound on-ramp and northbound off-ramp, curb ramps (one ramp at each of the four corners at the intersection of Barton Road and the southbound on- and off- ramps), and minimum traffic width during construction (three 11-foot [ft] inside traffic lanes and one 12 ft outside traffic lane).
- New right-of-way to accommodate the reconfigured ramps (full acquisitions, partial acquisitions, and temporary construction easements).

### 2.2.2. Local Circulation Components

Alternative 3 includes the following local circulation components:

- Reconfigure Commerce Way to intersect with Barton Road at Vivienda Avenue.
- Eliminate the intersection of Michigan Avenue at Barton Road. Michigan Avenue will form a T-intersection with Commerce Way.
- Widen Barton Road to four through lanes approximately between Grand Terrace Road and Vivienda Avenue.
- Convert the segment of Vivienda Avenue west of I-215 into a cul-de-sac.
- Construct a new two-lane road between La Crosse Avenue and Grand Terrace Road adjacent to Vivienda Avenue.
- Realign Grand Terrace Road and the Grand Terrace Road/Barton Road intersection.
- Extend Grand Terrace Road southwest of Barton Road to tie into East De Berry Street.
- Convert Grand Terrace Road at Barton Road into a cul-de-sac.
- Modify drainage facilities consistent with other project improvements.
- Traffic signal modifications.
- New right-of-way to accommodate the reconfigured local streets (full acquisitions, partial acquisitions, and temporary construction easements).

## 2.3. Alternative 6 (Modified Cloverleaf)

Under Alternative 6, Barton Road would be widened to two through lanes in each direction plus one left-turn and one right-turn lane. The existing overcrossing would be replaced with a new structure with four through lanes and three turn lanes. The conceptual design for Alternative 6 is described in the following sections.

### 2.3.1. Interchange Components

Alternative 6 includes the components listed below:

- The new southbound loop on-ramp would provide two lanes at Barton Road.
- The new southbound off-ramp would make a new connection at Barton Road with one right-turn lane, one left-turn lane, and one shared right-turn/left-turn lane. La Crosse Avenue north of Barton Road would be removed.
- The new northbound off-ramp would tie in to Commerce Way and provide for dual left-turn lanes and a single right-turn lane.
- A new northbound hook on-ramp would be provided in the southeast quadrant. The access to the ramp would be through a proposed extension of Commerce Way.
- Drainage for the entire interchange would be improved.
- Standard sidewalks and a Class II bicycle lane would be provided on both sides of the Barton Road overcrossing.
- Storm water treatment devices as needed to address storm water runoff in the project limits.
- Replacement landscaping consistent with the 215/91 Corridor Master Plan Conceptual Interchange design.
- Potential sound barriers in the vicinity of new on- and off-ramps.
- In-place utility relocation or protection during construction.
- Design exceptions for interchange spacing, superelevation design on the northbound on-ramp, curb ramps (one ramp at each of the four corners at the intersection of Barton Road and the southbound on- and off- ramps), minimum traffic width during construction (three 11 ft inside traffic lanes and one 12 ft outside traffic lane), and access control opposite the southbound on- and off-ramps.
- New right-of-way to accommodate the reconfigured ramps (full acquisitions, partial acquisitions, and temporary construction easements).

### 2.3.2. Local Circulation Components

Alternative 6 includes the following local circulation components:

- Reconfigure Commerce Way to intersect with Barton Road at Vivienda Avenue.
- Shift Commerce Way east to accommodate the northbound on- and off-ramps.
- Extend Commerce Way southeast of Barton Road to cross Michigan Avenue to the vicinity of De Berry Street.
- Tie the hook on-ramp and I-215 off-ramp to the new intersection at Commerce Way.
- Eliminate the intersection of Michigan Avenue at Barton Road. Michigan Avenue will form a T-intersection with Commerce Way.
- Widen Barton Road to four through lanes approximately between Grand Terrace Road and Vivienda Avenue.
- Construct a new two-lane road between La Crosse Avenue and Grand Terrace Road adjacent to Vivienda Avenue.
- Modify drainage facilities consistent with other project improvements.
- Traffic signal modifications.
- New right-of-way to accommodate the reconfigured local streets (full acquisitions, partial acquisitions, and temporary construction easements).

## 2.4. Alternative 7 (Modified Cloverleaf/Diamond) (Locally Preferred Alternative).

Under Alternative 7, Barton Road would be widened to two through lanes in each direction plus one left-turn and one right-turn lane. The existing overcrossing would be replaced with a new structure with four through lanes and two turn lanes. The conceptual design for Alternative 7 is described in the following sections.

### 2.4.1. Interchange Components.

This alternative includes the components listed below:

- A new southbound off-ramp, southbound loop on-ramp, northbound on-ramp, and northbound off-ramp.
- The new southbound off-ramp would make a new connection at Barton Road with one right-turn lane, one left-turn lane, and one shared right-turn/left-turn lane; La Crosse Avenue north of Barton Road would be removed.

- The new northbound off-ramp would intersect with Barton Road in a spread diamond configuration with one left-turn lane, one right-turn, and one shared through/right-turn lane, and the northbound on-ramp is a spread diamond configuration with two lanes at Barton Road.
- Drainage for the entire interchange would be improved.
- Standard sidewalks and a Class II bicycle lane would be provided on both sides of the Barton Road overcrossing.
- Storm water treatment devices as needed to address storm water runoff in the project limits.
- Replacement landscaping consistent with the 215/91 Corridor Master Plan Conceptual Interchange design.
- Potential sound barriers in the vicinity of new on- and off-ramps.
- Utility relocation or protection in place during construction.
- Design exceptions for interchange spacing, intersection spacing, superelevation design on the northbound on-ramp and off-ramp, weaving distance factor between the La Cadena on-ramp and northbound Barton exit ramp, curb ramps (one ramp at each of the four corners at the intersection of Barton Road and the southbound on- and off- ramps), minimum traffic width during construction (three 11 ft inside traffic lanes and one 12 ft outside traffic lane), and access control opposite the southbound on- and off-ramps.
- New right-of-way to accommodate the reconfigured ramps (full acquisitions, partial acquisitions, and temporary construction easements).

### 2.4.2. Local Circulation Components.

Alternative 7 includes the following local circulation components:

- Reconfigure Commerce Way to intersect with Barton Road at Vivienda Avenue.
- Eliminate the intersection of Michigan Avenue at Barton Road; Michigan Avenue will form a T-intersection with Commerce Way.
- Widen Barton Road to four through lanes approximately between Grand Terrace Road and Vivienda Avenue.
- Construct a new two-lane road between La Crosse Avenue and Grand Terrace Road adjacent to Vivienda Avenue.
- Modified drainage facilities consistent with other project improvements.
- Traffic signal modifications.

- New right-of-way to accommodate the reconfigured local streets (full acquisitions, partial acquisitions, and temporary construction easements).

## 2.5. Alternatives Considered but Eliminated from Further Discussion

Alternatives 2 and 4 included a new northbound on-ramp that encroached into the playfields and portable buildings at Grand Terrace Elementary School in the northeast quadrant of the interchange. Meetings with the Colton Joint Unified School District Director of Facilities and Planning and a California Department of Education representative determined that the acquisition of school property under these alternatives would require the school to be relocated. This would require that the project cost include the cost of moving the school and environmental clearance of a new site. Further study determined that a suitable site within the school enrollment area was not available.

During reviews of the Build Alternatives that occurred between September 7, 2011, and October 27, 2011, it was discovered that the northbound on-ramp associated with Alternative 5 conflicts with the designed placement of the eastside bridge abutment for the Newport Avenue Overcrossing (OC) Bridge Replacement Project. The Newport OC Bridge project is in final design, and determining potential resolutions to the engineering conflict is expected to cause critical delays to this project by requiring substantial redesign, which in turn would be expected to result in an environmental reevaluation. In addition, Alternative 5 would result in greater environmental impacts than Alternatives 3, 6, and 7, and is the most expensive Build Alternative.

For the reasons described above, and because Alternatives 3, 6, and 7 are feasible, the Project Development Team (PDT) made a decision to withdraw Alternatives 2 and 4 from further consideration on March 18, 2008, and to withdraw Alternative 5 from further consideration on January 17, 2012.

# Chapter 3. Fundamentals of Traffic Noise

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, refer to the California Department of Transportation (the Department) Technical Noise Supplement (TeNS) (Department November 2009), which is available on the Department website at www.dot.ca.gov/hq/env/noise.

## 3.1. Sound, Noise, and Acoustics

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

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

## 3.2. Frequency and Hertz

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

## 3.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (µPa). One µPa 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 µPa. Because of this huge range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic

scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is approximately 0 dB, which corresponds to 20 µPa.

## 3.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sounds 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, a difference of 3 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

## 3.5. A-Weighted Decibels

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

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

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-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 scales), but

these scales are rarely used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of dBA. Table 1 shows typical A-weighted noise levels.

**Table 1. Typical A-Weighted Noise Levels**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | **— 110 —** | Rock band |
| Jet fly-over at 1,000 ft | | |
| | **— 100 —** | |
| Gas lawn mower at 3 ft | | |
| | **— 90 —** | |
| Diesel truck at 50 ft at 50 mph | | Food blender at 3 ft |
| | **— 80 —** | Garbage disposal at 3 ft |
| Noisy urban area, daytime | | |
| Gas lawn mower, 100 ft | **— 70 —** | Vacuum cleaner at 10 ft |
| Commercial area | | Normal speech at 3 ft |
| Heavy traffic at 300 ft | **— 60 —** | |
| | | Large business office |
| Quiet urban daytime | **— 50 —** | Dishwasher next room |
| Quiet urban nighttime | **— 40 —** | Theater, large conference room (background) |
| Quiet suburban nighttime | | |
| | **— 30 —** | Library |
| Quiet rural nighttime | | Bedroom at night, concert |
| | **— 20 —** | |
| | | Broadcast/recording studio |
| | **— 10 —** | |
| Lowest threshold of human hearing | **— 0 —** | Lowest threshold of human hearing |

Source: Technical Noise Supplement, California Department of Transportation, November 2009.
dBA = A-weighted decibels
ft = feet
mph = miles per hour

## 3.6. Human Response to Changes in Noise Levels

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

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1 dB changes in sound levels when exposed to steady, single-frequency ("pure-tone") signals in the midfrequency range (1,000–8,000 Hz). In typical noisy environments, 1–2 dB changes in noise are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level

increases of 3 dB in typical noisy environments. Further, a 5 dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3 dB increase in sound would generally be perceived as barely detectable.

## 3.7. Noise Descriptors

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

- **Equivalent Continuous Sound Level ($L_{eq}$):** $L_{eq}$ represents an average of the sound energy occurring over a specified period. In effect, $L_{eq}$ is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level ($L_{eq}$[h]) is the energy average of A-weighted sound levels occurring during a 1-hour period and is the basis for Noise Abatement Criteria (NAC) used by the Department and Federal Highway Administration (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 percent of the time, and $L_{90}$ is the sound level exceeded 90 percent 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 the nighttime hours between 10:00 p.m. and 7:00 a.m.
- **Community Noise Equivalent Level (CNEL):** Similar to $L_{dn}$, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m., and a 5 dB penalty applied to

the A-weighted sound levels occurring during the evening hours between 7:00 p.m. and 10:00 p.m.

## 3.8. Sound Propagation

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

### 3.8.1. Geometric Spreading

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

### 3.8.2. Ground Absorption

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet (ft). 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 the cylindrical spreading, the excess ground attenuation results in an overall dropoff rate of 4.5 dB per doubling of distance.

### 3.8.3. Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 ft) from the

highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

### 3.8.4. Shielding by Natural or Human-made Features

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

# Chapter 4. Federal, State, and Local Policies and Procedures

This report focuses on the requirements of 23 Code of Federal Regulations (CFR) 772, as discussed below.

## 4.1. Federal Regulations

### 4.1.1. 23 CFR 772

23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23 CFR 772.7, projects are categorized as Type 1, Type 2, or Type 3 projects. FHWA defines a Type 1 project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway where there is either substantial horizontal or substantial vertical alteration, or increases the number of through-traffic lanes. A Type 2 project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type 3 project is a project that does not meet the classifications of a Type 1 or Type 2 project. Type 3 projects do not require a noise analysis.

Type 1 projects include the addition of through traffic lanes that function as high-occupancy vehicle (HOV) lanes, high-occupancy toll (HOT) lanes, bus lanes, or truck climbing lanes. Type 1 projects include the addition of an auxiliary lane (except when an auxiliary lane is a turn lane); addition or relocation of interchange lanes or ramps; restriping existing pavement for the purpose of adding a through-traffic lane or auxiliary lane; and the addition of a new or substantial alteration of a weigh station, rest stop, ride share lot, or toll plaza. Projects unrelated to increased noise levels, such as striping, lighting, signing, and landscaping projects, are not considered Type 1 projects.

Under 23 CFR 772.11, noise abatement must be considered for Type 1 projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR 772 requires that the project sponsor “consider” noise abatement before adoption of the final National Environmental Policy Act (NEPA) document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to

be incorporated into the project, and of noise impacts for which no apparent solution is available.

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

Table 2 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

**Table 2. Activity Categories and Noise Abatement Criteria (NAC)**

| Activity Category | Activity $L_{eq}(h)$ [1] | Evaluation Location | Description of Activities |
|---|---|---|---|
| A | 57 | Exterior | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B[2] | 67 | Exterior | Residential |
| C[2] | 67 | Exterior | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilitates, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. |
| D | 52 | Interior | Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios. |
| E | 72 | Exterior | Hotels, motels, offices, restaurants/bars, and other developed lands properties, or activities not included in A-D or F. |
| F | — | — | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing. |
| G | — | — | Undeveloped lands that are not permitted. |

Source: FHWA 23 CFR 772.
[1] The $L_{eq}(h)$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA)
[2] Includes undeveloped lands permitted for this activity category.
dBA = A-weighted decibels
FHWA = Federal Highway Administration
$L_{eq}(h)$ = equivalent continuous sound level per hour
NAC = Noise Abatement Criteria

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

## 4.2. State Regulations and Policies

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

The California Department of Transportation (Department) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The NAC specified in the Protocol are the same as those specified in 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 A-weighted decibels (dBA). The Protocol also states that a sound level is considered to approach an NAC level when the sound level is within 1 decibel (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).

The Department Technical Noise Supplement (TeNS) (November 2009) and the Protocol provide 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 1-hour equivalent sound level ($L_{eq}$[h]) in the interior of public or private elementary or secondary school classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the "approach or exceed" NAC criterion for Federal Highway Administration (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 that is at or below 52 dBA $L_{eq}(h)$. If the noise levels generated from freeway and nonfreeway sources exceed 52 dBA $L_{eq}(h)$ prior to construction of the proposed freeway project, noise abatement must be provided to reduce noise to the level that existed prior to construction of the project.

## 4.3. Local Regulations and Policies

### 4.3.1. City of Grand Terrance

Section 8.108.030 of the City of Grand Terrace Municipal Code limits noise sources associated with or vibration created by construction, repair, remodeling, or grading of any real property or during authorized seismic surveys, provided said activities do not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday.

### 4.3.2. City of Colton

Based on the City of Colton's Bid and Contracts document template, Article 31 (Hours of Work), it shall be unlawful for any person to operate, permit, use, or cause to operate powered vehicles, construction equipment, loading and unloading vehicles, and domestic power tools at the project site other than between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday, with no work allowed on City or Colton-observed holidays, unless otherwise approved by the Engineer.

# 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 project. Land uses in the project area were categorized by land use type, activity category (as defined in Table 2), and the frequency of human use. As stated in the Protocol, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this noise impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common-use areas at multifamily residences and recreational vehicle (RV) parks.

The geographical features of the project area relative to nearby existing and planned land uses were also identified.

Short-term measurement locations were selected to represent noise-sensitive land uses within the project area. One long-term measurement site was selected to capture the diurnal traffic noise level pattern in the project area. Another long-term measurement site was selected to capture nonvehicular traffic noise sources, such as train noise from the Union Pacific Railroad (UPRR) because the ambient noise level is also dominated by existing rail operations. Short-term measurement locations were selected to serve as representative modeling locations. Also, other nonmeasurement locations were selected as modeling locations. A total of 144 receiver locations were modeled to represent land uses in the project area. These modeled receiver and monitoring locations are shown on Figure 2.

## 5.2. Field Measurement Procedures

Short-term noise measurements were taken at sensitive receiver sites classified as Activity Categories B and C within the project area during off-peak traffic hours when traffic was flowing freely. Field measurements were taken at these locations to calibrate the noise prediction model and ambient noise levels. Measurements were taken in accordance with the procedures cited in the California Department of

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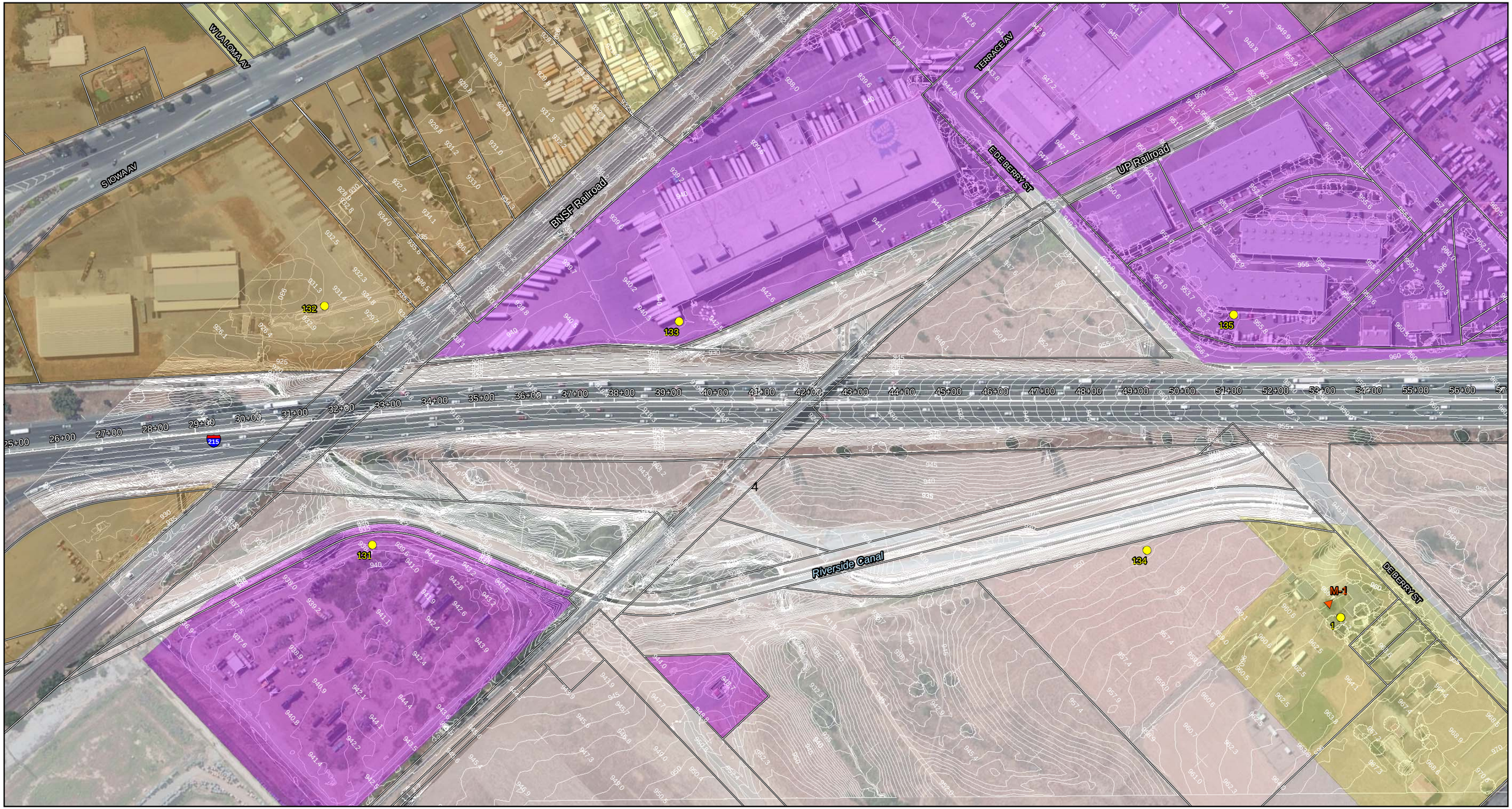


LEGEND

- Existing Sound Barriers
- Monitoring Locations
- Modeled Receiver Locations
- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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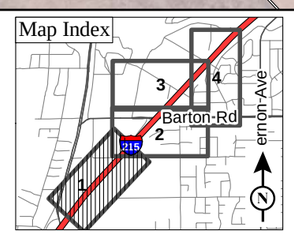


FIGURE 2
Sheet 1 of 4

*I-215/Barton Road Interchange Improvement Project*

Monitoring and Receiver Locations

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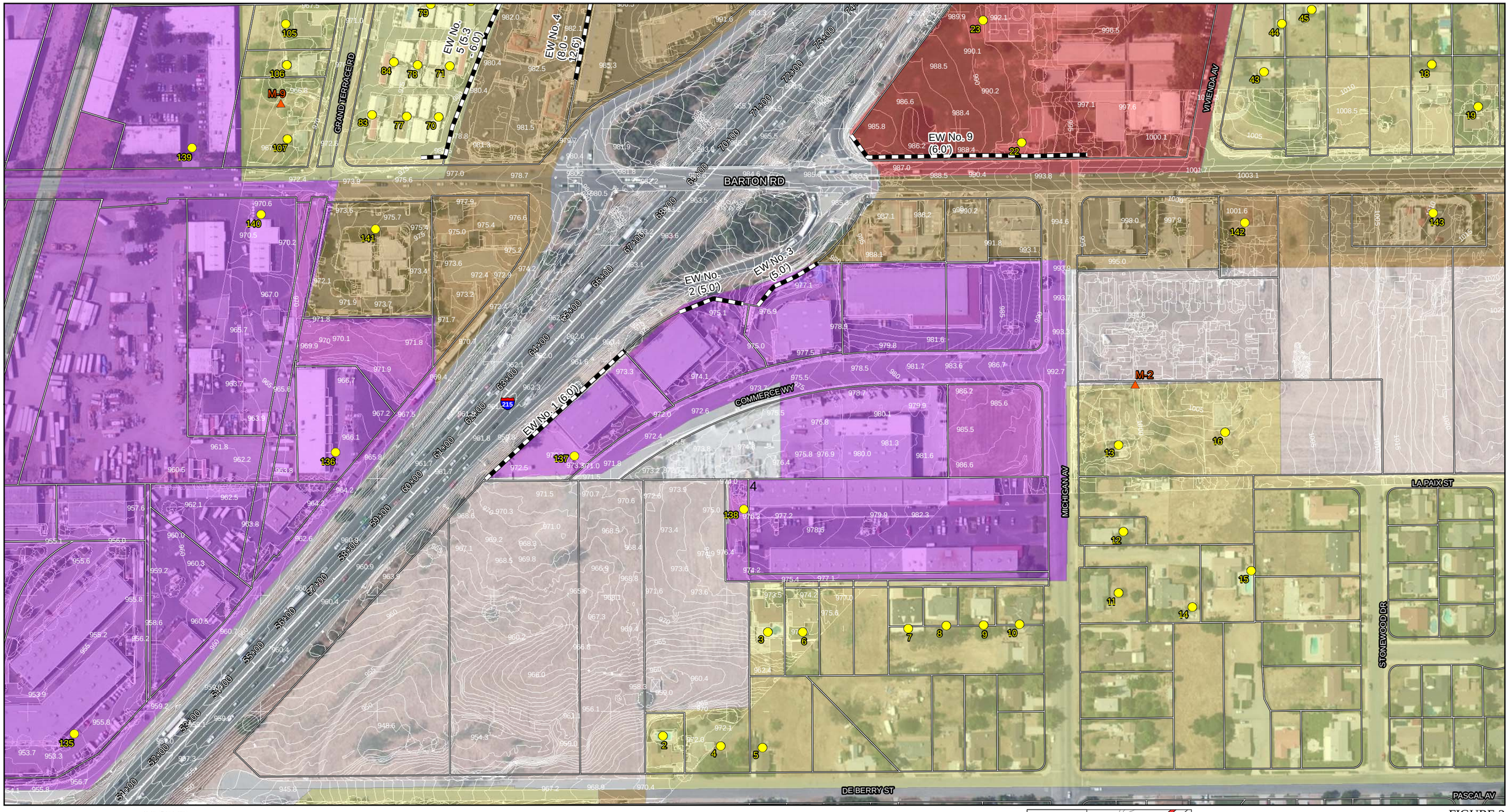


LEGEND

- Existing Sound Barriers
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- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

Land Use

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- Residential
- Utility
- Vacant

0 100 200 FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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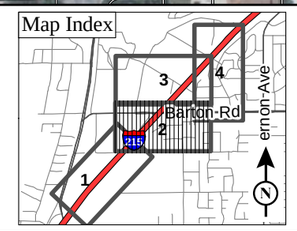


FIGURE 2
Sheet 2 of 4

*I-215/Barton Road Interchange Improvement Project*

Monitoring and Receiver Locations

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LEGEND

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- Monitoring Locations
- Modeled Receiver Locations
- 24-hour Noise Monitoring Location
- Exterior/Interior Noise Monitoring Location

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- Commercial
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SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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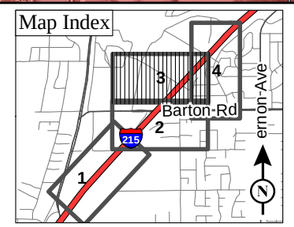


FIGURE 2
Sheet 3 of 4

*I-215/Barton Road Interchange Improvement Project*

Monitoring and Receiver Locations

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EA# 0J070

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LEGEND

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- Modeled Receiver Locations
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FEET

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Map Index

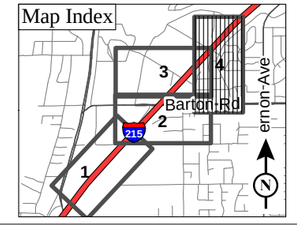


FIGURE 2
Sheet 4 of 4

*I-215/Barton Road Interchange Improvement Project*

Monitoring and Receiver Locations

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EA# 0J070

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Transportation (Department) Technical Noise Supplement (TeNS) document (Department 2009). All short-term noise measurements were made using Larson Davis Model 824 Type 1 (Serial No. 1612) and 820 Type 1 (Serial No. 4973) sound level meters.

The following measurement procedures were utilized:

- Calibrate sound level meter.
- Set up sound level meter at a height of 5 feet (ft).
- Commence noise monitoring.
- Collect site-specific data such as date, time, direction of traffic, vehicle speed, and the location of the sound level meter relative to any existing feature.
- Count passing vehicles for a period of 15 minutes during noise level measurement. Vehicles are split into three categories: automobiles, medium trucks, and heavy trucks.
- Stop measurement after 15 minutes.
- Calibrate sound level meter.
- Proceed to next monitoring site and repeat.

The traffic counts were expanded to hourly volumes (multiplied by four to normalize the results to hourly values) and entered into Traffic Noise Model (TNM) 2.5 for each monitoring site. The monitoring results were used to calibrate the model outputs.

## 5.3. Traffic Noise Level Prediction Methods

Traffic noise levels were predicted using the FHWA TNM 2.5. TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). Key inputs to the traffic noise model were the locations of roadways, shielding features (e.g., topography and buildings), sound barriers, ground type, and receptors. For receivers, barriers, and building rows located beyond the topographic map, the elevations were obtained using Global Positioning System (GPS) surveys, or they were determined to be generally similar to the closest area that has topographic map coverage because the area is generally flat, as observed during the field inspection. A detailed description of how the elevation was estimated for each receiver, barrier, and building row located beyond the topographic map is provided in Appendix A. Three-dimensional representations of these inputs were developed using computer-aided design (CAD) drawings, aerials, and topographic contours provided by AECOM. It should be noted that the CAD datum is currently in

NAD83, CCS83 Zone (0405) – EPOCH 1984 VERT DATUM-NGVD29. This datum is approximately 2.3 ft different than the datum used by the Department, which is NAD83, CCS83 Zone (0405) – EPOCH 2007.00 VERT DATUM-NAVD88.

Traffic counts, measured vehicle speeds, and ambient noise levels were used to calibrate the TNM 2.5 under existing roadway conditions. The existing traffic noise levels were calculated using the traffic volumes and actual travel speeds obtained during the short-term noise measurements. Future traffic noise levels at all 144 receiver locations were modeled using the worst-case traffic operations (prior to speed degradation) or the future (2040) peak-hour traffic volumes obtained from the Traffic Operations Analysis (October 2011), whichever is lower. The worst-case traffic condition is assumed to be level of service (LOS) D/E, which corresponds to 1,950 vehicles per lane per hour (vplph) on the highway mainline, 1,500 vplph on HOV lanes, 1,200 vplph on highway ramps and Barton Road, and 1,000 vplph on local roadways such as Grand Terrace Road, Vivienda Avenue, and La Crosse Avenue. Traffic noise is generally loudest when vehicles on a given roadway travel at free-flowing traffic conditions. Accordingly, these worst-case traffic volume assumptions are based on the maximum number of vehicles that can typically travel in a given lane while still resulting in free-flowing traffic conditions. A summary of traffic data inputs for existing and future conditions are presented in Appendix A.

TNM 2.5 is sensitive to the volume of trucks on the roadway because trucks contribute disproportionally to traffic noise. Vehicle distributions on all roadways within the project area were based on traffic counts collected during ambient noise level measurement. Vehicle distributions on I-215 were not obtained from the Department *Annual Average Daily Trucks on the California State Highway System* (Department 2009) because vehicle distributions obtained from traffic counts collected during ambient noise level measurement contained higher truck percentages, which represents a worse scenario than Department statistics. Table 3 shows the vehicle distribution and vehicle speeds for each vehicle category and roadway within the project area used to calculate existing and future traffic noise levels.

## 5.4. Methods for Identifying Traffic Noise Impact and Consideration of Abatement

Traffic noise impacts are considered to occur at receptor locations where predicted design-year noise levels are at least 12 dBA 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.

**Table 3. Vehicle Distribution and Vehicle Speed**

| Roadway | Vehicle (%) | | | Vehicle Speed (mph) | | |
|---|---|---|---|---|---|---|
| | Automobiles | Medium Trucks | Heavy Trucks | Automobiles | Medium Trucks | Heavy Trucks |
| I-215 Mainline | 92 | 4 | 4 | 65 | 65 | 55 |
| I-215 HOV | 94 | 6 | NA[1] | 65 | 65 | NA[1] |
| I-215 On-ramp at Barton Road | 91 | 6 | 3 | 65 | 65 | 55 |
| I-215 Off-ramp at Barton Road | 91 | 6 | 3 | 45 | 45 | 40 |
| Grand Terrace Road | 95 | 5 | 0 | 30 | 30 | 25 |
| Vivienda Avenue | 100 | 0 | 0 | 30 | 30 | 25 |
| Commerce Way | 92 | 6 | 2 | 35 | 35 | 30 |
| Michigan Avenue | 92 | 6 | 2 | 35 | 35 | 30 |
| Barton Road | 94 | 4 | 2 | 40 | 40 | 35 |
| La Crosse Avenue | 94 | 6 | 0 | 30 | 30 | 25 |

Source: LSA Associates, Inc., February 2012.
[1] NA = Not Applicable. Heavy trucks are not allowed on HOV Lanes.
HOV = high-occupancy vehicle
I-215 = Interstate 215
mph = miles per hour

According to the Protocol, abatement measures are considered acoustically feasible if a minimum noise reduction of 5 dBA at impacted receptor locations is predicted with implementation of the abatement measure. In addition, barriers should be designed to intercept the line of sight from the exhaust stack of a truck to the first tier of receptors as required by the *HDM*, Chapter 1100 (Caltrans 2007). Other factors that affect feasibility include topography, access requirements for driveways and ramps, presence of local cross streets, utility conflicts, other noise sources in the area, and safety considerations. The overall reasonableness of noise abatement is determined by considering factors such as the construction cost of the barrier, noise reduction design goal (a noise level reduction of 7 dBA or more at one or more benefited receptors), and the viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Protocol defines the procedure for assessing the reasonableness of sound barriers from a cost perspective. A cost-per-residence allowance is calculated for each benefited residence (i.e., residences that receive at least 5 dBA of noise reduction from a sound barrier). The 2011 allowance is $55,000 per benefited residence. Total

allowances are calculated by multiplying the cost per residence by the number of benefited residences.

# Chapter 6. Existing Noise Environment

## 6.1. Existing Land Uses

As previously mentioned, developed and undeveloped land uses in the project vicinity were identified through land use maps, aerial photography, and site inspection. Within each land use category, sensitive receivers were identified. Existing land uses in the project area include single-family and multifamily residences; two mobile home parks; a recreational vehicle (RV) park; a fast-food restaurant with an outdoor eating area; a school; a utility facility; office, commercial, and light industrial uses; and vacant land. Existing land uses in the project area are described below and in further detail.

- **East of Interstate 215 (I-215), South of Barton Road:** Land uses in this area include single-family residences; a fast-food restaurant with an outdoor eating area; vacant land; commercial and light industrial uses. These land uses are located up to 20 feet (ft) higher in elevation than I-215. Residential land uses were evaluated under Activity Category B, which has an exterior Noise Abatement Criteria (NAC) of 67 equivalent continuous sound levels measured in A-weighted decibels (dBA $L_{eq}$). The outdoor eating area associated with the fast-food restaurant was evaluated under the Activity Category E (72), which has an exterior NAC of 72 dBA $L_{eq}$. Vacant land, commercial, and light industrial uses were evaluated under Activity Categories F and G land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this noise study for reporting purposes.
- **East of I-215, Between Barton Road and Newport Avenue:** Land uses in this area include single-family residences and the Grand Terrace Elementary School. These land uses are located up to 20 ft higher in elevation than I-215. Residences and the school playground were evaluated under Activity Categories B and C, which has an exterior NAC of 67 dBA $L_{eq}$. The interior of the school classroom building was evaluated under Activity Category D, which has an interior NAC of 52 dBA $L_{eq}$.
- **East of I-215, North of Newport Avenue:** Land uses in this area include single- and multifamily residences that are located between 20 and 50 ft higher in elevation than I-215. These land uses were evaluated under Activity Category B, which has an exterior NAC of 67 dBA $L_{eq}$.

- **West of I-215, South of Barton Road:** Land uses in this area include commercial and light industrial uses that are located approximately up to 15 ft higher in elevation than I-215. Commercial and light industrial uses were evaluated under Activity Category F land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes.
- **West of I-215, Between Barton Road and Newport Avenue:** Land uses in this area include single-family residences, two mobile home parks, an RV park, commercial uses, and vacant land. The majority of the land uses are located approximately 15 ft higher in elevation than I-215. A small portion of the area is located approximately 10 ft lower in elevation than I-215. Single-family residences, mobile homes, and an RV park were evaluated under Activity Category B, which has an exterior NAC of 67 dBA $L_{eq}$. Commercial uses were evaluated under Activity Category F land uses. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes. Vacant land in this area would be acquired as part of the proposed project.
- **West of I-215, North of Newport Avenue:** Land uses in this area include utilities that are located between 20 and 50 ft higher in elevation than I-215. The utility facility was evaluated under Activity Category F land use. Although Activity Category F has no impact criteria, traffic noise levels were provided in this study for reporting purposes.

## 6.2. Noise Measurement Results

The existing noise environment in the project area is based on short-term and 24-hour traffic noise level measurements. Also, interior and exterior noise level measurements were conducted at the school classroom building to evaluate potential interior noise impacts.

### 6.2.1. Short-Term Monitoring

The primary source of noise in the project area is traffic on I-215 and Barton Road. Short-term (15-minute) noise measurements were conducted to document existing noise levels at 12 representative sensitive receiver locations along the project corridor. Short-term (15-minute) noise level measurements were conducted using Larson Davis Models 824 and 820 Type 1 sound level meters. Table 4 contains the results of the short-term noise level measurements.

## Table 4. Short-Term Ambient Noise Monitoring Results

| Monitor No. | Date | Start Time | Duration | dBA $L_{eq}$ |
|---|---|---|---|---|
| M-1 | 11/6/2008 | 2:20 p.m. | 15 minutes | 64.2 |
| M-2 | 2/2/2010 | 11:32 a.m. | 15 minutes | 51.6 |
| M-3 | 1/21/09 | 10:09 a.m. | 15 minutes | 54.8 |
| M-4 | 1/21/09 | 9:05 a.m. | 15 minutes | 71.2 |
| M-5 | 11/6/2008 | 10:42 a.m. | 15 minutes | 75.3 |
| M-6 | 11/6/2008 | 10:42 a.m. | 15 minutes | 51.6 |
| M-7 | 11/6/2008 | 9:54 a.m. | 15 minutes | 54.9 |
| M-8 | 11/6/2008 | 1:08 p.m. | 15 minutes | 54.2 |
| M-9 | 2/2/2010 | 12:08 p.m. | 15 minutes | 53.2 |
| M-10 | 11/6/2008 | 11:24 a.m. | 15 minutes | 68.9 |
| M-11 | 11/6/2008 | 11:24 a.m. | 15 minutes | 60.6 |
| M-12 | 11/20/2008 | 12:19 p.m. | 15 minutes | 51.7 |

Source: LSA Associates, Inc., February 2012.
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels

Table 5 describes the physical locations of the noise monitoring. These short-term noise measurements were used to calibrate the noise model and to predict the noise levels at all 144 modeled sensitive receivers in the project area. The short-term monitoring locations are shown in Figure 2. The noise monitoring results, concurrent traffic counts, and measured vehicle speeds for each monitoring site are included in Appendix A. Table 6 shows the meteorological conditions during the short-term noise measurements.

## Table 5. Physical Location of Noise Level Measurements

| Monitor No. | Location Description | Noise Sources | Comments |
|---|---|---|---|
| M-1 | 21875 De Berry Street; located between I-215 and the house; on the southeast corner of I-215 and Barton Road | Traffic on I-215 | There is no existing wall or property wall. There is open space between I-215 and residence. |
| M-2 | 12175 Michigan Avenue; on north edge of yard; no noise shielding only chain link fence | Light traffic on Michigan Avenue; trucks coming from both ways turn across the street onto Commerce Way; can't hear freeway noise from this location | There is no existing wall or property wall. |
| M-3 | 22270 Barton Road; in the backyard; located on the northeastern corner of I-215 and Barton Road | Traffic on Barton Road and faint aircraft noise | Driveway access from Barton Road onto property. |
| M-4 | 12066 Vivienda Avenue; Grand Terrace Elementary School; between classroom 30 and 25; located on the northeast corner of I-215 and Barton Road; approximately 100 ft from I-215 | Traffic on I-215 and one car moving in the parking lot | There is no existing wall or property wall. |
| M-5 | 11948 Vivienda Court; in the backyard; located on the east side of I-215 between Barton Road and Newport Avenue | Traffic on I-215 and dog barking next door | Residence is located approximately 4 ft higher in elevation than I-215. Sound meter is between property line and I-215. |
| M-6 | 11947 Vivienda Court; in the backyard; located on the east side of I-215 between Barton Road and Newport Avenue | Faint traffic from I-215 and faint aircraft noise | Second row residence, 4 ft high existing property wall around backyard. Backyard area is shielded by residence structure. |
| M-7 | 11750 Mount Vernon Avenue; The Highlands Apartments; located next to the patio at Apartment No. FF1206 at the northeast corner of I-215 and Newport Avenue | Traffic on I-215 and very light traffic on Canal Street, some faint aircraft noise, and faint train noise | There is no existing wall or property wall. |
| M-8 | 21900 Barton Road; Terrace Village RV Park; located at Unit No. 48 on the northwest corner of I-215 and Barton Road | Traffic on I-215, some leaf blower noise, aircraft noise, faint dog barking, door creaking when it blows open and closed, and noise from raking leaves | Existing 12.6 ft high property wall between I-215 and the RV Park. A 15 ft high building located on the east side of the RV Park. |
| M-9 | 21842 Grand Terrace Road; not in backyard; 12 ft behind orange tree | Traffic on Barton Road | There is no existing wall or property wall. |
| M-10 | 11981 La Crosse Avenue, in the backyard; located on the west side of I-215 between Barton Road and Newport Avenue | Traffic on I-215, I-215 off-ramp to Barton Road, and some faint aircraft noise | There is no existing wall or property wall. |
| M-11 | 22111 Newport Avenue Unit No. 181; Grand Royal Estates; located on the southwest corner of I-215 and Newport Avenue | Traffic on I-215 | Existing 5.3 ft high wall along the property line between the residences and I-215. |
| M-12 | 2211 Newport Avenue Unit No. 41; Grand Royal Estates; located at the end of the driveway on the southwest corner of I-215 and Newport Avenue | Traffic on I-215, quiet car driving by neighbors, birds chirping, and faint aircraft noise | Existing 5.3 ft high wall along the property line between the residence and I-215. Took measurement from the driveway due to no accessibility. |

Source: LSA Associates, Inc., February 2012.
ft = feet
I-215 = Interstate 215
RV = recreational vehicle

**Table 6. Meteorological Conditions During Noise Monitoring**

| Date | Temperature (°F) | Average Wind Speed (mph) |
|---|---|---|
| 11/6/2008 | 78.3–85.2 | 0.7–6.0 |
| 11/20/2008 | 77.0–85.3 | 0.0–2.1 |
| 1/21/2009 | 66.2–67.5 | 0.6–1.8 |
| 2/2/2010 | 68.9-69.0 | 0.8-1.0 |

Source: LSA Associates, Inc., February 2012.
°F = degrees Fahrenheit
mph = miles per hour

### 6.2.2. Noise Model Calibration

A total of 12 separate model runs were conducted using the traffic counts and measured vehicle speeds collected during the ambient noise monitoring. The results of these model runs were compared to the measured ambient noise levels to ensure the accuracy of Traffic Noise Model (TNM) 2.5. Correction factors known as K-factors were applied to each of the modeled receiver locations so that the monitored and modeled noise levels were the same. Table 7 shows the measured ambient noise level, the modeled noise levels using traffic counts and measured vehicle speeds during noise monitoring, and the K-factor at each of the 12 monitored locations. The model input and output data for the calibration model runs are included in Appendix B.

**Table 7. Model Calibration**

| Monitor No. | Measured Noise Level (dBA $L_{eq}$) | Modeled Noise Level (dBA $L_{eq}$) | K-Factor (dBA) |
|---|---|---|---|
| M-1 | 64.2 | 66.9 | -2.7 |
| M-2 | 51.6 | 57.3 | -5.7 |
| M-3 | 54.8 | 53.7 | 1.1 |
| M-4 | 71.2 | 75.2 | -4.0 |
| M-5 | 75.3 | 78.5 | -3.2 |
| M-6 | 51.6 | 59.1 | -7.5 |
| M-7 | 54.9 | 59.4 | -4.5 |
| M-8 | 54.2 | 54.5 | -0.3 |
| M-9 | 53.2 | 60.6 | -7.4 |
| M-10 | 68.9 | 73.9 | -5.0 |
| M-11 | 60.6 | 68.7 | -8.1 |
| M-12 | 51.7 | 60.1 | -8.4 |

Source: LSA Associates, Inc., February 2012.
dBA = A-weighted decibels
$L_{eq}$ = equivalent continuous sound level

As shown in Table 7, monitoring locations M-2, M-4, M-5, M-6, M-7, and M-9 through M-12 have K-factors greater than 3 dBA. Based on the Technical Noise Supplement (TeNS) in Section N-5460, K-factors between 3 and 4 can be calibrated unless the validity of the noise measurement conducted is in serious doubt. Also, differences of 5 dBA or greater should be approached with caution by retaking measurements and looking for obvious causes for the difference such as meteorology, pavement conditions, obstructions, reflections, etc. Monitoring locations M-2, M-4, M-5, and M-9 were rechecked; noise level measurements and field surveys of existing features and the TNM 2.5 modeled input data were also reexamined and determined to be accurate. Therefore, K-factors shown in Table 7 were used to calibrate the noise model. Additional site surveys of the existing terrain and ambient noise level measurements were reconducted for monitoring locations M-6, M-11, and M-12 to verify the K-factor.

The original noise level measurement results for monitoring locations M-6 and M-11 (November 6, 2008) and the new noise level measurement results for monitoring location M-12 (November 20, 2008) were selected for calibration because they yielded the lowest K-factor value. The complexity of the terrain, distance from I-215 to the receiver, and different roadway pavement types observed in the field are possible reasons as to why these nine monitoring locations have a K-factor greater than 3 dBA.

### 6.2.3. Long-term 24-Hour Monitoring (Traffic Noise Levels)

Long-term traffic noise level measurement was conducted to document the peak traffic noise hour. Long-term ambient noise monitoring was conducted using a Larson Davis Model 824 Type 1 sound level meter (Serial Number 1612) at one location. The long-term noise level measurement was performed at 11902 Pascal Avenue, Grand Terrace, California, from 3:00 p.m. on Tuesday, February 2, 2010, to 2:00 p.m. on Wednesday, February 3, 2010. The long-term noise monitoring location is shown on Figure 2.

Table 8 shows that traffic noise peaks during the 7:00 a.m. to 9:00 a.m. hours. To determine existing peak traffic noise levels in the project area, the difference between the hour in which the short-term ambient noise measurements were conducted and the peak traffic noise hour was added to the monitored noise levels. For example, monitoring location M-1 was conducted during the 2:00 p.m. hour. Table 8 shows that the noise level during this hour is generally 1 decibel (dB) lower than the level

**Table 8. Long-Term 24-hour Traffic Noise Levels Measurement Results at 11902 Pascal Avenue, Grand Terrace, California**

| Hour | Time | Date | Noise Level (dBA $L_{eq}$) |
|---|---|---|---|
| 1 | 3:00 PM | 2/2/10 | 67 |
| 2 | 4:00 PM | 2/2/10 | 67 |
| 3 | 5:00 PM | 2/2/10 | 67 |
| 4 | 6:00 PM | 2/2/10 | 66 |
| 5 | 7:00 PM | 2/2/10 | 66 |
| 6 | 8:00 PM | 2/2/10 | 66 |
| 7 | 9:00 PM | 2/2/10 | 66 |
| 8 | 10:00 PM | 2/2/10 | 65 |
| 9 | 11:00 PM | 2/2/10 | 64 |
| 10 | 12:00 AM | 2/3/10 | 63 |
| 11 | 1:00 AM | 2/3/10 | 61 |
| 12 | 2:00 AM | 2/3/10 | 60 |
| 13 | 3:00 AM | 2/3/10 | 61 |
| 14 | 4:00 AM | 2/3/10 | 61 |
| 15 | 5:00 AM | 2/3/10 | 64 |
| 16 | 6:00 AM | 2/3/10 | 66 |
| 17 | 7:00 AM | 2/3/10 | **68**[1] |
| 18 | 8:00 AM | 2/3/10 | **68** |
| 19 | 9:00 AM | 2/3/10 | **68** |
| 20 | 10:00 AM | 2/3/10 | 67 |
| 21 | 11:00 AM | 2/3/10 | 67 |
| 22 | 12:00 PM | 2/3/10 | 67 |
| 23 | 1:00 PM | 2/3/10 | 67 |
| 24 | 2:00 PM | 2/3/10 | 67 |

Source: LSA Associates, Inc., February 2012.
[1] Bold numbers represent peak traffic noise hour.
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels

during the peak traffic noise hour. Therefore, 1 dBA is added to the existing levels for receivers that represent monitoring location M-1 to determine the existing peak noise level. For receiver locations where ambient noise monitoring was not conducted, existing noise levels were calculated using TNM 2.5 with traffic volumes counted during the noise monitoring.

### 6.2.4. Long-term 24- Hour Monitoring (Background Noise Levels)

Other sources of noise within the project area include railroad noise. A 24-hour community background noise level measurement was conducted using a Larson Davis Model 820 Type 1 sound level meter (Serial No. 1584) to capture nonvehicular traffic noise sources, such as train noise from Union Pacific Railroad (UPRR), located within the project area. The 24-hour community background noise level measurement was performed at 21995 Vivienda Avenue, Grand Terrace, California, from 4:00 p.m. on Tuesday, February 2, 2010, to 4:00 p.m. on Wednesday, February 3, 2010. The location of the 24-hour community background noise level measurement is shown on

Figure 2. Table 9 shows the results of the 24-hour background noise level measurement. Table 9 shows that the ambient noise level peaks at 58 dBA during the 8:00 p.m.–9:00 p.m. and 12:00 p.m.–1:00 p.m. hours. The existing rail operation contributes to the ambient noise environment at nearby residences and would continue into the future.

**Table 9. 24-Hour Community Background Noise Level Measurement Results at 21995 Vivienda Avenue, Grand Terrace, California**

| Hour | Time | Date | Noise Level (dBA $L_{eq}$) |
|---|---|---|---|
| 1 | 4:00 PM | 2/2/10 | 52 |
| 2 | 5:00 PM | 2/2/10 | 54 |
| 3 | 6:00 PM | 2/2/10 | 55 |
| 4 | 7:00 PM | 2/2/10 | 56 |
| 5 | 8:00 PM | 2/2/10 | **58**[1] |
| 6 | 9:00 PM | 2/2/10 | 57 |
| 7 | 10:00 PM | 2/2/10 | 55 |
| 8 | 11:00 PM | 2/2/10 | 55 |
| 9 | 12:00 AM | 2/3/10 | 55 |
| 10 | 1:00 AM | 2/3/10 | 55 |
| 11 | 2:00 AM | 2/3/10 | 55 |
| 12 | 3:00 AM | 2/3/10 | 56 |
| 13 | 4:00 AM | 2/3/10 | 56 |
| 14 | 5:00 AM | 2/3/10 | 56 |
| 15 | 6:00 AM | 2/3/10 | 57 |
| 16 | 7:00 AM | 2/3/10 | 57 |
| 17 | 8:00 AM | 2/3/10 | 55 |
| 18 | 9:00 AM | 2/3/10 | 54 |
| 19 | 10:00 AM | 2/3/10 | 52 |
| 20 | 11:00 AM | 2/3/10 | 54 |
| 21 | 12:00 PM | 2/3/10 | **58** |
| 22 | 1:00 PM | 2/3/10 | 54 |
| 23 | 2:00 PM | 2/3/10 | 55 |
| 24 | 3:00 PM | 2/3/10 | 54 |

Source: LSA Associates, Inc., February 2012.
[1] Bold numbers represent highest background noise levels.
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels

### 6.2.5. Interior/Exterior Noise Level Measurements

Interior and exterior noise level measurements were conducted at Grand Terrace Elementary School to determine the existing exterior-to-interior noise level reduction. The classroom building closest to I-215 was evaluated to ensure that the interior noise standard of 52 dBA $L_{eq}$ NAC is preserved. Table 10 shows the results of the exterior and interior noise level measurements and the existing exterior-to-interior noise level reduction.

**Table 10. Exterior/Interior Noise Monitoring Results**

| Receiver | Exterior (dBA $L_{eq}$) | Interior (dBA $L_{eq}$) | Exterior to Interior Noise Level Reduction | Land Use Description |
|---|---|---|---|---|
| EI-1 | 64.9 | 42.7 | 22.2 | 12066 Vivienda Avenue; Grand Terrace Elementary School; classroom building closest to the I-215 |

Source: LSA Associates, Inc., February 2012.
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
I-215 = Interstate 215

## 6.3. Existing Noise Levels

Traffic volume counts and vehicle speeds measured during the ambient noise monitoring were coded into TNM 2.5 with existing roadway conditions to calibrate the modeling result. The model input and output data for the calibration model runs are included in Appendix B. The results of the existing traffic noise modeling are shown in Table 11. Currently, of the 144 modeled receiver locations, 20 receivers approach or exceed the 67 dBA $L_{eq}$ NAC. Figure 2 shows the locations of the modeled receivers.

## Table 11. Existing Traffic Noise Levels

| Receiver No. | Location | Type of Land Use | No. of Units Represented | Noise Abatement Category (NAC) | Adjusted Existing Noise Level (dBA $L_{eq}$) |
|---|---|---|---|---|---|
| R-1 | De Berry Street | Residential | 3 | B(67) | 65 |
| R-2 | De Berry Street | Residential | 1 | B(67) | 53 |
| R-3 | Rene Lane | Residential | 1 | B(67) | 51 |
| R-4 | De Berry Street | Residential | 1 | B(67) | 51 |
| R-5 | De Berry Street | Residential | 1 | B(67) | 51 |
| R-6 | Rene Lane | Residential | 1 | B(67) | 50 |
| R-7 | Rene Lane | Residential | 1 | B(67) | 49 |
| R-8 | Rene Lane | Residential | 1 | B(67) | 50 |
| R-9 | Rene Lane | Residential | 1 | B(67) | 52 |
| R-10 | Rene Lane | Residential | 2 | B(67) | 56 |
| R-11 | Michigan Street | Residential | 1 | B(67) | 55 |
| R-12 | Michigan Street | Residential | 1 | B(67) | 54 |
| R-13 | Michigan Street | Residential | 1 | B(67) | 55 |
| R-14 | Michigan Street | Residential | 1 | B(67) | 49 |
| R-15 | Michigan Street | Residential | 1 | B(67) | 47 |
| R-16 | Michigan Street | Residential | 1 | B(67) | 49 |
| R-17 | Barton Road | Residential | 3 | B(67) | 59 |
| R-18 | Barton Road | Residential | 1 | B(67) | 58 |
| R-19 | Barton Road | Residential | 2 | B(67) | 61 |
| R-20 | Barton Road | Residential | 2 | B(67) | 56 |
| R-21 | Barton Road | Residential | 2 | B(67) | 58 |
| R-22 | Barton Road | School | 1[1] | C(67) | 57 |
| R-23 | Vivienda Avenue | School | 3[1] | C(67) | **68**[2] |
| R-24 | Vivienda Avenue | School | 3[1] | C(67) | **70** |
| R-25 | Vivienda Avenue | School | 3[1] | C(67) | **73** |
| R-26 | Vivienda Avenue | Residential | 1 | B(67) | 61 |
| R-27 | Vivienda Court | Residential | 1 | B(67) | **70** |
| R-28 | Vivienda Court | Residential | 1 | B(67) | **74** |
| R-29 | Vivienda Avenue | Residential | 2 | B(67) | **69** |
| R-30 | Vivienda Avenue | Residential | 2 | B(67) | **68** |
| R-31 | Vivienda Avenue | Residential | 2 | B(67) | **67** |
| R-32 | Vivienda Avenue | Residential | 1 | B(67) | **69** |
| R-33 | Vivienda Avenue | Residential | 1 | B(67) | 62 |
| R-34 | Pascal Avenue | Residential | 2 | B(67) | 64 |
| R-35 | Pascal Avenue | Residential | 2 | B(67) | **74** |
| R-36 | Pascal Avenue | Residential | 3 | B(67) | 53 |
| R-37 | Pascal Avenue | Residential | 2 | B(67) | 55 |
| R-38 | Victoria Street | Residential | 2 | B(67) | 56 |
| R-39 | Victoria Street | Residential | 1 | B(67) | **73** |
| R-40 | Victoria Street | Residential | 1 | B(67) | **69** |
| R-41 | Canal Street | Residential | 1 | B(67) | **66** |
| R-42 | Newport Avenue | Residential | 1 | B(67) | **68** |
| R-43 | Barton Road | Residential | 1 | B(67) | 56 |
| R-44 | Vivienda Avenue | Residential | 1 | B(67) | 56 |
| R-45 | McClarren Street | Residential | 3 | B(67) | 55 |
| R-46 | Carhart Avenue | Residential | 1 | B(67) | 57 |
| R-47 | Carhart Avenue | Residential | 1 | B(67) | 53 |
| R-48 | Carhart Avenue | Residential | 2 | B(67) | 57 |
| R-49 | Vivienda Avenue | Residential | 2 | B(67) | 52 |
| R-50 | Pascal Avenue | Residential | 2 | B(67) | 57 |
| R-51 | Pascal Avenue | Residential | 3 | B(67) | 55 |
| R-52 | Canal Street | Apartment | 6 | B(67) | 50 |
| R-53 | Canal Street | Apartment | 8 | B(67) | 55 |
| R-54 | Canal Street | Apartment | 6 | B(67) | 57 |
| R-55 | Canal Street | Apartment | 8 | B(67) | 52 |
| R-56 | Canal Street | Apartment | 8 | B(67) | 55 |
| R-57 | Canal Street | Apartment | 8 | B(67) | 54 |
| R-58 | Canal Street | Apartment | 8 | B(67) | 54 |
| R-59 | Canal Street | Residential | 8 | B(67) | 54 |

## Table 11. Existing Traffic Noise Levels

| Receiver No. | Location | Type of Land Use | No. of Units Represented | Noise Abatement Category (NAC) | Adjusted Existing Noise Level (dBA $L_{eq}$) |
|---|---|---|---|---|---|
| R-60 | Grand Terrace Road | RV Park | 1 | B(67) | 60 |
| R-61 | Grand Terrace Road | RV Park | 9 | B(67) | 60 |
| R-62 | Grand Terrace Road | RV Park | 8 | B(67) | 60 |
| R-63 | Grand Terrace Road | RV Park | 8 | B(67) | 60 |
| R-64 | Grand Terrace Road | RV Park | 8 | B(67) | 59 |
| R-65 | Grand Terrace Road | RV Park | 8 | B(67) | 59 |
| R-66 | Grand Terrace Road | RV Park | 9 | B(67) | 59 |
| R-67 | Vivienda Avenue | Residential | 1 | B(67) | **69** |
| R-68 | La Crosse Avenue | Residential | 1 | B(67) | **69** |
| R-69 | La Crosse Avenue | Residential | 1 | B(67) | **70** |
| R-70 | Grand Terrace Road | Mobile Home | 4 | B(67) | 62 |
| R-71 | Grand Terrace Road | Mobile Home | 3 | B(67) | 60 |
| R-72 | Grand Terrace Road | Mobile Home | 2 | B(67) | 60 |
| R-73 | Grand Terrace Road | Mobile Home | 4 | B(67) | 59 |
| R-74 | Grand Terrace Road | Mobile Home | 2 | B(67) | 60 |
| R-75 | Grand Terrace Road | Mobile Home | 4 | B(67) | 59 |
| R-76 | Grand Terrace Road | Mobile Home | 4 | B(67) | 59 |
| R-77 | Grand Terrace Road | Mobile Home | 4 | B(67) | 63 |
| R-78 | Grand Terrace Road | Mobile Home | 4 | B(67) | 60 |
| R-79 | Grand Terrace Road | Mobile Home | 3 | B(67) | 60 |
| R-80 | Grand Terrace Road | Mobile Home | 4 | B(67) | 60 |
| R-81 | Grand Terrace Road | Mobile Home | 3 | B(67) | 59 |
| R-82 | Grand Terrace Road | Mobile Home | 3 | B(67) | 59 |
| R-83 | Grand Terrace Road | Mobile Home | 2 | B(67) | 63 |
| R-84 | Grand Terrace Road | Mobile Home | 3 | B(67) | 60 |
| R-85 | Grand Terrace Road | Mobile Home | 3 | B(67) | 61 |
| R-86 | Grand Terrace Road | Mobile Home | 4 | B(67) | 60 |
| R-87 | Grand Terrace Road | Mobile Home | 1 | B(67) | 60 |
| R-88 | Grand Terrace Road | Mobile Home | 3 | B(67) | 59 |
| R-89 | Grand Terrace Road | Mobile Home | 1 | B(67) | 59 |
| R-90 | Vivienda Avenue | Residential | 1 | B(67) | 61 |
| R-91 | Vivienda Avenue | Residential | 1 | B(67) | 60 |
| R-92 | Vivienda Avenue | Residential | 1 | B(67) | 60 |
| R-93 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-94 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-95 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-96 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-97 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-98 | Grand Terrace Road | Residential | 1 | B(67) | 58 |
| R-99 | Grand Terrace Road | Residential | 2 | B(67) | 58 |
| R-100 | Grand Terrace Road | Residential | 2 | B(67) | 58 |
| R-101 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-102 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-103 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-104 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-105 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-106 | Grand Terrace Road | Residential | 1 | B(67) | 59 |
| R-107 | Grand Terrace Road | Residential | 1 | B(67) | 62 |
| R-108 | Vivienda Avenue | Residential | 1 | B(67) | 60 |
| R-109 | Vivienda Avenue | Residential | 1 | B(67) | 62 |
| R-110 | Vivienda Avenue | Residential | 2 | B(67) | 63 |
| R-111 | Vivienda Avenue | Residential | 1 | B(67) | 65 |
| R-112 | Vivienda Avenue | Residential | 1 | B(67) | **70** |
| R-113 | Newport Avenue | Mobile Home | 2 | B(67) | 63 |
| R-114 | Newport Avenue | Mobile Home | 2 | B(67) | 62 |
| R-115 | Newport Avenue | Mobile Home | 2 | B(67) | **66** |
| R-116 | Newport Avenue | Mobile Home | 2 | B(67) | **66** |
| R-117 | Newport Avenue | Mobile Home | 2 | B(67) | 63 |
| R-118 | Newport Avenue | Mobile Home | 2 | B(67) | 60 |

## Table 11. Existing Traffic Noise Levels

| Receiver No. | Location | Type of Land Use | No. of Units Represented | Noise Abatement Category (NAC) | Adjusted Existing Noise Level (dBA $L_{eq}$) |
|---|---|---|---|---|---|
| R-119 | Newport Avenue | Mobile Home | 2 | B(67) | 60 |
| R-120 | Newport Avenue | Mobile Home | 1 | B(67) | 59 |
| R-121 | Newport Avenue | Mobile Home | 5 | B(67) | 64 |
| R-122 | Newport Avenue | Mobile Home | 2 | B(67) | 63 |
| R-123 | Newport Avenue | Mobile Home | 1 | B(67) | 64 |
| R-124 | Newport Avenue | Mobile Home | 2 | B(67) | 61 |
| R-125 | Newport Avenue | Mobile Home | 4 | B(67) | 60 |
| R-126 | Newport Avenue | Mobile Home | 3 | B(67) | 60 |
| R-127 | Newport Avenue | Mobile Home | 4 | B(67) | 59 |
| R-128 | Newport Avenue | Mobile Home | 3 | B(67) | 59 |
| R-129 | Newport Avenue | Mobile Home | 4 | B(67) | 59 |
| R-130 | Newport Avenue | Mobile Home | 3 | B(67) | 59 |
| R-131 | Taylor Street | Light Industrial | 1 | F | 68 |
| R-132 | S. Iowa Avenue | Commercial | 1 | F | 70 |
| R-133 | De Berry Street | Light Industrial | 1 | F | 73 |
| R-134 | De Berry Street | Vacant Land | 1 | G | 69 |
| R-135 | De Berry Street | Light Industrial | 1 | F | 72 |
| R-136 | La Crosse Avenue | Light Industrial | 1 | F | 72 |
| R-137 | Commerce Way | Light Industrial | 1 | F | 63 |
| R-138 | Michigan Avenue | Light Industrial | 1 | F | 53 |
| R-139 | Barton Road | Light Industrial | 1 | F | 58 |
| R-140 | Barton Road | Light Industrial | 1 | F | 61 |
| R-141 | Barton Road | Commercial | 1 | F | 61 |
| R-142 | Barton Road | Commercial | 1 | F | 66 |
| R-143 | Barton Road | Restaurant | 1 | E(72) | 66 |
| R-144 | Newport Avenue | Utilities | 1 | F | 60 |

Source: LSA Associates, Inc., February 2012.
[1] 100 ft frontage units were used to calculate the number of units represented for nonresidential land uses.
[2] Numbers in bold represent noise levels that approach or exceed the NAC.
dBA $L_{eq}$ = equivalent continuous noise level measured in A-weighted decibels
ft = feet
RV = recreational vehicle

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

## 7.1. Future Noise Environment and Impacts

The noise study was conducted to determine the future traffic noise impacts at sensitive receivers along Interstate 215 (I-215) from south of Barton Road to north of Newport Avenue. Potential long-term noise impacts associated with project operations are solely from traffic noise. Traffic noise was evaluated for the worst-case traffic condition. Using coordinates obtained from the topographic maps, 144 receiver locations associated with existing residences; a school; two mobile home parks; a recreational vehicle (RV) park; a fast-food restaurant with an outdoor eating area; a utility facility; and office, commercial, and light industrial uses were evaluated in the model.

Future traffic noise levels for all four Build Alternatives at all 144 receiver locations were determined with existing walls using the worst-case traffic operations (prior to speed degradation) or the future (2040) peak-hour traffic volumes obtained from the Traffic Operations Analysis (October 2011), as described in Section 5.3. The model input and output data for the future No Build Alternative is included in Appendix C. The model input and output data for Alternatives 3, 6, and 7 are included in Appendices D, E, and F, respectively. Table 12 shows the adjusted existing, the future No Build Alternative and Alternatives 3, 6, and 7 traffic noise level results. Traffic noise levels shown in Table 12 also reflect the 24-hour community background noise levels for all scenarios. A community background noise level of 58 equivalent continuous sound level measured in A-weighted decibels (dBA $L_{eq}$) was applied to traffic noise levels for Receivers R-60 through R-130 under all scenarios because they are located near existing rail operations and in the vicinity of the community background noise level measurement. The modeled future noise levels with the project were compared to the modeled existing noise levels (after calibration) from Traffic Noise Model (TNM) 2.5 to determine whether a substantial noise increase would occur. The modeled future noise levels for all three Build Alternatives were also

## Table 12. Predicted Traffic Noise Levels, dBA $L_{eq}$

| Receiver No. | Location | Adjusted Existing Peak Noise Level | Future No Build | Alternative 3 | Change from Existing Level | Alternative 6 | Change from Existing Level | Alternative 7 | Change from Existing Level |
|---|---|---|---|---|---|---|---|---|---|
| R-1 | De Berry Street | 65 | **66**[1] | **67** | 2 | **67** | 2 | **67** | 2 |
| R-2 | De Berry Street | 53 | 55 | 58 | 5 | 61 | 8 | 58 | 5 |
| R-3 | Rene Lane | 51 | 53 | 56 | 5 | 56 | 5 | 56 | 5 |
| R-4 | De Berry Street | 51 | 54 | 56 | 5 | 57 | 6 | 56 | 5 |
| R-5 | De Berry Street | 51 | 53 | 55 | 4 | 55 | 4 | 55 | 4 |
| R-6 | Rene Lane | 50 | 53 | 56 | 6 | 56 | 6 | 56 | 6 |
| R-7 | Rene Lane | 49 | 53 | 55 | 6 | 54 | 5 | 55 | 6 |
| R-8 | Rene Lane | 50 | 54 | 54 | 4 | 53 | 3 | 55 | 5 |
| R-9 | Rene Lane | 52 | 57 | 54 | 2 | 53 | 1 | 56 | 4 |
| R-10 | Rene Lane | 56 | 62 | 54 | -2[2] | 54 | -2 | 60 | 4 |
| R-11 | Michigan Street | 55 | 60 | 54 | -1 | 53 | -2 | 59 | 4 |
| R-12 | Michigan Street | 54 | 59 | 56 | 2 | 55 | 1 | 59 | 5 |
| R-13 | Michigan Street | 55 | 60 | 60 | 5 | 59 | 4 | 61 | 6 |
| R-14 | Michigan Street | 49 | 54 | 53 | 4 | 52 | 3 | 53 | 4 |
| R-15 | Michigan Street | 47 | 51 | 53 | 6 | 52 | 5 | 53 | 6 |
| R-16 | Michigan Street | 49 | 53 | 58 | 9 | 57 | 8 | 56 | 7 |
| R-17 | Barton Road | 59 | 62 | 65 | 6 | 64 | 5 | 64 | 5 |
| R-18 | Barton Road | 58 | 61 | 63 | 5 | 62 | 4 | 62 | 4 |
| R-19 | Barton Road | 61 | 64 | **66** | 5 | **66** | 5 | **66** | 5 |
| R-20 | Barton Road | 56 | 59 | 61 | 5 | 61 | 5 | 60 | 4 |
| R-21 | Barton Road | 58 | 61 | 63 | 5 | 62 | 4 | 62 | 4 |
| R-22 | Barton Road | 57 | 65 | 65 | 8 | 65 | 8 | 65 | 8 |
| R-23 | Vivienda Avenue | **68** | **69** | **69** | 1 | **69** | 1 | **72** | 4 |
| R-24 | Vivienda Avenue | **70** | **71** | **70** | 0 | **70** | 0 | **72** | 2 |
| R-25 | Vivienda Avenue | **73** | **74** | **75** | 2 | **75** | 2 | **75** | 2 |
| R-26 | Vivienda Avenue | 61 | 63 | 64 | 3 | 63 | 2 | 63 | 2 |
| R-27 | Vivienda Court | **70** | **71** | **71** | 1 | **71** | 1 | **71** | 1 |
| R-28 | Vivienda Court | **74** | **75** | **75** | 1 | **75** | 1 | **75** | 1 |
| R-29 | Vivienda Avenue | **69** | **70** | **70** | 1 | **70** | 1 | **70** | 1 |
| R-30 | Vivienda Avenue | **68** | **69** | **69** | 1 | **69** | 1 | **69** | 1 |

## Table 12. Predicted Traffic Noise Levels, dBA $L_{eq}$

| Receiver No. | Location | Adjusted Existing Peak Noise Level | Future No Build | Alternative 3 | Change from Existing Level | Alternative 6 | Change from Existing Level | Alternative 7 | Change from Existing Level |
|---|---|---|---|---|---|---|---|---|---|
| R-31 | Vivienda Avenue | **67** | **68** | **68** | 1 | **68** | 1 | **68** | 1 |
| R-32 | Vivienda Avenue | **69** | **70** | **70** | 1 | **70** | 1 | **70** | 1 |
| R-33 | Vivienda Avenue | 62 | 63 | 63 | 1 | 63 | 1 | 63 | 1 |
| R-34 | Pascal Avenue | 64 | 65 | --[4] | -- | --[4] | -- | 65 | 1 |
| R-35 | Pascal Avenue | **74** | **75** | --[4] | -- | --[4] | -- | **75** | 1 |
| R-36 | Pascal Avenue | 53 | 54 | --[4] | -- | --[4] | -- | 53 | 0 |
| R-37 | Pascal Avenue | 55 | 55 | --[4] | -- | --[4] | -- | 55 | 0 |
| R-38 | Victoria Street | 56 | 56 | --[4] | -- | --[4] | -- | 56 | 0 |
| R-39 | Victoria Street | **73** | **73** | --[4] | -- | --[4] | -- | --[4] | -- |
| R-40 | Victoria Street | **69** | **69** | --[4] | -- | --[4] | -- | --[4] | -- |
| R-41 | Canal Street | **66** | **66** | --[4] | -- | --[4] | -- | --[4] | -- |
| R-42 | Newport Avenue | **68** | **69** | --[4] | -- | --[4] | -- | --[4] | -- |
| R-43 | Barton Road | 56 | 62 | 64 | 8 | 64 | 8 | 63 | 7 |
| R-44 | Vivienda Avenue | 56 | 60 | 62 | 6 | 62 | 6 | 62 | 6 |
| R-45 | McClarren Street | 55 | 59 | 60 | 5 | 61 | 6 | 60 | 5 |
| R-46 | Carhart Avenue | 57 | 59 | 59 | 2 | 58 | 1 | 59 | 2 |
| R-47 | Carhart Avenue | 53 | 54 | 54 | 1 | 54 | 1 | 54 | 1 |
| R-48 | Carhart Avenue | 57 | 58 | 58 | 1 | 58 | 1 | 58 | 1 |
| R-49 | Vivienda Avenue | 52 | 53 | 53 | 1 | 53 | 1 | 53 | 1 |
| R-50 | Pascal Avenue | 57 | 58 | 58 | 1 | 58 | 1 | 58 | 1 |
| R-51 | Pascal Avenue | 55 | 56 | 56 | 1 | 56 | 1 | 56 | 1 |
| R-52 | Canal Street | 50 | 51 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-53 | Canal Street | 55 | 56 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-54 | Canal Street | 57 | 58 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-55 | Canal Street | 52 | 54 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-56 | Canal Street | 55 | 57 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-57 | Canal Street | 54 | 55 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-58 | Canal Street | 54 | 55 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-59 | Canal Street | 54 | 55 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-60 | Grand Terrace Road | 60 | 61 | --[3] | -- | **67** | 7 | **67** | 7 |

## Table 12. Predicted Traffic Noise Levels, dBA $L_{eq}$

| Receiver No. | Location | Adjusted Existing Peak Noise Level | Future No Build | Alternative 3 | Change from Existing Level | Alternative 6 | Change from Existing Level | Alternative 7 | Change from Existing Level |
|---|---|---|---|---|---|---|---|---|---|
| R-61 | Grand Terrace Road | 60 | 60 | 65 | 5 | 63 | 3 | 64 | 4 |
| R-62 | Grand Terrace Road | 60 | 60 | 63 | 3 | 63 | 3 | 63 | 3 |
| R-63 | Grand Terrace Road | 60 | 60 | 62 | 2 | 62 | 2 | 62 | 2 |
| R-64 | Grand Terrace Road | 59 | 60 | 61 | 2 | 61 | 2 | 61 | 2 |
| R-65 | Grand Terrace Road | 59 | 60 | 61 | 2 | 61 | 2 | 61 | 2 |
| R-66 | Grand Terrace Road | 59 | 60 | 61 | 2 | 61 | 2 | 60 | 1 |
| R-67 | Vivienda Avenue | **69** | **70** | --[3] | -- | **70** | 1 | **69** | 0 |
| R-68 | La Crosse Avenue | **69** | **70** | --[3] | -- | **70** | 1 | **69** | 0 |
| R-69 | La Crosse Avenue | **70** | **71** | --[3] | -- | --[3] | -- | --[3] | -- |
| R-70 | Grand Terrace Road | 62 | 63 | **66** | 4 | **66** | 4 | 65 | 3 |
| R-71 | Grand Terrace Road | 60 | 61 | 64 | 4 | 63 | 3 | 63 | 3 |
| R-72 | Grand Terrace Road | 60 | 61 | 63 | 3 | 62 | 2 | 62 | 2 |
| R-73 | Grand Terrace Road | 59 | 60 | 61 | 2 | 61 | 2 | 61 | 2 |
| R-74 | Grand Terrace Road | 60 | 60 | 61 | 1 | 60 | 0 | 61 | 1 |
| R-75 | Grand Terrace Road | 59 | 59 | 60 | 1 | 60 | 1 | 60 | 1 |
| R-76 | Grand Terrace Road | 59 | 60 | 60 | 1 | 60 | 1 | 60 | 1 |
| R-77 | Grand Terrace Road | 63 | 64 | **66** | 3 | **67** | 4 | **66** | 3 |
| R-78 | Grand Terrace Road | 60 | 61 | 65 | 5 | 64 | 4 | 64 | 4 |
| R-79 | Grand Terrace Road | 60 | 60 | 62 | 2 | 62 | 2 | 62 | 2 |
| R-80 | Grand Terrace Road | 60 | 60 | 61 | 1 | 61 | 1 | 61 | 1 |
| R-81 | Grand Terrace Road | 59 | 60 | 61 | 2 | 60 | 1 | 60 | 1 |
| R-82 | Grand Terrace Road | 59 | 60 | 60 | 1 | 60 | 1 | 60 | 1 |
| R-83 | Grand Terrace Road | 63 | **66** | **67** | 4 | **68** | 5 | **67** | 4 |
| R-84 | Grand Terrace Road | 60 | 63 | 63 | 3 | 64 | 4 | 63 | 3 |
| R-85 | Grand Terrace Road | 61 | 61 | 61 | 0 | 62 | 1 | 62 | 1 |
| R-86 | Grand Terrace Road | 60 | 62 | 61 | 1 | 63 | 3 | 62 | 2 |
| R-87 | Grand Terrace Road | 60 | 61 | 60 | 0 | 61 | 1 | 61 | 1 |
| R-88 | Grand Terrace Road | 59 | 61 | 61 | 2 | 62 | 3 | 62 | 3 |
| R-89 | Grand Terrace Road | 59 | 61 | 61 | 2 | 61 | 2 | 61 | 2 |
| R-90 | Vivienda Avenue | 61 | 62 | 61 | 0 | 61 | 0 | 62 | 1 |

## Table 12. Predicted Traffic Noise Levels, dBA $L_{eq}$

| Receiver No. | Location | Adjusted Existing Peak Noise Level | Future No Build | Alternative 3 | Change from Existing Level | Alternative 6 | Change from Existing Level | Alternative 7 | Change from Existing Level |
|---|---|---|---|---|---|---|---|---|---|
| R-91 | Vivienda Avenue | 60 | 61 | 61 | 1 | 61 | 1 | 61 | 1 |
| R-92 | Vivienda Avenue | 60 | 60 | 60 | 0 | 60 | 0 | 60 | 0 |
| R-93 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-94 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-95 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-96 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-97 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-98 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-99 | Grand Terrace Road | 58 | 58 | 58 | 0 | 58 | 0 | 58 | 0 |
| R-100 | Grand Terrace Road | 58 | 59 | 59 | 1 | 59 | 1 | 59 | 1 |
| R-101 | Grand Terrace Road | 59 | 59 | --[3] | -- | 59 | 0 | 59 | 0 |
| R-102 | Grand Terrace Road | 59 | 59 | --[3] | -- | 59 | 0 | 59 | 0 |
| R-103 | Grand Terrace Road | 59 | 59 | --[3] | -- | 59 | 0 | 59 | 0 |
| R-104 | Grand Terrace Road | 59 | 59 | --[3] | -- | 59 | 0 | 59 | 0 |
| R-105 | Grand Terrace Road | 59 | 59 | 59 | 0 | 59 | 0 | 59 | 0 |
| R-106 | Grand Terrace Road | 59 | 60 | 60 | 1 | 60 | 1 | 60 | 1 |
| R-107 | Grand Terrace Road | 62 | 63 | 64 | 2 | 64 | 2 | 63 | 1 |
| R-108 | Vivienda Avenue | 60 | 61 | 60 | 0 | 61 | 1 | 60 | 0 |
| R-109 | Vivienda Avenue | 62 | 63 | 62 | 0 | 62 | 0 | 63 | 1 |
| R-110 | Vivienda Avenue | 63 | 64 | 63 | 0 | 63 | 0 | 63 | 0 |
| R-111 | Vivienda Avenue | 65 | **66** | 65 | 0 | **65** | 0 | **66** | 1 |
| R-112 | Vivienda Avenue | **70** | **71** | --[3] | -- | **71** | 1 | **71** | 1 |
| R-113 | Newport Avenue | 63 | 64 | 64 | 1 | 64 | 1 | 65 | 2 |
| R-114 | Newport Avenue | 62 | 63 | 62 | 0 | 63 | 1 | 63 | 1 |
| R-115 | Newport Avenue | **66** | **66** | **67** | 1 | **66** | 0 | **67** | 1 |
| R-116 | Newport Avenue | **66** | **66** | --[4] | -- | --[4] | -- | **66** | 0 |
| R-117 | Newport Avenue | 63 | 63 | --[4] | -- | --[4] | -- | 63 | 0 |
| R-118 | Newport Avenue | 60 | 60 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-119 | Newport Avenue | 60 | 60 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-120 | Newport Avenue | 59 | 59 | --[4] | -- | --[4] | -- | --[4] | -- |

## Table 12. Predicted Traffic Noise Levels, dBA $L_{eq}$

| Receiver No. | Location | Adjusted Existing Peak Noise Level | Future No Build | Alternative 3 | Change from Existing Level | Alternative 6 | Change from Existing Level | Alternative 7 | Change from Existing Level |
|---|---|---|---|---|---|---|---|---|---|
| R-121 | Newport Avenue | 64 | 64 | 65 | 1 | 64 | 0 | 65 | 1 |
| R-122 | Newport Avenue | 63 | 64 | 64 | 1 | 64 | 1 | 64 | 1 |
| R-123 | Newport Avenue | 64 | 65 | 65 | 1 | 65 | 1 | 65 | 1 |
| R-124 | Newport Avenue | 61 | 62 | 62 | 1 | 62 | 1 | 62 | 1 |
| R-125 | Newport Avenue | 60 | 60 | --[4] | -- | --[4] | -- | 60 | 0 |
| R-126 | Newport Avenue | 60 | 60 | --[4] | -- | --[4] | -- | 60 | 0 |
| R-127 | Newport Avenue | 59 | 59 | --[4] | -- | --[4] | -- | 59 | 0 |
| R-128 | Newport Avenue | 59 | 59 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-129 | Newport Avenue | 59 | 59 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-130 | Newport Avenue | 59 | 59 | --[4] | -- | --[4] | -- | --[4] | -- |
| R-131 | Taylor Street | 68 | 70 | 71 | 3 | 71 | 3 | 71 | 3 |
| R-132 | S. Iowa Avenue | 70 | 71 | 72 | 2 | 71 | 1 | 72 | 2 |
| R-133 | De Berry Street | 73 | 74 | 75 | 2 | 75 | 2 | 75 | 2 |
| R-134 | De Berry Street | 69 | 70 | 70 | 1 | 70 | 1 | 71 | 2 |
| R-135 | De Berry Street | 72 | 74 | 74 | 2 | 73 | 1 | 74 | 2 |
| R-136 | La Crosse Avenue | 72 | 73 | 75 | 3 | 74 | 2 | 73 | 1 |
| R-137 | Commerce Way | 63 | 64 | --[3] | -- | --[3] | -- | --[3] | -- |
| R-138 | Michigan Avenue | 53 | 55 | 63 | 10 | 62 | 9 | 60 | 7 |
| R-139 | Barton Road | 58 | 60 | 62 | 4 | 61 | 3 | 60 | 2 |
| R-140 | Barton Road | 61 | 62 | 66 | 5 | 65 | 4 | 64 | 3 |
| R-141 | Barton Road | 61 | 62 | 66 | 5 | 65 | 4 | 64 | 3 |
| R-142 | Barton Road | 66 | 70 | 76 | 10 | 74 | 8 | 73 | 7 |
| R-143 | Barton Road | 66 | 70 | 73 | 7 | 73 | 7 | 72 | 6 |
| R-144 | Newport Avenue | 60 | 60 | --[4] | -- | --[4] | -- | --[4] | -- |

Source: LSA Associates, Inc., February 2012.

[1] Numbers in bold represent noise levels that approach or exceed the NAC.

[2] A receiver would experience a decrease in traffic noise levels under Future Build conditions because the proposed alignment would change shielding effects.

[3] This receiver would be acquired under this alternative.

[4] Noise levels for this receiver are not shown because it is located beyond limits of construction for these alternatives.

dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels

NAC = Noise Abatement Category

compared to the Noise Abatement Criteria (NAC) under Activity Categories B, C, D, and E to determine whether a traffic noise impact would occur.

Traffic noise impacts occur when either of the following occurs: (1) if the traffic noise level at a sensitive receiver location is predicted to "approach or exceed" its NAC, or (2) if the predicted traffic noise level is 12 dBA or more over its corresponding modeled existing noise level at the sensitive receiver locations analyzed. When traffic noise impacts occur, noise abatement measures must be considered. Of the 144 modeled receivers, 16, 20, and 22 receivers would approach or exceed the 67 dBA $L_{eq}$ NAC under Alternatives 3, 6, and 7, respectively. No receivers would experience a substantial increase of 12 dBA or more over their corresponding modeled existing noise levels.

The following receiver locations would be or would continue to be exposed to noise levels that approach or exceed the NAC under Activity Categories B, C, D, and E for each of the three Build Alternatives.

- **Alternative 3**
  - **Receiver R-1:** This receiver location represents an existing residence along De Berry Street on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield this residence. One sound barrier (Sound Barrier [SB] Nos. 1a and 1b) was modeled along the edge of shoulder to shield this residence. SB Nos. 1a and 1b are two barriers that are evaluated as one barrier because they overlap with one another.
  - **Receiver R-19:** This receiver location represents single-family residences along Barton Road, east of Vivienda Avenue. Currently there are no existing walls that shield these residences. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.
  - **Receivers R-23 through R-25, and R-27 through R-32:** These receiver locations represent existing residences and the playground associated with the Grand Terrace Elementary School located along Vivienda Avenue, Vivienda Court, and Pascal Avenue on the east side of I-215 between Barton Road and Newport Avenue. An existing 5- to 7-foot (ft) high wall (Existing Wall [EW] No. 6) along the residential property line currently shields these residences. Currently, there are no existing walls that shield the school playground from I-215. One sound barrier (SB Nos. 2a and 2b) along the State right-of-way (ROW) was modeled to shield these residences and the school playground. SB

Nos. 2a and 2b are two barriers that are evaluated as one barrier because they overlap with one another.

- **Receivers R-70, R-77, and R-83:** These receiver locations represent existing mobile homes on the northeastern corner of Barton Road and Grand Terrace Road. An existing 5.3 to 6 ft high wall (EW No. 5) along the residential property line currently shields the mobile homes. One sound barrier (SB No. 3) along the State ROW was modeled to shield these mobile homes.
- **Receiver R-115:** This receiver location represents mobile homes along the west side of I-215 between Vivienda Avenue and Newport Avenue. Two existing 5.3 ft high walls (EW Nos. 7 and 8) along the residential property line currently shield these mobile homes. Two sound barriers were modeled separately at two different locations to shield these mobile homes. One sound barrier (SB No. 4) was modeled along the edge of shoulder and the other sound barrier (SB No. 5) was modeled along the residential property line. Sound barrier effectiveness at the two different locations was evaluated.
- **Receiver R-143:** This receiver location represents a fast-food restaurant with an outdoor eating area located on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield the outdoor eating area. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.

- **Alternative 6**
  - **Receiver R-1:** This receiver location represents an existing residence along De Berry Street on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield this residence. One sound barrier (SB Nos. 11a and 11b) was modeled along the edge of shoulder to shield this residence. SB Nos. 11a and 11b are two barriers that are evaluated as one barrier because they overlap with one another.
  - **Receiver R-19:** This receiver location represents a single-family residence along Barton Road and east of Vivienda Avenue. Currently there are no existing walls that shield this residence. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.
  - **Receivers R-23 through R-25 and R-27 through R-32:** These receiver locations represent existing residences and the playground associated with Grand Terrace Elementary School located along Vivienda Avenue and Vivienda Court, on the east side of I-215 between Barton Road and Newport

Avenue. An existing 6 ft high wall (EW No. 6) along the residential property line currently shields these residences. Currently, there are no existing walls that shield the school playground from I-215. One sound barrier (SB Nos. 12a and 12b) along the State ROW was modeled to shield these residences and the school playground. SB Nos. 12a and 12b are two barriers that are evaluated as one barrier because they overlap with one another.

- **Receivers R-60, R-70, R-77, and R-83:** These receiver locations represent existing mobile homes and a swimming pool area at an RV park along Grand Terrace Road on the west side of I-215 between Barton Road and Vivienda Avenue. An existing 8 to 12.6 ft high wall (EW No. 4) along the RV park property line currently shields this area. One sound barrier (SB No. 13) was modeled along the State ROW to shield the mobile homes and the swimming pool area at the RV park.
- **Receivers R-67, R-68, R-112, and R-115:** These receiver locations represent existing mobile homes along Newport Avenue and residences along Vivienda Avenue and La Crosse Avenue on the west side of I-215 between Barton Road and Newport Avenue. Currently there are no existing walls that shield Receivers R-67, R-68, and R-112. Two existing 5.3 ft high walls (EW Nos. 7 and 8) along the residential property line currently shield Receiver R-115. Two sound barriers were modeled separately at two different locations to shield these residences. One sound barrier (SB No. 14) located along the edge of shoulder was modeled and the other sound barrier (SB No. 15) located along the residential property line was modeled to shield only Receiver R-115. Sound barrier effectiveness at the two different locations was evaluated.
- **Receiver R-143:** This receiver location represents a fast-food restaurant with an outdoor eating area located on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield the outdoor eating area. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.

- **Alternative 7**
  - **Receiver R-1:** This receiver location represents an existing residence along De Berry Street on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield this residence. One sound barrier (SB Nos. 16a and 16b) was modeled along the edge of shoulder to shield this residence. SB Nos. 16a and 16b are two barriers that are evaluated as one barrier because they overlap with one another.

- **Receivers R-19:** This receiver location represents a single-family residence along Barton Road and east of Vivienda Avenue. Currently there are no existing walls that shield this residence. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.
- **Receivers R-23 through R-25, R-27 through R-32, and R-35:** These receiver locations represent existing residences and the playground associated with Grand Terrace Elementary School along Vivienda Avenue, Vivienda Court, and Pascal Avenue on the east side of I-215 between Barton Road and Newport Avenue. An existing 5- to 7-ft high wall (EW No. 6) along the residential property line currently shields these residences. Currently, there are no existing walls that shield the school playground from I-215. One sound barrier (SB Nos. 17a and 17b) along the State right-of-way (ROW) was modeled to shield these residences and the school playground. SB Nos. 17a and 17b are two barriers that are evaluated as one barrier because they overlap with one another.
- **Receiver R-60:** This receiver location represents existing swimming pool at an RV park located on the west side of I-215 between Barton Road and Vivienda Avenue. An existing 8 to 12.6 ft high wall (EW No. 4) along the residential property line currently shields the swimming pool area. One sound barrier (SB No. 19) along the State ROW was modeled to shield these areas.
- **Receivers R-77 and R-83:** These receiver locations represent existing mobile homes along Grand Terrace Road on the west side of I-215 between Barton Road and Vivienda Avenue. An existing 5.3 to 6 ft high wall (EW No. 5) along the residential property line currently shields the mobile homes. One sound barrier (SB No. 18) along the State ROW was modeled to shield these areas.
- **Receivers R-67, R-68, R-111, R-112, R-115, and R-116:** These receiver locations represent existing single-family residences and mobile homes on the west side of I-215 between Barton Road and Newport Avenue. Two existing 5.3 ft high walls (EW Nos. 7 and 8) along the residential property line currently shield these mobile homes. Two sound barriers were modeled at two different locations to shield the mobile homes. One sound barrier (SB No. 20) was modeled along the edge of shoulder and the other sound barrier (SB No. 21) was modeled along the residential property line to shield only Receivers R-115 and R-116. Sound barrier effectiveness at the two different locations was evaluated.

- **Receiver R-143:** This receiver location represents a fast-food restaurant with an outdoor eating area located on the east side of I-215, south of Barton Road. Currently there are no existing walls that shield the outdoor eating area. As there is driveway access onto the property from Barton Road, it is not feasible to abate traffic noise with sound barriers.

### 7.1.1. Interior Noise Impacts

An interior noise analysis was conducted at Grand Terrace Elementary School to evaluate classroom buildings under Activity Category D (52) and to meet the requirements of Section 216 of the California Streets and Highways Code. Figure 2 shows the location of the interior noise evaluation. As shown in Table 11, the calculated existing exterior to interior noise level attenuation for the school classroom building is 22.2 dBA. Table 13 shows that the predicted traffic noise levels would be 72.2, 72.3, and 73.3 dBA $L_{eq}$ under Alternatives 3, 6, and 7, respectively. As shown in Table 13, based on the measured existing exterior to interior noise level attenuation (Table 10), the predicted future classroom interior noise level would be 50.0, 50.1, and 51.1 dBA $L_{eq}$ under Alternatives 3, 6, and 7. Interior noise levels would approach or exceed the 52 dBA $L_{eq}$ NAC under Alternatives 3, 6, and 7. SB Nos. 2a & 2b, 12a & 12b, and 17a & 17b were analyzed to shield classroom buildings closest to I-215.

**Table 13. Predicted Future Interior Noise Levels (dBA)**

| Receiver | Exterior to Interior Reduction[1] | Alternative 3 | | Alternative 6 | | Alternative 7 | |
|---|---|---|---|---|---|---|---|
| | | Exterior | Interior | Exterior | Interior | Exterior | Interior |
| EI-1 | 22.2 | 72.2 | 50.0 | 72.3 | 50.1 | 73.3 | 51.1 |

Source: LSA Associates, Inc., February 2012.
[1] The exterior to interior reduction was calculated based on the exterior and interior noise level measurements shown in Table 10.
dBA = A-weighted decibels

## 7.2. Preliminary Noise Abatement Analysis

### 7.2.1. Sound Barrier Modeling

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

- Avoiding the impact by using design alternatives, such as altering the horizontal and vertical alignment of the proposed project;

- Constructing sound barriers;
- Acquiring property to serve as a buffer zone;
- Using traffic management measures to regulate types of vehicles and speeds; and
- Acoustically insulating public-use or nonprofit institutional structures.

All of these abatement options have been considered. However, because of the configuration and location of the project, abatement in the form of a sound barrier is the only abatement that is considered to be feasible.

Sound barriers were considered to shield noise-sensitive receivers along the proposed I-215/Barton Road Interchange improvement from south of Barton Avenue to north of Newport Avenue, where receivers would continue to be exposed to traffic noise levels approaching or exceeding the NAC. All properties requiring abatement consideration are within Categories B through D (67 and 52 dBA $L_{eq}$ NAC). Bold numbers in Table 12 show receiver locations that would approach or exceed the 67 dBA $L_{eq}$ NAC under Alternatives 3, 6 and 7 traffic conditions. Sound barriers were analyzed for each of these sensitive receiver locations. At each location, six sound barrier heights were analyzed: 6, 8, 10, 12, 14, and 16 ft. Sound barriers with the height of 16 ft were not analyzed if the barrier would be located within 15 ft of the nearest travel lane (see Department *Highway Design Manual*, January 2007). The results of the sound barrier modeling along the State ROW or the edge of shoulder are shown in Tables 14, 15, and 16 for Alternatives 3, 6, and 7, respectively. Also, the results of the sound barrier modeling along the residential property line are shown in Tables 17, 18, and 19, for Alternatives 3, 6, and 7, respectively. The locations of the sound barriers for Alternatives 3, 6, and 7 are shown in Figures 3, 4, and 5, respectively. The TNM 2.5 printouts for the sound barrier model runs are located in Appendices D, E, and F for Alternatives 3, 6, and 7, respectively.

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 1a & 1b | | R-1 | **67**[2] | **66** | 1 | **66** | 1 | 65 | 2 | 63 | 4 | 62[3] | 5 | 61 | 6 |
| | | R-2 | 58 | --[4] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-3 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-4 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-5 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-6 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-7 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-8 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-9 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-10 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-11 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-12 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-13 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-14 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-15 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-16 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-17 | 65 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-18 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-19 | **66** | NF[5] | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-20 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-21 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2a & 2b | 9 | R-22 | 65 | --[6] | --[6] | 64 | 1 | 64 | 1 | 64 | 1 | 64 | 1 | NP[7] | NP |
| | | R-23 | **69** | 64 | 5 | 63 | 6 | 62 | 7 | 61 | 8 | 61 | 8 | NP | NP |
| | | R-24 | **70** | 64 | 6 | 63 | 7 | 62 | 8 | 61 | 9 | 60 | 10 | NP | NP |
| | | R-25 | **75** | **67** | 8 | 65 | 10 | 63 | 12 | 62 | 13 | 61 | 14 | NP | NP |
| | | R-26 | 64 | 62 | 2 | 61 | 3 | 61 | 3 | 60 | 4 | 60 | 4 | NP | NP |
| | | R-27 | **71** | **66** | 5 | 65 | 6 | 64 | 7 | 62 | 9 | 61 | 10 | NP | NP |
| | | R-28 | **75** | **69** | 6 | **67** | 8 | 65 | 10 | 64 | 11 | 63 | 12 | NP | NP |

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 2a & 2b | | R-29 | **70** | **66** | 4 | 65 | 5 | 64 | 6 | 62 | 8 | 61 | 9 | NP | NP |
| | | R-30 | **69** | **67** | 2 | **67** | 2 | **66** | 3 | 65 | 4 | 64 | 5 | NP | NP |
| | | R-31 | **68** | **67** | 1 | 65 | 3 | 64 | 4 | 63 | 5 | 62 | 6 | NP | NP |
| | 6 | R-32 | **70** | --[6] | --[6] | **67** | 3 | **66** | 4 | 65 | 5 | 63 | 7 | NP | NP |
| | | R-33 | 63 | --[6] | --[6] | 60 | 3 | 59 | 4 | 58 | 5 | 57 | 6 | NP | NP |
| | | R-34 | --[8] | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-35 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-36 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-37 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-38 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-39 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-40 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-41 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-42 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-43 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-44 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-45 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2a & 2b | | R-46 | 59 | 56 | 3 | 56 | 3 | 56 | 3 | 55 | 4 | 54 | 5 | NP | NP |
| | | R-47 | 54 | 53 | 1 | 53 | 1 | 53 | 1 | 52 | 2 | 52 | 2 | NP | NP |
| | | R-48 | 58 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | 53 | 5 | NP | NP |
| | | R-49 | 53 | 52 | 1 | 52 | 1 | 52 | 1 | 51 | 2 | 50 | 3 | NP | NP |
| | | R-50 | 58 | 57 | 1 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | NP | NP |
| | | R-51 | 56 | 54 | 2 | 54 | 2 | 54 | 2 | 53 | 3 | 52 | 4 | NP | NP |
| | | R-52 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-53 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-54 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-55 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-56 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-57 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-58 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-59 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-60 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | 4 | R-61 | 65 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-62 | 63 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-63 | 62 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-64 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-65 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-66 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-67 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-68 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-69 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3 | 5 | R-70 | **66** | --[6] | --[6] | 65 | 1 | 64 | 2 | 63 | 3 | 62 | 4 | 62 | 4 |
| | | R-71 | 64 | --[6] | --[6] | 63 | 1 | 63 | 1 | 62 | 2 | 62 | 2 | 62 | 2 |
| | | R-72 | 63 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-73 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-74 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-75 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-76 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3 | | R-77 | **66** | --[6] | --[6] | 64 | 2 | 63 | 3 | 63 | 3 | 62 | 4 | 62 | 4 |
| | | R-78 | 65 | --[6] | --[6] | 63 | 2 | 63 | 2 | 62 | 3 | 62 | 3 | 62 | 3 |
| | | R-79 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-80 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-81 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-82 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3 | | R-83 | **67** | --[6] | --[6] | 63 | 4 | 63 | 4 | 62 | 5 | 62 | 5 | 61 | 6 |
| | | R-84 | 63 | --[6] | --[6] | 62 | 1 | 61 | 2 | 61 | 2 | 61 | 2 | 61 | 2 |
| | | R-85 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | 5 | R-86 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-87 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-88 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-89 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-90 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-91 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-92 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-93 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-94 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-95 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-96 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-97 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-98 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-99 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-100 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-101 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-102 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-103 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-104 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-105 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3 | | R-106 | 60 | 59 | 1 | 59 | 1 | 59 | 1 | 59 | 1 | 59 | 1 | 59 | 1 |
| | | R-107 | 64 | 61 | 3 | 60 | 4 | 60 | 4 | 59 | 5 | 59 | 5 | 59 | 5 |
| | | R-108 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-109 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-110 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-111 | 65 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-112 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 4 | 7 | R-113 | 64 | 64 | 0 | 64 | 0 | 64 | 0 | 64 | 0 | 64 | 0 | NP | NP |
| | | R-114 | 62 | 62 | 0 | 62 | 0 | 62 | 0 | 62 | 0 | 61 | 1 | NP | NP |
| | 8 | R-115 | **67** | **66** | 1 | 65 | 2 | 64 | 3 | 63 | 4 | 63 | 4 | NP | NP |
| | | R-116 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-117 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-118 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-119 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-120 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4 | 7 | R-121 | 65 | 64 | 1 | 64 | 1 | 64 | 1 | 63 | 2 | 63 | 2 | NP | NP |
| | 8 | R-122 | 64 | 63 | 1 | 63 | 1 | 63 | 1 | 62 | 2 | 62 | 2 | NP | NP |
| | | R-123 | 65 | 65 | 0 | 64 | 1 | 64 | 1 | 63 | 2 | 62 | 3 | NP | NP |
| | | R-124 | 62 | 62 | 0 | 61 | 1 | 61 | 1 | 61 | 1 | 61 | 1 | NP | NP |
| | | R-125 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-126 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-127 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-128 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-129 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-130 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-131 | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-132 | 72 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-133 | 75 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-134 | 70 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-135 | 74 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-136 | 75 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-137 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-138 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-139 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-140 | 66 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 14. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-141 | 66 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-142 | 76 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-143 | **73** | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-144 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | EI | 72/50[10] | 65/43 | 7 | 63/41 | 9 | 62/40 | 10 | 61/39 | 11 | 60/38 | 12 | NP | NP |

Source: LSA Associates, Inc., February 2012.

[1] I.L.: Insertion Loss.

[2] Numbers in bold represent noise levels that approach or exceed the NAC.

[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).

[4] Either no barrier was analyzed at this location because the modeled receiver would not approach or exceed the NAC or this receiver would be acquired under this alternative.

[5] NF = Not Feasible. It is not feasible to attenuate traffic noise levels with sound barriers due to driveway and pedestrian access to the property.

[6] Shaded area represents the existing wall height.

[7] NP = Not Permitted. Sound barriers within 15 ft of the nearest travel lane are not permitted to exceed 14 ft in height.

[8] Noise levels for this receiver are not shown because it is located beyond the limits of construction under Alternative 3.

[9] This receiver would be acquired under Alternative 3.

[10] Exterior/Interior noise level.

dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ES = edge of shoulder
ft = feet
H = height
NAC = Noise Abatement Criteria
ROW = right-of-way

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 11a &11b | | R-1 | **67**[2] | 64 | 3 | 63 | 4 | 62[3] | 5 | 61 | 6 | 60 | 7 | 59 | 8 |
| | | R-2 | 61 | --[4] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-3 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-4 | 57 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-5 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-6 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-7 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-8 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-9 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-10 | 54 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-11 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-12 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-13 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-14 | 52 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-15 | 52 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-16 | 57 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-17 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-18 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-19 | **66** | NF[5] | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-20 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-21 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12a &12b | 9 | R-22 | 65 | --[6] | --[6] | 64 | 1 | 64 | 1 | 64 | 1 | 64 | 1 | NP[7] | NP |
| | | R-23 | **69** | 64 | 5 | 63 | 6 | 62 | 7 | 61 | 8 | 61 | 8 | NP | NP |
| | | R-24 | **70** | 64 | 6 | 63 | 7 | 62 | 8 | 61 | 9 | 60 | 10 | NP | NP |
| | | R-25 | **75** | **67** | 8 | 65 | 10 | 64 | 11 | 62 | 13 | 61 | 14 | NP | NP |
| | | R-26 | 63 | 62 | 1 | 61 | 2 | 60 | 3 | 60 | 3 | 59 | 4 | NP | NP |
| | | R-27 | **71** | **66** | 5 | 65 | 6 | 64 | 7 | 62 | 9 | 61 | 10 | NP | NP |
| | | R-28 | **75** | **69** | 6 | **67** | 8 | 65 | 10 | 63 | 12 | 62 | 13 | NP | NP |

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 12a &12b | | R-29 | **70** | **66** | 4 | 65 | 5 | 64 | 6 | 62 | 8 | 61 | 9 | NP | NP |
| | | R-30 | **69** | **67** | 2 | **66** | 3 | 65 | 4 | 64 | 5 | 63 | 6 | NP | NP |
| | | R-31 | **68** | **67** | 1 | 65 | 3 | 64 | 4 | 62 | 6 | 62 | 6 | NP | NP |
| | 6 | R-32 | **70** | --[6] | --[6] | **67** | 3 | **66** | 4 | 65 | 5 | 63 | 7 | NP | NP |
| | | R-33 | 63 | --[6] | --[6] | 60 | 3 | 60 | 3 | 58 | 5 | 58 | 5 | NP | NP |
| | | R-34 | --[8] | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-35 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-36 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-37 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-38 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-39 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-40 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-41 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-42 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12a &12b | | R-43 | 64 | 63 | 1 | 63 | 1 | 63 | 1 | 63 | 1 | 63 | 1 | NP | NP |
| | | R-44 | 62 | 61 | 1 | 61 | 1 | 61 | 1 | 61 | 1 | 60 | 2 | NP | NP |
| | | R-45 | 61 | 60 | 1 | 59 | 2 | 59 | 2 | 59 | 2 | 59 | 2 | NP | NP |
| | | R-46 | 58 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | 54 | 4 | NP | NP |
| | | R-47 | 54 | 53 | 1 | 53 | 1 | 53 | 1 | 52 | 2 | 51 | 3 | NP | NP |
| | | R-48 | 58 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | 53 | 5 | NP | NP |
| | | R-49 | 53 | 52 | 1 | 51 | 2 | 52 | 1 | 51 | 2 | 50 | 3 | NP | NP |
| | | R-50 | 58 | 57 | 1 | 57 | 1 | 56 | 2 | 55 | 3 | 54 | 4 | NP | NP |
| | | R-51 | 56 | 54 | 2 | 54 | 2 | 54 | 2 | 53 | 3 | 52 | 4 | NP | NP |
| | | R-52 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-53 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-54 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-55 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-56 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-57 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-58 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-59 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 13 | | R-60 | **67** | 61 | 6 | 60 | 7 | 59 | 8 | 59 | 8 | 58 | 9 | 57 | 10 |
| | 4 | R-61 | 63 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | 60 | 3 | 57 | 6 |
| | | R-62 | 63 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | 60 | 3 | 56 | 7 |
| | | R-63 | 62 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-64 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-65 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-66 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| 14 | | R-67 | **70** | 65 | 5 | 64 | 6 | 63 | 7 | 62 | 8 | 62 | 8 | NP | NP |
| | | R-68 | **70** | 65 | 5 | 63 | 7 | 62 | 8 | 62 | 8 | 61 | 9 | NP | NP |
| | | R-69 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 13 | 5 | R-70 | **66** | --[6] | --[6] | 64 | 2 | 63 | 3 | 62 | 4 | 62 | 4 | 59 | 7 |
| | | R-71 | 63 | --[6] | --[6] | 62 | 1 | 61 | 2 | 61 | 2 | 61 | 2 | 57 | 6 |
| | | R-72 | 62 | --[6] | --[6] | 61 | 1 | 61 | 1 | 61 | 1 | 61 | 1 | 57 | 5 |
| | | R-73 | 61 | --[6] | --[6] | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | 55 | 6 |
| | | R-74 | 60 | --[6] | --[6] | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | 55 | 5 |
| | | R-75 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-76 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 13 | | R-77 | **67** | --[6] | --[6] | 63 | 4 | 63 | 4 | 62 | 5 | 62 | 5 | 59 | 8 |
| | | R-78 | 64 | --[6] | --[6] | 63 | 1 | 62 | 2 | 62 | 2 | 61 | 3 | 58 | 6 |
| | | R-79 | 62 | --[6] | --[6] | 61 | 1 | 61 | 1 | 61 | 1 | 61 | 1 | 57 | 5 |
| | | R-80 | 61 | --[6] | --[6] | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | 56 | 5 |
| | | R-81 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-82 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 13 | | R-83 | **68** | --[6] | --[6] | 65 | 3 | 65 | 3 | 65 | 3 | 65 | 3 | 64 | 4 |
| | | R-84 | 64 | --[6] | --[6] | 64 | 0 | 63 | 1 | 63 | 1 | 63 | 1 | 62 | 2 |

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 13 | 5 | R-85 | 62 | --[6] | --[6] | 62 | 0 | 62 | 0 | 62 | 0 | 62 | 0 | 60 | 2 |
| | | R-86 | 63 | --[6] | --[6] | 62 | 1 | 62 | 1 | 62 | 1 | 62 | 1 | 60 | 3 |
| | | R-87 | 61 | --[6] | --[6] | 61 | 0 | 61 | 0 | 61 | 0 | 61 | 0 | 58 | 3 |
| | | R-88 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-89 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | | R-90 | 61 | 61 | 0 | 61 | 0 | 60 | 1 | 60 | 1 | 60 | 1 | NP | NP |
| | | R-91 | 61 | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | NP | NP |
| | | R-92 | 60 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | NP | NP |
| | | R-93 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-94 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-95 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-96 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-97 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-98 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-99 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-100 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-101 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-102 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-103 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-104 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-105 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-106 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-107 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | | R-108 | 61 | 60 | 1 | 60 | 1 | 60 | 1 | 59 | 2 | 59 | 2 | NP | NP |
| | | R-109 | 62 | 61 | 1 | 61 | 1 | 60 | 2 | 60 | 2 | 60 | 2 | NP | NP |
| | | R-110 | 63 | 62 | 1 | 61 | 2 | 61 | 2 | 60 | 3 | 60 | 3 | NP | NP |
| | | R-111 | 65 | 63 | 2 | 63 | 2 | 62 | 3 | 61 | 4 | 61 | 4 | NP | NP |
| | | R-112 | **71** | **67** | 4 | **66** | 5 | 65 | 6 | 63 | 8 | 63 | 8 | NP | NP |

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 14 | 7 | R-113 | 64 | 64 | 0 | 64 | 0 | 63 | 1 | 62 | 2 | 61 | 3 | NP | NP |
| | | R-114 | 63 | 62 | 1 | 62 | 1 | 61 | 2 | 60 | 3 | 60 | 3 | NP | NP |
| | 8 | R-115 | **66** | **66** | 0 | 65 | 1 | 64 | 2 | 63 | 3 | 62 | 4 | NP | NP |
| | | R-116 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-117 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-118 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-119 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-120 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | 7 | R-121 | 64 | 64 | 0 | 63 | 1 | 62 | 2 | 61 | 3 | 60 | 4 | NP | NP |
| | 8 | R-122 | 64 | 63 | 1 | 63 | 1 | 62 | 2 | 61 | 3 | 61 | 3 | NP | NP |
| | | R-123 | 65 | 64 | 1 | 64 | 1 | 63 | 2 | 62 | 3 | 61 | 4 | NP | NP |
| | | R-124 | 62 | 61 | 1 | 61 | 1 | 61 | 1 | 60 | 2 | 60 | 2 | NP | NP |
| | | R-125 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-126 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-127 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-128 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-129 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-130 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-131 | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-132 | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-133 | 75 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-134 | 70 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-135 | 73 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-136 | 74 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-137 | --[9] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-138 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-139 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-140 | 65 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 15. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-141 | 65 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-142 | 74 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-143 | **73** | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-144 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | EI | 72/50[10] | 66/43 | 6 | 63/41 | 9 | 62/40 | 10 | 61/39 | 11 | 60/38 | 12 | NP | NP |

Source: LSA Associates, Inc., February 2012.

[1] I.L.: Insertion Loss.

[2] Numbers in bold represent noise levels that approach or exceed the NAC.

[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).

[4] Either no barrier was analyzed at this location because the modeled receiver would not approach or exceed the NAC or this receiver would be acquired under this alternative.

[5] NF = Not Feasible. It is not feasible to attenuate traffic noise levels with sound barriers due to driveway and pedestrian access to the property.

[6] Shaded area represents the existing wall height.

[7] NP = Not Permitted. Sound barriers within 15 ft of the nearest travel lane are not permitted to exceed 14 ft in height.

[8] Noise levels for this receiver are not shown because it is located beyond the limits of construction under Alternative 6.

[9] This receiver would be acquired under Alternative 6.

[10] Exterior/Interior noise level.

dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ES = edge of shoulder
ft = feet
H = height
NAC = Noise Abatement Criteria
NP = Not Permitted. Sound barriers within 15 ft of the nearest travel lane are not permitted to exceed 14 ft in height.
ROW = right-of-way

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 16a & 16b | | R-1 | **67**[2] | **66** | 1 | 65 | 2 | 64 | 3 | 63 | 4 | 62[3] | 5 | 60 | 7 |
| | | R-2 | 58 | --[4] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-3 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-4 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-5 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-6 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-7 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-8 | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-9 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-10 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-11 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-12 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-13 | 61 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-14 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-15 | 53 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-16 | 56 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-17 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-18 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-19 | **66** | NF[5] | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-20 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-21 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 17a &17b | 9 | R-22 | 65 | --[6] | --[6] | 64 | 1 | 64 | 1 | 64 | 1 | 63 | 2 | NP[7] | NP |
| | | R-23 | **72** | **70** | 2 | **68** | 4 | **66** | 6 | 65 | 7 | 63 | 9 | NP | NP |
| | | R-24 | **72** | **71** | 1 | **69** | 3 | **67** | 5 | 65 | 7 | 63 | 9 | NP | NP |
| | | R-25 | **75** | **74** | 1 | **72** | 3 | **69** | 6 | **66** | 9 | 64 | 11 | NP | NP |
| | | R-26 | 63 | 62 | 1 | 61 | 2 | 61 | 2 | 60 | 3 | 59 | 4 | NP | NP |
| | | R-27 | **71** | **68** | 3 | **66** | 5 | 65 | 6 | 63 | 8 | 62 | 9 | NP | NP |
| | | R-28 | **75** | **71** | 4 | **68** | 7 | **66** | 9 | 64 | 11 | 63 | 12 | NP | NP |

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 17a &17b | | R-29 | **70** | **67** | 3 | **66** | 4 | 65 | 5 | 63 | 7 | 61 | 9 | NP | NP |
| | | R-30 | **69** | **67** | 2 | **66** | 3 | 65 | 4 | 64 | 5 | 63 | 6 | NP | NP |
| | | R-31 | **68** | **67** | 1 | 65 | 3 | 64 | 4 | 62 | 6 | 62 | 6 | NP | NP |
| | 6 | R-32 | **70** | --[6] | --[6] | **67** | 3 | **66** | 4 | 65 | 5 | 63 | 7 | NP | NP |
| | | R-33 | 63 | --[6] | --[6] | 60 | 3 | 59 | 4 | 58 | 5 | 57 | 6 | NP | NP |
| | | R-34 | 65 | --[6] | --[6] | 63 | 2 | 62 | 3 | 61 | 4 | 60 | 5 | NP | NP |
| | | R-35 | **75** | --[6] | --[6] | **69** | 6 | **67** | 8 | 65 | 10 | 64 | 11 | NP | NP |
| | | R-36 | 53 | --[6] | --[6] | 51 | 2 | 52 | 1 | 51 | 2 | 50 | 3 | NP | NP |
| | | R-37 | 55 | --[6] | --[6] | 53 | 2 | 53 | 2 | 52 | 3 | 51 | 4 | NP | NP |
| | | R-38 | 56 | --[6] | --[6] | 55 | 1 | 55 | 1 | 54 | 2 | 53 | 3 | NP | NP |
| | | R-39 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-40 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-41 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-42 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-43 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-44 | 62 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-45 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 17a &17b | | R-46 | 59 | 57 | 2 | 56 | 3 | 56 | 3 | 55 | 4 | 54 | 5 | NP | NP |
| | | R-47 | 54 | 53 | 1 | 53 | 1 | 53 | 1 | 52 | 2 | 51 | 3 | NP | NP |
| | | R-48 | 58 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | 53 | 5 | NP | NP |
| | | R-49 | 53 | 52 | 1 | 51 | 2 | 52 | 1 | 51 | 2 | 50 | 3 | NP | NP |
| | | R-50 | 58 | 57 | 1 | 56 | 2 | 56 | 2 | 55 | 3 | 54 | 4 | NP | NP |
| | | R-51 | 56 | 54 | 2 | 54 | 2 | 54 | 2 | 53 | 3 | 52 | 4 | NP | NP |
| | | R-52 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-53 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-54 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-55 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-56 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-57 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-58 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-59 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 19 | | R-60 | **67** | 64 | 3 | 63 | 4 | 63 | 4 | 62 | 5 | 62 | 5 | 62 | 5 |
| | 4 | R-61 | 64 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-62 | 63 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-63 | 62 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-64 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-65 | 61 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| | | R-66 | 60 | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | --[6] | -- | -- | -- | -- |
| 20 | | R-67 | **69** | 65 | 4 | 64 | 5 | 63 | 6 | 63 | 6 | 62 | 7 | NP | NP |
| | | R-68 | **69** | 64 | 5 | 63 | 6 | 62 | 7 | 62 | 7 | 61 | 8 | NP | NP |
| | | R-69 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | 5 | R-70 | 65 | --[6] | --[6] | 64 | 1 | 63 | 2 | 62 | 3 | 62 | 3 | 61 | 4 |
| | | R-71 | 63 | --[6] | --[6] | 62 | 1 | 62 | 1 | 61 | 2 | 61 | 2 | 61 | 2 |
| | | R-72 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-73 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-74 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-75 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-76 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | | R-77 | **66** | --[6] | --[6] | 63 | 3 | 62 | 4 | 62 | 4 | 62 | 4 | 62 | 4 |
| | | R-78 | 64 | --[6] | --[6] | 62 | 2 | 62 | 2 | 62 | 2 | 62 | 2 | 62 | 2 |
| | | R-79 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-80 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-81 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-82 | 60 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | | R-83 | **67** | --[6] | --[6] | 64 | 3 | 64 | 3 | 64 | 3 | 63 | 4 | 63 | 4 |
| | | R-84 | 63 | --[6] | --[6] | 63 | 0 | 63 | 0 | 62 | 1 | 62 | 1 | 62 | 1 |

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | 5 | R-85 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-86 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-87 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-88 | 62 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-89 | 61 | --[6] | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 20 | | R-90 | 62 | 61 | 1 | 61 | 1 | 61 | 1 | 61 | 1 | 60 | 2 | NP | NP |
| | | R-91 | 61 | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | 60 | 1 | NP | NP |
| | | R-92 | 60 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | NP | NP |
| | | R-93 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-94 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-95 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-96 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-97 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-98 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-99 | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-100 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-101 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-102 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-103 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-104 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-105 | 59 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-106 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-107 | 63 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 20 | | R-108 | 60 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | 60 | 0 | NP | NP |
| | | R-109 | 63 | 61 | 2 | 61 | 2 | 61 | 2 | 61 | 2 | 60 | 3 | NP | NP |
| | | R-110 | 63 | 62 | 1 | 62 | 1 | 61 | 2 | 61 | 2 | 60 | 3 | NP | NP |
| | | R-111 | **66** | 64 | 2 | 63 | 3 | 62 | 4 | 62 | 4 | 61 | 5 | NP | NP |
| | | R-112 | **71** | **67** | 4 | **66** | 5 | 65 | 6 | 65 | 6 | 63 | 8 | NP | NP |

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 20 | 7 | R-113 | 65 | 65 | 0 | 64 | 1 | 63 | 2 | 63 | 2 | 61 | 4 | NP | NP |
| | | R-114 | 63 | 62 | 1 | 62 | 1 | 61 | 2 | 61 | 2 | 60 | 3 | NP | NP |
| | 8 | R-115 | **67** | **66** | 1 | 65 | 2 | 64 | 3 | 64 | 3 | 62 | 5 | NP | NP |
| | | R-116 | **66** | 63 | 3 | 63 | 3 | 62 | 4 | 62 | 4 | 60 | 6 | NP | NP |
| | | R-117 | 63 | 62 | 1 | 62 | 1 | 61 | 2 | 61 | 2 | 60 | 3 | NP | NP |
| | | R-118 | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-119 | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-120 | --[6] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 20 | 7 | R-121 | 65 | 64 | 1 | 64 | 1 | 62 | 3 | 62 | 3 | 60 | 5 | NP | NP |
| | 8 | R-122 | 64 | 63 | 1 | 63 | 1 | 62 | 2 | 62 | 2 | 61 | 3 | NP | NP |
| | | R-123 | 65 | 65 | 0 | 64 | 1 | 63 | 2 | 63 | 2 | 61 | 4 | NP | NP |
| | | R-124 | 62 | 62 | 0 | 61 | 1 | 61 | 1 | 61 | 1 | 60 | 2 | NP | NP |
| | | R-125 | 60 | 60 | 0 | 60 | 0 | 59 | 1 | 59 | 1 | 59 | 1 | NP | NP |
| | | R-126 | 60 | 59 | 1 | 59 | 1 | 59 | 1 | 59 | 1 | 59 | 1 | NP | NP |
| | | R-127 | 59 | 59 | 0 | 59 | 0 | 59 | 0 | 59 | 0 | 59 | 0 | NP | NP |
| | | R-128 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-129 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-130 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-131 | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-132 | 72 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-133 | 75 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-134 | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-135 | 74 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-136 | 73 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-137 | --[8] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-138 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-139 | 60 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-140 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## Table 16. Noise Levels and Sound Barrier Modeling along the State ROW or ES for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 7 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| | | R-141 | 64 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-142 | 73 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | R-143 | **72** | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| | | R-144 | --[7] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | EI | 73/51[9] | 73/51 | 0 | 67/45 | 6 | 66/44 | 7 | 63/41 | 10 | 62/40 | 11 | NP | NP |

Source: LSA Associates, Inc., February 2012.

[1] I.L.: Insertion Loss.

[2] Numbers in bold represent noise levels that approach or exceed the NAC.

[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).

[4] Either no barrier was analyzed at this location because the modeled receiver would not approach or exceed the NAC or this receiver would be acquired under this alternative.

[5] NF = Not Feasible. It is not feasible to attenuate traffic noise levels with sound barriers due to driveway and pedestrian access to the property.

[6] Shaded area represents the existing wall height.

[7] Noise levels for this receiver are not shown because it is located beyond the limits of construction under Alternative 7.

[8] This receiver would be acquired under Alternative 7.

[9] Exterior/Interior noise level.

dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ES = edge of shoulder
ft = feet
H = height
NAC = Noise Abatement Criteria
NP = Not Permitted. Sound barriers within 15 ft of the nearest travel lane are not permitted to exceed 14 ft in height.
ROW = right-of-way

## Table 17. Noise Levels and Sound Barrier Modeling along the PL for Alternative 3 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 3 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 5 | 8 | R-115 | **67**[2] | 64 | 3 | 62[3] | 5 | 60 | 7 | 60 | 7 | 59 | 8 | 59 | 8 |
| | | R-123 | 65 | 64 | 1 | 61 | 4 | 60 | 5 | 60 | 5 | 59 | 6 | 59 | 6 |

Source: LSA Associates, Inc., February 2012.
[1] I.L.: Insertion Loss.
[2] Numbers in bold represent noise levels that approach or exceed the NAC.
[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ft = feet
H = height
NAC = Noise Abatement Criteria
PL = property line

## Table 18. Noise Levels and Sound Barrier Modeling along the PL for Alternative 6 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 15 | 8 | R-115 | **66**[2] | 63 | 3 | 59[3] | 7 | 57 | 9 | 55 | 11 | 54 | 12 | 53 | 13 |
| | | R-123 | 65 | 63 | 2 | 59 | 6 | 57 | 8 | 55 | 10 | 54 | 11 | 53 | 12 |

Source: LSA Associates, Inc., February 2012.
[1] I.L.: Insertion Loss.
[2] Numbers in bold represent noise levels that approach or exceed the NAC.
[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ft = feet
H = height
NAC = Noise Abatement Criteria
PL = property line

## Table 19. Noise Levels and Sound Barrier Modeling along the PL for Alternative 7 (dBA $L_{eq}$)

| Sound Barrier No. | Existing Wall No. | Receiver No. | Alternative 6 | With Barrier H = 6 ft | | With Barrier H = 8 ft | | With Barrier H = 10 ft | | With Barrier H = 12 ft | | With Barrier H = 14 ft | | With Barrier H = 16 ft | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $L_{eq}$ | I.L.[1] | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. | $L_{eq}$ | I.L. |
| 21 | 8 | R-115 | **67**[2] | 64 | 3 | 62[3] | 5 | 60 | 7 | 60 | 7 | 59 | 8 | 59 | 8 |
| | | R-116 | **66** | 64 | 2 | 61 | 5 | 60 | 6 | 60 | 6 | 59 | 7 | 59 | 7 |
| | | R-123 | 65 | 64 | 1 | 61 | 4 | 60 | 5 | 60 | 5 | 59 | 6 | 59 | 6 |

Source: LSA Associates, Inc., February 2012.
[1] I.L.: Insertion Loss.
[2] Numbers in bold represent noise levels that approach or exceed the NAC.
[3] Underlined noise levels have been attenuated by at least 5 dBA (i.e., feasible barrier height).
dBA $L_{eq}$ = equivalent continuous sound level measured in A-weighted decibels
ft = feet
H = height
NAC = Noise Abatement Criteria
PL = property line

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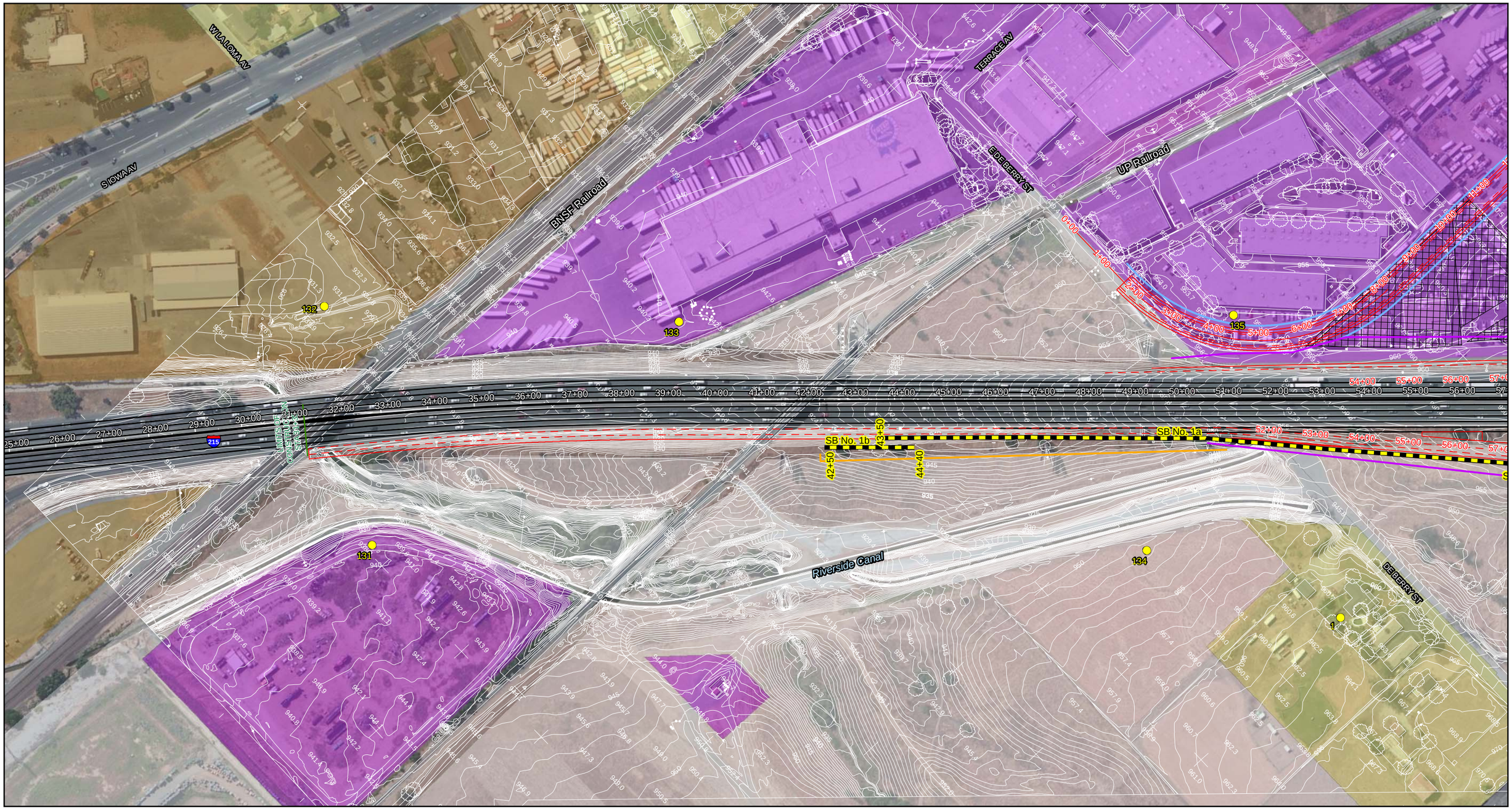


LEGEND

- Alternative 3
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-39 to R-42, R-52 to R-59, R-119 to R-120, and R-129 to R-130 are not shown because they are located beyond the limits of construction under alternative 3.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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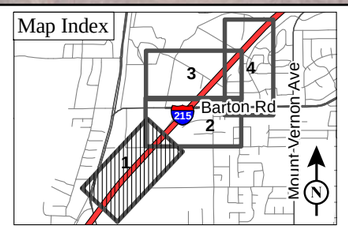


FIGURE 3
Sheet 1 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 3
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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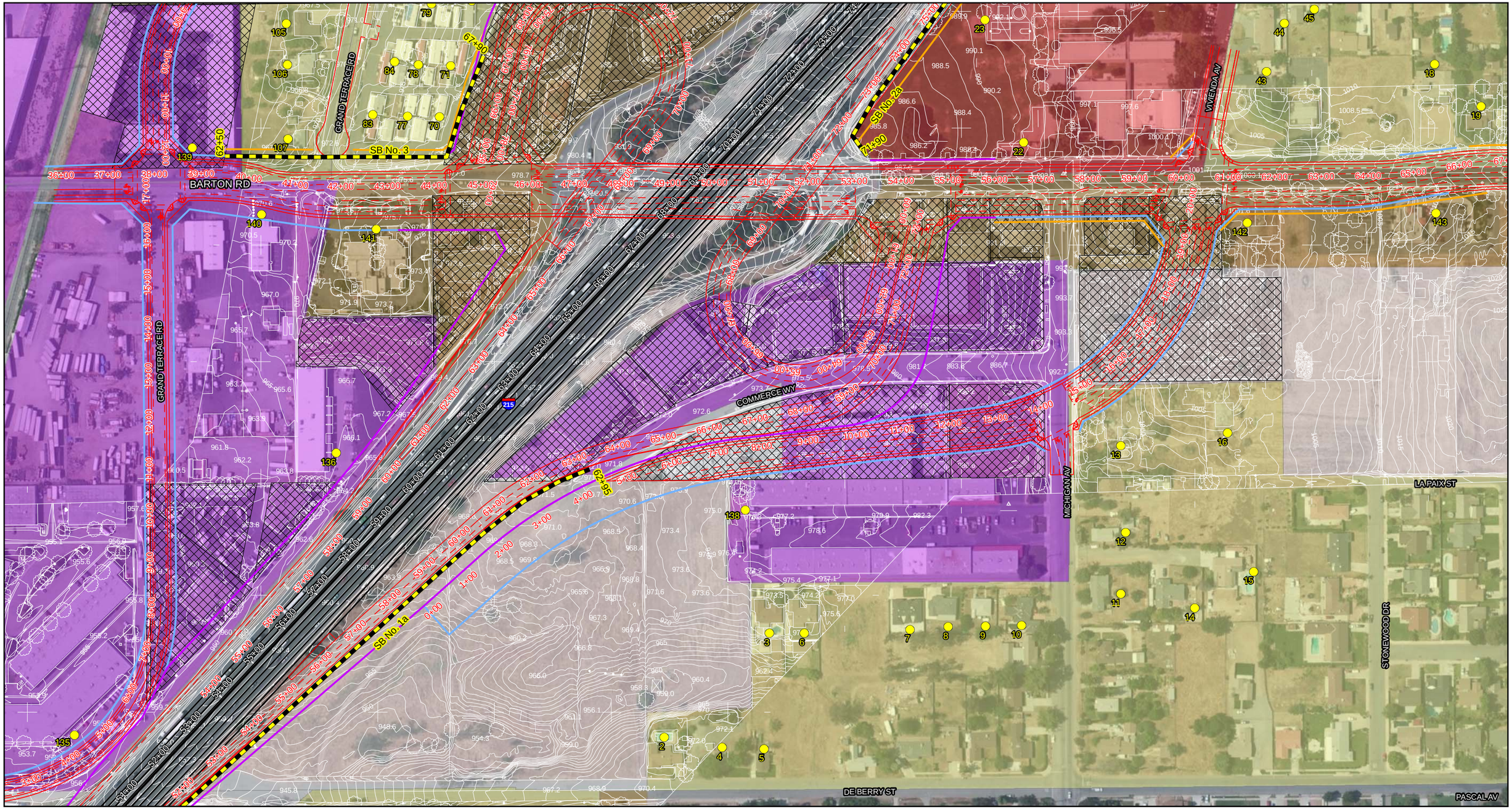


LEGEND

- Alternative 3
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

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- Industrial
- Institutional
- Residential
- Utility
- Vacant

Note: Receivers R-39 to R-42, R-52 to R-59, R-119 to R-120, and R-129 to R-130 are not shown because they are located beyond the limits of construction under alternative 3.

0 100 200
FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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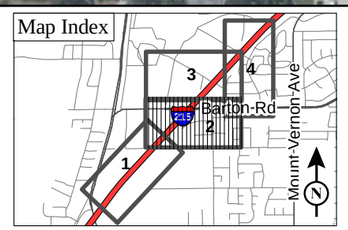


FIGURE 3
Sheet 2 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 3
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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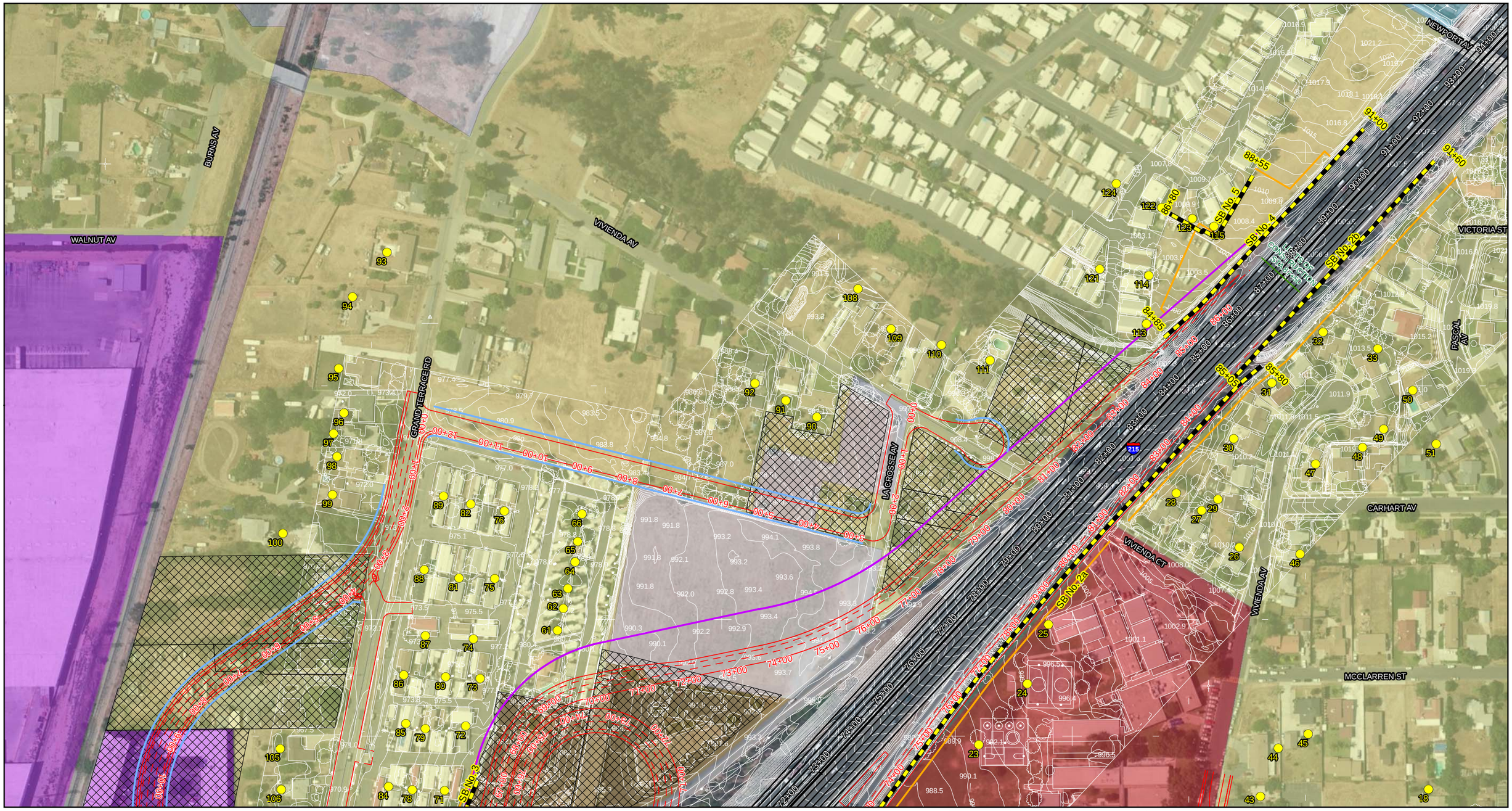


LEGEND

- Alternative 3
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

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- Institutional
- Residential
- Utility
- Vacant

0 100 200 FEET

Note: Receivers R-39 to R-42, R-52 to R-59, R-119 to R-120, and R-129 to R-130 are not shown because they are located beyond the limits of construction under alternative 3.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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Map Index

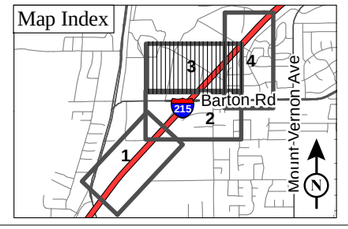


FIGURE 3
Sheet 3 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 3
Modeled Sound Barriers and Receiver Locations
08-SBd-215-PM 0.58/1.66
EA# 0J070

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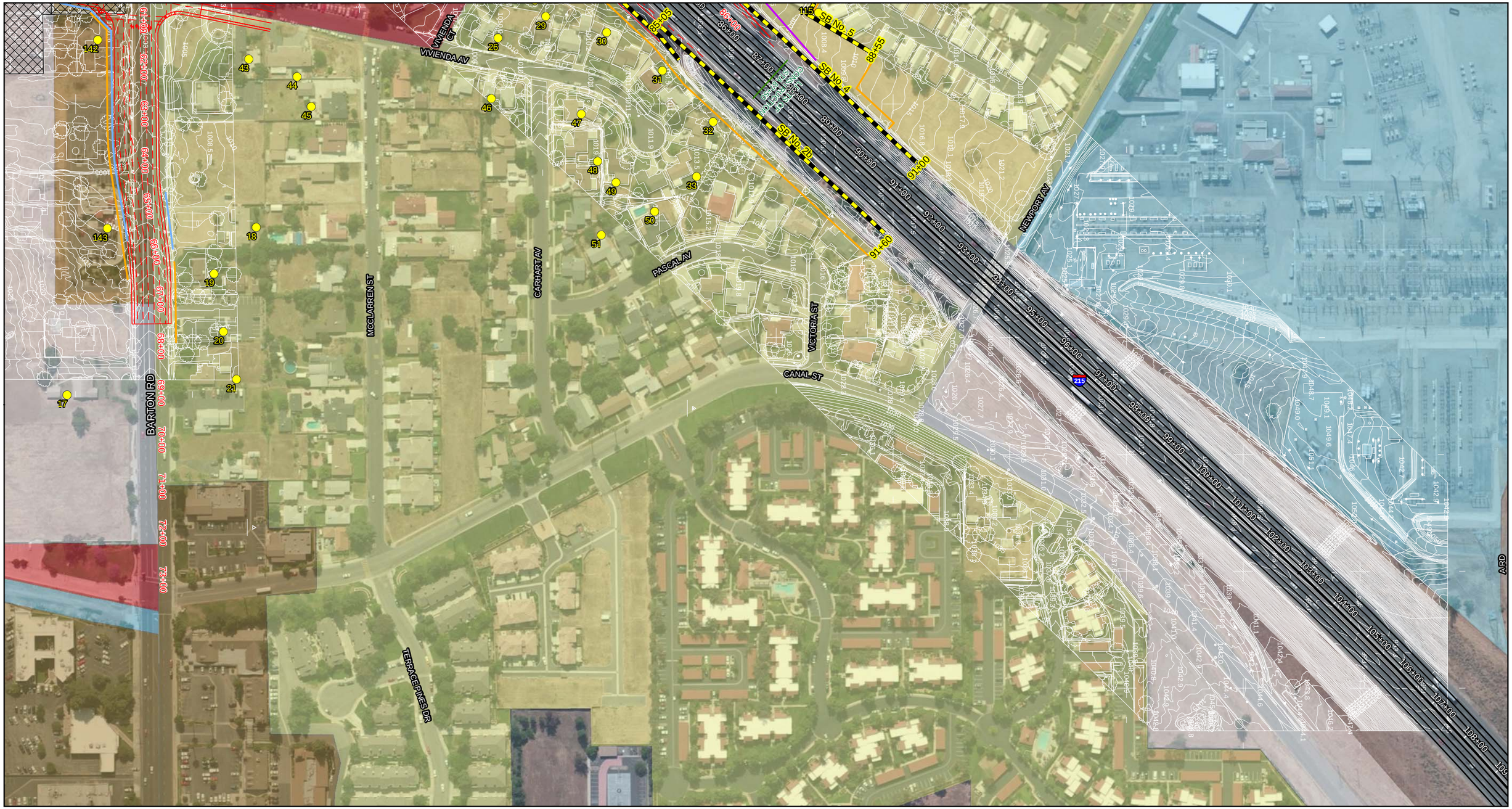


LEGEND

- Alternative 3
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
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Land Use

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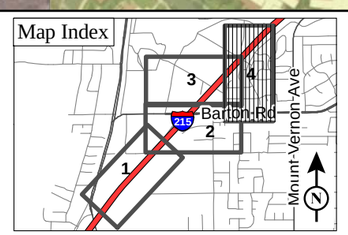
0 100 200
FEET

Map Index




SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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FIGURE 3
Sheet 4 of 4

*I-215/Barton Road Interchange Improvement Project*

Alternative 3
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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LEGEND

- Alternative 6
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
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- Utility
- Vacant

0 100 200
FEET

Note: Receivers R-34 to R-42, R-52 to R-59, R-116 to R-120, and R-125 to R-130 are not shown because they are located beyond the limits of construction under Alternative 6.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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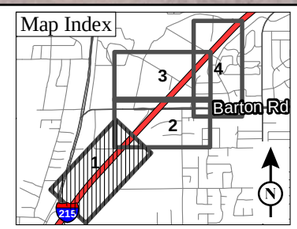


FIGURE 4
Sheet 1 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 6
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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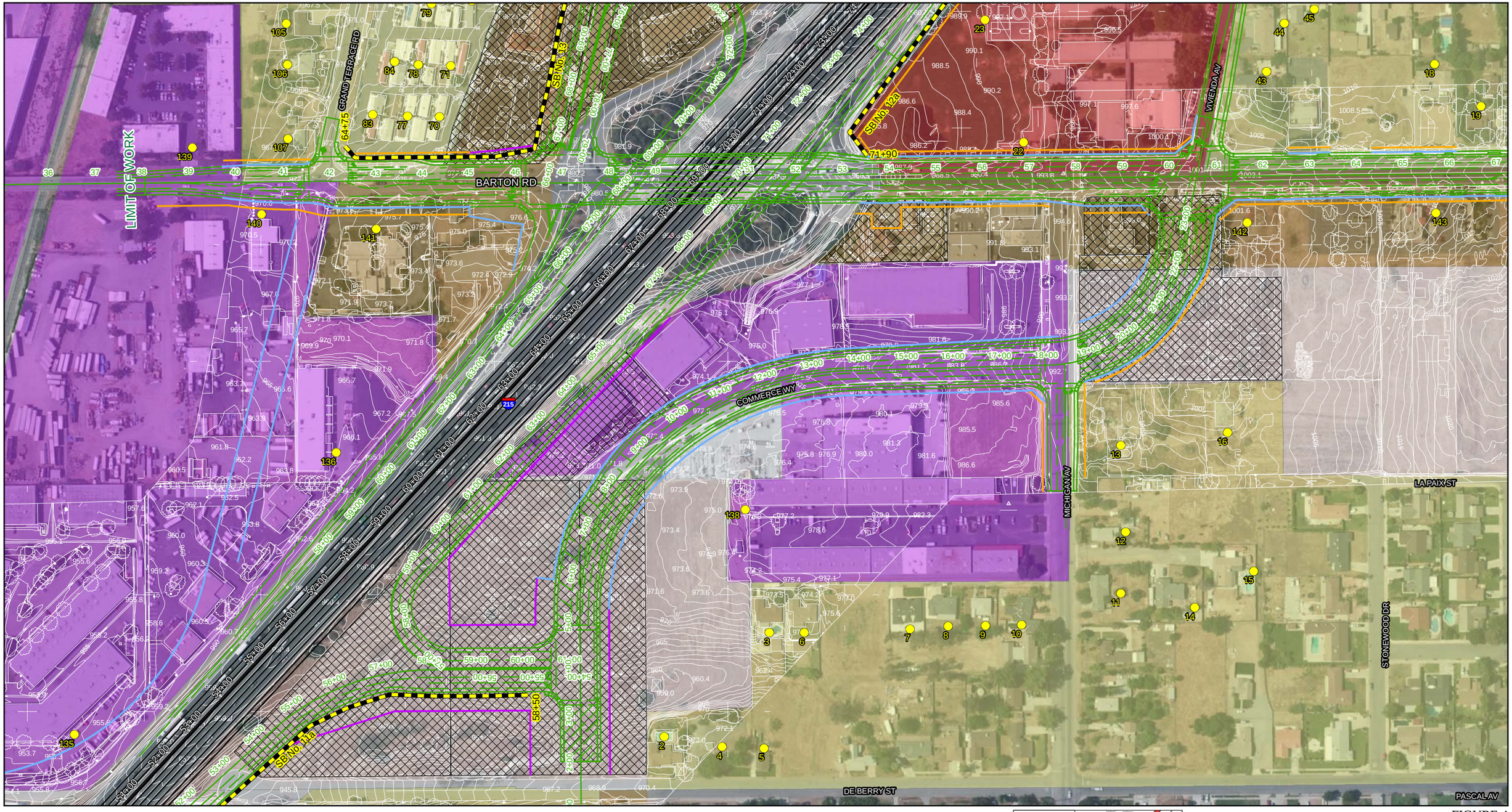


LEGEND

- Alternative 6
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
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Land Use

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Note: Receivers R-34 to R-42, R-52 to R-59, R-116 to R-120, and R-125 to R-130 are not shown because they are located beyond the limits of construction under Alternative 6.

0 100 200 FEET

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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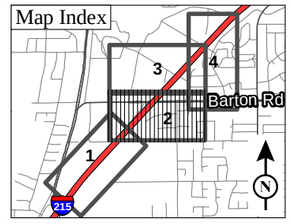


FIGURE 4
Sheet 2 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 6
Modeled Sound Barriers and Receiver Locations
08-SBd-215-PM 0.58/1.66
EA# 0J070

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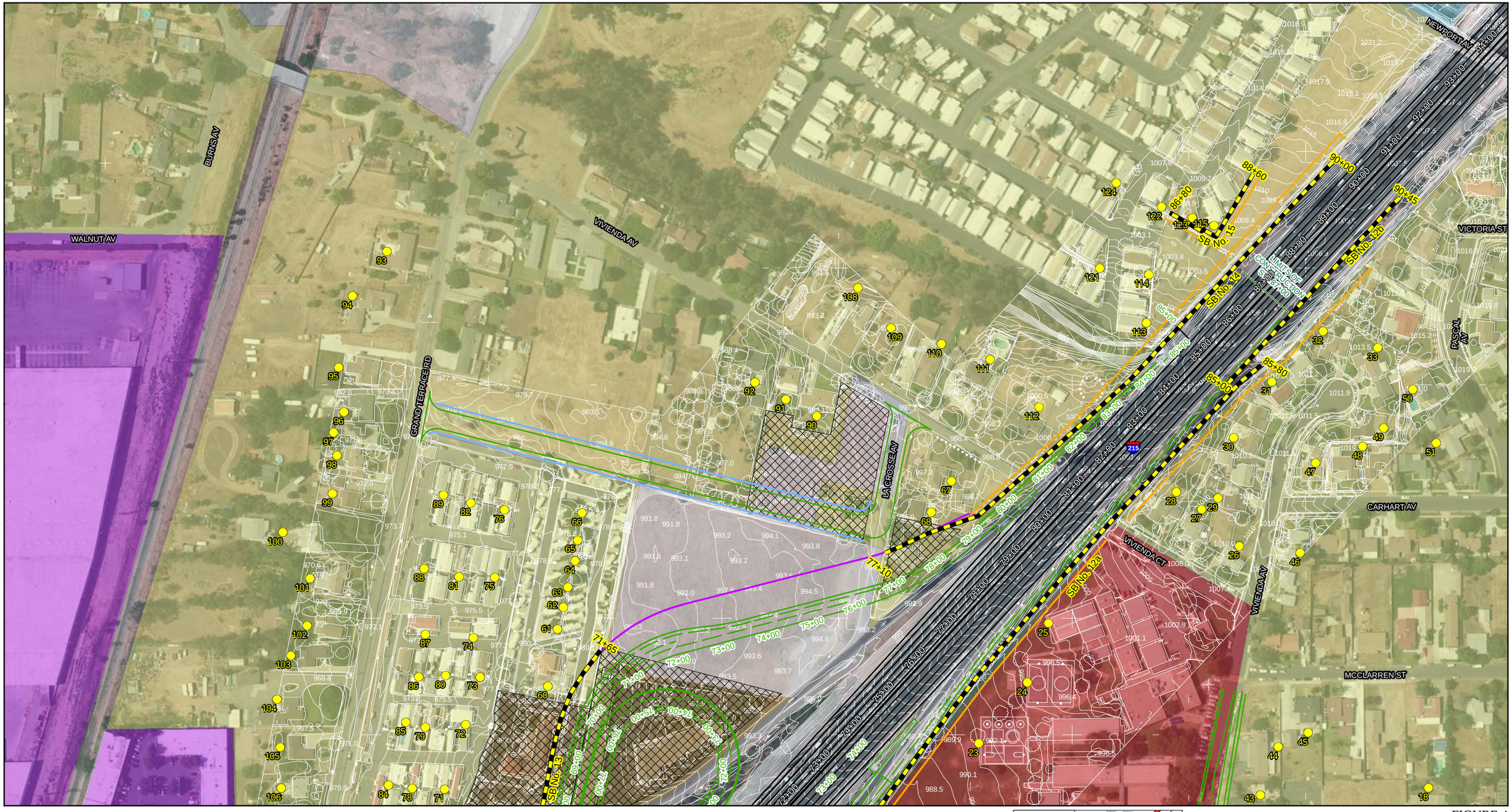


LEGEND

- Alternative 6
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
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0 100 200 FEET

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SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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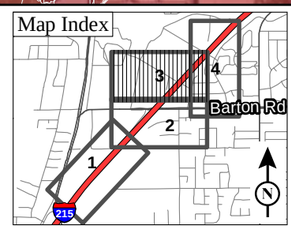


FIGURE 4
Sheet 3 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 6
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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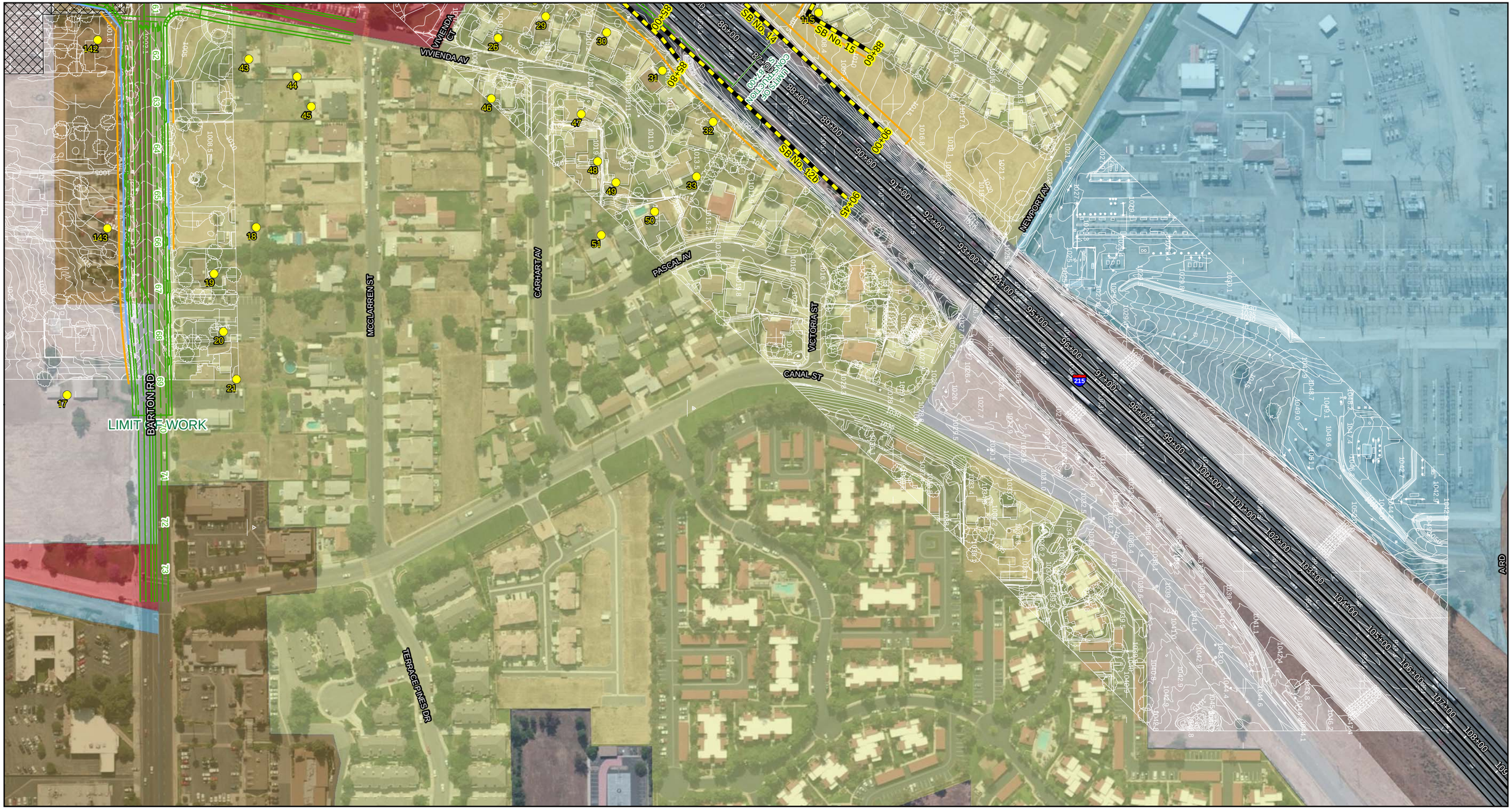


LEGEND

- Alternative 6
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

- Commercial
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- Institutional
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0 100 200
FEET

Note: Receivers R-34 to R-42, R-52 to R-59, R-116 to R-120, and R-125 to R-130 are not shown because they are located beyond the limits of construction under Alternative 6.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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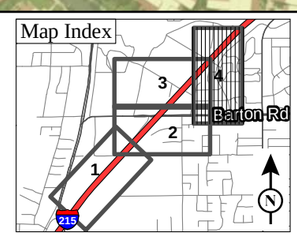


FIGURE 4
Sheet 4 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 6
Modeled Sound Barriers and Receiver Locations
08-SBd-215-PM 0.58/1.66
EA# 0J070

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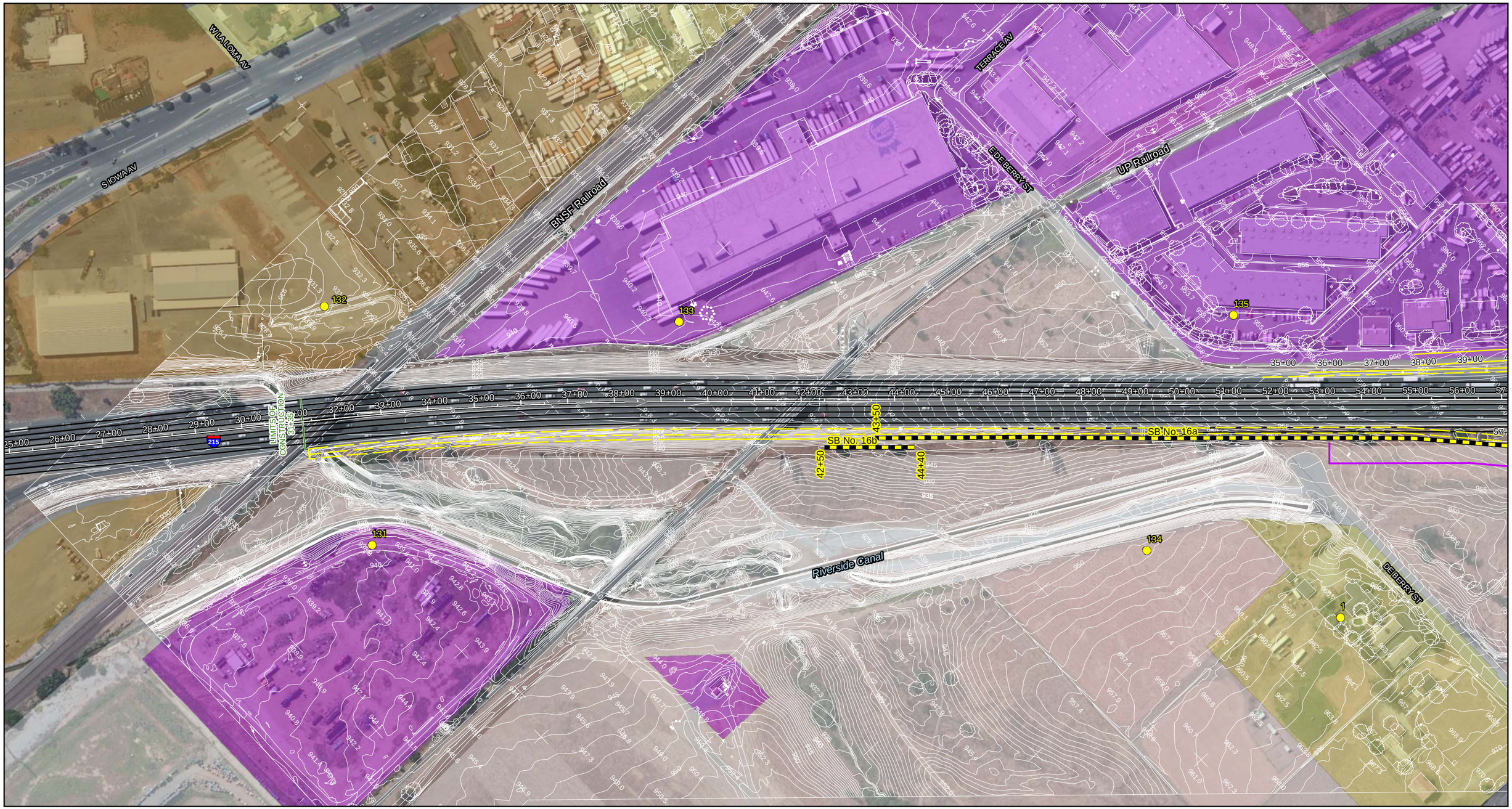


LEGEND

- Alternative 7
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

Land Use

- Commercial
- Industrial
- Institutional
- Residential
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- Vacant

0 100 200 FEET

Note: Receivers R-35 to R-42, R-52 to R-59, R-118 to R-120, and R-128 to R-130 are not shown because they are located beyond the limits of construction under Alternative 7.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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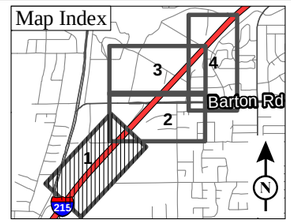


FIGURE 5
Sheet 1 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 7
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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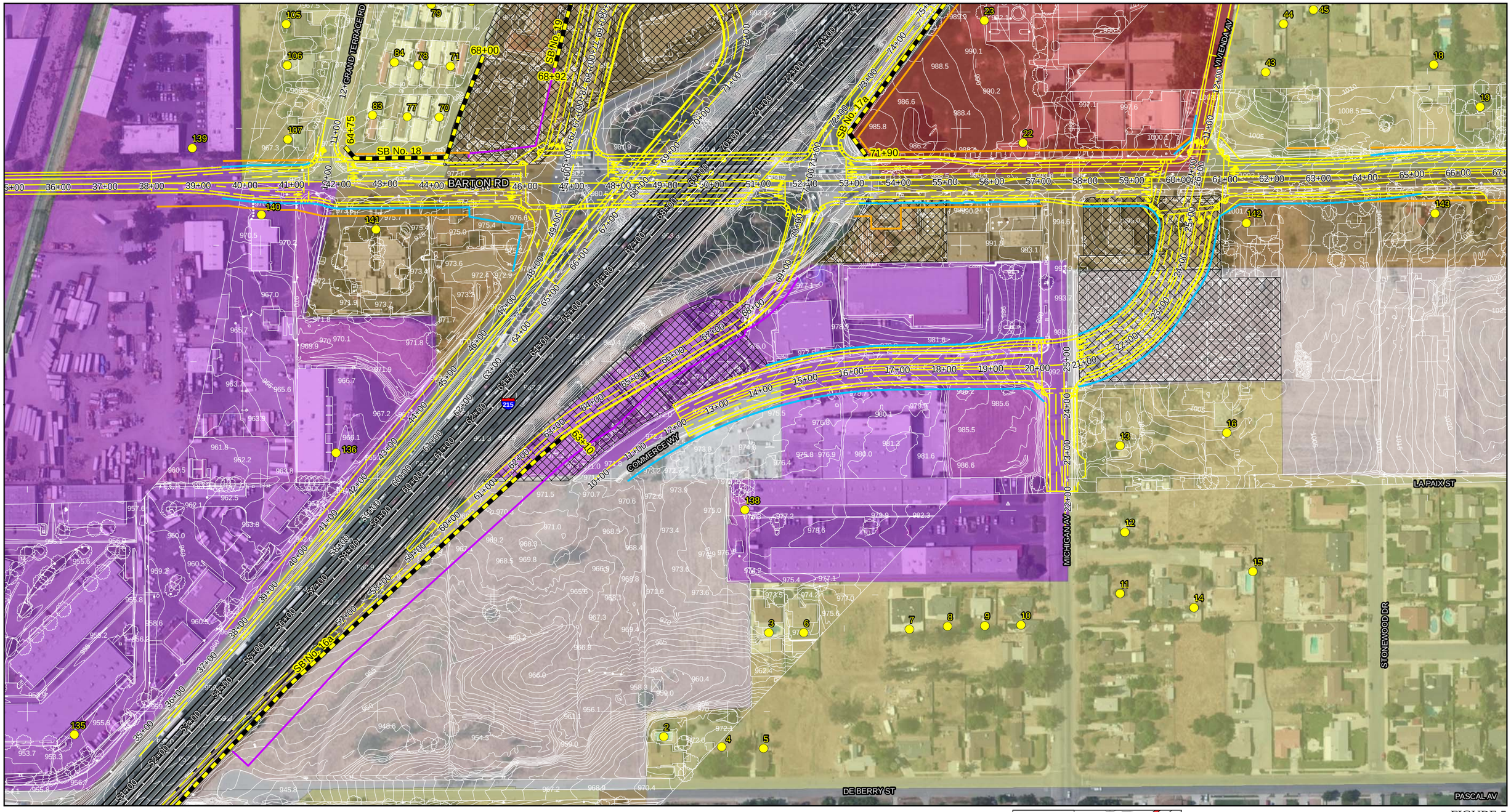


LEGEND

- Alternative 7
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
- Full Acquisition

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- Institutional
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0 100 200 FEET

Note: Receivers R-35 to R-42, R-52 to R-59, R-118 to R-120, and R-128 to R-130 are not shown because they are located beyond the limits of construction under Alternative 7.

SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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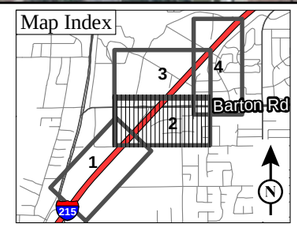


FIGURE 5
Sheet 2 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 7
Modeled Sound Barriers and Receiver Locations
08-SBd-215-PM 0.58/1.66
EA# 0J070

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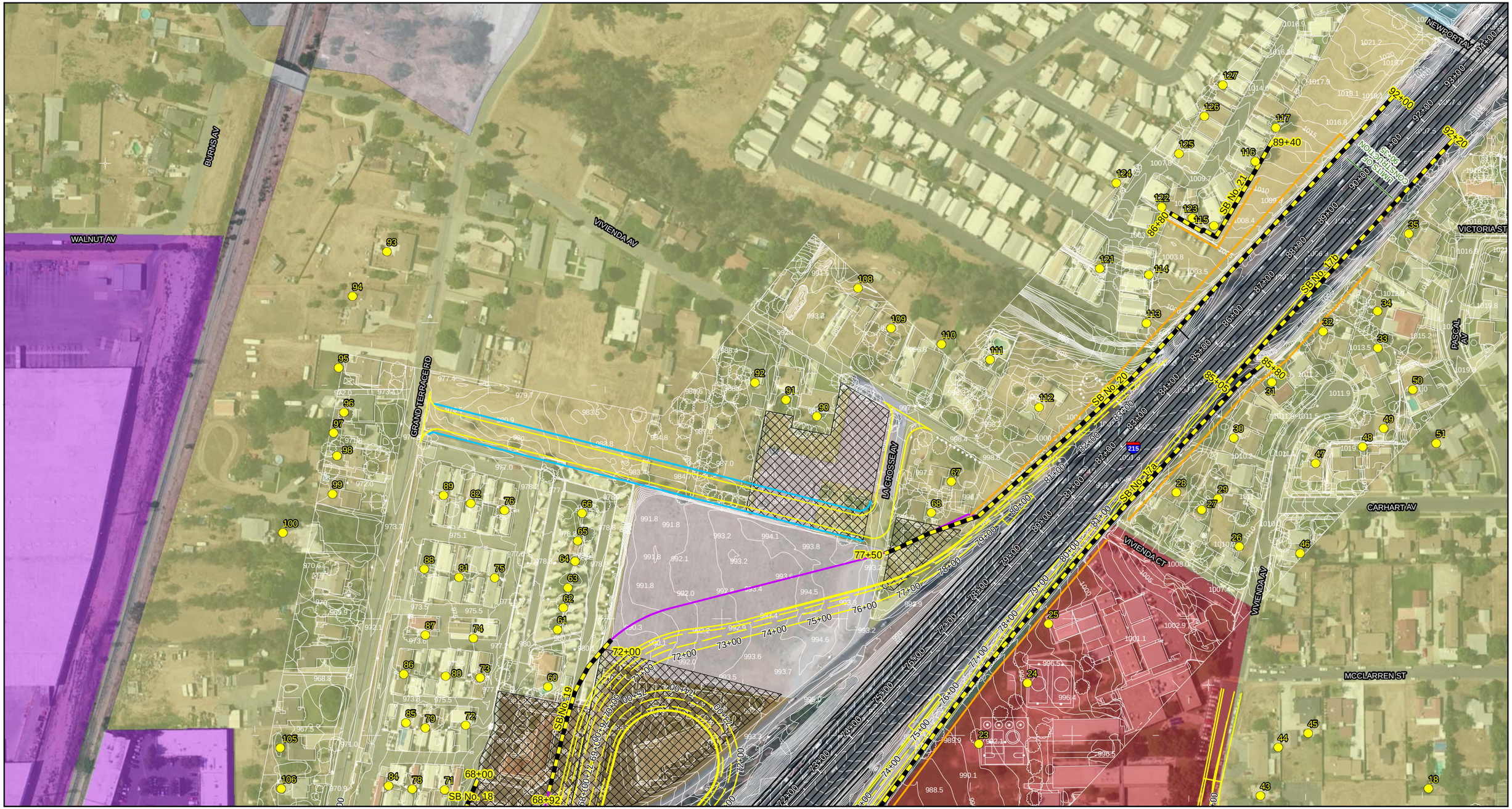


LEGEND

- Alternative 7
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
- Receiver Locations
- Modeled Sound Barrier
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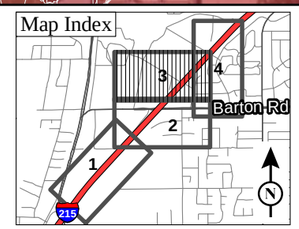
Note: Receivers R-35 to R-42, R-52 to R-59, R-118 to R-120, and R-128 to R-130 are not shown because they are located beyond the limits of construction under Alternative 7.

0 100 200 FEET

Map Index




SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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FIGURE 5
Sheet 3 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 7
Modeled Sound Barriers and Receiver Locations

08-SBd-215-PM 0.58/1.66
EA# 0J070

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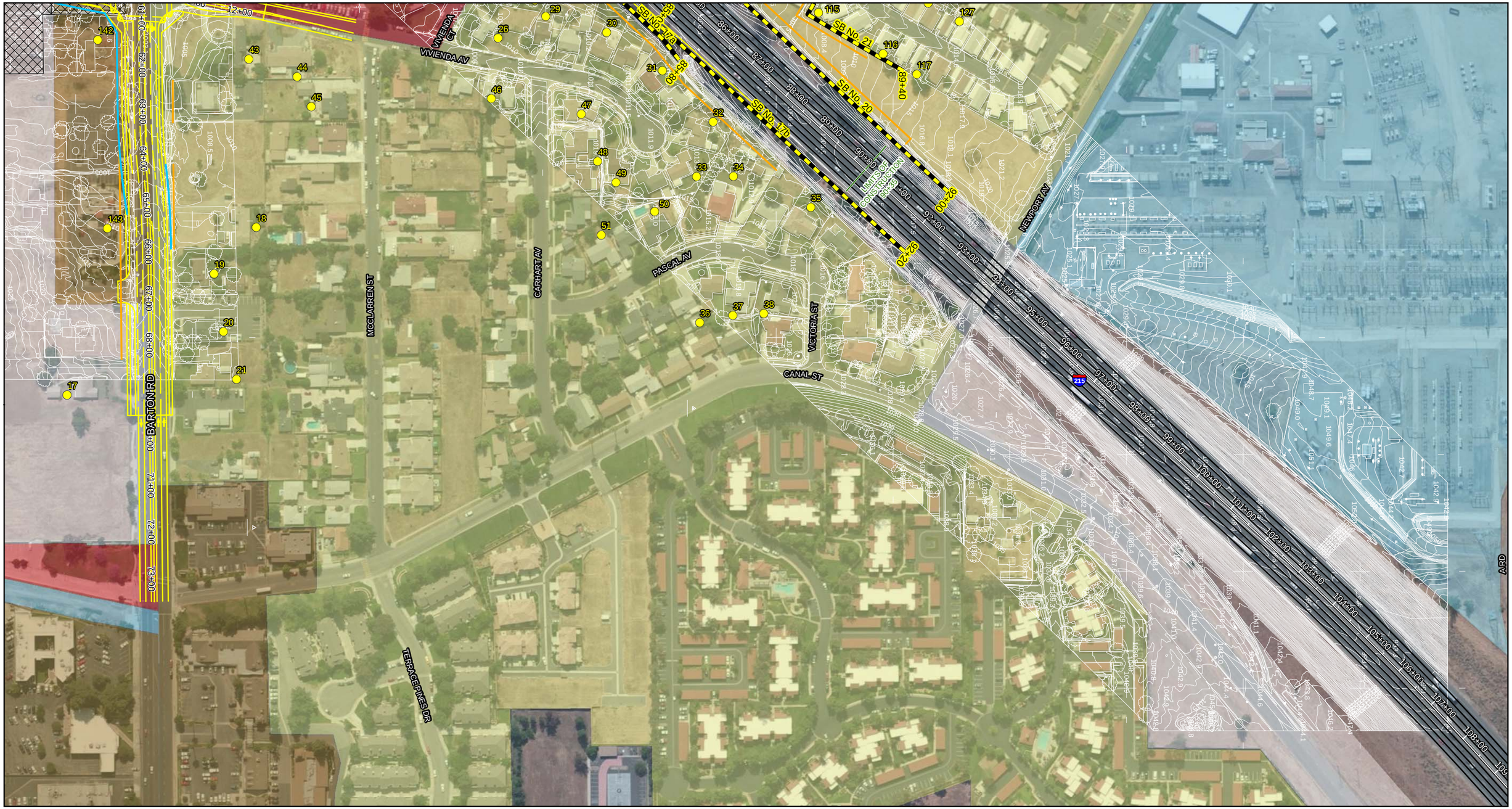


LEGEND

- Alternative 7
- Proposed Caltrans Right of Way
- Proposed City Right of Way
- Temporary Construction Easement
- Mixed Flow Lanes and HOV Lanes
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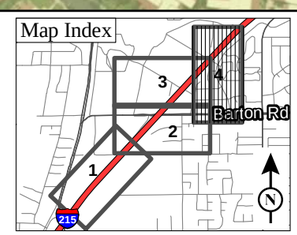
Note: Receivers R-35 to R-42, R-52 to R-59, R-118 to R-120, and R-128 to R-130 are not shown because they are located beyond the limits of construction under Alternative 7.

0 100 200
FEET

Map Index




SOURCE: Bing (2008); TBM (2008); County of San Bernardino (5/09); AECOM (5/2011)

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FIGURE 5
Sheet 4 of 4

*I-215/Barton Road Interchange Improvement Project*
Alternative 7
Modeled Sound Barriers and Receiver Locations
08-SBd-215-PM 0.58/1.66
EA# 0J070

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The following sound barriers were analyzed to shield receiver locations that would be exposed to traffic noise levels approaching or exceeding the NAC for each of the four Build Alternatives.

- **Alternative 3**
  - **SB Nos. 1a and 1b:** A 2,144 ft long barrier along the State ROW on the east side of I-215 south of Barton Road was analyzed to shield Receiver R-1.
  - **SB Nos. 2a and 2b:** A 2,086 ft long barrier along the State ROW on the east side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-23 through R-25, R-27 through R-32, and the exterior/interior receiver.
  - **SB No. 3:** A 705 ft long barrier along the State ROW on the northeastern corner of Barton Road and Grand Terrace Road was analyzed to shield Receivers R-70, R-77, and R-83.
  - **SB No. 4:** A 619 ft long barrier along the edge of shoulder on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receiver R-115.
  - **SB No. 5:** A 270 ft long barrier along the residential property line on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receiver R-115

- **Alternative 6**
  - **SB Nos. 11a and 11b:** A 1,801 ft long barrier along the State ROW on the east side of I-215 south of Barton Road was analyzed to shield Receiver R-1.
  - **SB Nos. 12a and 12b:** A 1,985 ft long barrier within the State ROW on the east side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-23 through R-25, R-27 through R-32, and the exterior/interior receiver.
  - **SB No. 13:** A 926 ft long barrier along the State ROW on the west side of I-215 between Barton Road and Vivienda Avenue was analyzed to shield Receivers R-60, R-70, R-77, and R-83.
  - **SB No. 14:** A 1,291 ft long barrier along the edge of shoulder on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receivers R-67, R-68, R-112, and R-115. It should be noted that a portion of SB No. 14 along the edge of shoulder on the west side of I-215 was analyzed to shield only Receiver R-115. A shorter sound barrier length of 500 ft from Station (STA) 85+00 to STA 90+00 would be used to compare

with SB No. 15 to evaluate the effectiveness of the two sound barrier locations.

- **SB No. 15:** A 270 ft long barrier along the residential property line on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receiver R-115.

- **Alternative 7**
  - **SB Nos. 16a and 16b:** A 2,149 ft long barrier along the State ROW on the east side of I-215 south of Barton Road was analyzed to shield Receiver R-1.
  - **SB Nos. 17a and 17b:** A 2,160 ft long barrier within the State ROW on the east side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-23 through R-25, R-27 through R-32, R-35, and the exterior/interior receiver.
  - **SB No. 18:** A 459 ft long barrier along the State ROW on the northwestern corner of I-215 and Barton Road was analyzed to shield Receivers R-77 and R-83.
  - **SB No. 19:** A 333 ft long barrier along the State ROW on the northwestern corner of I-215 and Barton Road was analyzed to shield Receiver R-60.
  - **SB No. 20:** A 1,481 ft long barrier along the edge of shoulder on the west side of I-215 between Barton Road and Newport Avenue was analyzed to shield Receivers R-67, R-68, R-111, R-112, R-115, and R-116. It should be noted that a portion of SB No. 20 along the edge of shoulder on the west side of I-215 was analyzed to shield only Receivers R-115 and R-116. A shorter sound barrier length of 500 ft from STA 85+00 to STA 90+00 was used to compare with SB No. 21 to evaluate the effectiveness of the two sound barrier locations.
  - **SB No. 21:** A 353 ft long barrier along the residential property line on the west side of I-215 between Vivienda Avenue and Newport Avenue was analyzed to shield Receivers R-115 and R-116.

### 7.2.2. Parallel Barriers

Parallel barrier effects occur when sound barriers are located on both sides of the roadway, reflecting traffic noise back and forth across the roadway multiple times, and build up a reverberant sound field between them. This reverberation increases noise levels at nearby receivers on both sides of the roadway, compared to what would exist without the barrier on the opposite side. Parallel barrier configurations that have a roadway width to sound barrier height ratio of 15:1 or less (width/height)

would degrade the performance of sound barriers. Parallel barriers within the project area are located along I-215 north of Barton Road. The minimum parallel barrier ratio along the I-215 north of Barton Road would be 11:1. Therefore, to avoid this effect, the Department's standard practice would require sound barriers along I-215 north of Barton Road to be provided with an acoustically absorptive surface with a noise reduction coefficient (NRC) of 0.80 or greater.

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# Chapter 8. Feasibility and Reasonable Allowance

Section 3 of the California Department of Transportation (Department) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) states that a minimum noise reduction of 5 A-weighted decibels (dBA) must be achieved at the impacted receivers in order for the proposed noise abatement measure to be considered feasible. Greater noise reductions are encouraged if they can be reasonably achieved. The following elements may restrict feasibility:

- Topography
- Access requirements for driveways
- Local cross streets
- Underground utilities
- Other noise sources in the area
- Safety considerations

Tables 14, 15, and 16 show the sound levels at the sensitive receivers with sound barriers located along the State right-of-way (ROW) or the edge of shoulder under Alternatives 3, 6, and 7, respectively. Tables 17, 18, and 19 show the traffic noise levels at receivers with sound barriers located along the residential property line under Alternatives 3, 6, and 7, respectively. Underlined noise levels represent a minimum of 5 dBA in noise reduction resulting from the sound barrier height listed.

Table 20 shows the feasible sound barriers along with their heights, approximate length, receiver locations benefited, number of benefited units, and the beginning and ending sound barrier station number. Of the 16 sound barriers evaluated, 14 sound barriers were capable of reducing noise levels by 5 dBA or more, as required to be considered feasible. Sound Barrier (SB) Nos. 4 and 18 were determined to be not feasible because the barriers would not reduce noise levels by 5 dBA or more.

Table 21 lists all the feasible sound barriers along with their height, approximate length, noise attenuation range, number of benefited units, sound barrier location, reasonable allowance per unit, and the total reasonable allowance. The cost consideration in the reasonableness determination of noise abatement is based on a 2011 allowance per benefited unit of $55,000.

## Table 20. Feasible Sound Barriers

| Alt. | Sound Barrier No.[1] | Height (ft) | Approximate Length (ft) | Receiver Locations Benefited | Number of Benefited Units[2] | Station Number | |
|---|---|---|---|---|---|---|---|
| | | | | | | Begin | End |
| 3 | 1a & 1b | 14 | 2,144 | R-1 | 3 | 43+50 & 42+50 | 62+95 & 44+40 |
| | | 16 | 2,144 | R-1 | 3 | | |
| | 2a & 2b | 6 | 2,086 | R-23–R-25, R-27, R-28, EI | 14 | 71+90 & 85+05 | 85+80 & 91+60 |
| | | 8 | 2,086 | R-23–R-25, R-27–R-29, EI | 16 | | |
| | | 10 | 2,086 | R-23–R-25, R-27–R-29, EI | 16 | | |
| | | 12 | 2,086 | R-23–R-25, R-27–R-28, R-31–R-33, EI | 20 | | |
| | | 14[3] | 2,086 | R-23–R-25, R-27–R-33, R-46, R-48, EI | 25 | | |
| | 3 | 12 | 705 | R-83, R-107 | 3 | 62+50 | 67+90 |
| | | 14 | 705 | R-83, R-107 | 3 | | |
| | | 16[3] | 705 | R-83, R-107 | 3 | | |
| | 5 | 8 | 270 | R-115 | 2 | 86+80 | 88+55 |
| | | 10[3] | 270 | R-115, R-123 | 3 | | |
| | | 12 | 270 | R-115, R-123 | 3 | | |
| | | 14 | 270 | R-115, R-123 | 3 | | |
| | | 16 | 270 | R-115, R-123 | 3 | | |
| 6 | 11a & 11b | 10 | 1,801 | R-1 | 3 | 43+50 & 42+50 | 58+50 & 44+40 |
| | | 12 | 1,801 | R-1 | 3 | | |
| | | 14 | 1,801 | R-1 | 3 | | |
| | | 16 | 1,801 | R-1 | 3 | | |
| | 12a & 12b | 6 | 1,985 | R-23–R-25, R-27, R-28, EI | 14 | 71+90 & 85+00 | 85+80 & 90+45 |
| | | 8 | 1,985 | R-23–R-25, R-27–R-29, EI | 16 | | |
| | | 10 | 1,985 | R-23–R-25, R-27–R-29, EI | 16 | | |
| | | 12 | 1,985 | R-23–R-25, R-27–R-33, EI | 22 | | |
| | | 14 | 1,985 | R-23–R-25, R-27–R-33, R-48, EI | 24 | | |
| | 13 | 6 | 926 | R-60 | 1 | 64+75 | 71+65 |
| | | 8[3] | 926 | R-60 | 1 | | |
| | | 10 | 926 | R-60 | 1 | | |
| | | 12 | 926 | R-60, R-77 | 5 | | |
| | | 14 | 926 | R-60, R-77 | 5 | | |
| | | 16 | 926 | R-60-R-62, R-70-R-74, R-77-R-80 | 48 | | |
| | 14 | 6 | 1,291 | R-67, R-68 | 2 | 77+10 | 90+00 |
| | | 8 | 1,291 | R-67, R-68, R-112 | 3 | | |
| | | 10 | 1,291 | R-67, R-68, R-112 | 3 | | |
| | | 12 | 1,291 | R-67, R-68, R-112 | 3 | | |
| | | 14 | 1,291 | R-67, R-68, R-112 | 3 | | |
| | 15 | 8[3] | 270 | R-115, R-123 | 3 | 86+80 | 88+60 |
| | | 10 | 270 | R-115, R-123 | 3 | | |
| | | 12 | 270 | R-115, R-123 | 3 | | |
| | | 14 | 270 | R-115, R-123 | 3 | | |
| | | 16 | 270 | R-115, R-123 | 3 | | |
| 7 | 16a & 16b | 14 | 2,149 | R-1 | 3 | 43+50 & 42+50 | 63+10 & 44+40 |
| | | 16 | 2,149 | R-1 | 3 | | |
| | 17a & 17b | 8 | 2,160 | R-27, R-28, R-35, EI | 7 | 71+90 & 85+05 | 85+80 & 92+20 |
| | | 10 | 2,160 | R-23-R-25, R-27-R-29, R-35, EI | 18 | | |
| | | 12 | 2,160 | R-23-R-25, R-27-R-33, R-35, EI | 24 | | |
| | | 14 | 2,160 | R-23-R-25, R-27-R-35, R-46, R-48, EI | 29 | | |
| | 19 | 12 | 333 | R-60 | 1 | 68+92 | 72+00 |
| | | 14 | 333 | R-60 | 1 | | |
| | | 16 | 333 | R-60 | 1 | | |
| | 20 | 6 | 1,481 | R-68 | 1 | 77+50 | 92+00 |
| | | 8 | 1,481 | R-67, R-68, R-112 | 3 | | |
| | | 10 | 1,481 | R-67, R-68, R-112 | 3 | | |
| | | 12 | 1,481 | R-67, R-68, R-112 | 3 | | |
| | | 14 | 1,481 | R-67, R-68, R-111, R-112, R-115, R-116, R-121 | 13 | | |
| | 21 | 8 | 353 | R-115, R-116 | 4 | 86+80 | 89+40 |

## Table 20. Feasible Sound Barriers

| Alt. | Sound Barrier No.[1] | Height (ft) | Approximate Length (ft) | Receiver Locations Benefited | Number of Benefited Units[2] | Station Number | |
|---|---|---|---|---|---|---|---|
| | | | | | | Begin | End |
| 7 | 21 | 10 | 353 | R-115, R-116, R-123 | 5 | 86+80 | 89+40 |
| | | 12 | 353 | R-115, R-116, R-123 | 5 | | |
| | | 14 | 353 | R-115, R-116, R-123 | 5 | | |
| | | 16 | 353 | R-115, R-116, R-123 | 5 | | |

Source: LSA Associates, Inc., February 2012.
[1] Sound barriers evaluated are acoustically feasible.
[2] Number of units represented by receptor(s) that would experience a noise level reduction of 5 dBA or more by the modeled barrier.
[3] Denotes the minimum wall height required to break the line of sight between the receiver and truck exhaust stack.
dBA = A-weighted decibels
ft = feet

## Table 21. Total Reasonable Allowance Per Sound Barrier

| Alternative | Sound Barrier No. | Height (ft) | Approximate Length (ft) | Noise Attenuation Range (dBA) | Number of Benefited Units[1] | Sound Barrier Location | Reasonable Allowance Per Unit[2] | Total Reasonable Allowance |
|---|---|---|---|---|---|---|---|---|
| 3 | 1a & 1b | 14 | 2,144 | 5 | 3 | Edge of Shoulder | $55,000 | $165,000 |
| | | 16 | 2,144 | 6 | 3 | | $55,000 | $165,000 |
| | 2a & 2b | 6 | 2,086 | 5-8 | 14 | State ROW | $55,000 | $770,000 |
| | | 8 | 2,086 | 5-10 | 16 | | $55,000 | $880,000 |
| | | 10 | 2,086 | 6-12 | 16 | | $55,000 | $880,000 |
| | | 12 | 2,086 | 5-13 | 20 | | $55,000 | $1,100,000 |
| | | 14[3] | 2,086 | 5-14 | 25 | | $55,000 | $1,375,000 |
| | 3 | 12 | 705 | 5 | 3 | State ROW | $55,000 | $165,000 |
| | | 14 | 705 | 5 | 3 | | $55,000 | $165,000 |
| | | 16[3] | 705 | 5-6 | 3 | | $55,000 | $165,000 |
| | 5 | 8 | 270 | 5 | 2 | Residential Property Line | $55,000 | $110,000 |
| | | 10[3] | 270 | 5-7 | 3 | | $55,000 | $165,000 |
| | | 12 | 270 | 5-7 | 3 | | $55,000 | $165,000 |
| | | 14 | 270 | 6-8 | 3 | | $55,000 | $165,000 |
| | | 16 | 270 | 6-8 | 3 | | $55,000 | $165,000 |
| 6 | 11a &11b | 10 | 1,801 | 5 | 3 | Edge of Shoulder | $55,000 | $165,000 |
| | | 12 | 1,801 | 6 | 3 | | $55,000 | $165,000 |
| | | 14 | 1,801 | 7 | 3 | | $55,000 | $165,000 |
| | | 16 | 1,801 | 8 | 3 | | $55,000 | $165,000 |
| | 12a &12b | 6 | 1,985 | 5-8 | 14 | Within State ROW | $55,000 | $770,000 |
| | | 8 | 1,985 | 5-10 | 16 | | $55,000 | $880,000 |
| | | 10 | 1,985 | 6-11 | 16 | | $55,000 | $880,000 |
| | | 12 | 1,985 | 5-13 | 22 | | $55,000 | $1,210,000 |
| | | 14 | 1,985 | 5-14 | 24 | | $55,000 | $1,320,000 |
| | 13 | 6 | 926 | 6 | 1 | State ROW | $55,000 | $55,000 |
| | | 8[3] | 926 | 7 | 1 | | $55,000 | $55,000 |
| | | 10 | 926 | 8 | 1 | | $55,000 | $55,000 |
| | | 12 | 926 | 5-8 | 5 | | $55,000 | $275,000 |
| | | 14 | 926 | 5-9 | 5 | | $55,000 | $275,000 |
| | | 16 | 926 | 5-10 | 48 | | $55,000 | $2,640,000 |
| | 14 | 6 | 1,291 | 5-6 | 2 | Edge of Shoulder | $55,000 | $110,000 |

## Table 21. Total Reasonable Allowance Per Sound Barrier

| Alternative | Sound Barrier No. | Height (ft) | Approximate Length (ft) | Noise Attenuation Range (dBA) | Number of Benefited Units[1] | Sound Barrier Location | Reasonable Allowance Per Unit[2] | Total Reasonable Allowance |
|---|---|---|---|---|---|---|---|---|
| 6 | 14 | 8 | 1,291 | 5-7 | 3 | Edge of Shoulder | $55,000 | $165,000 |
| | | 10 | 1,291 | 6-8 | 3 | | $55,000 | $165,000 |
| | | 12 | 1,291 | 8 | 3 | | $55,000 | $165,000 |
| | | 14 | 1,291 | 8-9 | 3 | | $55,000 | $165,000 |
| | 15 | 8[3] | 270 | 6-7 | 3 | Residential Property Line | $55,000 | $165,000 |
| | | 10 | 270 | 8-9 | 3 | | $55,000 | $165,000 |
| | | 12 | 270 | 10-11 | 3 | | $55,000 | $165,000 |
| | | 14 | 270 | 11-12 | 3 | | $55,000 | $165,000 |
| | | 16 | 270 | 12-13 | 3 | | $55,000 | $165,000 |
| 7 | 16a & 16b | 14 | 2,149 | 5 | 3 | Edge of Shoulder | $55,000 | $165,000 |
| | | 16 | 2,149 | 7 | 3 | | $55,000 | $165,000 |
| | 17a & 17b | 8 | 2,160 | 5-7 | 7 | Within State ROW | $55,000 | $385,000 |
| | | 10 | 2,160 | 5-9 | 18 | | $55,000 | $990,000 |
| | | 12 | 2,160 | 5-11 | 24 | | $55,000 | $1,320,000 |
| | | 14 | 2,160 | 5-12 | 29 | | $55,000 | $1,595,000 |
| | 19 | 12 | 333 | 5 | 1 | State ROW | $55,000 | $55,000 |
| | | 14 | 333 | 5 | 1 | | $55,000 | $55,000 |
| | | 16 | 333 | 5 | 1 | | $55,000 | $55,000 |
| | 20 | 6 | 1,481 | 5 | 1 | Edge of Shoulder | $55,000 | $55,000 |
| | | 8 | 1,481 | 5-6 | 3 | | $55,000 | $165,000 |
| | | 10 | 1,481 | 6-7 | 3 | | $55,000 | $165,000 |
| | | 12 | 1,481 | 6-7 | 3 | | $55,000 | $165,000 |
| | | 14 | 1,481 | 5-8 | 13 | | $55,000 | $715,000 |
| | 21 | 8 | 353 | 5 | 4 | Residential Property Line | $55,000 | $220,000 |
| | | 10 | 353 | 5-7 | 5 | | $55,000 | $275,000 |
| | | 12 | 353 | 5-7 | 5 | | $55,000 | $275,000 |
| | | 14 | 353 | 6-8 | 5 | | $55,000 | $275,000 |
| | | 16 | 353 | 6-8 | 5 | | $55,000 | $275,000 |

Source: LSA Associates, Inc., February 2012.

[1] Number of units represented by receptors that would experience a noise level reduction of 5 dBA or more by the modeled barrier.

[2] This value is the current base allowance provided by Department.

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

Department = California Department of Transportation dBA = A-weighted decibels ft = feet ROW = right-of-way

The design of sound barriers presented in this report is preliminary and has been conducted at a level appropriate for environmental review and not for final design of the project. If pertinent parameters change substantially during the final project design, preliminary sound barrier designs may be modified or eliminated from the final project. A final decision regarding the construction of noise abatement measures will be made upon completion of the public involvement process during the final project design process.

A Noise Abatement Decision Report (NADR) will be prepared for this project. The NADR is a design responsibility and is prepared to compile information from the Noise Study Report (NSR), other relevant environmental studies, and design considerations into a single comprehensive document before public review of the project. The NADR is prepared after completion of the NSR and prior to publication of the draft environmental document. The NADR includes noise abatement construction cost estimates that have been prepared and signed by the project engineer based on site-specific conditions. Construction cost estimates are compared to reasonable allowances in the NADR to identify which wall configurations are reasonable from a cost perspective. The reasonableness determination of the feasible sound barriers shown in Table 21 will be reported in the NADR for the proposed project.

# Chapter 9. Construction Noise

Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on access roads leading to the site. The pieces of heavy equipment for grading and construction activities will be moved on site, will remain for the duration of each construction phase, and will not add to the daily traffic volume in the project vicinity. A high single-event noise exposure potential at a maximum level of 87 maximum instantaneous sound level measured in A-weighted decibels (dBA $L_{max}$) from trucks passing at 50 feet (ft) will exist. However, the projected construction traffic will be minimal when compared to existing traffic volumes on Interstate 215 (I-215) and other affected streets, and its associated long-term noise level change will not be perceptible. Therefore, short-term construction-related worker commutes and equipment transport noise impacts would be less than substantial.

The second type of short-term noise impact is related to noise generated during roadway construction. Construction is performed in discrete steps, each of which has its own mix of equipment and consequently its own noise characteristics. These various sequential phases would change the character of the noise generated and the noise levels along the project alignment as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table 22 lists typical construction equipment noise levels ($L_{max}$) recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receiver.

Typical noise levels at 50 ft from an active construction area range up to 91 dBA $L_{max}$ during the noisiest construction phases. The site preparation phase, which includes grading and paving, tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, and front loaders. Earthmoving and compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full power operation followed by 3 or 4 minutes at lower power settings.

## Table 22. Typical Construction Equipment Noise Levels

| Type of Equipment | Range of Maximum Sound Levels (dBA $L_{max}$ at 50 ft) | Suggested Maximum Sound Levels for Analysis (dBA $L_{max}$ at 50 ft) |
|---|---|---|
| Pile drivers | 81–96 | 93 |
| Rock drills | 83–99 | 96 |
| Jackhammers | 75–85 | 82 |
| Pneumatic tools | 78–88 | 85 |
| Pumps | 74–84 | 80 |
| Scrapers | 83–91 | 87 |
| Haul trucks | 83–94 | 88 |
| Cranes | 79–86 | 82 |
| Portable generators | 71–87 | 80 |
| Rollers | 75–82 | 80 |
| Dozers | 77–90 | 85 |
| Tractors | 77–82 | 80 |
| Front-end loaders | 77–90 | 86 |
| Hydraulic backhoe | 81–90 | 86 |
| Hydraulic excavators | 81–90 | 86 |
| Graders | 79–89 | 86 |
| Air compressors | 76–89 | 86 |
| Trucks | 81–87 | 86 |

Source: *Noise Control for Buildings and Manufacturing Plants* (Bolt, Beranek & Newman, 1987).
dBA = A-weighted decibels
ft = feet
$L_{max}$ = maximum instantaneous sound level

Construction of the proposed project is expected to require the use of earthmovers, bulldozers, water trucks, and pickup trucks. Noise associated with the use of construction equipment is estimated between 79 and 89 dBA $L_{max}$ at a distance of 50 ft from the active construction area for the grading phase. As seen in Table 22, the maximum noise level generated by each earthmover is assumed to be approximately 86 dBA $L_{max}$ at 50 ft from the earthmover in operation. Each bulldozer would generate approximately 85 dBA $L_{max}$ at 50 ft. The maximum noise level generated by water trucks and pickup trucks is approximately 86 dBA $L_{max}$ at 50 ft from these vehicles. Each doubling of the sound source with equal strength increases the noise level by 3 dBA. Each piece of construction equipment operates as an individual point source. The worst-case composite noise level at the nearest residence during this phase of construction would be 91 dBA $L_{max}$ (at a distance of 50 ft from an active construction area).

In addition to standard construction equipment, the project may require the use of pile drivers. As shown in Table 22, pile driving generates noise levels of approximately 93 dBA $L_{max}$ at 50 ft. If pile driving is conducted concurrently with site preparation,

the construction site could potentially generate noise levels of 95 dBA $L_{max}$ at a distance of 50 ft.

The closest sensitive receiver locations are located 50 ft from the project construction areas. Therefore, these receiver locations may be subject to short-term noise reaching 95 dBA $L_{max}$ generated by construction activities along the project alignment. Compliance with the construction hours specified in the City of Colton's Bid and Contract template, City of Grand Terrace Municipal Code, the Department's Standard Special Provisions (SSP) will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by the Department's Standard Specifications in Section 14-8.02, "Noise Control," and also by Standard Special Provisions S5-310, "Noise Control." Noise control shall conform to the provisions in Section 14-8.02 and the Standard Special Provision in S5-310. The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dBA $L_{max}$ at a distance of 50 ft. The Contractor should use an alternative warning method instead of a sound signal unless required by safety laws. In addition, the Contractor shall equip all internal combustion engines with the manufacturer-recommended muffler and shall not operate any internal combustion engine on the job site without the appropriate muffler.

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# Chapter 10. References

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Federal Highway Administration, Traffic Noise Model (TNM) Version 2.5, April 2004.

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United States Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise, CFR 23 Part 772, as amended July 8, 1982.

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# Appendix A. Traffic Counts, Measured Vehicle Speeds, Modeled Traffic Volumes, Noise Monitoring Results, and Supplemental Data

This appendix contains the traffic counts with measured vehicle speeds during ambient noise level measurement; modeled traffic volumes for existing, Future No Build, and Alternatives 3, 6, and 7 conditions; noise monitoring results; supplemental data justifying receiver and building row elevations located outside of the topographic map coverage, the description of each TNM 2.5 file, and roadway profiles for each build alternative.

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**TRAFFIC COUNTS AND MEASURED VEHICLE SPEEDS FOR EXISTING CONDITIONS (MODEL CALIBRATION) AND MODELED FUTURE TRAFFIC VOLUMES (FUTURE NO BUILD AND ALTERNATIVES 3, 6, AND 7)**

## Traffic Counts for Model Calibration (Short-Term Noise Level Measurements)

| | Traffic Counts (15 min) | | | Distribution | | | Traffic Volume (Hourly) | | | Lanes 1 & 2 | | | Lane 3 | | | Measured Average Speed | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Auto | Medium | Heavy | Auto | Medium | Heavy | Auto | Medium | Heavy | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Medium | Heavy |
| | | | | | | | | | | | | | | | | | | |
| **M-1** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1185 | 36 | 44 | 0.94 | 0.03 | 0.03 | 4740 | 144 | 176 | 3160 | 96 | 117 | 1580 | 48 | 59 | 60 | 47 | 53 |
| I-215 SB | 1108 | 30 | 44 | 0.94 | 0.03 | 0.04 | 4432 | 120 | 176 | 2955 | 80 | 117 | 1477 | 40 | 59 | 60 | 47 | 53 |
| | | | | | | | | | | | | | | | | | | |
| **M-2** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 980 | 38 | 35 | 0.93 | 0.04 | 0.03 | 3920 | 152 | 140 | 2613 | 101 | 93 | 1307 | 51 | 47 | 67 | 61 | 60 |
| I-215 SB | 956 | 26 | 47 | 0.93 | 0.03 | 0.05 | 3824 | 104 | 188 | 2549 | 69 | 125 | 1275 | 35 | 63 | 67 | 61 | 60 |
| Barton NB Off Ramp | 78 | 8 | 5 | 0.86 | 0.09 | 0.05 | 312 | 32 | 20 | | | | | | | 45 | 45 | 40 |
| Michigan Avenue NB | 60 | 5 | 1 | 0.91 | 0.08 | 0.02 | 240 | 20 | 4 | | | | | | | 35 | 35 | 30 |
| Michigan Avenue SB | 50 | 2 | 1 | 0.94 | 0.04 | 0.02 | 200 | 8 | 4 | | | | | | | 35 | 35 | 30 |
| | | | | | | | | | | | | | | | | | | |
| **M-3** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1022 | 71 | 40 | 0.90 | 0.06 | 0.04 | 4088 | 284 | 160 | 2725 | 189 | 107 | 1363 | 95 | 53 | 61 | 51 | 52 |
| I-215 SB | 878 | 27 | 36 | 0.93 | 0.03 | 0.04 | 3512 | 108 | 144 | 2341 | 72 | 96 | 1171 | 36 | 48 | 61 | 51 | 52 |
| Barton NB On Ramp | 56 | 6 | 3 | 0.86 | 0.09 | 0.05 | 224 | 24 | 12 | | | | | | | 61 | 51 | 52 |
| Barton EB | 105 | 6 | 1 | 0.94 | 0.05 | 0.01 | 420 | 24 | 4 | | | | | | | 40 | 40 | 35 |
| Barton WB | 99 | 3 | 3 | 0.94 | 0.03 | 0.03 | 396 | 12 | 12 | | | | | | | 40 | 40 | 35 |
| | | | | | | | | | | | | | | | | | | |
| **M-4** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1263 | 52 | 39 | 0.93 | 0.04 | 0.03 | 5052 | 208 | 156 | 3368 | 139 | 104 | 1684 | 69 | 52 | 64 | 52 | 56 |
| I-215 SB | 891 | 44 | 59 | 0.90 | 0.04 | 0.06 | 3564 | 176 | 236 | 2376 | 117 | 157 | 1188 | 59 | 79 | 64 | 52 | 56 |
| Barton NB On Ramp | 73 | 8 | 2 | 0.88 | 0.10 | 0.02 | 292 | 32 | 8 | | | | | | | 64 | 52 | 56 |
| | | | | | | | | | | | | | | | | | | |
| **M-5** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 918 | 39 | 40 | 0.92 | 0.04 | 0.04 | 3672 | 156 | 160 | 2448 | 104 | 107 | 1224 | 52 | 53 | 67 | 52 | 52 |
| I-215 SB | 915 | 59 | 46 | 0.90 | 0.06 | 0.05 | 3660 | 236 | 184 | 2440 | 157 | 123 | 1220 | 79 | 61 | 67 | 52 | 52 |
| Barton NB On Ramp | 52 | 3 | 5 | 0.87 | 0.05 | 0.08 | 208 | 12 | 20 | | | | | | | 67 | 52 | 52 |
| Barton SB Off Ramp | 76 | 9 | 2 | 0.87 | 0.10 | 0.02 | 304 | 36 | 8 | | | | | | | 45 | 45 | 40 |
| | | | | | | | | | | | | | | | | | | |
| **M-6** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 918 | 39 | 40 | 0.92 | 0.04 | 0.04 | 3672 | 156 | 160 | 2448 | 104 | 107 | 1224 | 52 | 53 | 66 | 64 | 61 |
| I-215 SB | 915 | 59 | 46 | 0.90 | 0.06 | 0.05 | 3660 | 236 | 184 | 2440 | 157 | 123 | 1220 | 79 | 61 | 66 | 63 | 61 |
| Barton NB On Ramp | 52 | 3 | 5 | 0.87 | 0.05 | 0.08 | 208 | 12 | 20 | | | | | | | 66 | 63 | 61 |
| Barton SB Off Ramp | 76 | 9 | 2 | 0.87 | 0.10 | 0.02 | 304 | 36 | 8 | | | | | | | 55 | 51 | 48 |
| | | | | | | | | | | | | | | | | | | |
| **M-7** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 947 | 74 | 61 | 0.88 | 0.07 | 0.06 | 3788 | 296 | 244 | 2525 | 197 | 163 | 1263 | 99 | 81 | 65 | 55 | 49 |
| I-215 SB | 983 | 39 | 56 | 0.91 | 0.04 | 0.05 | 3932 | 156 | 224 | 2621 | 104 | 149 | 1311 | 52 | 75 | 65 | 55 | 49 |
| Barton NB On Ramp | 70 | 3 | 0 | 0.96 | 0.04 | 0.00 | 280 | 12 | 0 | | | | | | | 65 | 55 | 0 |
| Barton SB Off Ramp | 74 | 3 | 3 | 0.93 | 0.04 | 0.04 | 296 | 12 | 12 | | | | | | | 45 | 45 | 40 |
| | | | | | | | | | | | | | | | | | | |
| **M-8** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1067 | 41 | 30 | 0.94 | 0.04 | 0.03 | 4268 | 164 | 120 | 2845 | 109 | 80 | 1423 | 55 | 40 | 60 | 47 | 53 |
| I-215 SB | 1034 | 48 | 33 | 0.93 | 0.04 | 0.03 | 4136 | 192 | 132 | 2757 | 128 | 88 | 1379 | 64 | 44 | 60 | 47 | 53 |
| Barton NB On Ramp | 83 | 2 | 2 | 0.95 | 0.02 | 0.02 | 332 | 8 | 8 | | | | | | | 60 | 47 | 53 |
| Barton SB Off Ramp | 90 | 5 | 2 | 0.93 | 0.05 | 0.02 | 360 | 20 | 8 | | | | | | | 45 | 45 | 40 |
| Barton EB | 73 | 3 | 1 | 0.95 | 0.04 | 0.01 | 292 | 12 | 4 | | | | | | | 40 | 40 | 35 |
| Barton WB | 73 | 3 | 1 | 0.95 | 0.04 | 0.01 | 292 | 12 | 4 | | | | | | | 40 | 40 | 35 |

## Traffic Counts for Model Calibration (Short-Term Noise Level Measurements)

| | Traffic Counts (15 min) | | | Distribution | | | Traffic Volume (Hourly) | | | Lanes 1 & 2 | | | Lane 3 | | | Measured Average Speed | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Auto | Medium | Heavy | Auto | Medium | Heavy | Auto | Medium | Heavy | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Medium | Heavy |
| | | | | | | | | | | | | | | | | | | |
| **M-9** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1008 | 27 | 64 | 0.92 | 0.02 | 0.06 | 4032 | 108 | 256 | 2688 | 72 | 171 | 1344 | 36 | 85 | 71 | 58 | 58 |
| I-215 SB | 1019 | 51 | 34 | 0.92 | 0.05 | 0.03 | 4076 | 204 | 136 | 2717 | 136 | 91 | 1359 | 68 | 45 | 71 | 58 | 58 |
| Barton EB | 127 | 7 | 5 | 0.91 | 0.05 | 0.04 | 508 | 28 | 20 | | | | | | | 40 | 40 | 35 |
| Barton WB | 99 | 2 | 4 | 0.94 | 0.02 | 0.04 | 396 | 8 | 16 | | | | | | | 40 | 40 | 35 |
| Grand Terrace NB | 10 | 1 | 0 | 0.91 | 0.09 | 0.00 | 40 | 4 | 0 | | | | | | | 30 | 30 | 0 |
| Grand Terrace SB | 5 | 0 | 0 | 1.00 | 0.00 | 0.00 | 20 | 0 | 0 | | | | | | | 30 | 0 | 0 |
| Barton SB Off Ramp | 88 | 7 | 4 | 0.89 | 0.07 | 0.04 | 352 | 28 | 16 | | | | | | | 45 | 45 | 40 |
| | | | | | | | | | | | | | | | | | | |
| **M-10** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1042 | 48 | 40 | 0.92 | 0.04 | 0.04 | 4168 | 192 | 160 | 2779 | 128 | 107 | 1389 | 64 | 53 | 64 | 53 | 54 |
| I-215 SB | 1005 | 25 | 45 | 0.93 | 0.02 | 0.04 | 4020 | 100 | 180 | 2680 | 67 | 120 | 1340 | 33 | 60 | 64 | 53 | 54 |
| Barton NB On Ramp | 70 | 4 | 2 | 0.92 | 0.05 | 0.03 | 280 | 16 | 8 | | | | | | | 64 | 53 | 54 |
| Barton SB Off Ramp | 88 | 7 | 0 | 0.93 | 0.07 | 0.00 | 352 | 28 | 0 | | | | | | | 45 | 45 | 0 |
| | | | | | | | | | | | | | | | | | | |
| **M-11** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1042 | 48 | 40 | 0.92 | 0.04 | 0.04 | 4168 | 192 | 160 | 2779 | 128 | 107 | 1389 | 64 | 53 | 64 | 53 | 54 |
| I-215 SB | 1005 | 25 | 45 | 0.93 | 0.02 | 0.04 | 4020 | 100 | 180 | 2680 | 67 | 120 | 1340 | 33 | 60 | 64 | 53 | 54 |
| Barton NB On Ramp | 70 | 4 | 2 | 0.92 | 0.05 | 0.03 | 280 | 16 | 8 | | | | | | | 64 | 53 | 54 |
| Barton SB Off Ramp | 88 | 7 | 0 | 0.93 | 0.07 | 0.00 | 352 | 28 | 0 | | | | | | | 45 | 45 | 0 |
| | | | | | | | | | | | | | | | | | | |
| **M-12** | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1056 | 33 | 40 | 0.94 | 0.03 | 0.04 | 4224 | 132 | 160 | 2816 | 88 | 107 | 1408 | 44 | 53 | 69 | 58 | 52 |
| I-215 SB | 1133 | 49 | 49 | 0.92 | 0.04 | 0.04 | 4532 | 196 | 196 | 3021 | 131 | 131 | 1511 | 65 | 65 | 69 | 58 | 52 |
| Barton NB On Ramp | 75 | 2 | 0 | 0.97 | 0.03 | 0.00 | 300 | 8 | 0 | | | | | | | 69 | 58 | 0 |
| Barton SB Off Ramp | 91 | 2 | 1 | 0.97 | 0.02 | 0.01 | 364 | 8 | 4 | | | | | | | 45 | 45 | 40 |
| Newport Avenue EB | 13 | 0 | 0 | 1.00 | 0.00 | 0.00 | 52 | 0 | 0 | | | | | | | 30 | 0 | 0 |
| Newport Avenue WB | 8 | 0 | 0 | 1.00 | 0.00 | 0.00 | 32 | 0 | 0 | | | | | | | 30 | 0 | 0 |

| Traffic Counts for Model Calibration (Exterior/Interior Noise Level Measurement) | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Traffic Counts (15 min) | | | | Distribution | | | | Traffic Volume (Hourly) | | | | Lanes 1 & 2 | | | | Lane 3 | | | | Measured Average Speed | | |
| | Auto | Medium | Heavy | | Auto | Medium | Heavy | | Auto | Medium | Heavy | | Auto | Med | Heavy | | Auto | Med | Heavy | | Auto | Medium | Heavy |
| **Exterior/Interior 1** | | | | | | | | | | | | | | | | | | | | | | | |
| I-215 NB | 1263 | 52 | 39 | | 0.93 | 0.04 | 0.03 | | 5052 | 208 | 156 | | 3368 | 139 | 104 | | 1684 | 69 | 52 | | 64 | 52 | 56 |
| I-215 SB | 891 | 44 | 59 | | 0.90 | 0.04 | 0.06 | | 3564 | 176 | 236 | | 2376 | 117 | 157 | | 1188 | 59 | 79 | | 64 | 52 | 56 |
| Barton NB on Ramp | 73 | 8 | 2 | | 0.88 | 0.10 | 0.02 | | 292 | 32 | 8 | | | | | | | | | | 64 | 52 | 56 |
| | | | | | | | | | | | | | | | | | | | | | | | |

## Future No Build Traffic Volumes

| Future No Build | AM Peak | PM Peak | Worst-Case | Volume | No of Lanes | Vehicle Distribution | | | Modeled Traffic Volume | | | Vehicle Speeds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Med | Heavy |
| I-215 NB Lanes 1 & 2 | 5509 | 6329 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 SB Lanes 1 & 2 | 5479 | 5519 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 NB Lane 3 | 2754 | 3165 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 SB Lane 3 | 2740 | 2759 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 NB HOV | 1430 | 1605 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| I-215 SB HOV | 1524 | 1551 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| Barton NB Off ramp | 706 | 935 | 1200 | 935 | 1 | 0.91 | 0.06 | 0.03 | 851 | 56 | 28 | 45 | 45 | 40 |
| Barton NB On ramp | 1095 | 922 | 1200 | 1095 | 1 | 0.91 | 0.06 | 0.03 | 996 | 66 | 33 | 65 | 65 | 55 |
| Barton SB On ramp | 1026 | 873 | 1200 | 1026 | 1 | 0.91 | 0.06 | 0.03 | 934 | 62 | 31 | 65 | 65 | 55 |
| Barton SB Off ramp | 710 | 889 | 1200 | 889 | 1 | 0.91 | 0.06 | 0.03 | 809 | 53 | 27 | 45 | 45 | 40 |
| La Crosse (northern) | 328 | 366 | 1000 | 366 | 1 | 1.00 | 0.00 | 0.00 | 366 | 0 | 0 | 30 | 0 | 0 |
| Grand Terrace NB | 253 | 78 | 1000 | 253 | 1 | 0.95 | 0.05 | 0.00 | 240 | 13 | 0 | 30 | 30 | 0 |
| Grand Terrace SB | 214 | 41 | 1000 | 214 | 1 | 0.95 | 0.05 | 0.00 | 203 | 11 | 0 | 30 | 30 | 0 |
| Vivienda NB | 220 | 68 | 1000 | 220 | 1 | 1.00 | 0.00 | 0.00 | 220 | 0 | 0 | 30 | 0 | 0 |
| Vivienda SB | 186 | 36 | 1000 | 186 | 1 | 1.00 | 0.00 | 0.00 | 186 | 0 | 0 | 30 | 0 | 0 |
| La Crosse NB | 24 | 71 | 1000 | 71 | 1 | 0.94 | 0.06 | 0.00 | 67 | 4 | 0 | 30 | 30 | 0 |
| La Crosse SB | 46 | 16 | 1000 | 46 | 1 | 0.94 | 0.06 | 0.00 | 43 | 3 | 0 | 30 | 30 | 0 |
| Michigan NB | 1079 | 880 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 35 | 30 |
| Michigan SB | 653 | 875 | 1000 | 875 | 1 | 0.92 | 0.06 | 0.02 | 805 | 53 | 18 | 35 | 35 | 30 |
| Barton WB (La Cadena to SB Ramps) | 769 | 992 | 1200 | 992 | 2 | 0.94 | 0.04 | 0.02 | 932 | 40 | 20 | 40 | 40 | 35 |
| Barton WB (SB Ramps to NB Ramps) | 1509 | 1402 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton WB (NB Ramp to Michigan) | 2246 | 2023 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton WB (East of Michigan) | 1490 | 1762 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (La Cadena to SB Ramps) | 868 | 1407 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (SB Ramps to NB Ramps) | 1136 | 1779 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (NB Ramps and Michigan) | 1483 | 2413 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (East of Michigan) | 1141 | 2146 | 1200 | 1200 | 2 | 0.94 | 0.04 | 0.02 | 1128 | 48 | 24 | 40 | 40 | 35 |

## Alternative 3 Traffic Volumes

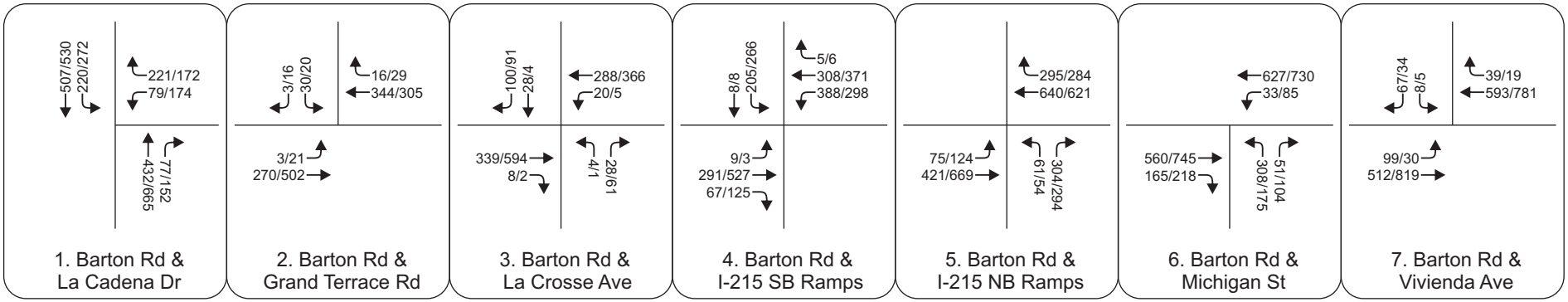
| Alternative 3 | AM Peak | PM Peak | Worst-Case | Volume | No of Lanes | Vehicle Distribution | | | Modeled Traffic Volume | | | Vehicle Speeds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Med | Heavy |
| I-215 NB Lanes 1 & 2 | 5509 | 6329 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 SB Lanes 1 & 2 | 5479 | 5519 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 NB Lane 3 | 2754 | 3165 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 SB Lane 3 | 2740 | 2759 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 NB HOV | 1430 | 1605 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| I-215 SB HOV | 1524 | 1551 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| Barton NB Off ramp | 706 | 935 | 1200 | 935 | 1 | 0.91 | 0.06 | 0.03 | 851 | 56 | 28 | 45 | 45 | 40 |
| Barton NB On ramp | 1095 | 922 | 1200 | 1095 | 1 | 0.91 | 0.06 | 0.03 | 996 | 66 | 33 | 65 | 65 | 55 |
| Barton SB On ramp | 1026 | 873 | 1200 | 1026 | 1 | 0.91 | 0.06 | 0.03 | 934 | 62 | 31 | 65 | 65 | 55 |
| Barton SB Off ramp | 688 | 883 | 1200 | 883 | 1 | 0.91 | 0.06 | 0.03 | 804 | 53 | 26 | 45 | 45 | 40 |
| Grand Terrace NB | 257 | 84 | 1000 | 257 | 1 | 0.95 | 0.05 | 0.00 | 244 | 13 | 0 | 30 | 30 | 0 |
| Grand Terrace SB | 214 | 41 | 1000 | 214 | 1 | 0.95 | 0.05 | 0.00 | 203 | 11 | 0 | 30 | 30 | 0 |
| La Crosse NB | 52 | 192 | 1000 | 192 | 1 | 0.94 | 0.06 | 0.00 | 180 | 12 | 0 | 30 | 30 | 0 |
| La Crosse SB | 61 | 70 | 1000 | 70 | 1 | 0.94 | 0.06 | 0.00 | 66 | 4 | 0 | 30 | 30 | 0 |
| Vivienda NB | 261 | 166 | 1000 | 261 | 1 | 1.00 | 0.00 | 0.00 | 261 | 0 | 0 | 30 | 0 | 0 |
| Vivienda SB | 186 | 36 | 1000 | 186 | 1 | 1.00 | 0.00 | 0.00 | 186 | 0 | 0 | 30 | 0 | 0 |
| Commerce NB | 1083 | 905 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 0 | 0 |
| Commerce SB | 686 | 882 | 1000 | 882 | 1 | 0.92 | 0.06 | 0.02 | 811 | 53 | 18 | 35 | 0 | 0 |
| Barton WB (La Cadena to Grand Terrace/La Crosse) | 818 | 1039 | 2400 | 1039 | 2 | 0.94 | 0.04 | 0.02 | 977 | 42 | 21 | 40 | 40 | 35 |
| Barton WB (Grand Terrace/La Crosse to SB Ramps) | 879 | 1136 | 2400 | 1136 | 2 | 0.94 | 0.04 | 0.02 | 1068 | 45 | 23 | 40 | 40 | 35 |
| Barton WB (SB Ramps to NB Ramps) | 1498 | 1391 | 2400 | 1498 | 2 | 0.94 | 0.04 | 0.02 | 1408 | 60 | 30 | 40 | 40 | 35 |
| Barton WB (NB Ramps to Michigan/Vivienda) | 2235 | 2012 | 2400 | 2235 | 2 | 0.94 | 0.04 | 0.02 | 2101 | 89 | 45 | 40 | 40 | 35 |
| Barton WB (East of Michigan/Vivenda) | 1445 | 1751 | 2400 | 1751 | 2 | 0.94 | 0.04 | 0.02 | 1646 | 70 | 35 | 40 | 40 | 35 |
| Barton EB (La Cadena to Grand Terrace/La Crosse) | 858 | 1212 | 2400 | 1212 | 2 | 0.94 | 0.04 | 0.02 | 1139 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (Grand Terrace/La Crosse to SB ramps) | 873 | 1514 | 2400 | 1514 | 2 | 0.94 | 0.04 | 0.02 | 1423 | 61 | 30 | 40 | 40 | 35 |
| Barton EB (SB Ramps to NB Ramps) | 1136 | 1779 | 2400 | 1779 | 2 | 0.94 | 0.04 | 0.02 | 1672 | 71 | 36 | 40 | 40 | 35 |
| Barton EB (NB Ramps to Michigan/Vivienda) | 1483 | 2413 | 2400 | 2400 | 2 | 0.94 | 0.04 | 0.02 | 2256 | 96 | 48 | 40 | 40 | 35 |
| Barton EB (East of Michigan/Vivenda) | 1015 | 2045 | 2400 | 2045 | 2 | 0.94 | 0.04 | 0.02 | 1922 | 82 | 41 | 40 | 40 | 35 |

## Alternative 6 Traffic Volumes

| Alternative 6 | AM Peak | PM Peak | Worst-Case | Volume | No of Lanes | Vehicle Distribution | | | Modeled Traffic Volume | | | Vehicle Speeds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Med | Heavy |
| I-215 NB Lanes 1 & 2 | 5509 | 6329 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 SB Lanes 1 & 2 | 5479 | 5519 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 NB Lane 3 | 2754 | 3165 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 SB Lane 3 | 2740 | 2759 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 NB HOV | 1430 | 1605 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| I-215 SB HOV | 1524 | 1551 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| Barton NB Off ramp | 706 | 935 | 1200 | 935 | 1 | 0.91 | 0.06 | 0.03 | 851 | 56 | 28 | 45 | 45 | 40 |
| Barton NB On ramp | 1094 | 422 | 1200 | 1094 | 1 | 0.91 | 0.06 | 0.03 | 996 | 66 | 33 | 65 | 65 | 55 |
| Barton SB On ramp | 1026 | 873 | 1200 | 1026 | 1 | 0.91 | 0.06 | 0.03 | 934 | 62 | 31 | 65 | 65 | 55 |
| Barton SB Off ramp | 688 | 883 | 1200 | 883 | 1 | 0.91 | 0.06 | 0.03 | 804 | 53 | 26 | 45 | 45 | 40 |
| Grand Terrace NB | 257 | 84 | 1000 | 257 | 1 | 0.95 | 0.05 | 0.00 | 244 | 13 | 0 | 30 | 30 | 0 |
| Grand Terrace SB | 214 | 41 | 1000 | 214 | 1 | 0.95 | 0.05 | 0.00 | 203 | 11 | 0 | 30 | 30 | 0 |
| Vivienda NB | 52 | 192 | 1000 | 192 | 1 | 1.00 | 0.00 | 0.00 | 192 | 0 | 0 | 30 | 0 | 0 |
| Vivienda SB | 61 | 70 | 1000 | 70 | 1 | 1.00 | 0.00 | 0.00 | 70 | 0 | 0 | 30 | 0 | 0 |
| Commerce NB | 1582 | 1606 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 35 | 30 |
| Commerce SB | 1574 | 1570 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 35 | 30 |
| Barton WB (La Cadena to Grand Terrace/La Crosse) | 818 | 860 | 2400 | 860 | 2 | 0.94 | 0.04 | 0.02 | 808 | 34 | 17 | 40 | 40 | 35 |
| Barton WB (Grand Terrace/La Crosse to SB Ramps) | 879 | 873 | 2400 | 879 | 2 | 0.94 | 0.04 | 0.02 | 826 | 35 | 18 | 40 | 40 | 35 |
| Barton WB (SB Ramps to Michigan/Vivienda) | 1498 | 1139 | 2400 | 1498 | 2 | 0.94 | 0.04 | 0.02 | 1408 | 60 | 30 | 40 | 40 | 35 |
| Barton WB (East of Michigan/Vivienda) | 1445 | 1021 | 2400 | 1445 | 2 | 0.94 | 0.04 | 0.02 | 1358 | 58 | 29 | 40 | 40 | 35 |
| Barton EB (La Cadena to Grand Terrace/La Crosse) | 1039 | 1212 | 2400 | 1212 | 2 | 0.94 | 0.04 | 0.02 | 1139 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (Grand Terrace/La Crosse to SB Ramps) | 1136 | 1514 | 2400 | 1514 | 2 | 0.94 | 0.04 | 0.02 | 1423 | 61 | 30 | 40 | 40 | 35 |
| Barton EB (SB Ramps to Michigan/Vivienda) | 1498 | 1779 | 2400 | 1779 | 2 | 0.94 | 0.04 | 0.02 | 1672 | 71 | 36 | 40 | 40 | 35 |
| Barton EB (East of Michigan/Vivienda) | 1445 | 2046 | 2400 | 2046 | 2 | 0.94 | 0.04 | 0.02 | 1923 | 82 | 41 | 40 | 40 | 35 |

## Alternative 7 Traffic Volumes

| Alternative 7 | AM Peak | PM Peak | Worst-Case | Volume | No of Lanes | Vehicle Distribution | | | Modeled Traffic Volume | | | Vehicle Speeds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Auto | Med | Heavy | Auto | Med | Heavy | Auto | Med | Heavy |
| I-215 NB Lanes 1 & 2 | 5509 | 6329 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 SB Lanes 1 & 2 | 5479 | 5519 | 3900 | 3900 | 2 | 0.92 | 0.04 | 0.04 | 2392 | 104 | 104 | 65 | 65 | 55 |
| I-215 NB Lane 3 | 2754 | 3165 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 SB Lane 3 | 2740 | 2759 | 1950 | 1950 | 1 | 0.92 | 0.04 | 0.04 | 1794 | 78 | 78 | 65 | 65 | 55 |
| I-215 NB HOV | 1430 | 1605 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| I-215 SB HOV | 1524 | 1551 | 1500 | 1500 | 1 | 0.94 | 0.06 | 0.00 | 1410 | 90 | 0 | 65 | 65 | 0 |
| Barton NB Off ramp | 706 | 935 | 1200 | 935 | 1 | 0.91 | 0.06 | 0.03 | 851 | 56 | 28 | 45 | 45 | 40 |
| Barton NB On ramp | 1095 | 922 | 1200 | 1095 | 1 | 0.91 | 0.06 | 0.03 | 996 | 66 | 33 | 65 | 65 | 55 |
| Barton SB On ramp | 1026 | 873 | 1200 | 1026 | 1 | 0.91 | 0.06 | 0.03 | 934 | 62 | 31 | 65 | 65 | 55 |
| Barton SB Off ramp | 688 | 883 | 1200 | 883 | 1 | 0.91 | 0.06 | 0.03 | 804 | 53 | 26 | 45 | 45 | 40 |
| Grand Terrace NB | 257 | 84 | 1000 | 257 | 1 | 0.95 | 0.05 | 0.00 | 244 | 13 | 0 | 30 | 30 | 0 |
| Grand Terrace SB | 214 | 41 | 1000 | 214 | 1 | 0.95 | 0.05 | 0.00 | 203 | 11 | 0 | 30 | 30 | 0 |
| La Crosse NB | 52 | 192 | 1000 | 192 | 1 | 0.94 | 0.06 | 0.00 | 180 | 12 | 0 | 30 | 30 | 0 |
| La Crosse NB | 61 | 70 | 1000 | 70 | 1 | 0.94 | 0.06 | 0.00 | 66 | 4 | 0 | 30 | 30 | 0 |
| Vivienda NB | 261 | 166 | 1000 | 261 | 1 | 1.00 | 0.00 | 0.00 | 261 | 0 | 0 | 30 | 0 | 0 |
| Vivienda SB | 186 | 36 | 1000 | 186 | 1 | 1.00 | 0.00 | 0.00 | 186 | 0 | 0 | 30 | 0 | 0 |
| Commerce NB | 1083 | 905 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 35 | 30 |
| Commerce SB | 686 | 882 | 1000 | 882 | 1 | 0.92 | 0.06 | 0.02 | 811 | 53 | 18 | 35 | 35 | 30 |
| Michigan NB | 1079 | 880 | 1000 | 1000 | 1 | 0.92 | 0.06 | 0.02 | 920 | 60 | 20 | 35 | 35 | 30 |
| Michigan SB | 653 | 876 | 1000 | 876 | 1 | 0.92 | 0.06 | 0.02 | 806 | 53 | 18 | 35 | 35 | 30 |
| Barton WB (La Cadena to Grand Terrace/La Crosse) | 818 | 858 | 2400 | 858 | 2 | 0.94 | 0.04 | 0.02 | 807 | 34 | 17 | 40 | 40 | 35 |
| Barton WB (Grand Terrace/La Crosse to SB Ramps) | 897 | 873 | 2400 | 897 | 2 | 0.94 | 0.04 | 0.02 | 843 | 36 | 18 | 40 | 40 | 35 |
| Barton WB (SB Ramps to NB Ramps) | 1498 | 1136 | 2400 | 1498 | 2 | 0.94 | 0.04 | 0.02 | 1408 | 60 | 30 | 40 | 40 | 35 |
| Barton WB (NB Ramps to Michigan/Vivienda) | 2235 | 1486 | 2400 | 2235 | 2 | 0.94 | 0.04 | 0.02 | 2101 | 89 | 45 | 40 | 40 | 35 |
| Barton WB (East of Michigan/Vivienda) | 1445 | 1015 | 2400 | 1445 | 2 | 0.94 | 0.04 | 0.02 | 1358 | 58 | 29 | 40 | 40 | 35 |
| Barton EB (La Cadena to Grand Terrace/La Crosse) | 1039 | 1212 | 2400 | 1212 | 2 | 0.94 | 0.04 | 0.02 | 1139 | 48 | 24 | 40 | 40 | 35 |
| Barton EB (Grand Terrace/La Crosse to SB Ramps) | 1136 | 1514 | 2400 | 1514 | 2 | 0.94 | 0.04 | 0.02 | 1423 | 61 | 30 | 40 | 40 | 35 |
| Barton EB (SB Ramps to NB Ramps) | 1391 | 1779 | 2400 | 1779 | 2 | 0.94 | 0.04 | 0.02 | 1672 | 71 | 36 | 40 | 40 | 35 |
| Barton EB (NB Ramps to Michigan/Vivienda) | 2012 | 2413 | 2400 | 2400 | 2 | 0.94 | 0.04 | 0.02 | 2256 | 96 | 48 | 40 | 40 | 35 |
| Barton EB (East of Michigan/Vivienda) | 1445 | 2045 | 2400 | 2045 | 2 | 0.94 | 0.04 | 0.02 | 1922 | 82 | 41 | 40 | 40 | 35 |





**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

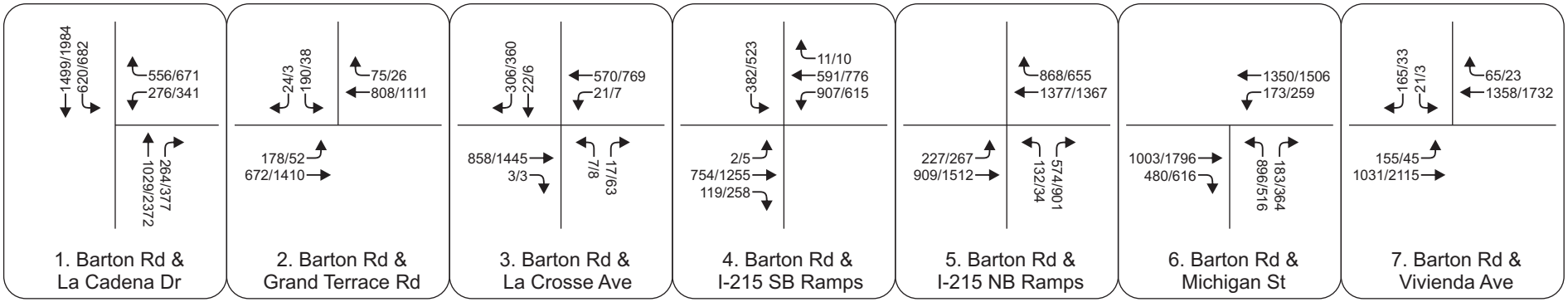
ITERIS Innovation for better mobility

**Barton Road Interchange Improvement Project**

FIGURE 11

Existing (2009) Peak Hour Volumes

G:\USERS\2007\U07-1660 Barton Road Interchange\gra\Alternatives Volumes HOV.cdr





**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

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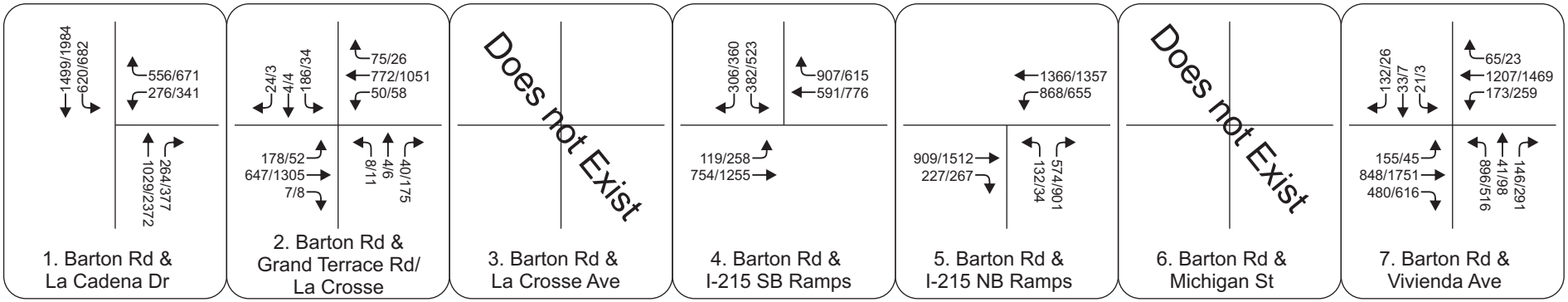
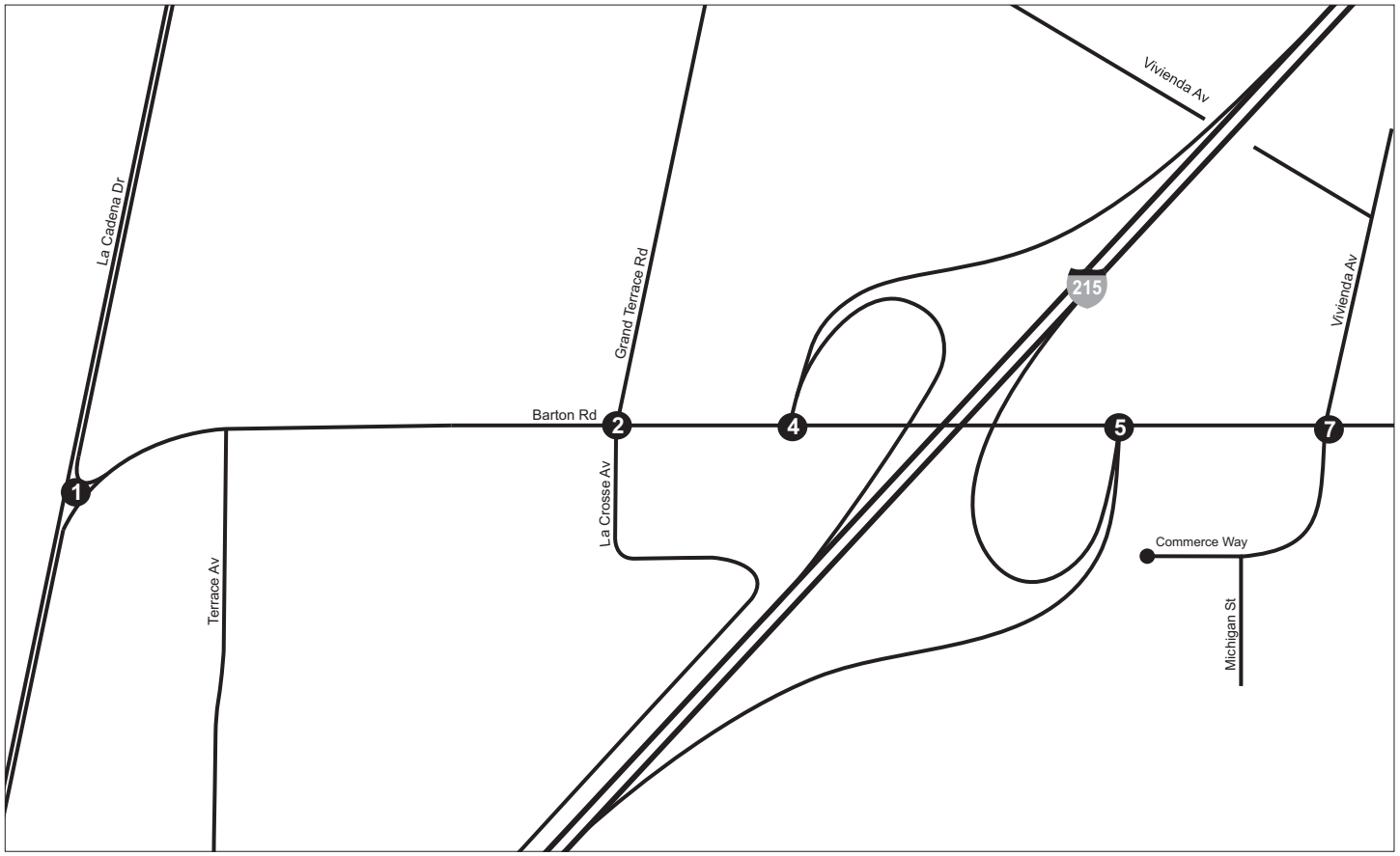
**Barton Road Interchange Improvement Project**

FIGURE 19

Year 2040 Alternative 1 - Peak Hour Volumes

G:\USERS\2007\J07-1660 Barton Road Interchange\gra\Alternatives Volumes.cdr




**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

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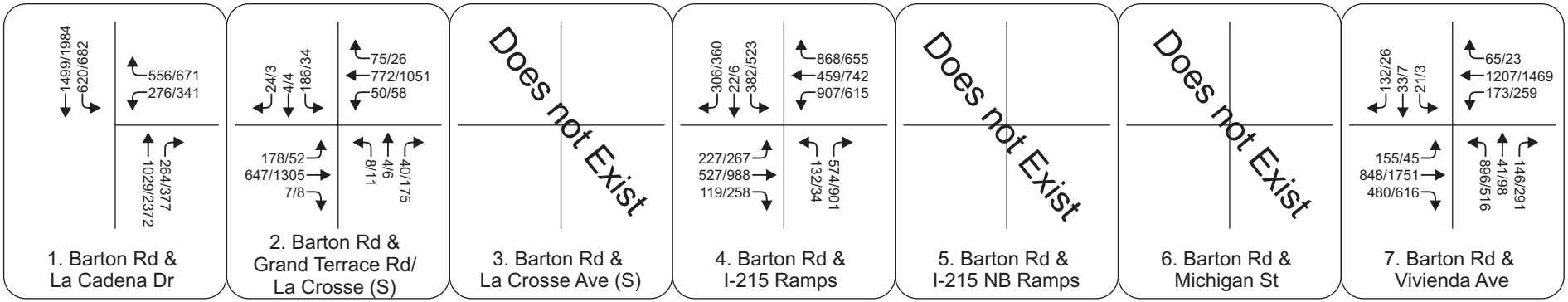
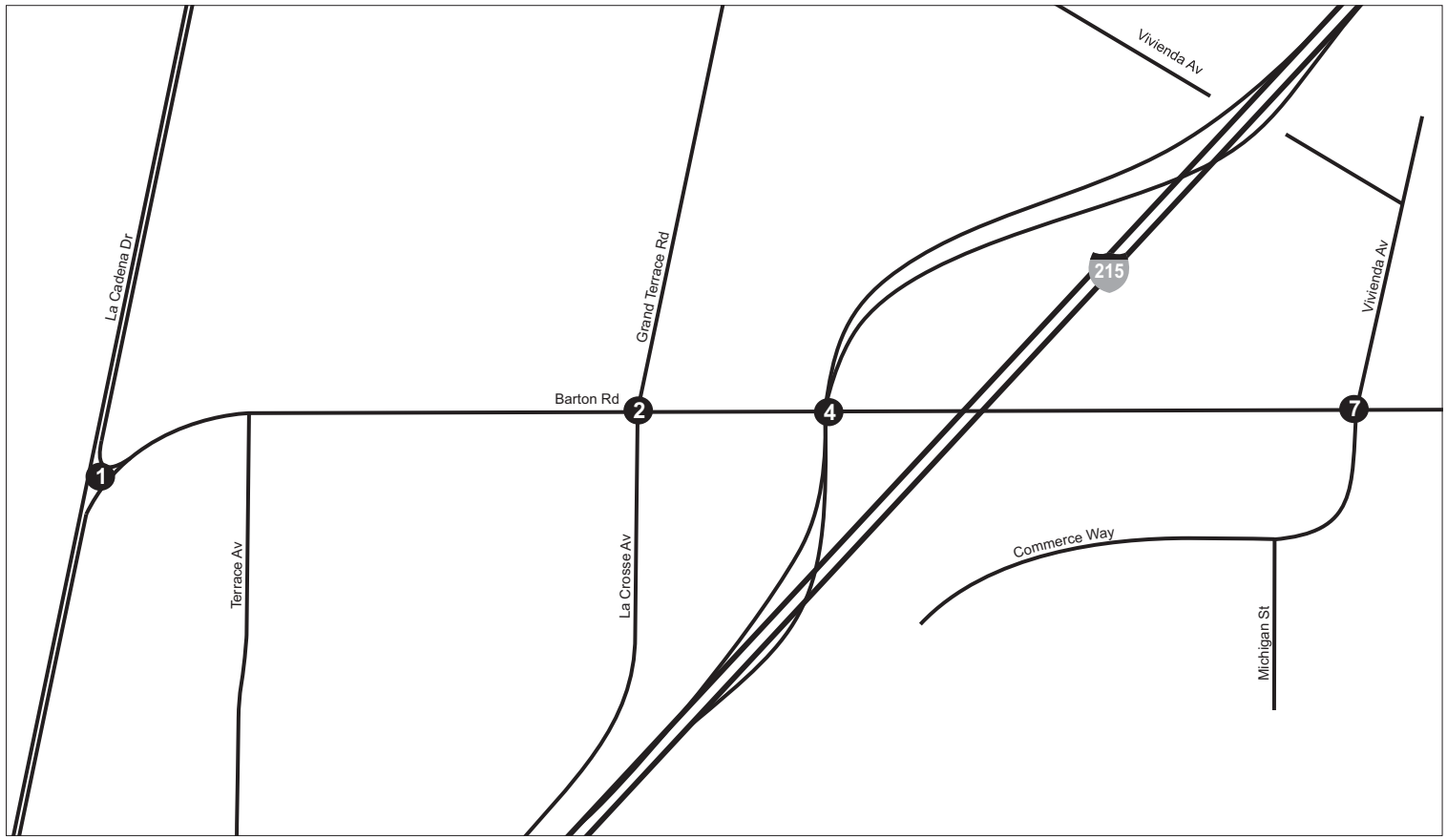
FIGURE 21

Year 2040 Alternative 3 - Peak Hour Volumes

G:\USERS\2007\J07-1660 Barton Road Interchange\gra\Alternatives Volumes.cdr




**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

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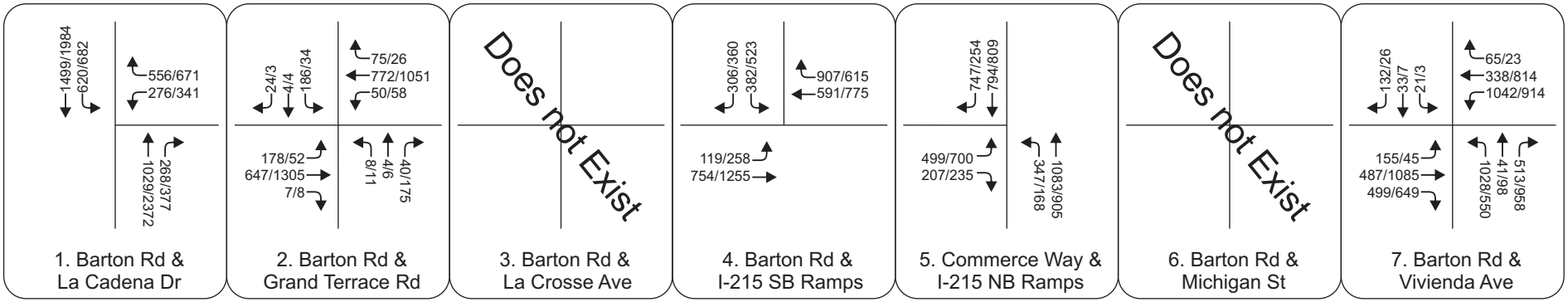
FIGURE 23

Year 2040 Alternative 5 - Peak Hour Volumes

G:\USERS\2007\J07-1660 Barton Road Interchange\gra\Alternatives Volumes.cdr





**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

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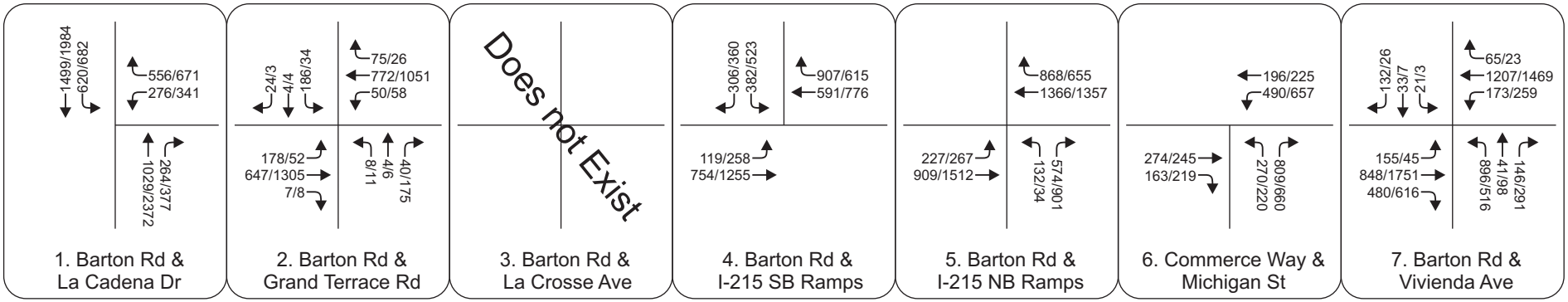
FIGURE 24

Year 2040 Alternative 6 Peak Hour Volumes

G:\USERS\2007\J07-1660 Barton Road Interchange\gra\Alternatives Volumes.cdr





**Legend**

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume

N

NOT TO SCALE

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FIGURE 25

Year 2040 Alternative 7 Peak Hour Volumes

G:\USERS\2007\J07-1660 Barton Road Interchange\gra\Alternatives Volumes.cdr

**Table 29: Year 2040 Alternative 6 Freeway Weaving Segment Levels of Service**

| | Non-Weaving Volume | Weaving Volume | Density (pc/mi/ln) | LOS | Non-Weaving Volume | Weaving Volume | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| **Northbound** | | | | | | | | |
| Iowa Av On Ramp to Barton Rd Off Ramp | 6619 | 1802 | 34.1 | D | 7506 | 2357 | 41.1 | E |

Notes:
Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.
**BOLD** indicates unsatisfactory level of service.

## Freeway Mainline Analysis

Year 2040 a.m. and p.m. peak hour levels of service for the study area freeway segments are summarized in **Table 30**. The freeway mainline LOS calculation sheets are contained in **Appendix E**. As **Table 30** indicates, all freeway segments in the study area are projected to operate at satisfactory levels of service, with the following exception:

- I-215 Northbound Barton Road Off Ramp to Barton Road On Ramp (p.m. peak hour)

This segment is over capacity based on the assumption of a peak hour factor (PHF) of 0.95 and a capacity of 2300 vph for a mixed-flow lane, as specified in the San Bernardino County Congestion Management Program (CMP) and agreed to by the PDT. However, the CMP allows the use of a PHF of 0.98 for congested freeway conditions. Based on a PHF of 0.98 and a capacity of 2350 vph for a mixed-flow lane (per HCM), the LOS for the above mentioned freeway segment will be E.

**Table 30: Year 2040 Freeway Mainline Levels of Service**

| | AM Peak Hour | | | | | PM Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HOV Vol | MF Vol | Mixed Flow | | | HOV Vol | MF Vol | Mixed Flow | | |
| | | | Speed[1] | Density (pc/mi/ln) | LOS | | | Speed[1] | Density (pc/mi/ln) | LOS |
| **Northbound** | | | | | | | | | | |
| Iowa Avenue On Ramp to Barton Road Off Ramp † | 1381 | 8417 | 59.5 | 30.8 | D | 1553 | 9863 | 55.9 | 37.9 | E |
| Barton Road Off Ramp to Barton Road On Ramp | 1381 | 7711 | 56.3 | 37.3 | E | 1553 | 8928 | - | - | **F*** |
| Barton Road On Ramp to Washington Street Off Ramp | 1528 | 8660 | 59.1 | 31.9 | D | 1710 | 9692 | 56.6 | 36.7 | E |
| **Southbound** | | | | | | | | | | |
| Washington Street On Ramp to Barton Road Off Ramp | 1521 | 8342 | 59.6 | 30.5 | D | 1568 | 8560 | 59.5 | 30.9 | D |
| Barton Road Off Ramp to Barton Road On Ramp | 1521 | 7639 | 56.6 | 36.7 | E | 1568 | 7670 | 57.0 | 36.1 | E |
| Barton Road On Ramp to La Cadena Dr Off Ramp | 1531 | 8676 | 59.1 | 32.0 | D | 1518 | 8604 | 59.4 | 31.1 | D |

Notes:
[1] Average passenger-car speed. * Freeway is over capacity during peak 15 minute period. **BOLD** indicates unsatisfactory level of service.
Level of Service (LOS) criteria are provided in the Highway Capacity Manual, and are based on density.
† This segment is weaving segment in Alternative 6.

# SHORT-TERM NOISE LEVEL MEASUREMENTS

Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-1 Date: 11-6-2008 Time: From 2:20 To 2:35 PM

Site Location: 21875 DeBerry Street, FRONT SEATING AREA

Noise Sources: TRAFFIC ON I-215

Measurement Results (dBA)

Leq 64.2
Lmax 70.1
Lmin 60.1
Lpeak 88.8
L2 67.1
L8 66.0
L25 64.8
L50 63.8
SEL 93.8

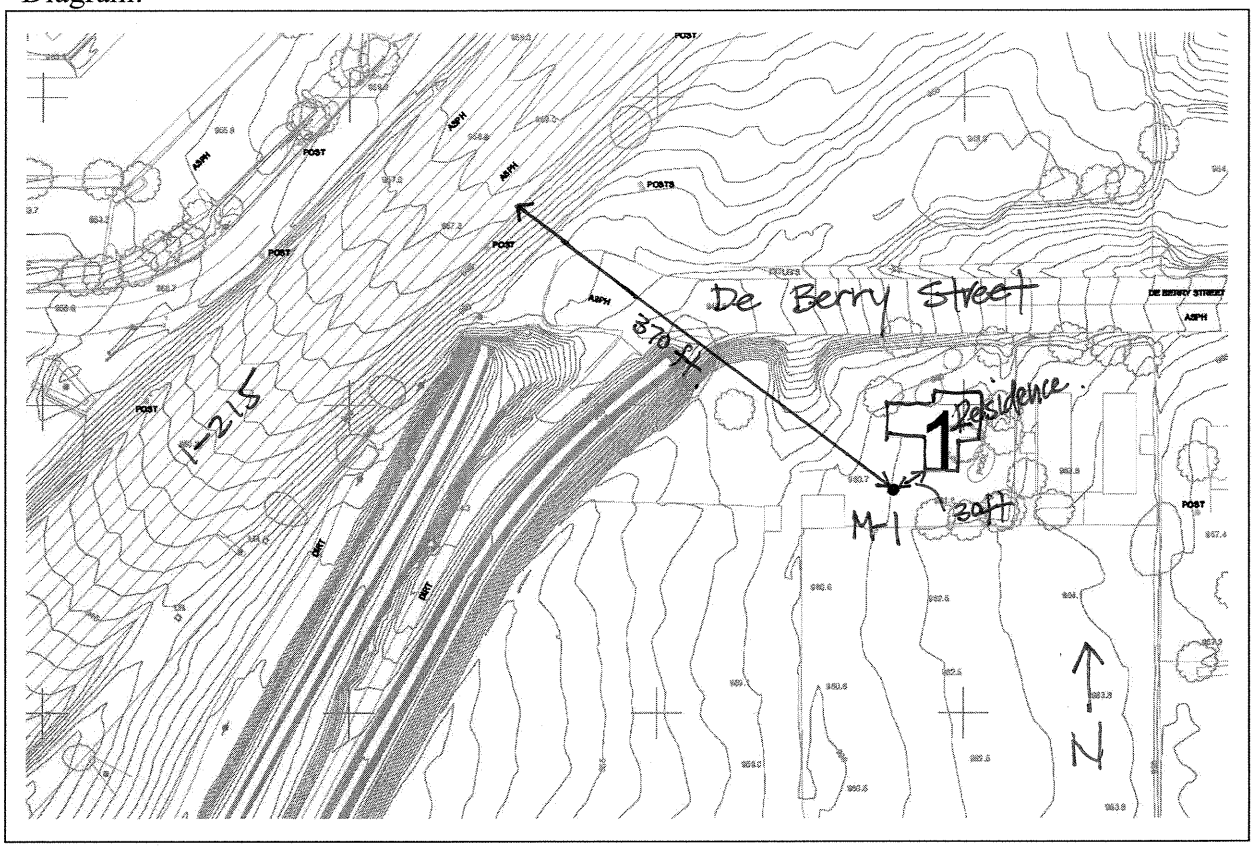
Comments: Vacant area B/W I-215 and house NO EXISTING BARRIER

Equipment: LARSON DAVIS 824 MODEL Sound METER

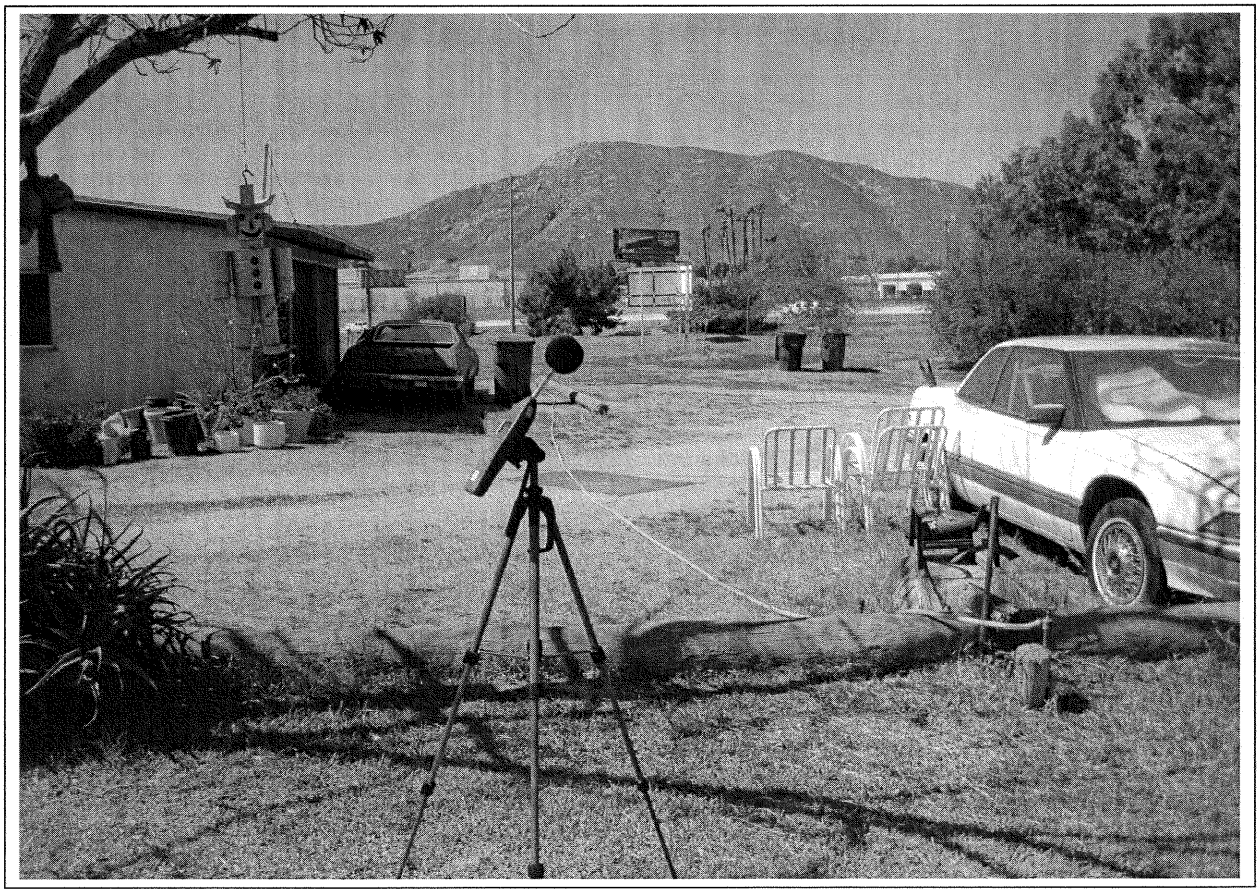
Atmospheric Conditions: to the SE
Wind Velocity: ~~Ave~~ / MAX 11.3 (MPH); Temperature: 79.8 (F)
Relative Humidity: 13.6 (%)

Test Personnel: TEAK KIM

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: 2 Date: 2/2/10 Time: From 11:32 To 11:47

Site Location: 12175 Michigan Ave on North edge of yard. no noise shielding - only chain link fence. House is abandoned.

Noise Sources: light traffic on Michigan Ave. The trucks coming from both ways turn across the street onto Commerce Way. Can not hear freeway from this location

Measurement Results (dBA)

| | |
|---|---|
| Leq | 51.6 |
| Lmax | 61.7 |
| Lmin | 43.1 |
| Lpeak | 79.0 |
| L2 | 57.1 |
| L8 | 54.7 |
| L25 | 52.2 |
| L50 | 50.4 |
| SEL | 81.6 |

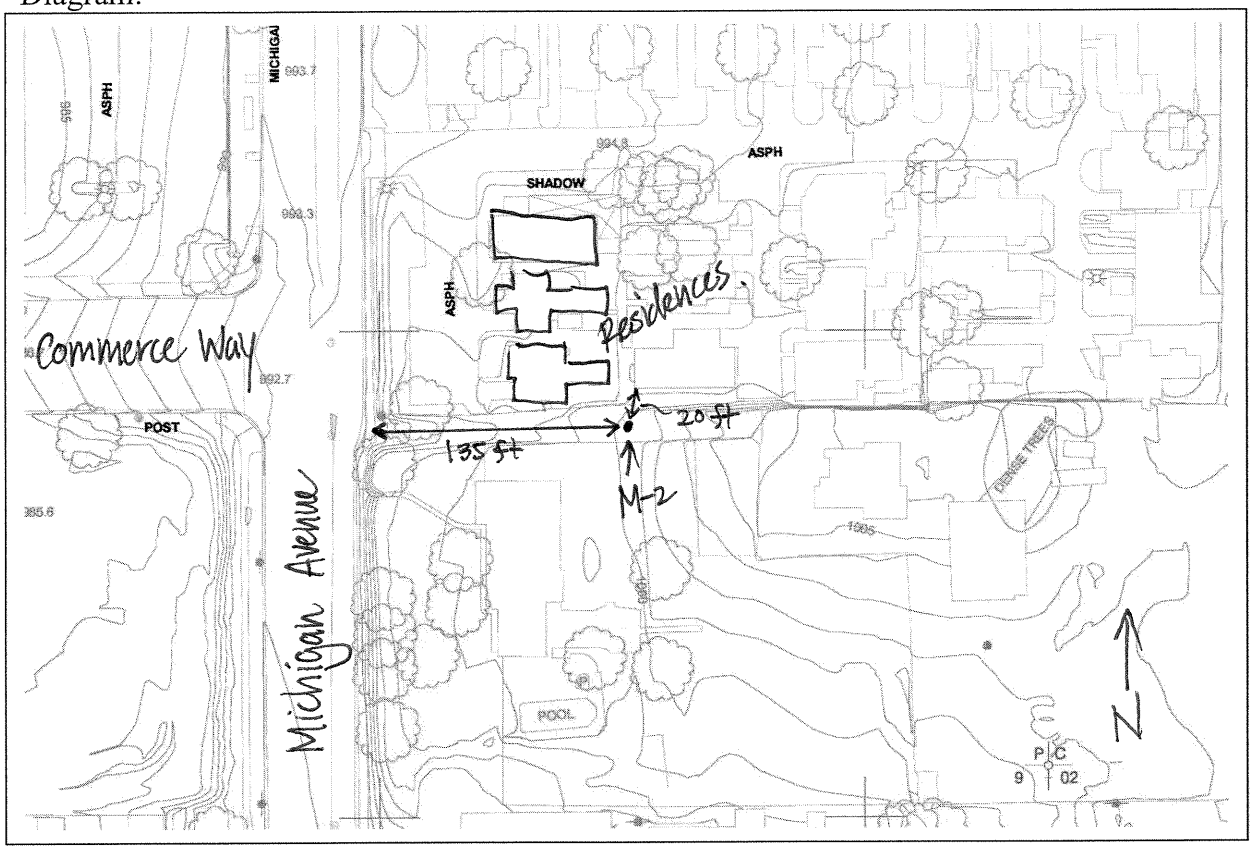
Comments: _____

Equipment: Larson Davis 824 Sound Level Meter

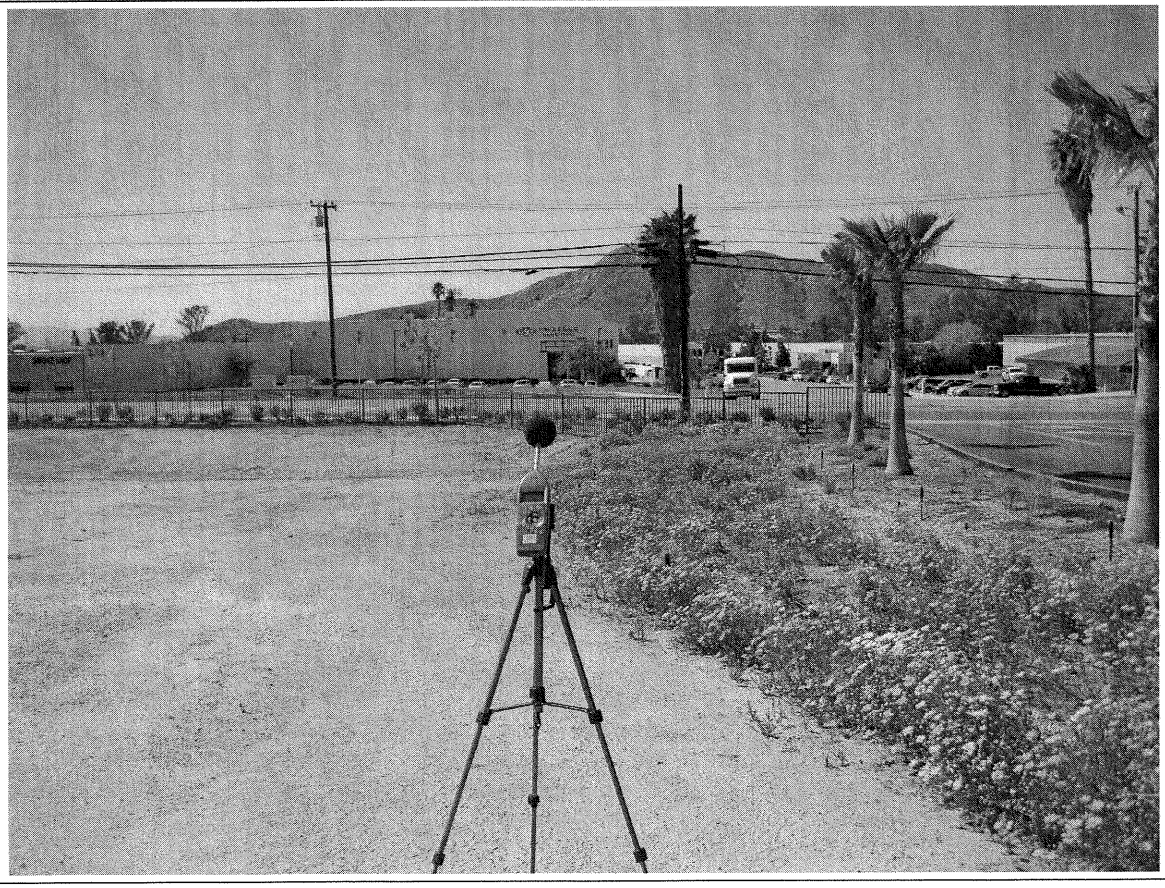
Atmospheric Conditions: Max/Avg
Wind Velocity: 1.7/0.8 (MPH); Temperature: 68.9° (F)
Relative Humidity: 40 (%)

Test Personnel: Corey Knips

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-3 Date: 1-21-09 Time: From 10:09 To 10:24 am

Site Location: 22270 Barton Rd. Grand Terrace, CA
IN THE Backyard Near the Patio

Noise Sources: Barton Road Traffic
FAINT AIRCRAFT Noise

Measurement Results (dBA)

Leq 54.8
Lmax 65.4
Lmin 45.2
Lpeak 86.5
L2 60.7
L8 58.4
L25 55.8
L50 53.2
SEL

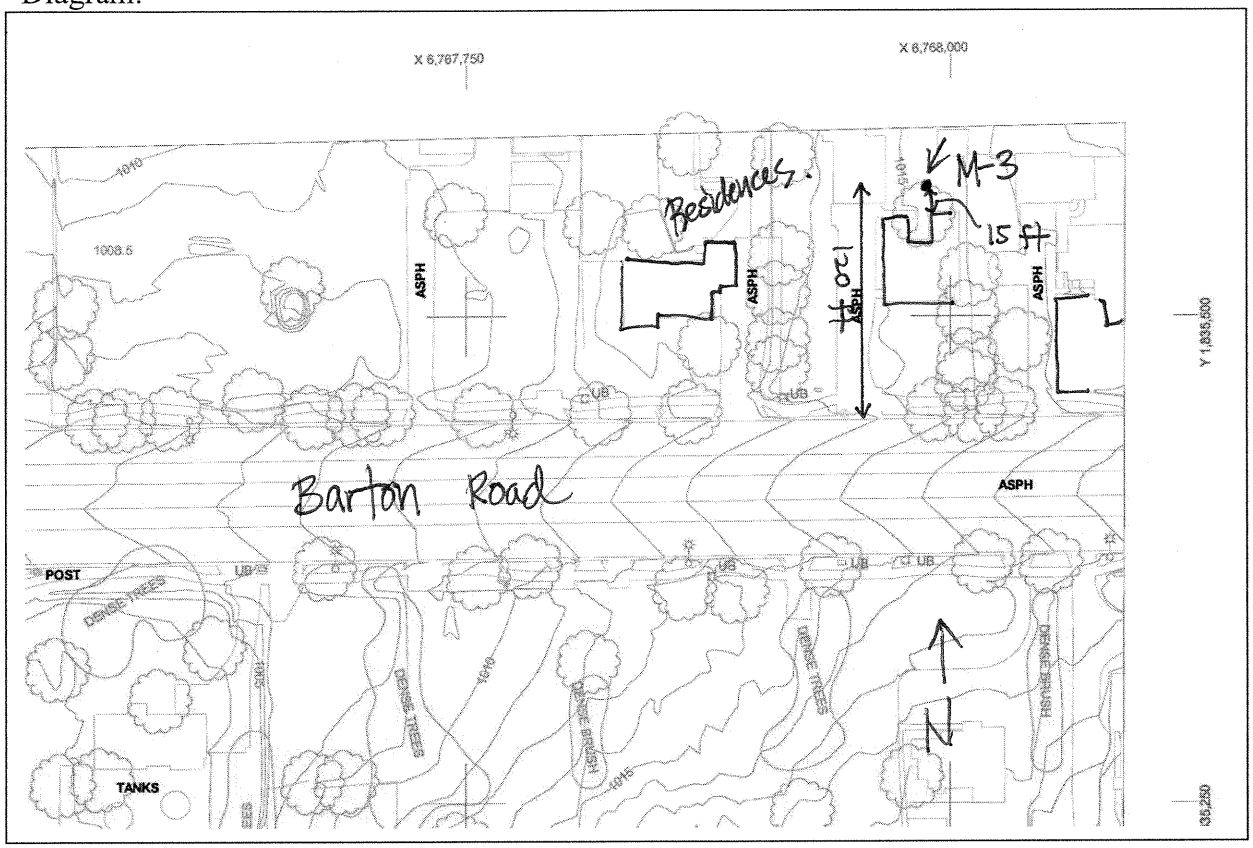
Comments: House was for sale with no current resident

Equipment: Larson DAvis 820

Atmospheric Conditions: MAx. Avg.
Wind Velocity: 1.1 / 0.6 (MPH); Temperature: 67.5 (F)
Relative Humidity: 62.6 (%)

Test Personnel: Ryo Braco

Diagram:




Location Photo:

Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-4 Date: 1/21/09 Time: From 9:05 To 9:20 a.m.

Site Location: 12066 Vivienda Avenue
END OF VIVIEND Avenue on Dirt between Vivienda Avenue and School Parking lot.

Noise Sources: I-215 TRAFFIC
One car starting nearby in the parking lot.

Measurement Results (dBA)

Leq 71.2
Lmax 76.5
Lmin 63.9
Lpeak 94.9
L2 74.4
L8 73.2
L25 71.8
L50 70.9
SEL

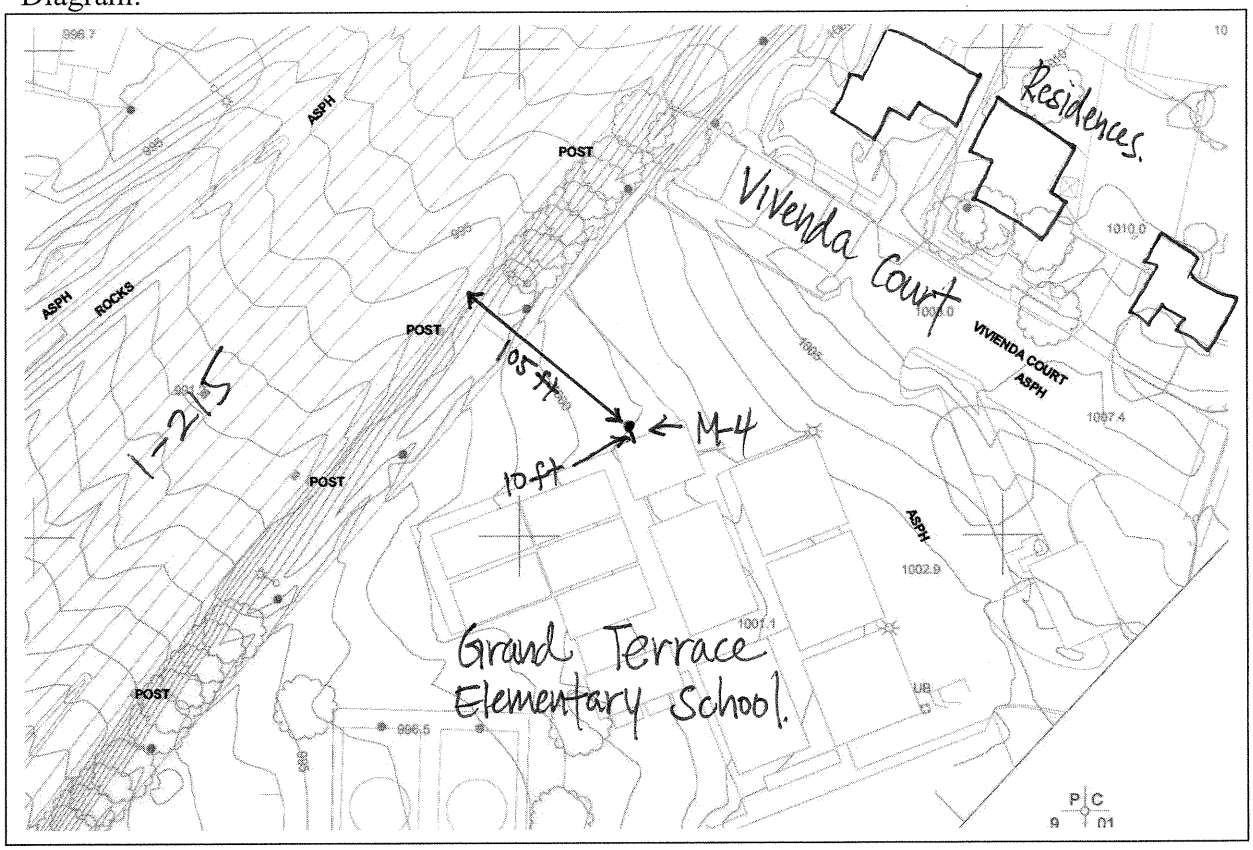
Comments: Free flowing traffic,

Equipment: Larson Davis 820

Atmospheric Conditions: MAX. AVG.
Wind Velocity: 3.2/1.8 (MPH); Temperature: 66.2 (F)
Relative Humidity: 50.3 (%)

Test Personnel: Ryo Braco

Diagram:

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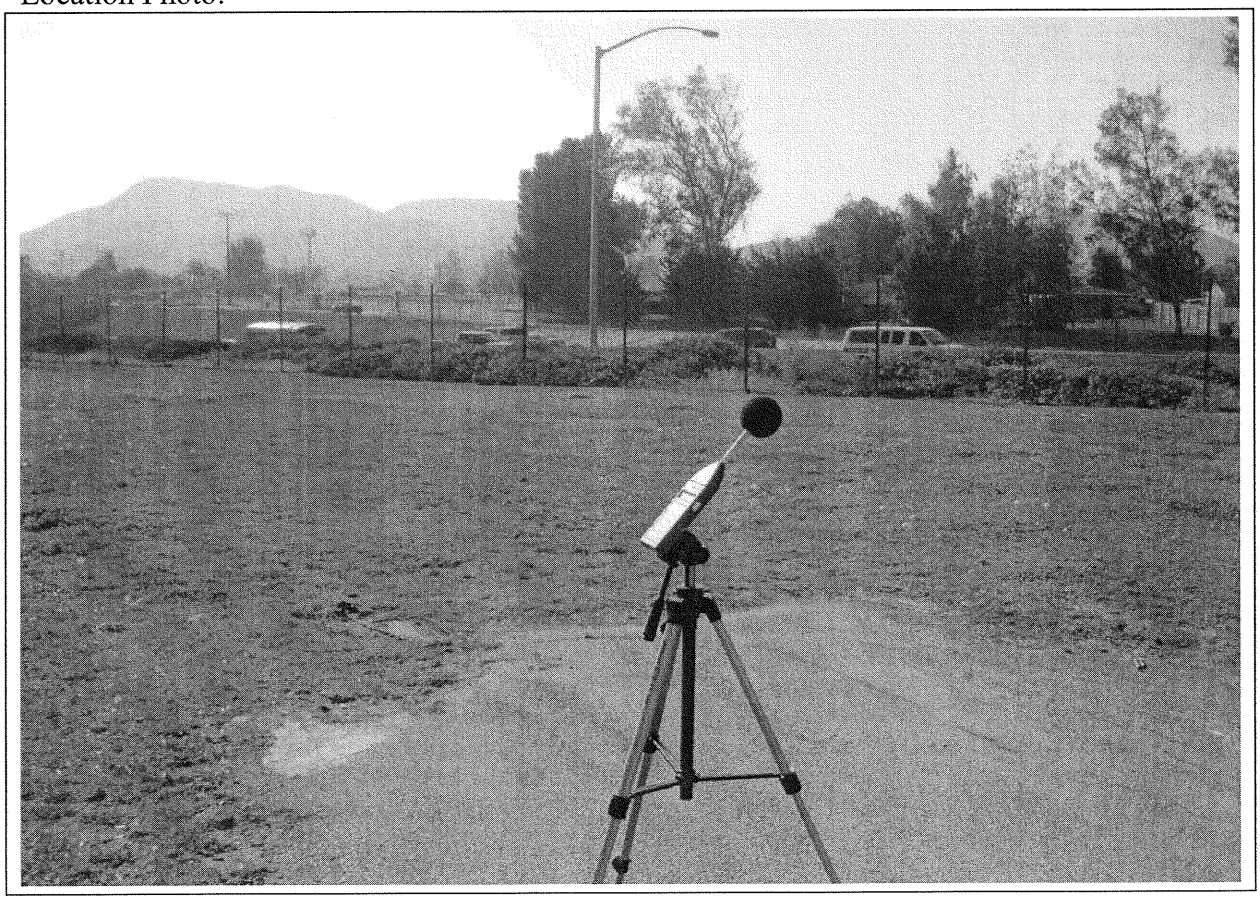


Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-5 Date: 11/6/08 Time: From 10:42 A.M To 10:57

Site Location: 11948 Vivienda Ct, between wall and I-215

Noise Sources: I-215 freeway traffic, noisy dogs next door

#2

**Measurement Results (dBA)**

| | |
|---|---|
| **Leq** | 75.3 |
| **Lmax** | 87.4 |
| **Lmin** | 64.6 |
| **Lpeak** | 107.8 |
| **L2** | 79.3 |
| **L8** | 77.5 |
| **L25** | 76.0 |
| **L50** | 74.6 |
| **SEL** | 104.9 |

**Comments:** Meter is between property wall and I-215, ground level where meter is located is approximately 4 feet above freeway. There are some tall trees diagonally to the right and left of meter, but it is clear between meter and the freeway

**Equipment:** Larson Davis 824 Noise Meter

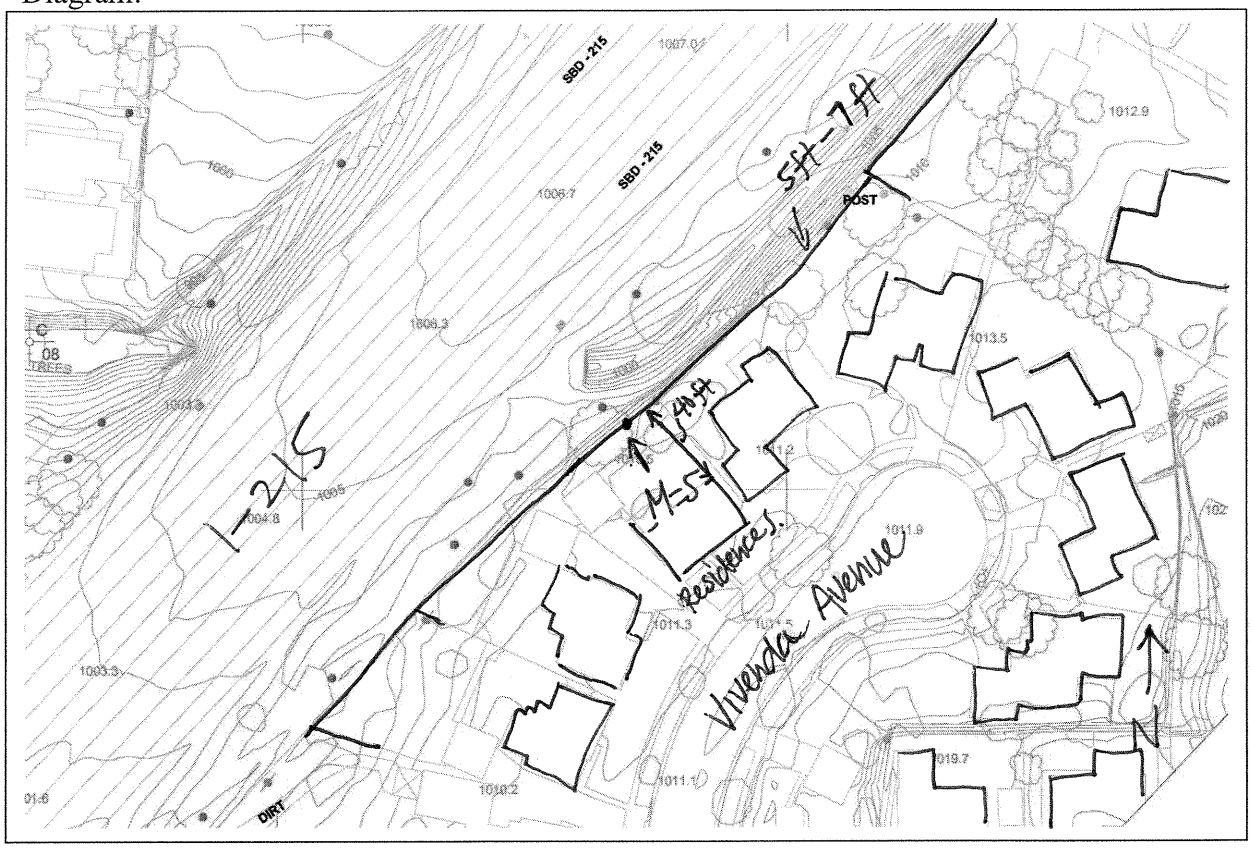
**Atmospheric Conditions:**

Wind Velocity: _____ (MPH); Temperature: _____ (F)

Relative Humidity: _____ (%)

**Test Personnel:** Corey Knips

Diagram:

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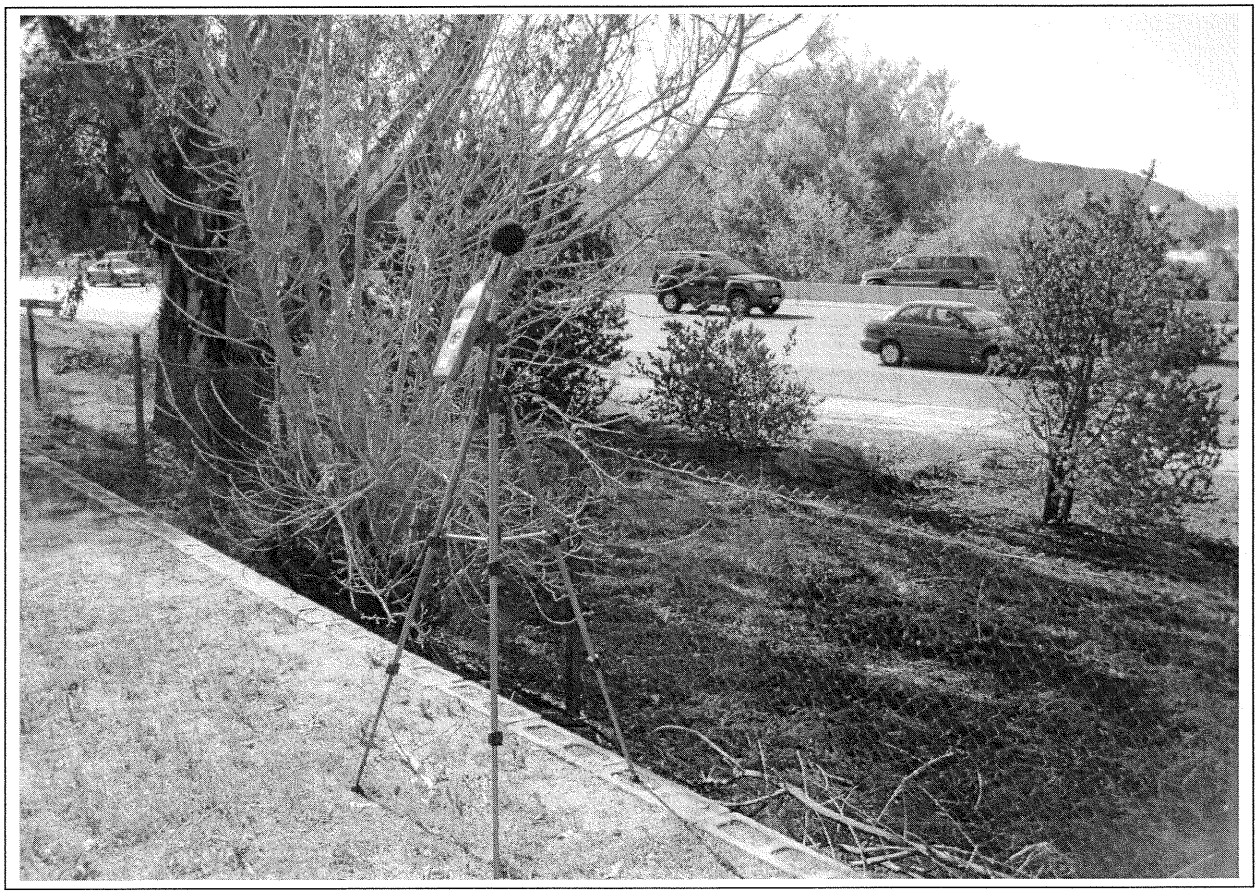


Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-6 Date: 11-6-2008 Time: From 10:42 To 10:57 AM

Site Location: 11947 VIVIENDA CT, SECOND ROW HOUSE IN THE BACKYARD,

Noise Sources: TRAFFIC ON I-215 BUT QUIET - VERY FAINT NOISE FROM I-215

Measurement Results (dBA)

Leq 51.6
Lmax 59.4
Lmin 44.2
Lpeak 81.2
L2 57.3
L8 55.5
L25 52.5
L50 49.7
SEL

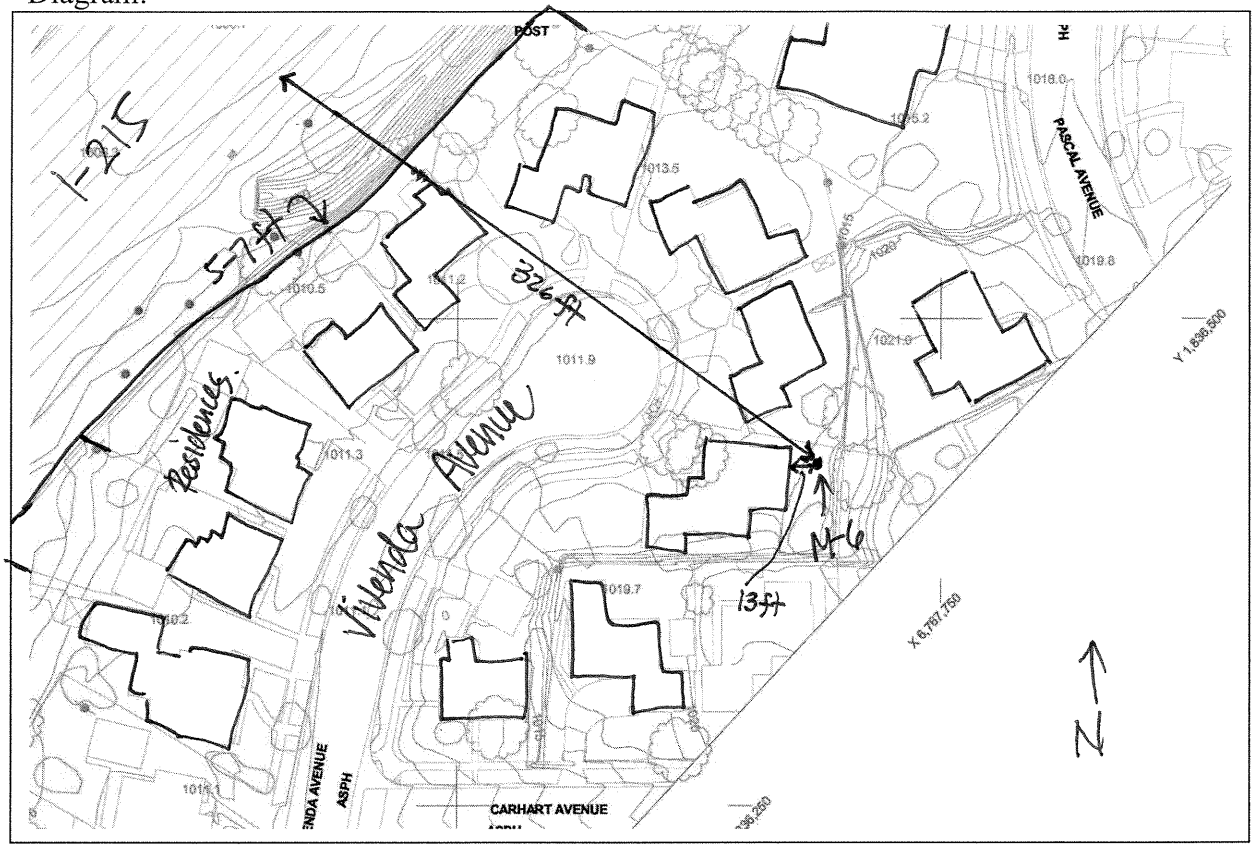
Comments: FAINT AIRCRAFT NOISE
4 FT PROPERTY WALL
BACKYARD AREA IS SHIELDED BY RESIDENTIAL STRUCTURE

Equipment: LARSON DAVIS 820 MODEL Sound METER

Atmospheric Conditions: Ave. / Max.
Wind Velocity: 0.7/1.3 (MPH); Temperature: 80.1 (F)
Relative Humidity: 18.1 (%)

Test Personnel: TEAK KIM

Diagram:

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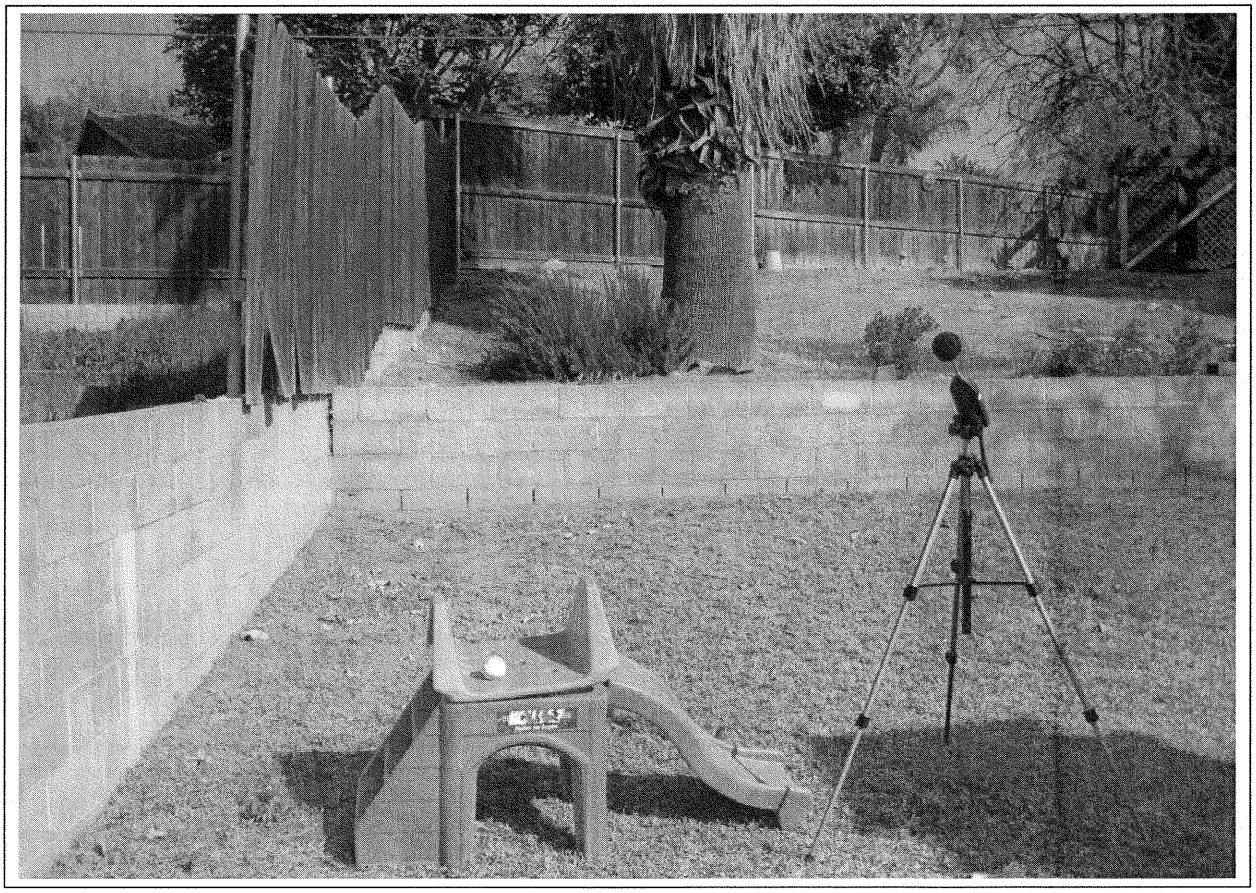


Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-1 Date: 11-6-2008 Time: From 9:54 To 10:09 A.M

Site Location: 11750 Mt. Vernon Avenue (Apt# FF1206)
IN THE PATIO

Noise Sources: TRAFFIC ON I-215
CANAL STREET - VERY LIGHT TRAFFIC VOLUME
- SLOW TRAFFIC SPEED

Measurement Results (dBA)

Leq 54.9
Lmax 68.8
Lmin 49.1
Lpeak 87.7
L2 61.7
L8 57.0
L25 54.5
L50 53.2
SEL

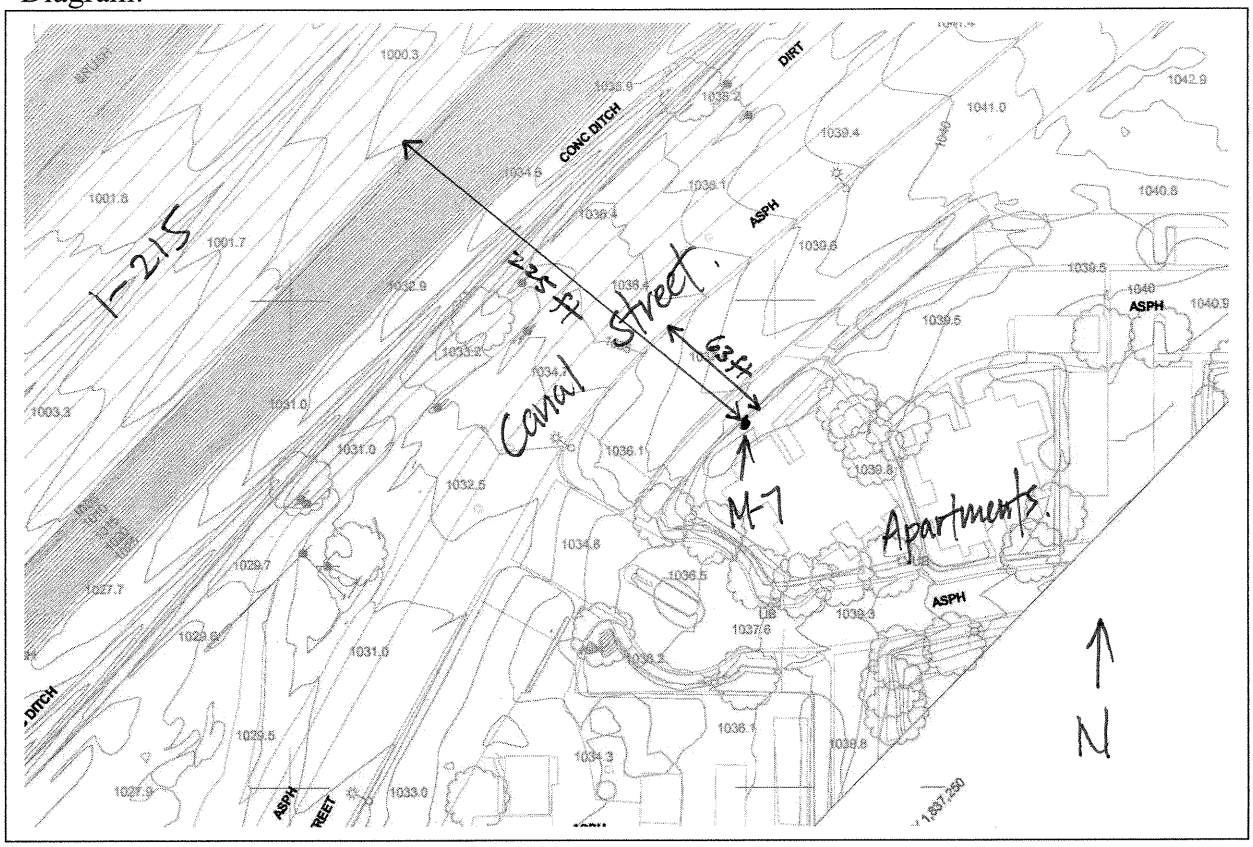
Comments: NO EXISTING WALL
FAINT AIRCRAFT NOISE
FAINT TRAIN NOISE

Equipment: LARSON DAVIS 820 MODE SOUND METER

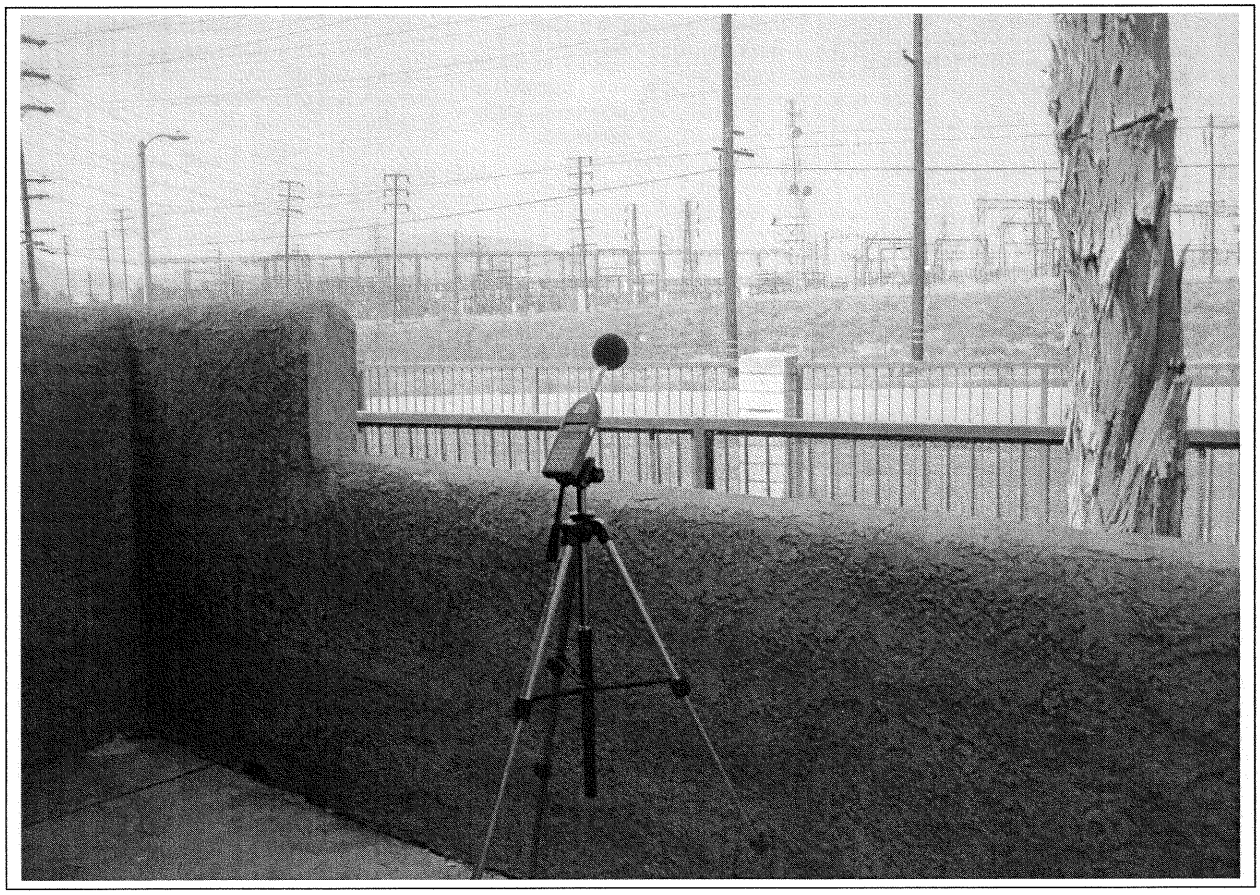
Atmospheric Conditions: MAX, AVG
Wind Velocity: 4.3/1.9 (MPH); Temperature: 78.3 (F)
Relative Humidity: 25 (%)

Test Personnel: TEAK KIM

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-8 Date: 11/6/08 Time: From 1:08 To 1:23 pm.

Site Location: 21900 Barton Rd #48 Terrace Village R.V. Park #48 SE CORNER

Noise Sources: TRAFFIC ON I-215 Leaf blower - (filtered out the loudest of it) aircraft noise, dog barking (faraway), door creaking when it blows open and shuts at #48, raking leaves

Measurement Results (dBA)

Leq 54.2
Lmax 69.4
Lmin 48.0
Lpeak 84.2
L2 61.4
L8 57.5
L25 53.9
L50 52.1
SEL 83.7

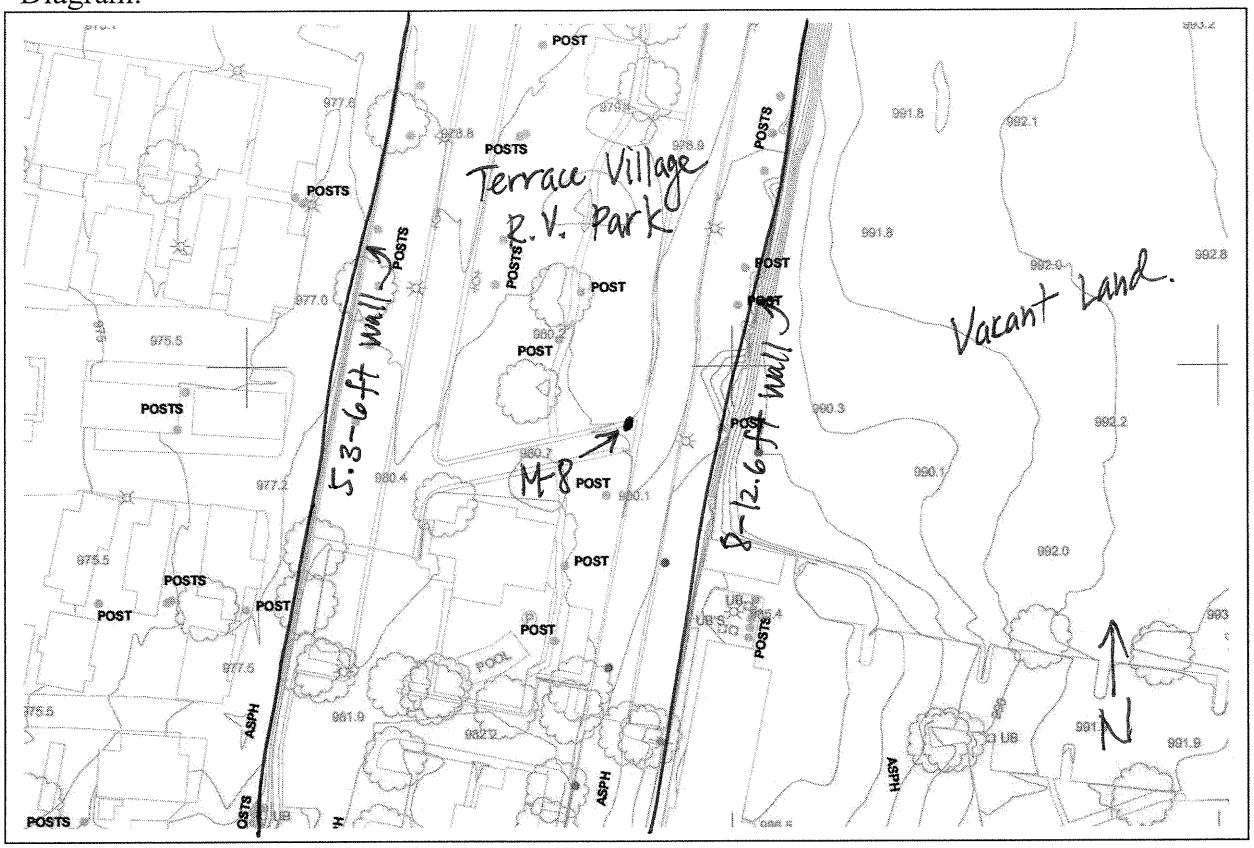
Comments: EXISTING 12.6 ft high ~~way~~ property wall between I-215 and the R.V. Park. A 15.8FT High building located on the EAST side of the R.V. Park

Equipment: Larson Davis 824 NOISE METER

Atmospheric Conditions:
Wind Velocity: _____ (MPH); Temperature: _____ (F)
Relative Humidity: _____ (%)

Test Personnel: Corey Knips

Diagram:

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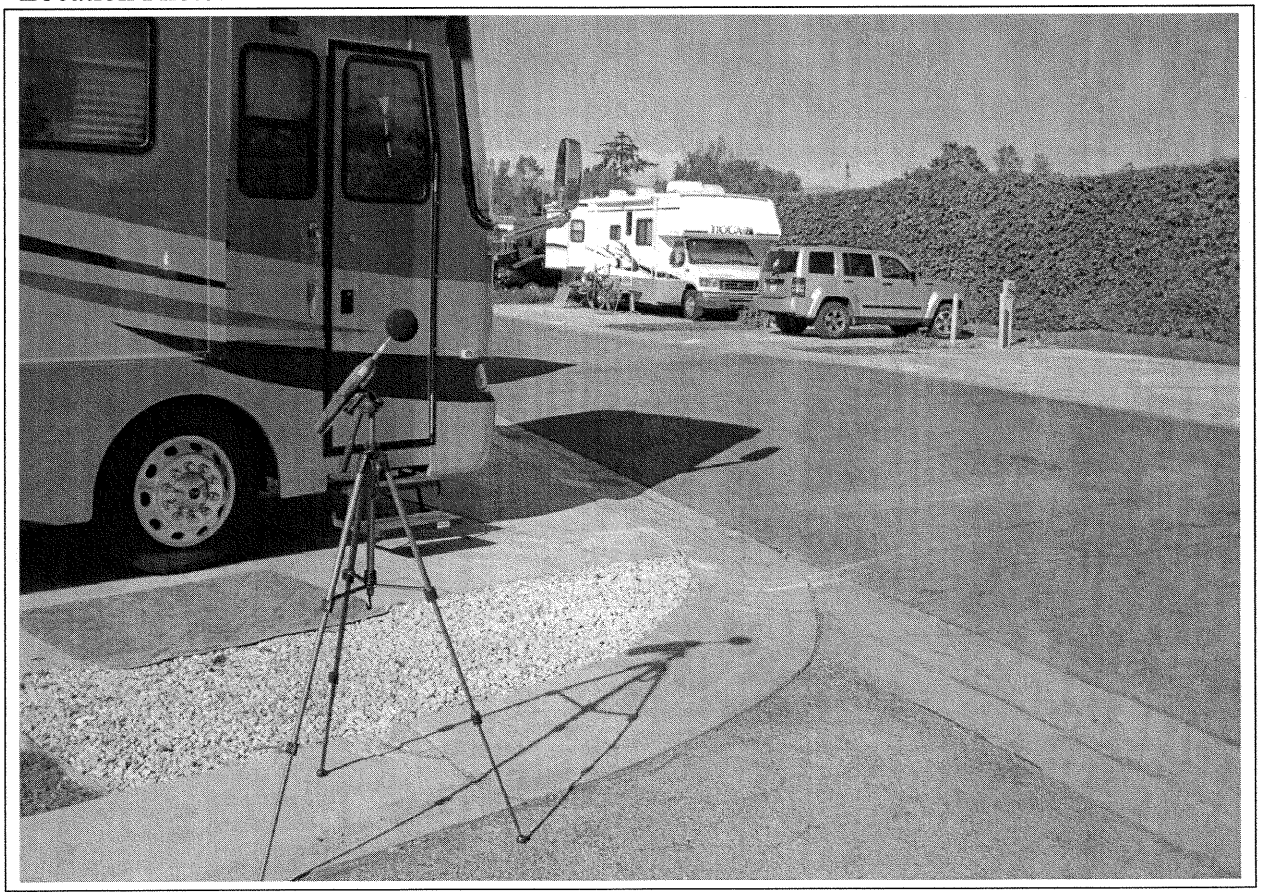


# NOISE MEASUREMENT SURVEY

Site Number: M-9 Date: 2/2/10 Time: From 12:08 To 12:23

Site Location: 21842 Grand Terrace Road Not in backyard. 12 feet behind orange tree

Noise Sources: Barton Road traffic, little dog barking a couple houses away (quiet and very brief), birds

Measurement Results (dBA)

Leq 53.2
Lmax 68.9
Lmin 40.7
Lpeak 85.6
L2 60.4
L8 56.4
L25 53.4
L50 50.4
SEL 82.7

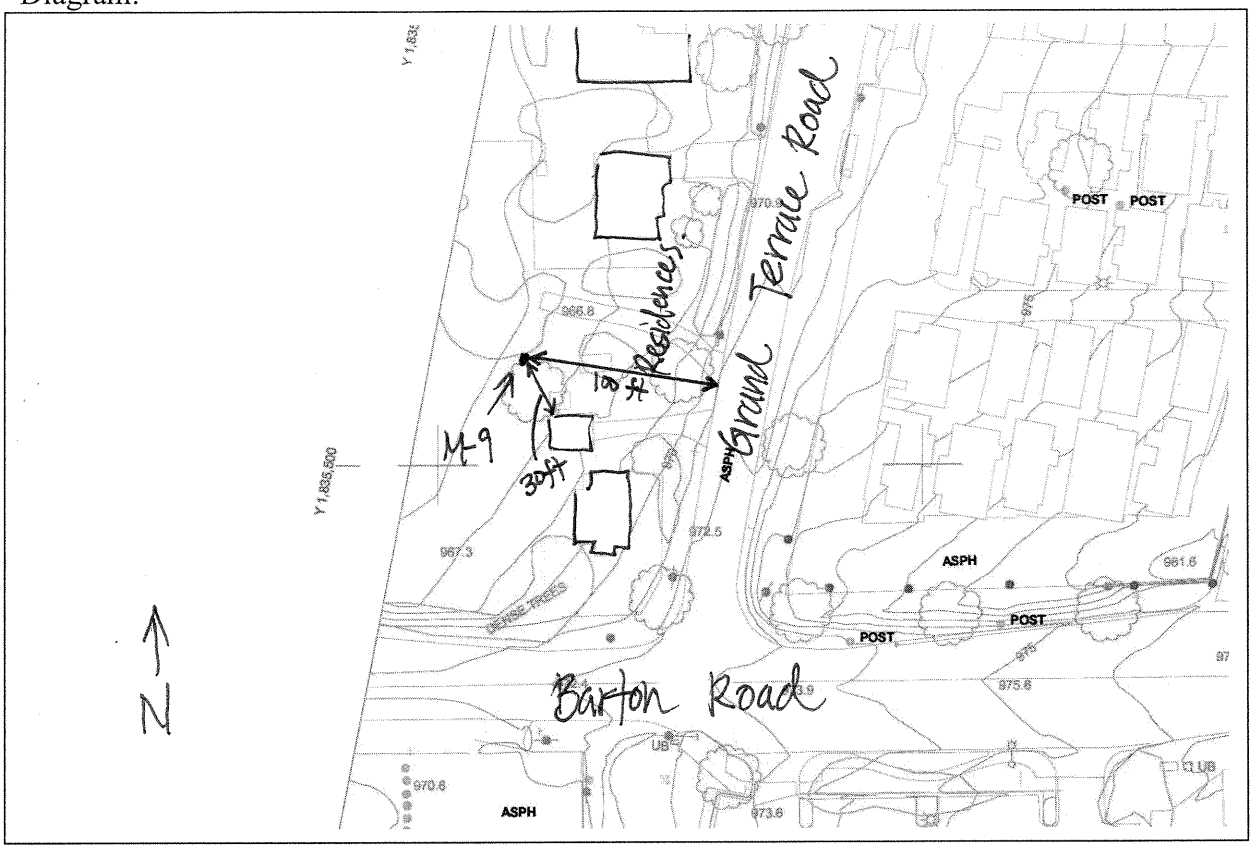
Comments: Dog in backyard kept barking until I set up the meter behind the tree. No houses around here have any walls only chainlink or barred fences

Equipment: Larson Davis 824 Sound Level Meter

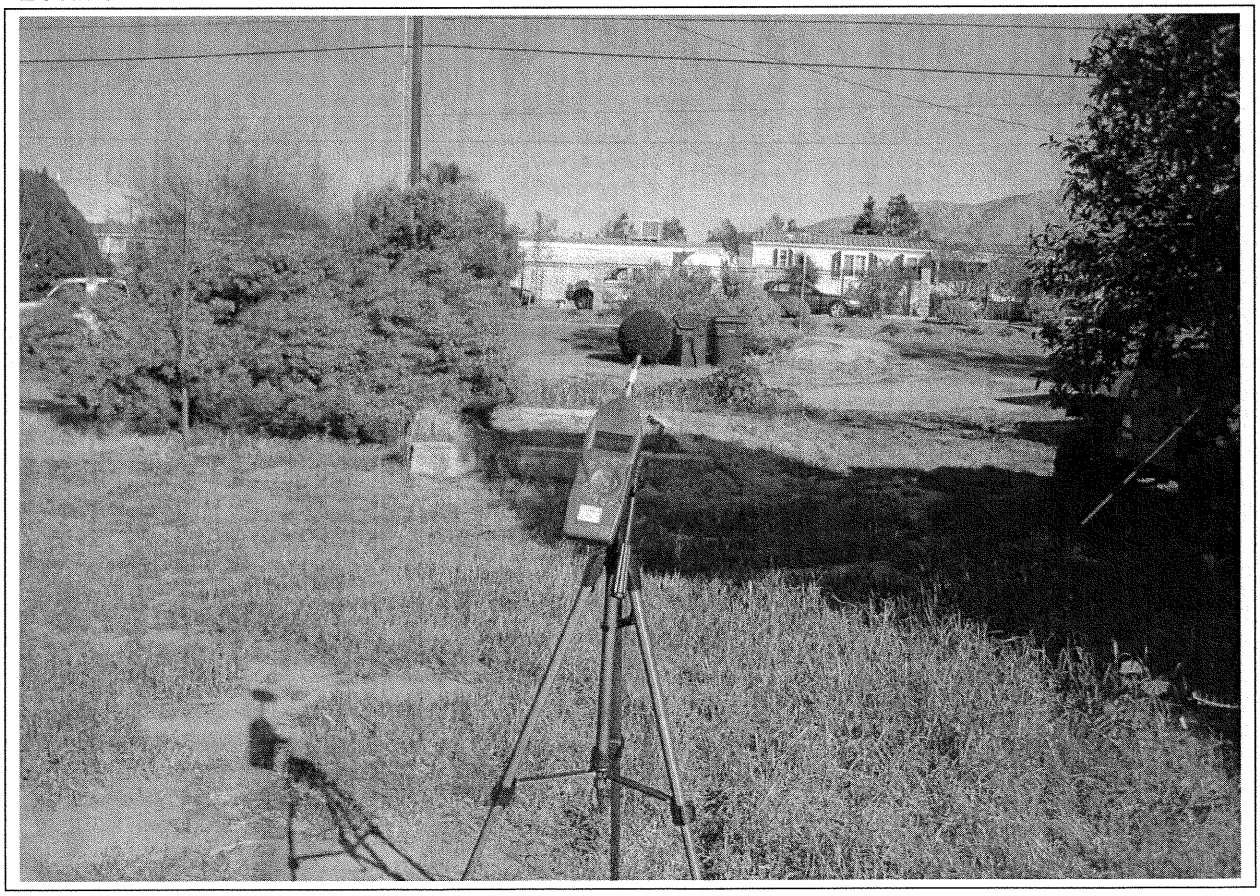
Atmospheric Conditions: Max/Avg
Wind Velocity: 2.6/1.0 (MPH); Temperature: 69.0° (F)
Relative Humidity: 39.0 (%)

Test Personnel: Corey Knips

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-10 Date: 11-06-2008 Time: From 11:24 To 11:39 PM

Site Location: 11981 La Crosse Avenue, IN THE BACKYARD

Noise Sources: TRAFFIC ON I-215 OFF RAMP TO BARTON Road

Measurement Results (dBA)

Leq 68.9
Lmax 77.7
Lmin 61.0
Lpeak 91.9
L2 72.4
L8 71.3
L25 69.9
L50 68.4
SEL

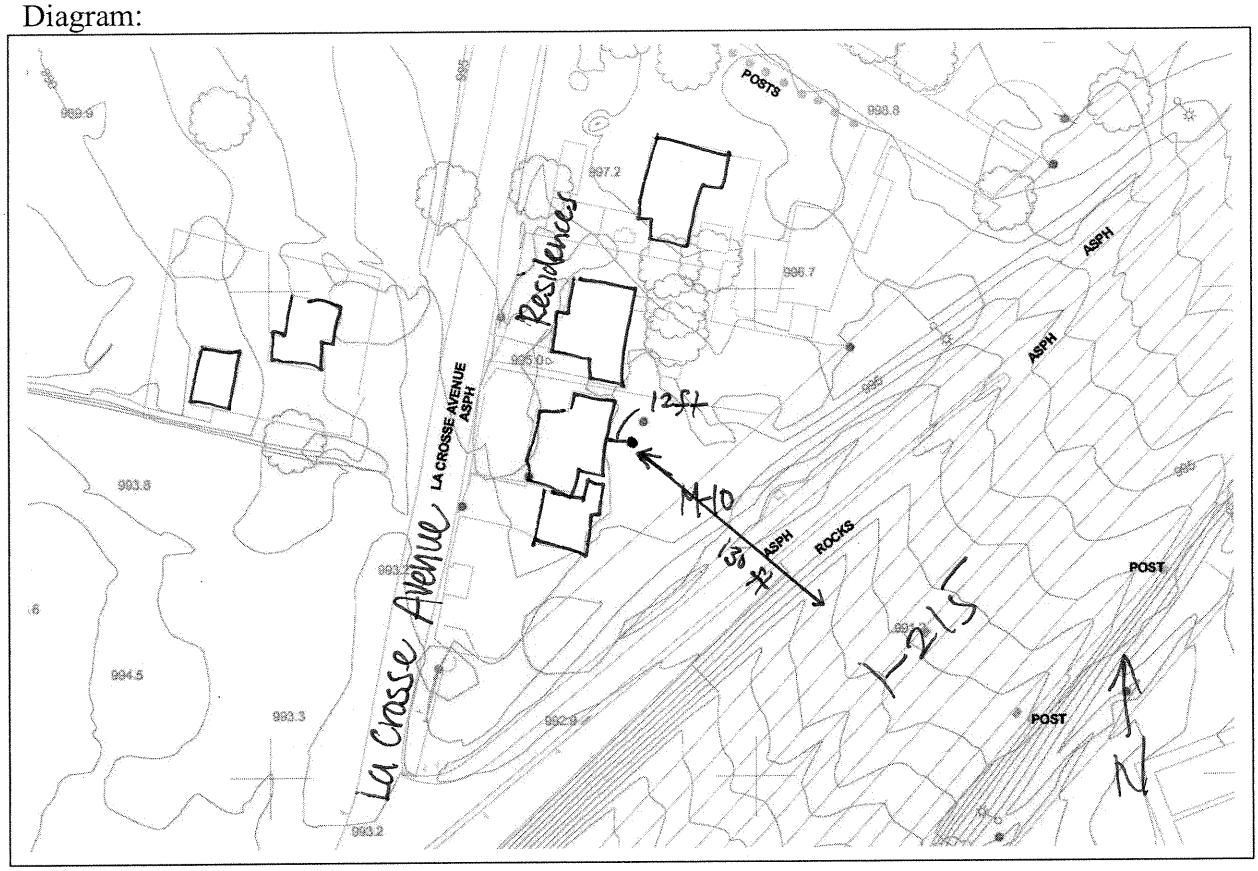
Comments: NO EXISTING WALL NO PROPERTY WALL FAINT AIRCRAFT NOISE

Equipment: LARSON DAVIS 820 MODEL SOUND METER

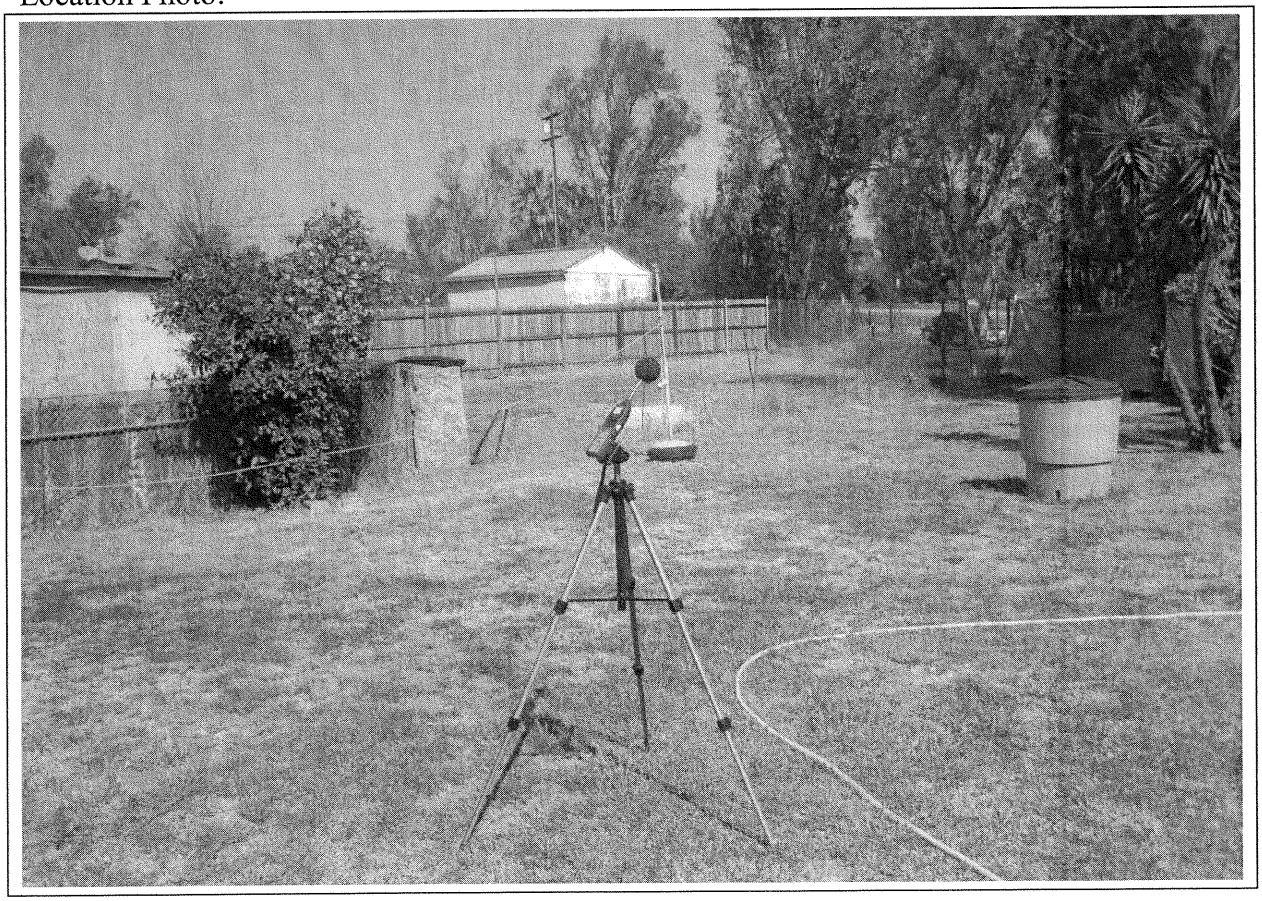
Atmospheric Conditions: Ave. 0.7 / MAX. 3.8 (MPH); Temperature: 84.2 (F)
Relative Humidity: 11.7 (%)

Test Personnel: TEAK KIM

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-11 Date: 11/6/08 Time: From 11:24 To 11:39

Site Location: 22111 Newport Ave. #181 Grand Royal Estates
North side of backyard 10 ft west of wall, 9 ft north of home

Noise Sources: I-215 freeway traffic

#3

**Measurement Results (dBA)**

| | |
|---|---|
| Leq | 60.6 |
| Lmax | 69.8 |
| Lmin | 51.3 |
| Lpeak | 84.3 |
| L2 | 65.1 |
| L8 | 63.5 |
| L25 | 61.4 |
| L50 | 59.6 |
| SEL | 90.1 |

Comments: 5.3 FT EXISTING WALL

Equipment: Larson Davis 824 Noise Meter

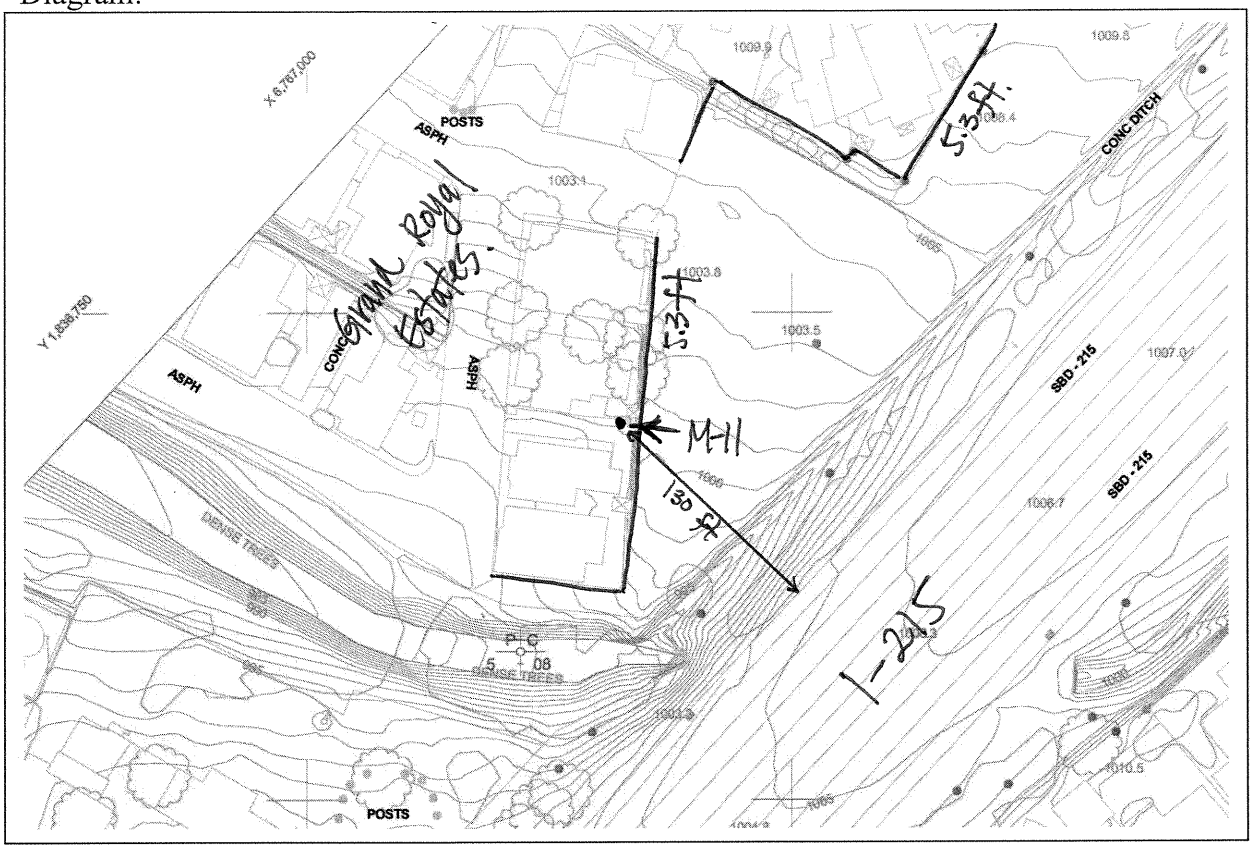
**Atmospheric Conditions:**

Wind Velocity: _____ (MPH); Temperature: _____ (F)

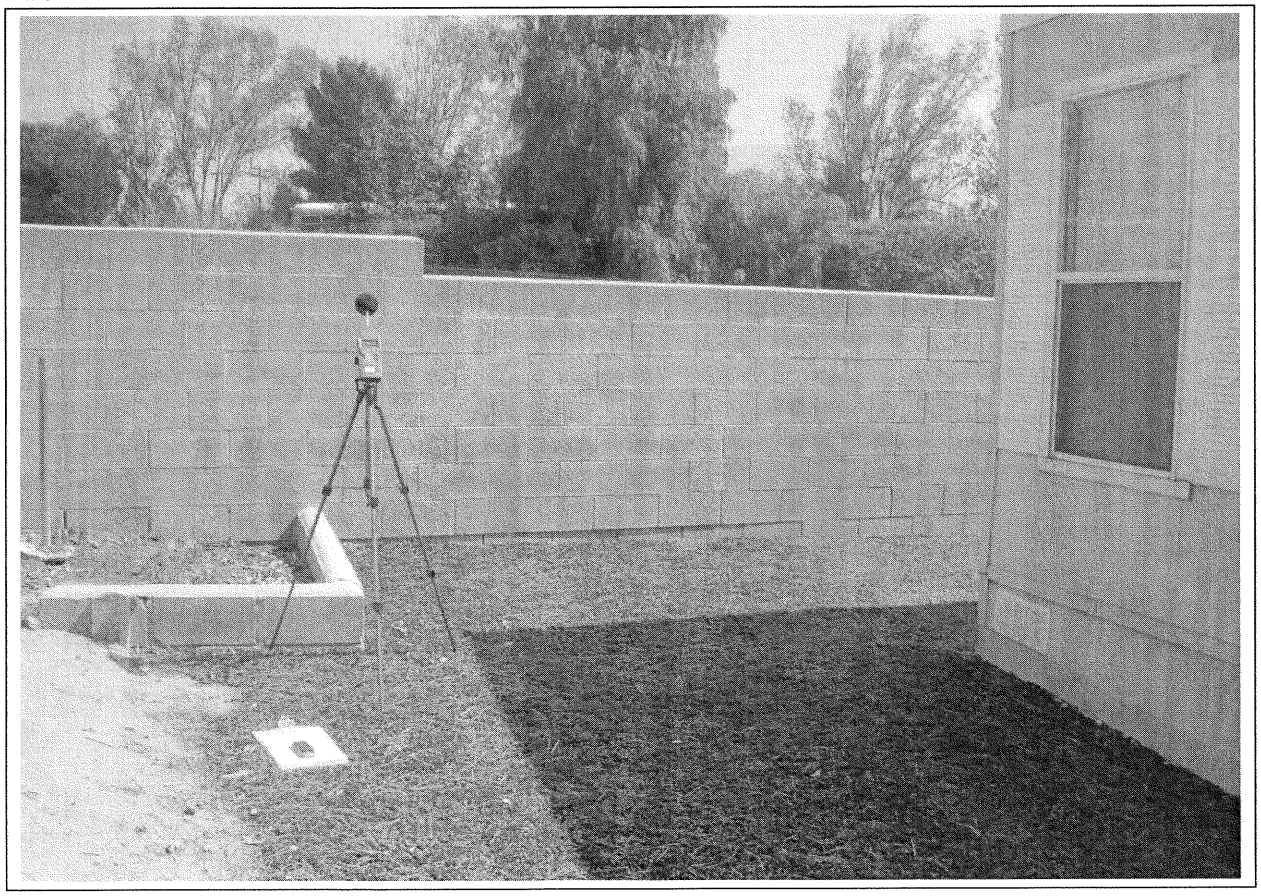
Relative Humidity: _____ (%)

Test Personnel: Corey Knips

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-12 Date: 11-6-08 Time: From 9:54 am To 10:09 am

Site Location: 22111 Newport Avenue at Grand Royal Estates at the end of the driveway of #41

Noise Sources: Traffic on I-215 and Newport Avenue

Measurement Results (dBA)

Leq 48.9
Lmax 58.1
Lmin 44.9
Lpeak 82.0
L2 52.8
L8 50.9
L25 49.3
L50 48.2
SEL 78.5

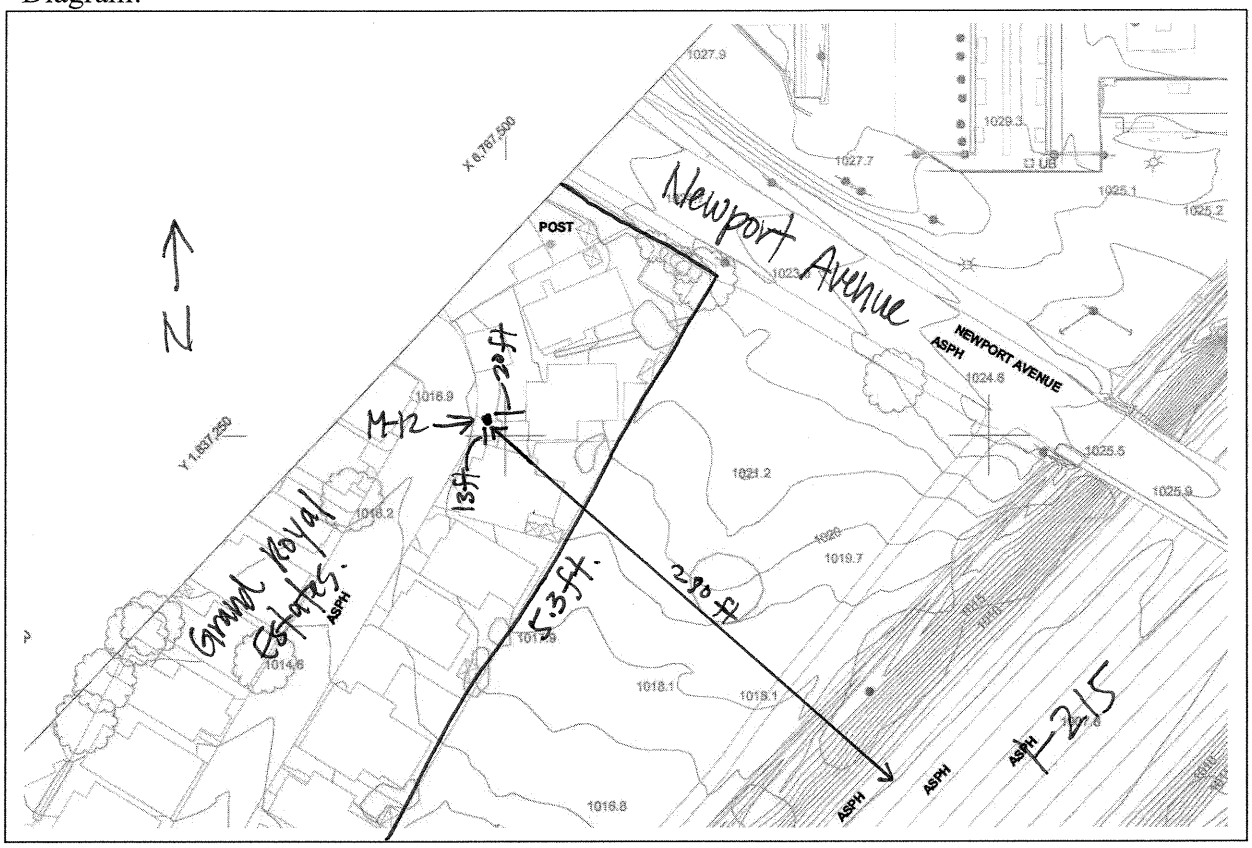
Comments: _____

Equipment: Larson Davis model 824 Sound Level Meter.

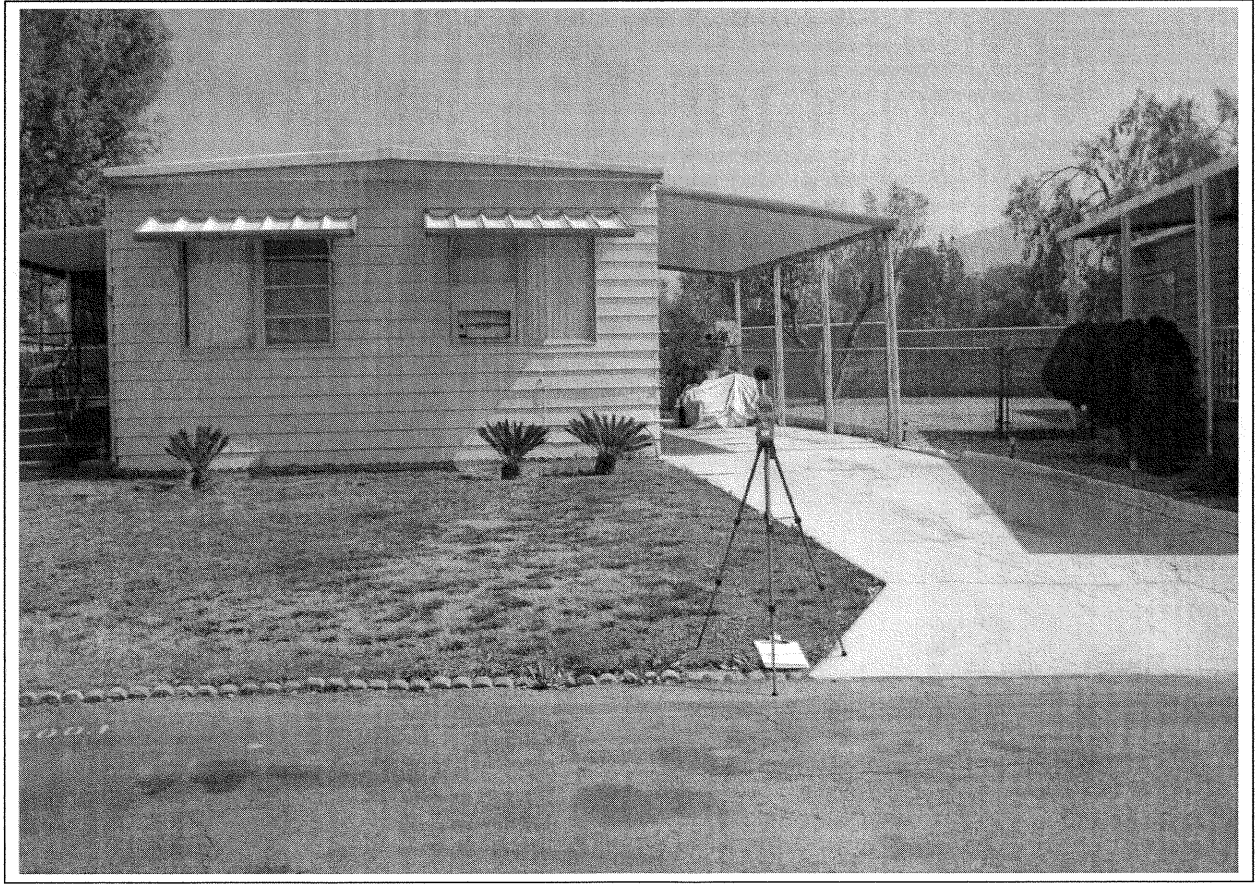
Atmospheric Conditions:
Wind Velocity: _____ (MPH); Temperature: _____ (F)
Relative Humidity: _____ (%)

Test Personnel: Corey Knips

Diagram:




Location Photo:



# NOISE LEVEL MEASUREMENTS RETAKE

Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-6 Date: 11-20-08 Time: From 11:27 am To 11:42 am

Site Location: 11947 Vivienda Court, in the middle of the backyard

Noise Sources: Some dogs barking (the neighbors and the property with noise meter had a small dog). Faint I-215 traffic. Birds chirping. Faint aircraft noise

Measurement Results (dBA)

Leq 50.6
Lmax 63.3
Lmin 45.6
Lpeak 82.5
L2 56.6
L8 52.5
L25 50.5
L50 49.5
SEL —

Comments: Elevated approx. 20 ft higher than I-215. There is an existing 4.5 ft wall (7 Blocks @ 8in between I-215 and Noise meter). As well as a partial 6 ft high wooden fence starting where the backyard becomes elevated. The backyard has two levels. Noise level measurement was taken in the lowest section of the higher level (average elevation). Meter appears to be above I-215. Residence is slightly elevated above the freeway.

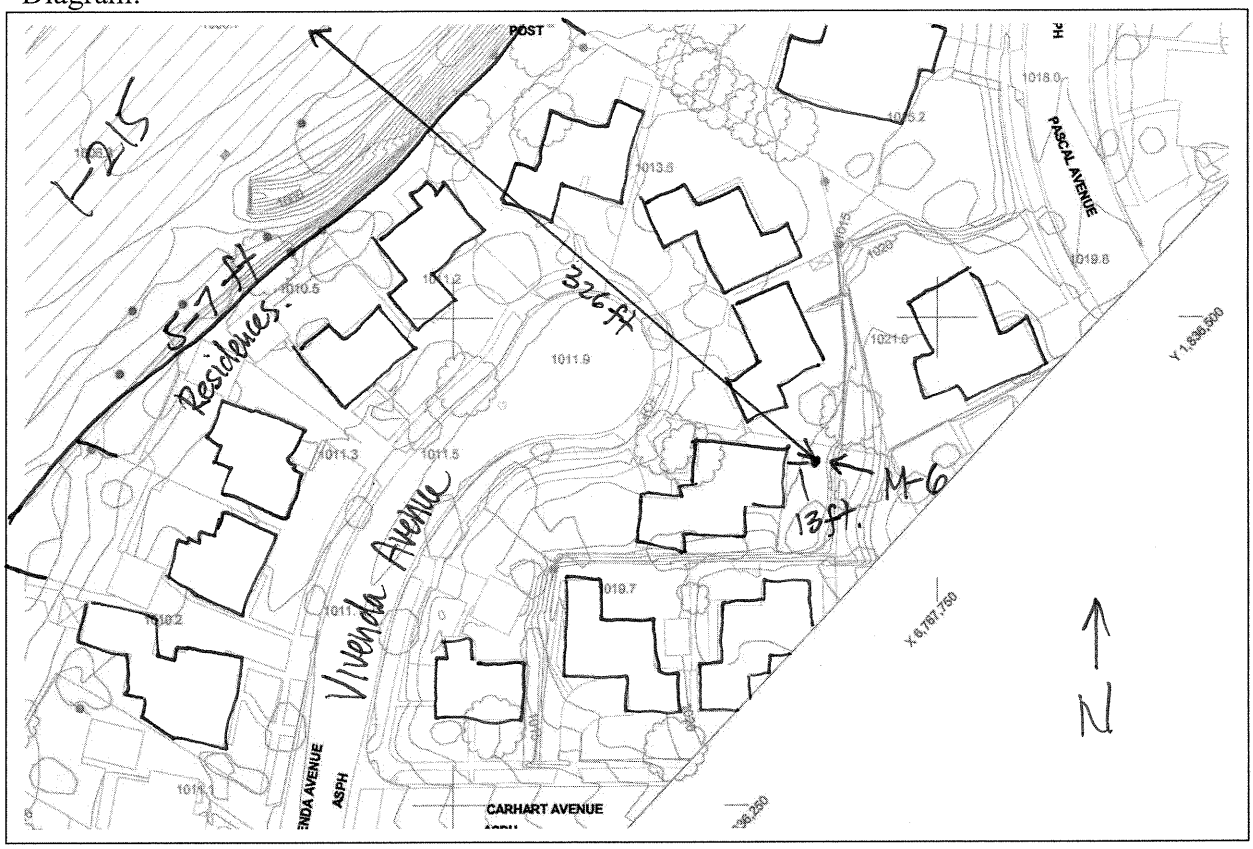
Equipment: Larson Davis model 820 Sound Level Meter

Atmospheric Conditions: Avg / Max
Wind Velocity: 0.0 / 1.1 (MPH); Temperature: 80.2 (F)
Relative Humidity: 28.5 (%)

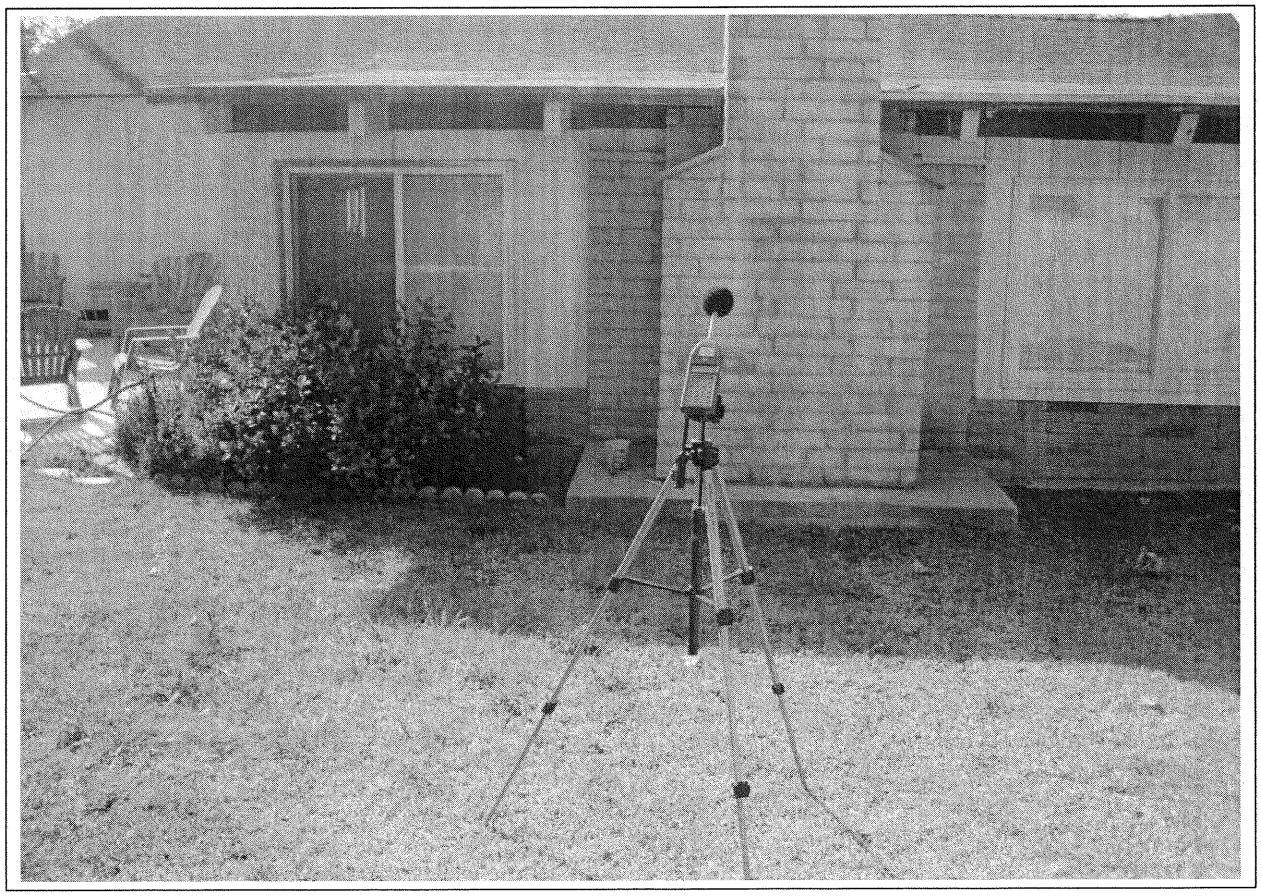
Test Personnel: Ryo Braco

Approx. 15 ft with a gradual down slope towards the freeway. Noise meter is approximately 20 ft above freeway but still has the top half of the house as a barrier.

Diagram:




Location Photo:



Sheet _____ of _____

# NOISE MEASUREMENT SURVEY

Site Number: M-11 Date: 1-20-08 Time: From 12:52 pm To 1:07 pm

Site Location: 2211 Newport Avenue #181 on the northside of the backyard. along the property line of #180

Noise Sources: I-215 traffic. Helicopter flying over. Brief talking with resident was mostly filtered out

Measurement Results (dBA)

Leq 60.8
Lmax 74.6
Lmin 54.3
Lpeak 92.9
L2 66.5
L8 63.0
L25 60.9
L50 59.5
SEL —

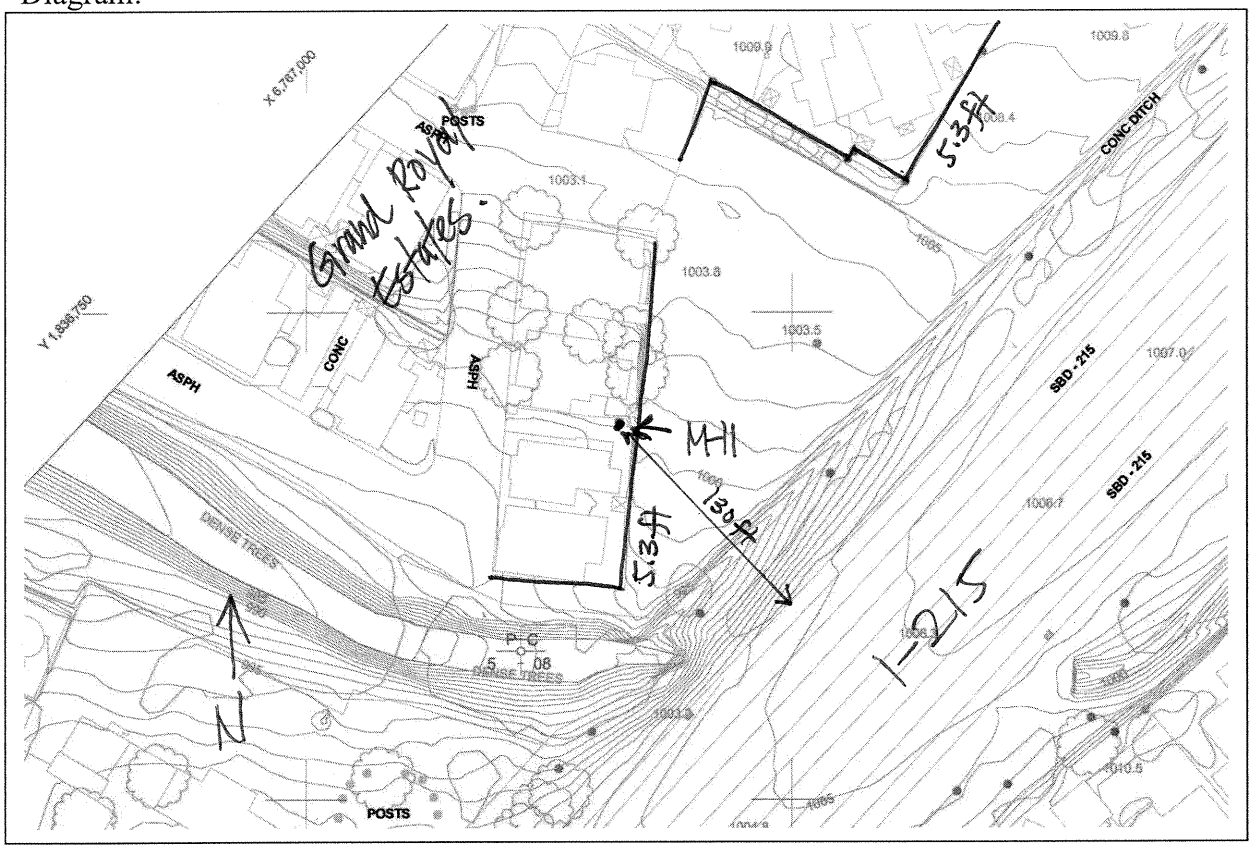
Comments: Noise meter is approx. 4 ft below the I-215. There is an existing 5.3 ft high wall along the property line between the house and I-215. Noise meter is below the freeway.

Equipment: Larson Davis model 820 Sound Level Meter.

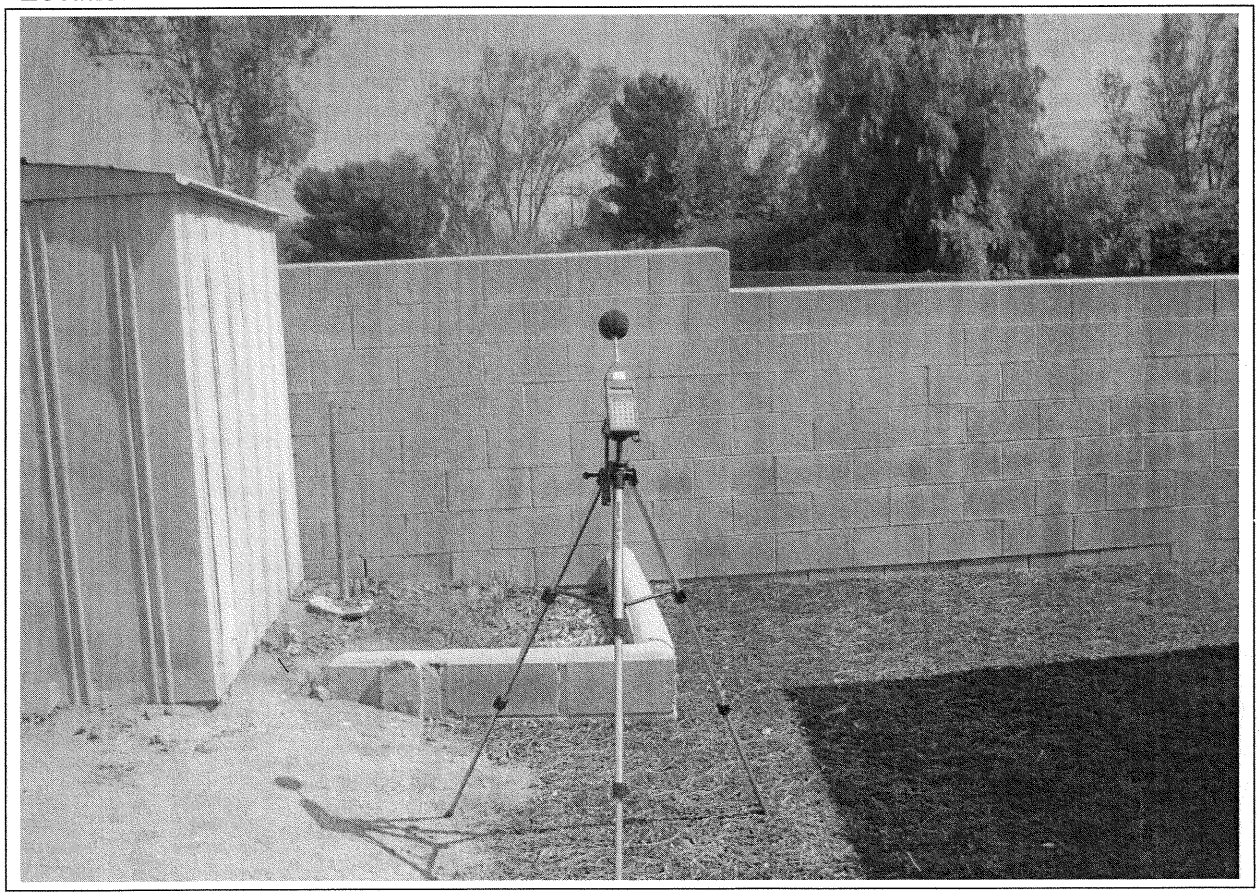
Atmospheric Conditions: Avg Max
Wind Velocity: 0.0 / 0.9 (MPH); Temperature: 82.4 (F)
Relative Humidity: 18.4 (%)

Test Personnel: Ryo Braco.

Diagram:




Location Photo:



# NOISE MEASUREMENT SURVEY

Site Number: M-12 Date: 11/20/08 Time: From 12:19 pm To 12:24 pm

Site Location: Grand Royal Estates 2211 Newport Avenue
House number 41, in the front street near the driveway

Noise Sources: I-215 traffic, quiet car driving by, neighbors
bird chirping faint aircraft noise

Measurement Results (dBA)

Leq 51.7
Lmax 61.5
Lmin 47.5
Lpeak 92.4
L2 57.9
L8 54
L25 51.7
L50 50.5
SEL

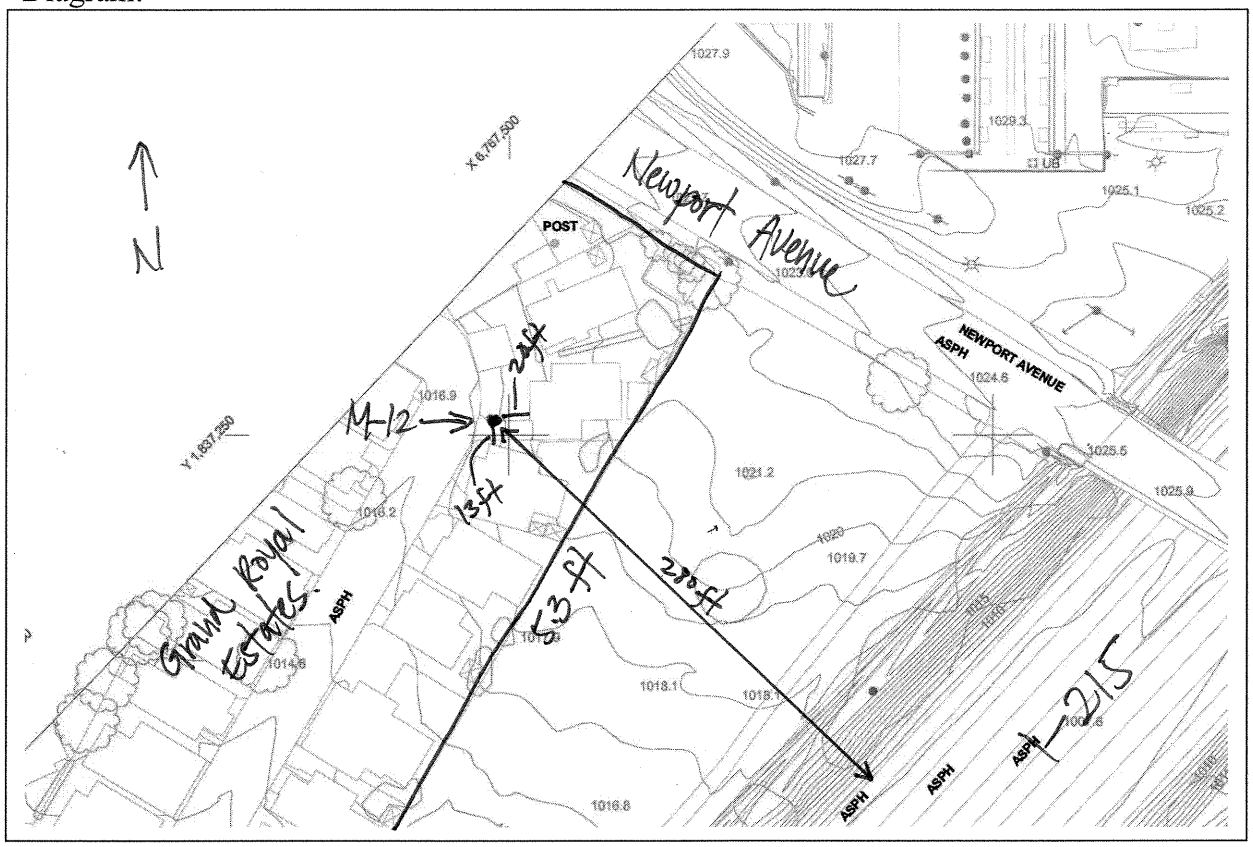
Comments: Office was closed so took measurement from the driveway and street. Existing sound wall 5.3 foot high 8 8 inch blocks, which is 75 feet east of sound meter. The wall reduces to 7 blocks at 8 inches 4.5 feet behind house 42. Noise meter is at a similar elevation as I-215.

Equipment: Larson-Davis 820

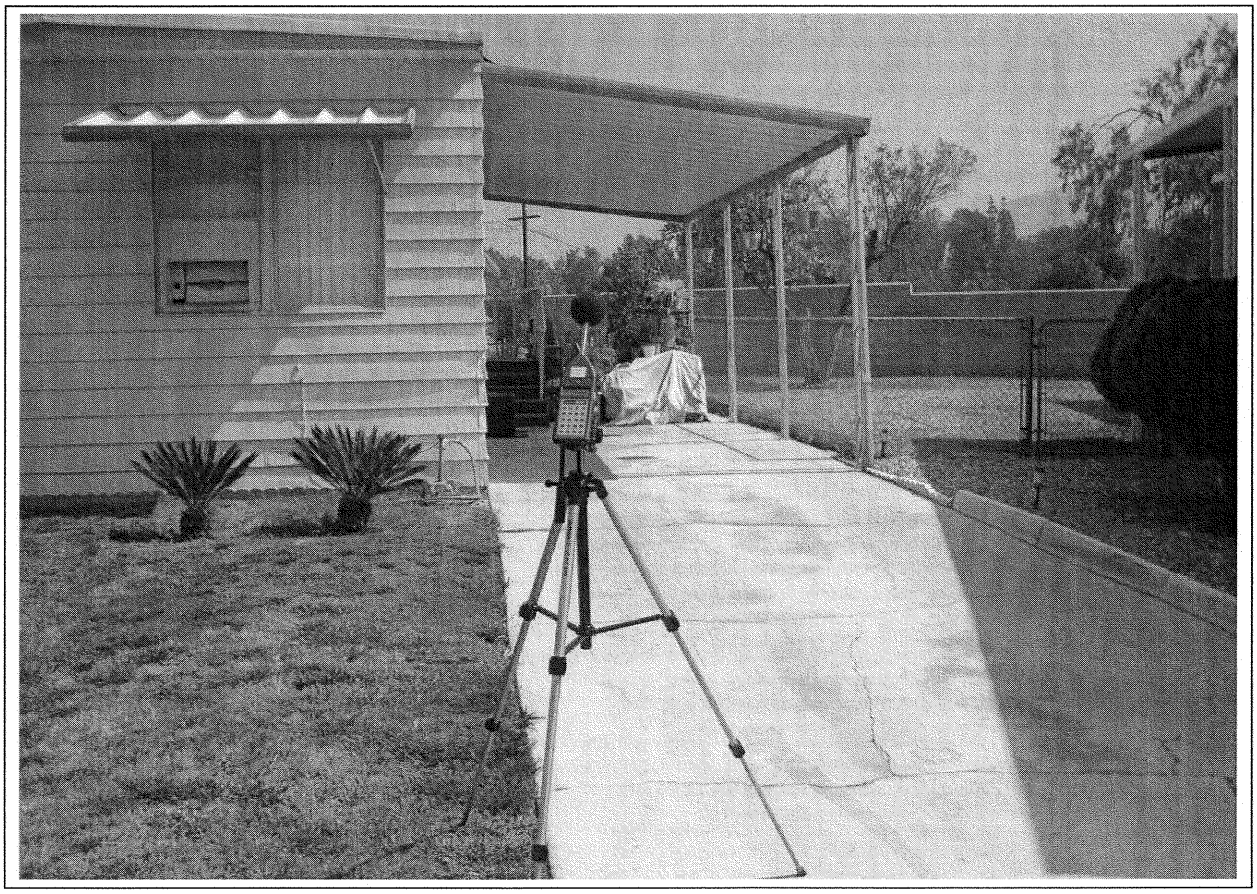
Atmospheric Conditions: AVG / MAX
Wind Velocity: 1.4 / 2.9 (MPH); Temperature: 85.3 (F)
Relative Humidity: 20.0 (%)

Test Personnel: Ryo Braco

Diagram:




Location Photo:



# INTERIOR/EXTERIOR NOISE LEVEL MEASUREMENTS

# NOISE MEASUREMENT SURVEY

Site Number: INTERIOR Date: 11/20/08 Time: From 10:03am To 10:18am

Site Location: 12066 Vivienda Avenue, Grand Terrace Elementary School
Inside of classroom 30 in the middle of the room. Noise meter was approximately 100 feet from the I-215.

Noise Sources: None. Classroom door was cracked open slightly (less than 1 inch) to keep it from locking. Noticed some extremely faint air conditioner noise when picking up the noise meter along with the ticking of a clock 12 feet away.

**Measurement Results (dBA)**

Leq 42.7
Lmax 53.0
Lmin 34.1
Lpeak 71.4
L2 49.1
L8 46.2
L25 43.5
L50 41.1
SEL

Comments: No children were present. Measurement could'nt be taken in classroom 34 (closest to freeway) because children were having a music class. No music was audible inside or outside classroom 30 Noise meter is at a similar elevation as I-215.

Equipment: Larson-Davis 820

Atmospheric Conditions:
Wind Velocity: 0.0/0.0 (MPH); Temperature: 77.0 (F)
Relative Humidity: 48.2 (%)

Test Personnel: Ryo Braco

# NOISE MEASUREMENT SURVEY

Site Number: ~~EXTERIOR~~ Date: 11/20/08 Time: From 10:03 am To 10:18 am

Site Location: 12066 Viviendra Avenue, Grand Terrace CA Elementary School
Between classroom 30 and 25, approximately 100 feet Southeast of I-215.

Noise Sources: I-215 traffic

Measurement Results (dBA)

Leq 64.9
Lmax 71.3
Lmin 56.4
Lpeak 84.6
L2 69.1
L8 67.5
L25 65.7
L50 64.1
SEL 94.6

Comments: No sound walls between noise meter and I-215. Approximately 10 feet from classroom 30's building. No children present. An 8 foot chain link fence is along the property line which is ~75 feet southwest of noise meter. Noise meter is 10 feet from classroom 25's building. There is a large freeway sign between the freeway and noise meter but it appears to have very minimal impact.

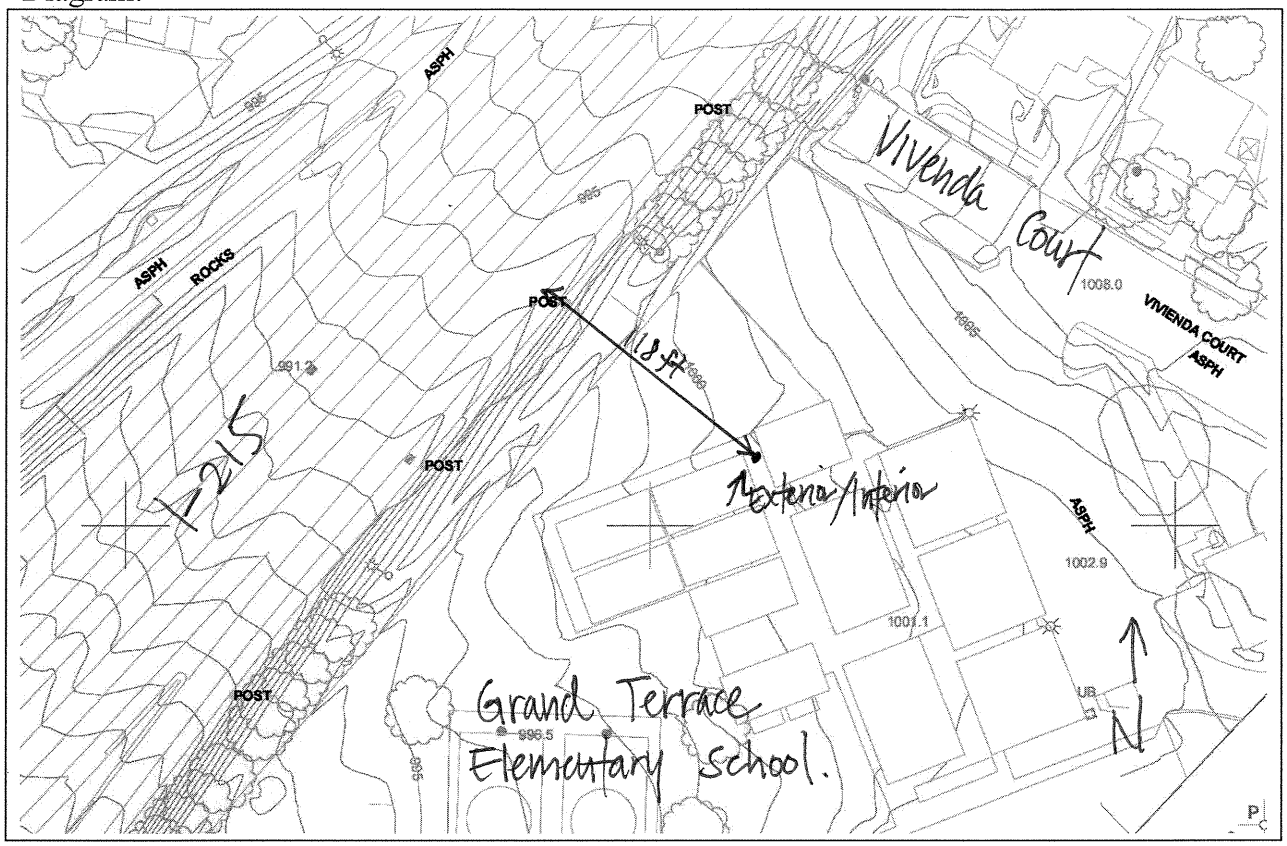
Equipment: Larson-Davis 824

Atmospheric Conditions: Avg / Max
Wind Velocity: 0.7 / 2.5 (MPH); Temperature: 79.9 (F)
Relative Humidity: 32.1 (%)

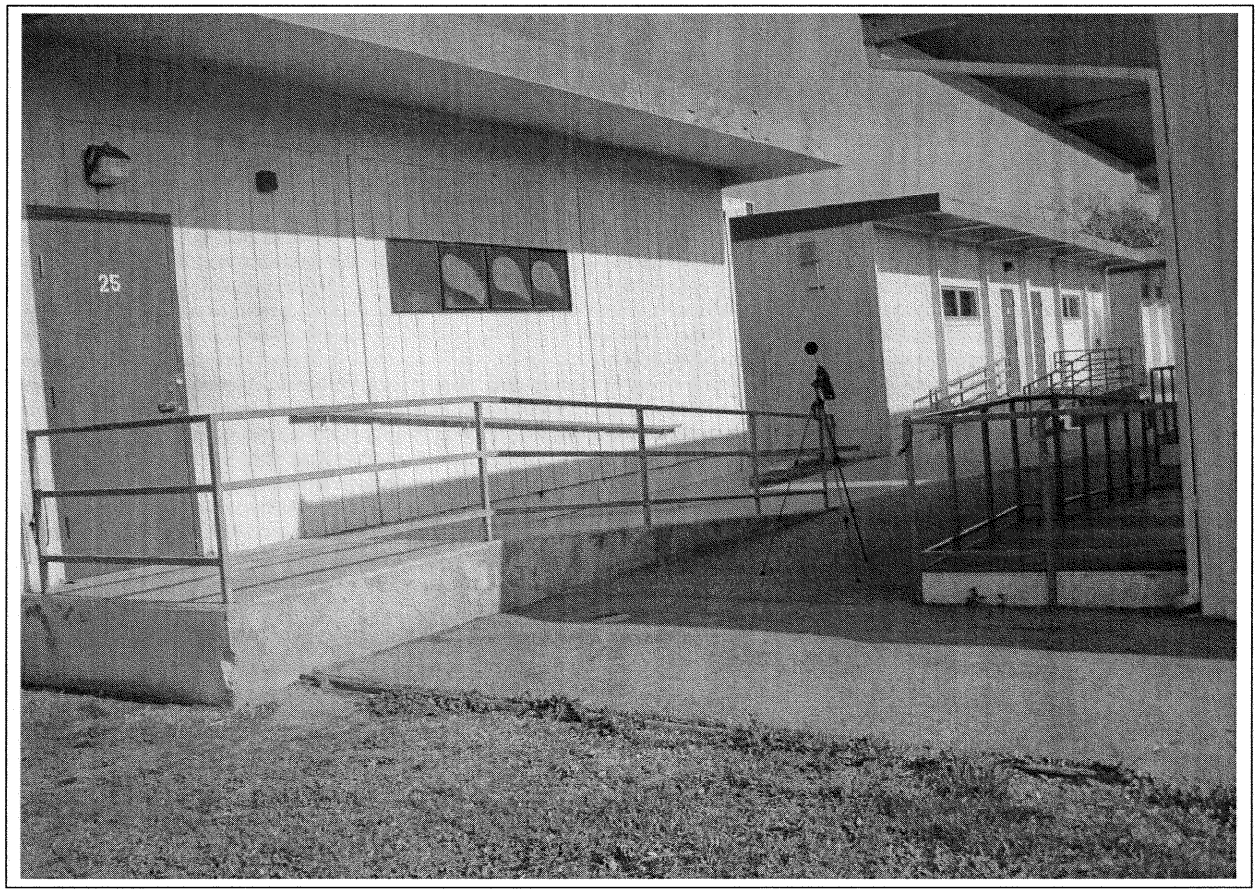
Test Personnel: Kyo Braco

School buildings 25 and 30 are approximately 11 feet high. All buildings are the same height. Noise meter is at a similar elevation as I-215.

Diagram:




Location Photo:



**LONG-TERM NOISE LEVEL MEASUREMENT**
**(Traffic and Background Noise Levels)**

# 24-Hour Noise Level Measurement (Traffic Noise Levels)

**11902 Pascal Avenue, Grand Terrace, CA**

| | Date | Time | Duration | Leq | Lmax | Lmin | Peak | L( 2) | L( 8) | L(25) | L(50) | SEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2/2/10 | 3:00 PM | 60.0 | 67 | 77.4 | 60.8 | 103.5 | 70.6 | 69.3 | 68.0 | 67.1 | 103.0 |
| 2 | 2/2/10 | 4:00 PM | 60.0 | 67 | 89.8 | 61.6 | 109.7 | 70.2 | 68.8 | 67.6 | 66.6 | 102.9 |
| 3 | 2/2/10 | 5:00 PM | 60.0 | 67 | 82.2 | 60.8 | 101.1 | 70.1 | 68.4 | 67.0 | 66.0 | 102.1 |
| 4 | 2/2/10 | 6:00 PM | 60.0 | 66 | 76.7 | 61.0 | 99.0 | 69.3 | 67.8 | 66.5 | 65.5 | 101.5 |
| 5 | 2/2/10 | 7:00 PM | 60.0 | 66 | 75.9 | 59.3 | 100.4 | 69.4 | 67.6 | 66.4 | 65.3 | 101.3 |
| 6 | 2/2/10 | 8:00 PM | 60.0 | 66 | 76.9 | 58.2 | 100.2 | 69.3 | 67.8 | 66.5 | 65.3 | 101.3 |
| 7 | 2/2/10 | 9:00 PM | 60.0 | 66 | 83.1 | 54.3 | 105.0 | 70.0 | 68.3 | 66.7 | 65.4 | 101.6 |
| 8 | 2/2/10 | 10:00 PM | 60.0 | 65 | 71.8 | 54.8 | 100.8 | 68.9 | 67.7 | 66.2 | 64.9 | 100.8 |
| 9 | 2/2/10 | 11:00 PM | 60.0 | 64 | 74.5 | 46.9 | 100.4 | 68.9 | 67.2 | 65.5 | 63.8 | 100.0 |
| 10 | 2/3/10 | 12:00 AM | 60.0 | 63 | 74.1 | 43.1 | 100.8 | 67.9 | 66.2 | 64.1 | 62.0 | 98.5 |
| 11 | 2/3/10 | 1:00 AM | 60.0 | 61 | 74.3 | 41.9 | 100.0 | 67.3 | 65.2 | 62.5 | 59.9 | 96.9 |
| 12 | 2/3/10 | 2:00 AM | 60.0 | 60 | 71.5 | 42.3 | 102.0 | 66.7 | 64.3 | 61.5 | 58.3 | 95.8 |
| 13 | 2/3/10 | 3:00 AM | 60.0 | 61 | 73.8 | 42.7 | 100.7 | 67.1 | 64.8 | 61.5 | 58.3 | 96.0 |
| 14 | 2/3/10 | 4:00 AM | 60.0 | 61 | 79.3 | 44.4 | 101.7 | 67.7 | 65.5 | 62.5 | 59.6 | 97.0 |
| 15 | 2/3/10 | 5:00 AM | 60.0 | 64 | 72.6 | 46.9 | 100.9 | 68.9 | 67.1 | 64.7 | 62.5 | 99.1 |
| 16 | 2/3/10 | 6:00 AM | 60.0 | 66 | 82.2 | 53.8 | 103.6 | 70.7 | 69.0 | 67.4 | 65.7 | 102.0 |
| 17 | 2/3/10 | 7:00 AM | 60.0 | **68** | 76.7 | 58.9 | 102.8 | 70.7 | 69.7 | 68.6 | 67.4 | 103.2 |
| 18 | 2/3/10 | 8:00 AM | 60.0 | **68** | 76.8 | 63.4 | 102.0 | 70.4 | 69.5 | 68.6 | 67.8 | 103.5 |
| 19 | 2/3/10 | 9:00 AM | 60.0 | **68** | 80.2 | 62.5 | 103.5 | 70.6 | 69.3 | 68.3 | 67.4 | 103.3 |
| 20 | 2/3/10 | 10:00 AM | 60.0 | 67 | 74.8 | 59.9 | 100.3 | 70.3 | 69.1 | 67.9 | 66.8 | 102.7 |
| 21 | 2/3/10 | 11:00 AM | 60.0 | 67 | 76.2 | 56.3 | 101.2 | 70.0 | 68.7 | 67.4 | 66.3 | 102.2 |
| 22 | 2/3/10 | 12:00 PM | 60.0 | 67 | 74.9 | 58.4 | 104.3 | 69.0 | 68.7 | 67.4 | 66.2 | 102.1 |
| 23 | 2/3/10 | 1:00 PM | 60.0 | 67 | 78.4 | 57.9 | 101.5 | 69.9 | 68.7 | 67.6 | 66.6 | 102.4 |
| 24 | 2/3/10 | 2:00 PM | 60.0 | 67 | 79.6 | 60.3 | 102.1 | 70.6 | 69.3 | 67.9 | 67.0 | 102.9 |
| | | | | | | | | | | | | |
| | | | **Overall** | 66 | 89.8 | 41.9 | 110.9 | 69.8 | 68.5 | 67.1 | 65.7 | 115.8 |
| | | | | | | | | | | | | |
| **2/2/2010** | | | | | | | | | | | | |

# 24-Hour Noise Level Measurement (Background Noise Levels)

**21995 Vivienda Avenue, Grand Terrace, CA**

| | Date | Time | Duration | Leq | Lmax | Lmin | Peak | L( 2) | L( 8) | L(25) | L(50) | SEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2/2/10 | 4:00 PM | 60.0 | 52 | 63.7 | 45.4 | 83.5 | 57.3 | 54.6 | 52.5 | 51.0 | 87.6 |
| 2 | 2/2/10 | 5:00 PM | 60.0 | 54 | 47.4 | 70.7 | 91.4 | 61.5 | 55.3 | 53.3 | 52.1 | 89.6 |
| 3 | 2/2/10 | 6:00 PM | 60.0 | 55 | 70.4 | 50.4 | 94.7 | 61.9 | 57.9 | 55.4 | 54.0 | 91.0 |
| 4 | 2/2/10 | 7:00 PM | 60.0 | 56 | 71.0 | 53.3 | 85.2 | 59.8 | 57.4 | 56.4 | 55.6 | 91.9 |
| 5 | 2/2/10 | 8:00 PM | 60.0 | **58** | 76.1 | 54.1 | 89.2 | 62.3 | 58.8 | 57.6 | 56.7 | 93.0 |
| 6 | 2/2/10 | 9:00 PM | 60.0 | 57 | 68.8 | 54.7 | 88.9 | 58.6 | 57.7 | 56.9 | 56.4 | 92.2 |
| 7 | 2/2/10 | 10:00 PM | 60.0 | 55 | 70.8 | 53.5 | 82.2 | 57.9 | 55.8 | 55.0 | 54.6 | 90.7 |
| 8 | 2/2/10 | 11:00 PM | 60.0 | 55 | 69.0 | 52.6 | 80.8 | 60.3 | 56.8 | 55.2 | 54.6 | 90.9 |
| 9 | 2/3/10 | 12:00 AM | 60.0 | 55 | 67.7 | 53.5 | 80.0 | 57.3 | 55.9 | 55.3 | 54.7 | 90.8 |
| 10 | 2/3/10 | 1:00 AM | 60.0 | 55 | 71.6 | 53.3 | 84.3 | 58.6 | 56.5 | 55.4 | 54.8 | 91.0 |
| 11 | 2/3/10 | 2:00 AM | 60.0 | 55 | 65.5 | 53.5 | 76.1 | 57.3 | 55.8 | 54.9 | 54.6 | 90.4 |
| 12 | 2/3/10 | 3:00 AM | 60.0 | 56 | 64.5 | 54.2 | 78.4 | 58.5 | 57.0 | 56.0 | 55.6 | 91.4 |
| 13 | 2/3/10 | 4:00 AM | 60.0 | 56 | 73.9 | 54.5 | 86.4 | 59.1 | 57.1 | 56.0 | 55.6 | 91.9 |
| 14 | 2/3/10 | 5:00 AM | 60.0 | 56 | 67.8 | 54.6 | 80.0 | 59.2 | 57.0 | 56.2 | 55.7 | 91.6 |
| 15 | 2/3/10 | 6:00 AM | 60.0 | 57 | 68.6 | 54.5 | 80.2 | 60.7 | 57.4 | 56.5 | 55.8 | 92.1 |
| 16 | 2/3/10 | 7:00 AM | 60.0 | 57 | 81.8 | 51.2 | 101.5 | 61.5 | 58.0 | 56.5 | 55.7 | 92.5 |
| 17 | 2/3/10 | 8:00 AM | 60.0 | 55 | 72.6 | 50.5 | 86.6 | 58.8 | 56.7 | 55.0 | 53.8 | 90.5 |
| 18 | 2/3/10 | 9:00 AM | 60.0 | 54 | 78.1 | 48.4 | 98.6 | 60.1 | 55.9 | 53.1 | 52.0 | 89.4 |
| 19 | 2/3/10 | 10:00 AM | 60.0 | 52 | 64.9 | 47.9 | 80.3 | 56.7 | 53.7 | 52.0 | 50.9 | 87.4 |
| 20 | 2/3/10 | 11:00 AM | 60.0 | 54 | 65.2 | 50.0 | 80.9 | 58.1 | 55.6 | 54.3 | 53.4 | 89.6 |
| 21 | 2/3/10 | 12:00 PM | 60.0 | **58** | 84.9 | 49.6 | 97.7 | 62.4 | 56.2 | 54.6 | 53.5 | 93.6 |
| 22 | 2/3/10 | 1:00 PM | 60.0 | 54 | 67.0 | 49.7 | 86.8 | 58.0 | 55.8 | 54.5 | 53.5 | 89.7 |
| 23 | 2/3/10 | 2:00 PM | 60.0 | 55 | 74.7 | 48.4 | 90.0 | 59.5 | 55.8 | 54.2 | 53.3 | 90.7 |
| 24 | 2/3/10 | 3:00 PM | 60.0 | 54 | 67.0 | 49.0 | 82.5 | 57.4 | 55.5 | 54.0 | 53.0 | 89.3 |
| | | | | | | | | | | | | |
| | | | **Overall** | 55 | 84.9 | 44.0 | 101.5 | 59.5 | 57.0 | 55.6 | 54.5 | 87.2 |
| | | | | | | | | | | | | |
| **2/2/2010** | | | | | | | | | | | | |

# RECEIVER AND BUILDING BARRIER JUSTIFICATION

| Receiver No. | Receiver Elevation Justification |
|---|---|
| R-4 | An elevation of 973.0 ft was obtained using GPS for Receiver R-4. |
| R-5 | An elevation of 973.0 ft was obtained using GPS for Receiver R-5. |
| R-7 | An elevation of 980.0 ft was obtained using GPS for Receiver R-7. |
| R-8 | An elevation of 982.0 ft was obtained using GPS for Receiver R-8. |
| R-9 | An elevation of 986.0 ft was obtained using GPS for Receiver R-9. |
| R-10 | An elevation of 992.0 ft was obtained using GPS for Receiver R-10. |
| R-11 | An elevation of 996.0 ft was obtained using GPS for Receiver R-11. |
| R-12 | An elevation of 995.0 ft was obtained using GPS for Receiver R-12. |
| R-14 | An elevation of 998.0 ft was obtained using GPS for Receiver R-14. |
| R-15 | An elevation of 973.0 ft was obtained using GPS for Receiver R-15. |
| R-17 | The area without topographic coverage for Receiver R-17 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 1023.0 ft. The elevation for Receiver R-17 was estimated to be 1023.0 ft. |
| R-18 | An elevation of 1,010.0 ft was obtained using GPS for Receiver R-18. |
| R-36 | An elevation of 1,021.0 ft was obtained using GPS for Receiver R-36. |
| R-43 | An elevation of 1,010.0 ft was obtained using GPS for Receiver R-43. |
| R-44 | An elevation of 1,012.0 ft was obtained using GPS for Receiver R-44. |
| R-45 | An elevation of 1,012.0 ft was obtained using GPS for Receiver R-45. |
| R-51 | An elevation of 1,025.0 ft was obtained using GPS for Receiver R-51. |
| R-52 | An elevation of 1,030.0 ft was obtained using GPS for Receiver R-52. |
| R-53 | An elevation of 1,039.0 ft was obtained using GPS for Receiver R-53. |
| R-55 | The area without topographic coverage for Receiver R-55 was determined to be similar to building pad for the residential structure. The area representing the building pad from the topographic map coverage is 1044.0 ft. The elevation for Receiver R-55 was estimated to be 1044.0 ft. |
| R-58 | An elevation of 1,042.0 ft was obtained using GPS for Receiver R-58. |
| R-59 | An elevation of 1,042.0 ft was obtained using GPS for Receiver R-59. |
| R-93 | An elevation of 975.0 ft was obtained using GPS for Receiver R-93. |
| R-94 | An elevation of 975.0 ft was obtained using GPS for Receiver R-94. |
| R-95 | An elevation of 973.0 ft was obtained using GPS for Receiver R-95. |
| R-100 | An elevation of 971.0 ft was obtained using GPS for Receiver R-100. |
| R-110 | An elevation of 973.0 ft was obtained using GPS for Receiver R-110. |
| R-128 | An elevation of 1,016.0 ft was obtained using GPS for Receiver R-128. |
| R-129 | An elevation of 1,017.0 ft was obtained using GPS for Receiver R-129. |
| R-139 | The area without topographic coverage for Receiver R-139 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 966.0 ft. The elevation for Receiver R-139 was estimated to be 966.0 ft. |

| Buidings | Building Elevation Justification |
|---|---|
| Building Barrier 7 | Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 7 was determined to be similar to the closest area with topographic map coverage. The closest area with topographic map coverage is 1,022.0. |
| Building Barrier 10 | An elevation of 1,010.0 ft was obtained using GPS for this area. The elevation for Building Barrier 20 is slightly lower and is estimated to be 1,009.0 ft. |
| Building Barrier 14 | Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 14 was estimated to be 1,021.0 ft based on the closest area with topographic map coverage. |
| Building Barrier 15 | Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 15 was estimated to be 1,024.0 ft based on the closest area with topographic map coverage. |
| Building Barrier 28 | An elevation of 971.0 ft was obtained using GPS for this area. The elevation for Building Barrier 28 is 971.0 ft. |
| Building Barrier 33 | Field observation indicated that this area is generally flat. The area without topographic coverage for Building Barrier 33 was estimated to be 974.0 ft based on the closest area with topographic map coverage. |
| Building Barrier 34 | An elevation of 975.0 ft was obtained using GPS for this area. The elevation for Building Barrier 34 is 975.0 ft. |
| Building Barrier 35 | An elevation of 975.0 ft was obtained using GPS for this area. The elevation for Building Barrier 33 is slightly higher in elevation and is estimated to be 977.0 ft. |
| Building Barrier 36 | An elevation of 975.0 ft was obtained using GPS near this area. The elevation for Building Barrier 36 is higher in elevation and is estimated to be 978.0 ft. |
| Building Barrier 37 | An elevation of 975.0 ft was obtained using GPS near this area. The elevation for Building Barrier 37 is higher in elevation and is estimated to be 979.0 ft. |

# TNM 2.5 FILE DESCRIPTION

# TNM 2.5 FILE DESCRIPTION

Below is a list of all Traffic Noise Model (TNM) version 2.5 files along with a brief description for the I-215/Barton Road Interchange Project.

**Alt 3** – This is the TNM 2.5 file for Alternative 3. The sound barrier analysis is included in this file as well.

**Alt 3 (Ext-Int)** – This is the TNM 2.5 file for Alternative 3 that evaluates the future exterior noise level for the classroom building at the Grand Terrace Elementary School.

**Alt 5** – This is the TNM 2.5 file for Alternative 5. The sound barrier analysis is included in this file as well.

**Alt 5 (Ext-Int)** – This is the TNM 2.5 file for Alternative 5 that evaluates the future exterior noise level for the classroom building at the Grand Terrace Elementary School.

**Alt 6** – This is the TNM 2.5 file for Alternative 6. The sound barrier analysis is included in this file as well.

**Alt 6 (Ext-Int)** – This is the TNM 2.5 file for Alternative 6 that evaluates the future exterior noise level for the classroom building at the Grand Terrace Elementary School.

**Alt 7** – This is the TNM 2.5 file for Alternative 7. The sound barrier analysis is included in this file as well.

**Alt 7 (Ext-Int)** – This is the TNM 2.5 file for Alternative 7 that evaluates the future exterior noise level for the classroom building at the Grand Terrace Elementary School.

**Future No Build** – This TNM 2.5 file evaluates the future no project traffic noise levels within the project area.

**Ext-Int 01** – This TNM 2.5 files calibrates the noise model for the Exterior/Interior Monitoring Location-01 at the Grand Terrance Elementary School using the concurrent traffic counts.

**Calibration 01** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-01 using the concurrent traffic counts.

**Calibration 02** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-02 using the concurrent traffic counts.

**Calibration 03** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-03 using the concurrent traffic counts.

**Calibration 04** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-04 using the concurrent traffic counts.

**Calibration 05** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-05 using the concurrent traffic counts.

**Calibration 06** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-06 using the concurrent traffic counts.

**Calibration 07** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-07 using the concurrent traffic counts.

**Calibration 08** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-08 using the concurrent traffic counts.

**Calibration 09** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-09 using the concurrent traffic counts.

**Calibration 10** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-10 using the concurrent traffic counts.

**Calibration 11** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-11 using the concurrent traffic counts.

**Calibration 12** – This TNM 2.5 files calibrates the noise model for Monitoring Location M-12 using the concurrent traffic counts.

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

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REGISTERED PROFESSIONAL ENGINEER — FUN P. ONG — No. 70543 — Exp. 12/31/12 — CIVIL — STATE OF CALIFORNIA

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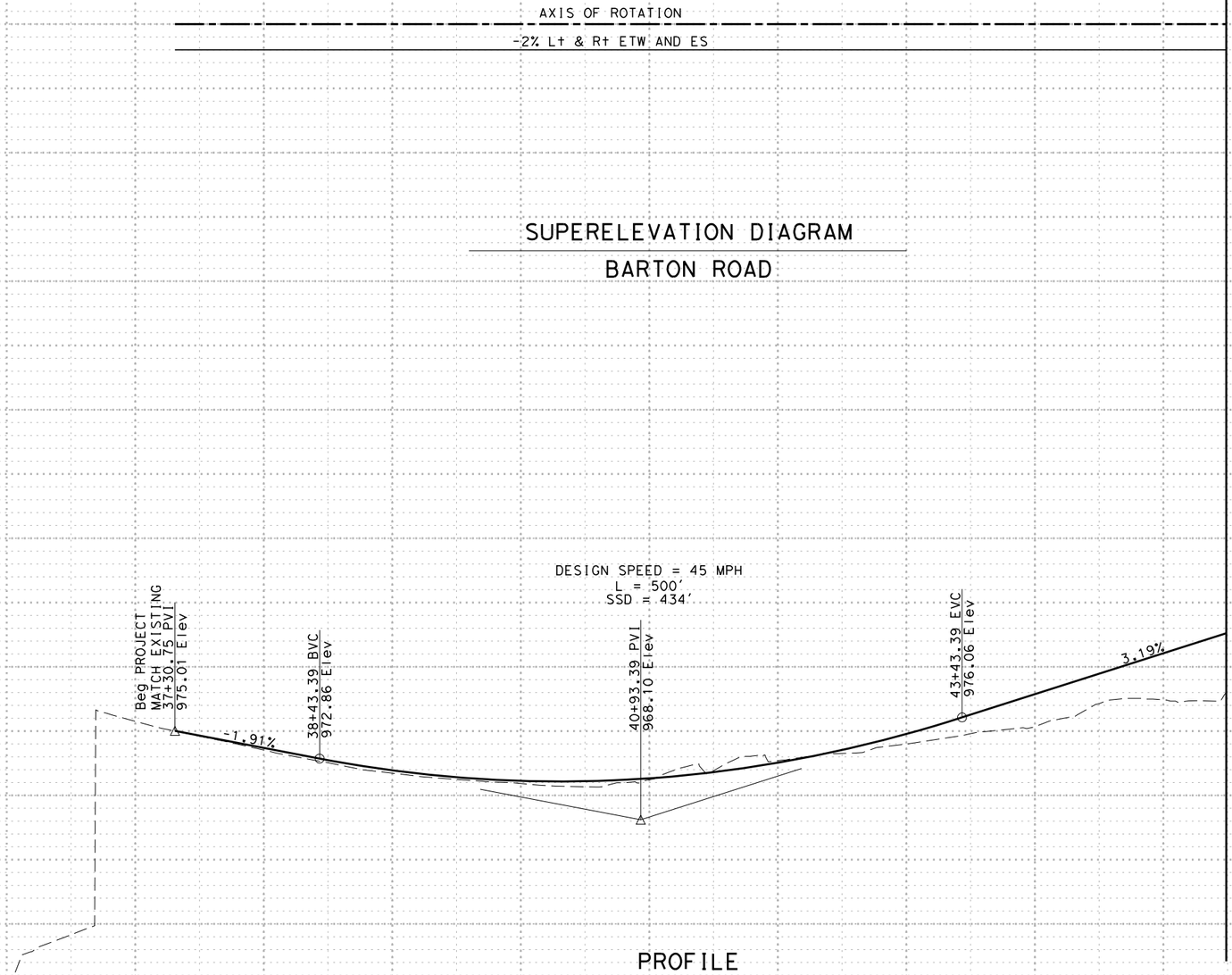
# SUPERELEVATION DIAGRAM
## BARTON ROAD




# PROFILE
## BARTON ROAD

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-1**

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DATE PLOTTED => 6/7/2011
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BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 3\80J070fb001.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
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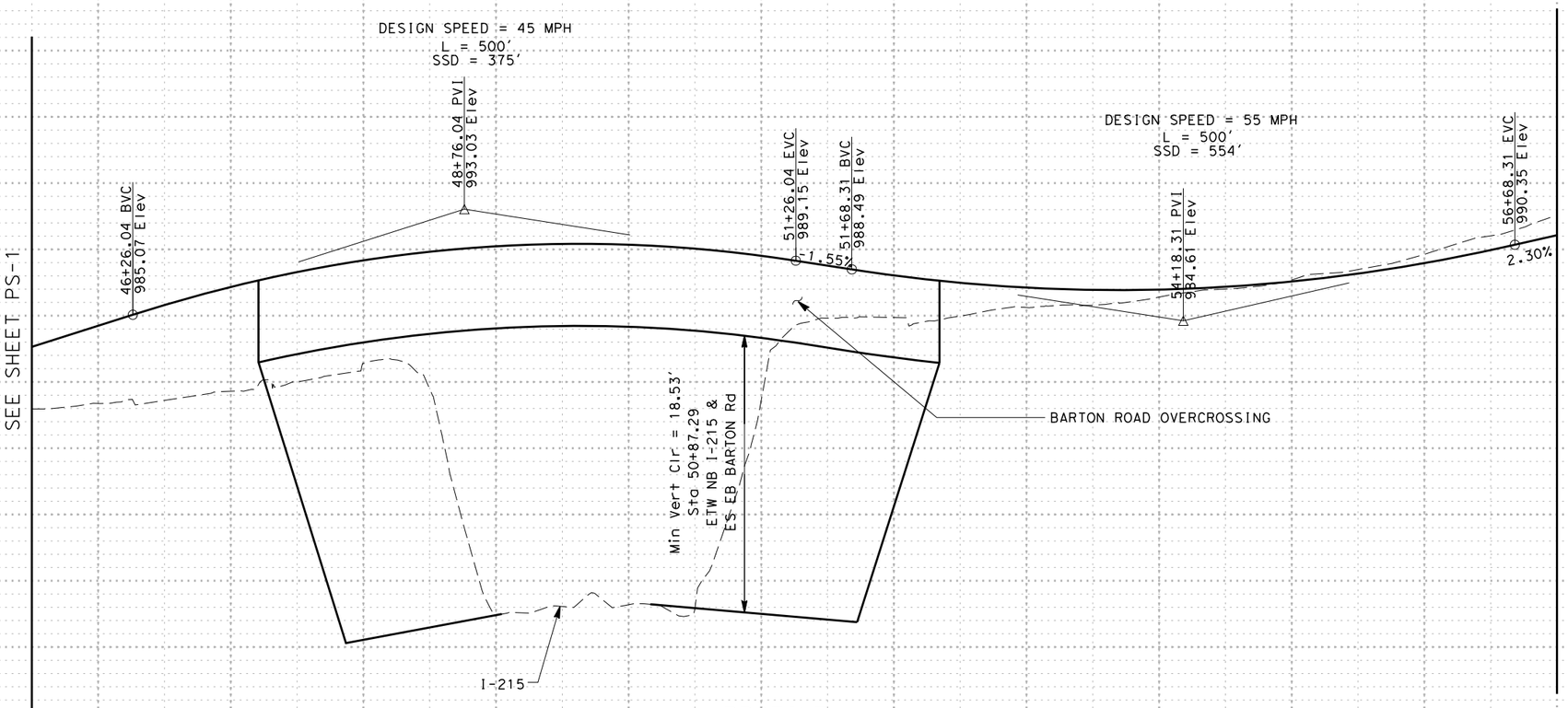
# SUPERELEVATION DIAGRAM
## BARTON ROAD




## PROFILE
## BARTON ROAD

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-2**

| STATION | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | |

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

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AXIS OF ROTATION

-2% Lt & Rt ETW AND ES

MATCH LINE STA 57+00
SEE SHEET PS-2

## SUPERELEVATION DIAGRAM
## BARTON ROAD

END PROJECT
MATCH EXISTING
67+67.76 PVI
1015.59 Elev

2.30%

## PROFILE
## BARTON ROAD

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-3**

| STATION | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | |

10% 0% -10% 1020 1010 1000 990 980

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UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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|---|---|---|---|---|---|
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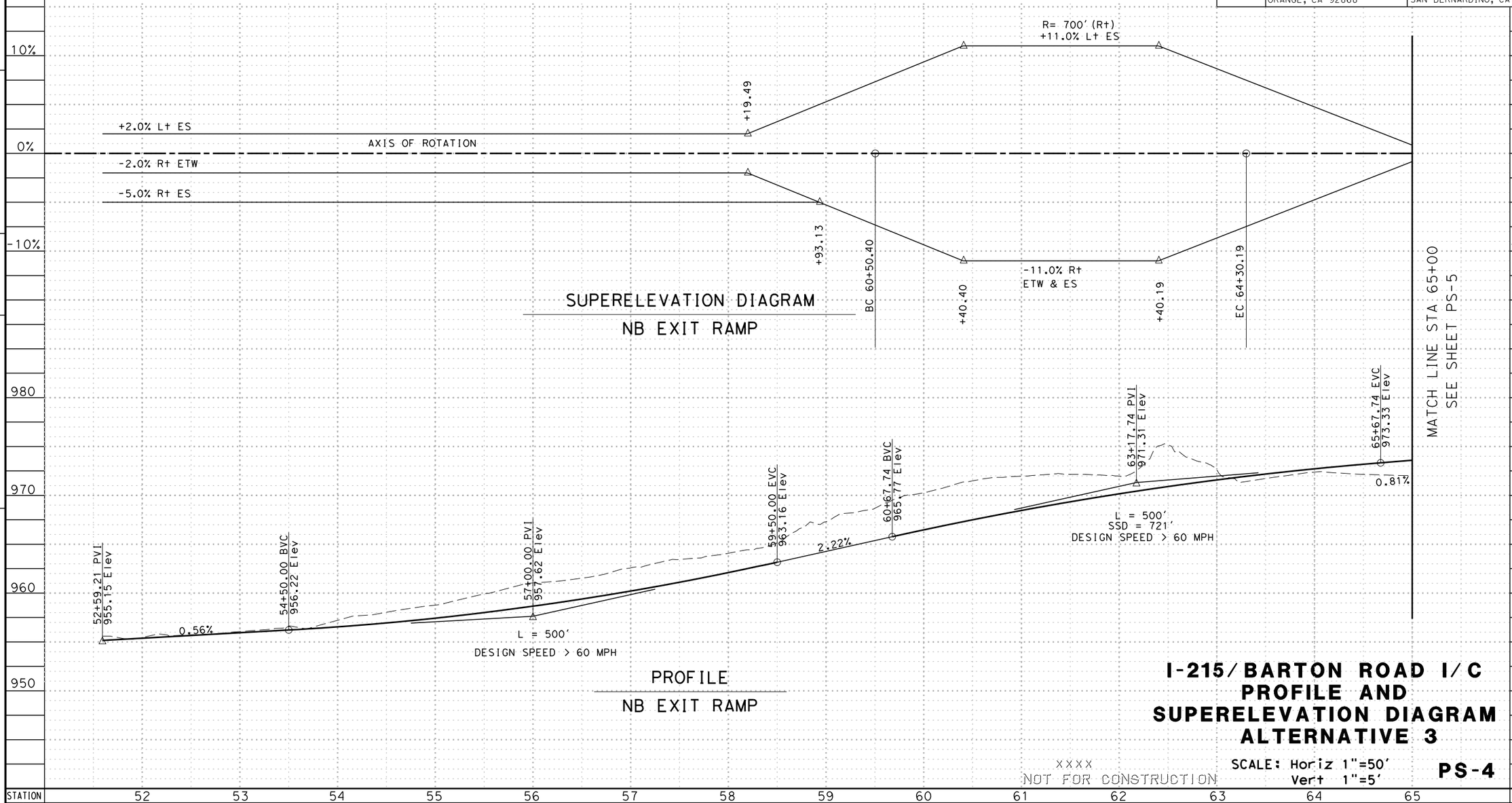


SUPERELEVATION DIAGRAM
NB EXIT RAMP

PROFILE
NB EXIT RAMP

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-4**

| STATION | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | |

REVISED BY | DATE REVISED
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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

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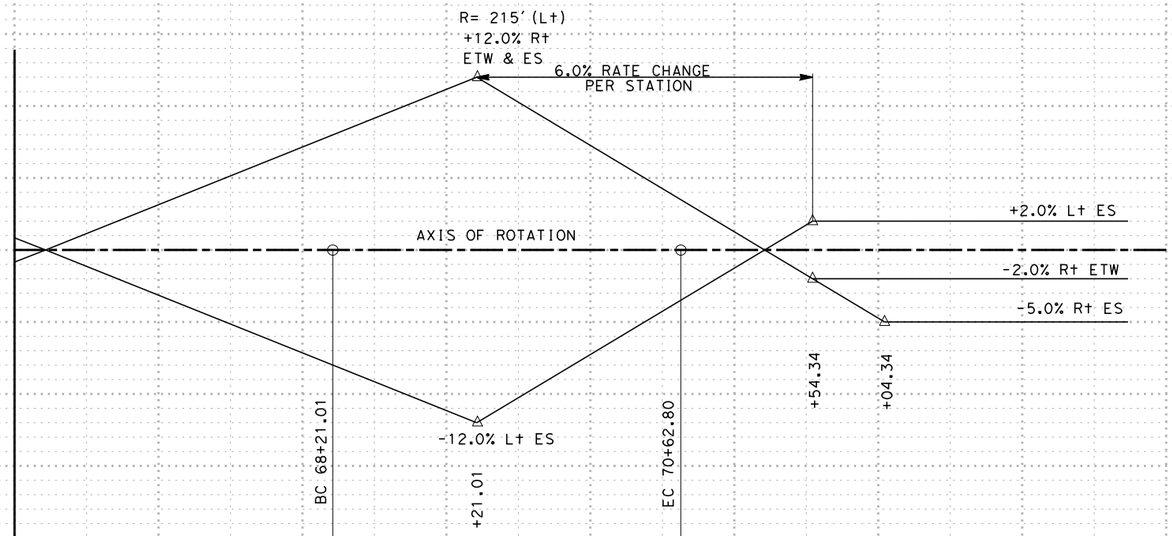
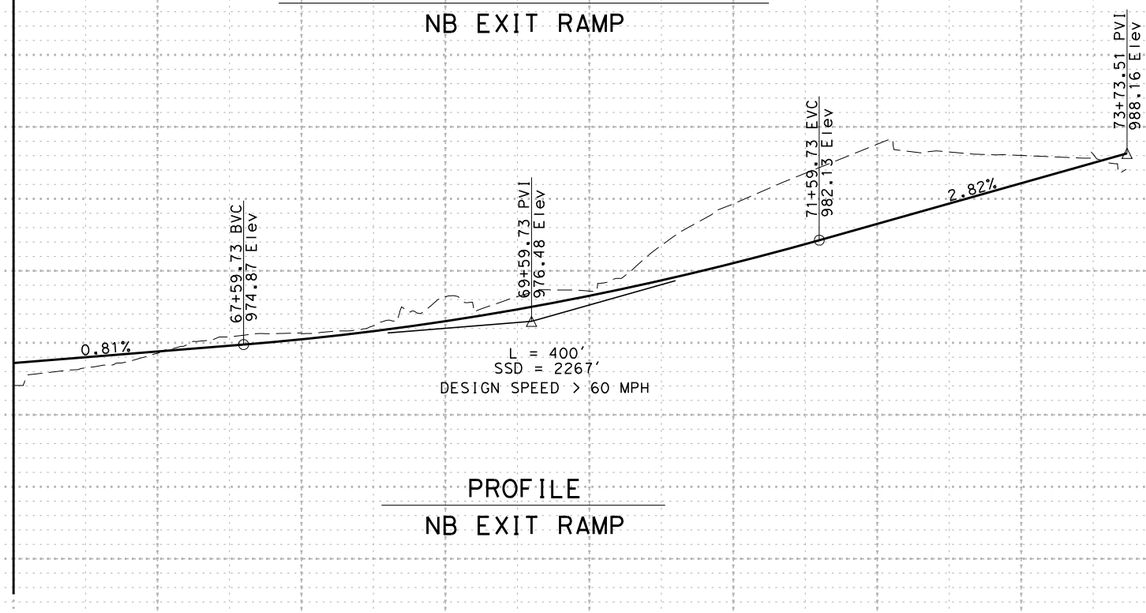



## SUPERELEVATION DIAGRAM
## NB EXIT RAMP




## PROFILE
## NB EXIT RAMP

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-5**

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UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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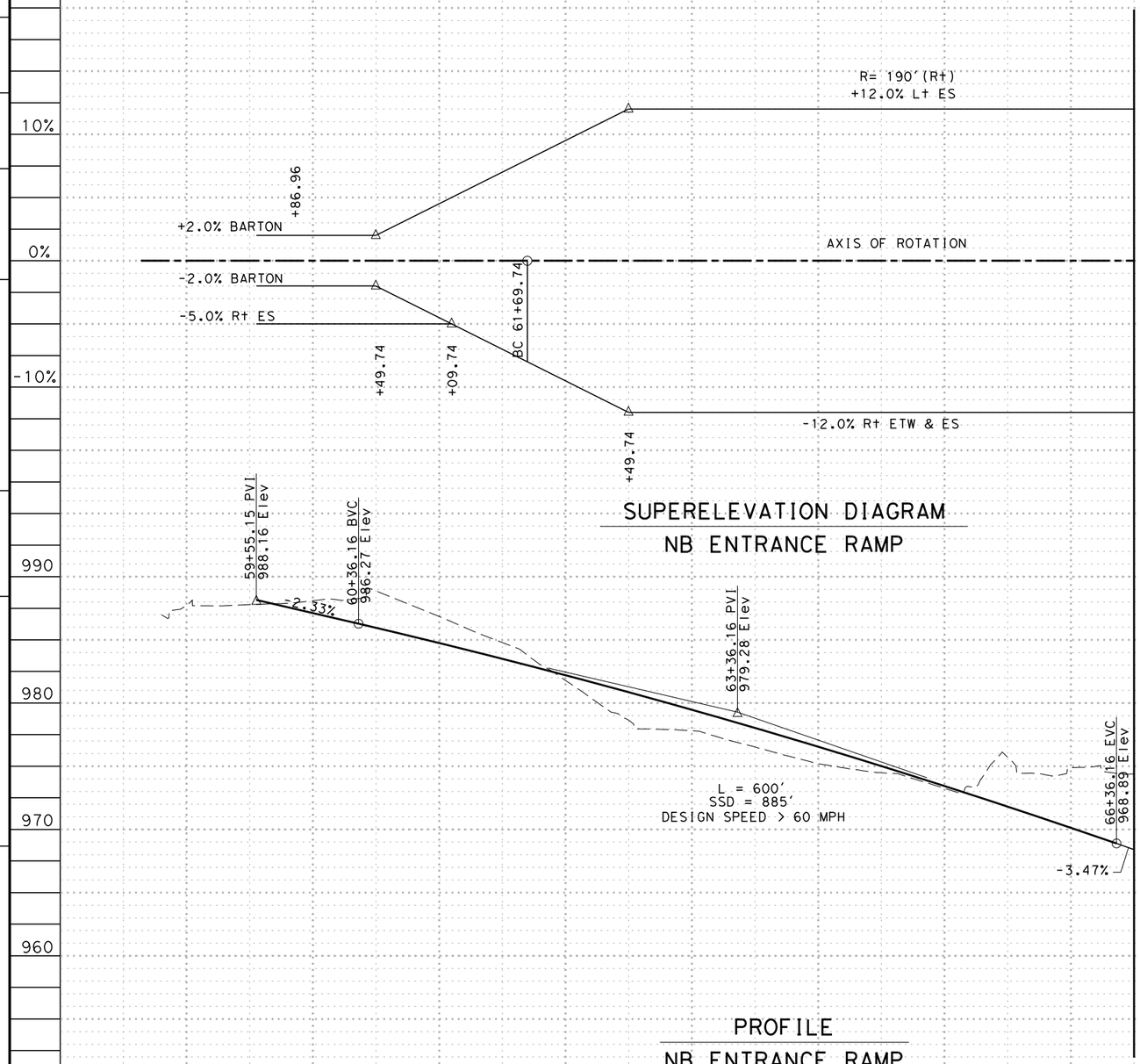


SUPERELEVATION DIAGRAM
NB ENTRANCE RAMP

PROFILE
NB ENTRANCE RAMP

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-6**

STATION: 60 61 62 63 64 65 66 67 68 69 70 71 72 73 TOTAL

CY Exc
CY Emb

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UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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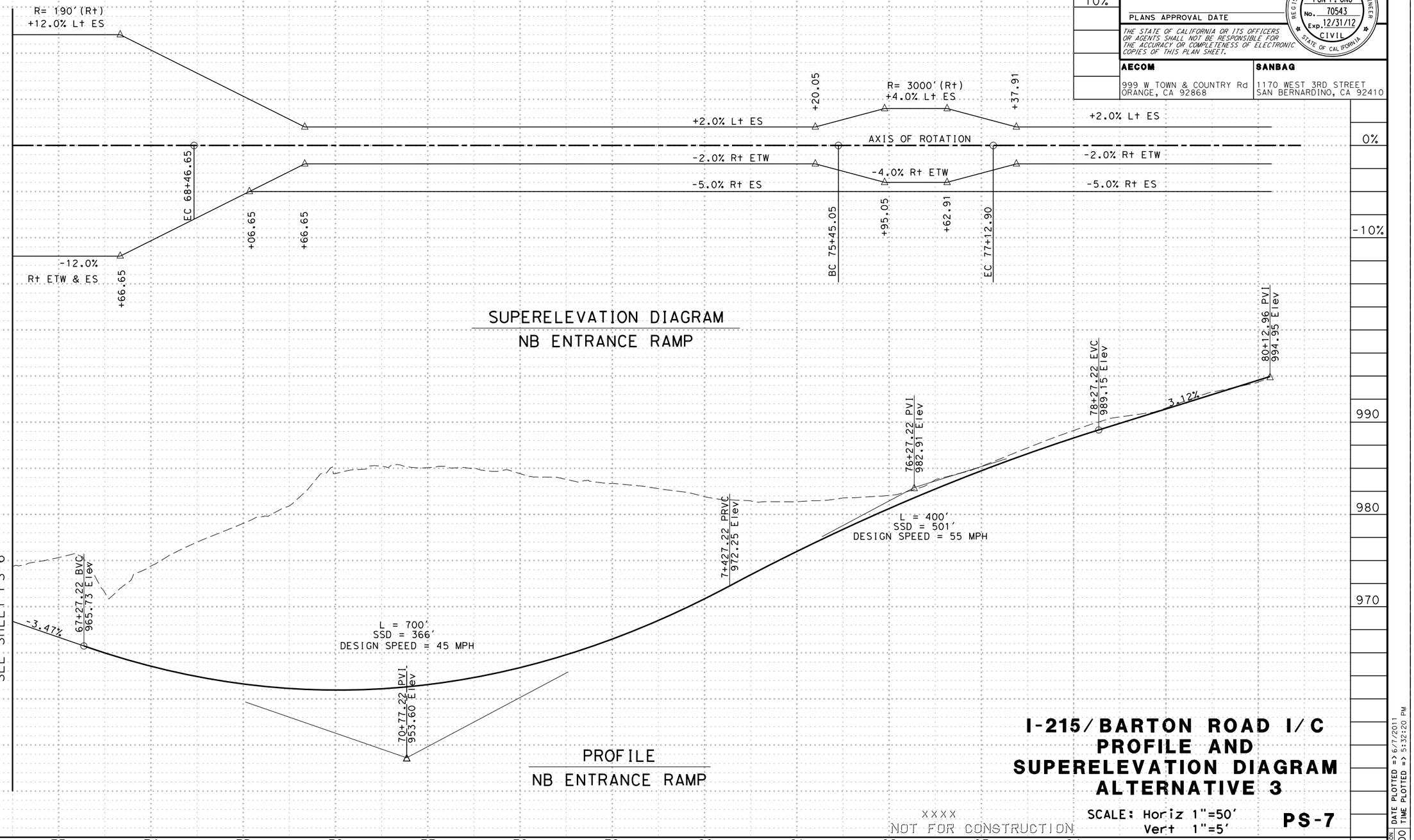


# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-7**

XXXX
NOT FOR CONSTRUCTION

| STATION | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | |

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UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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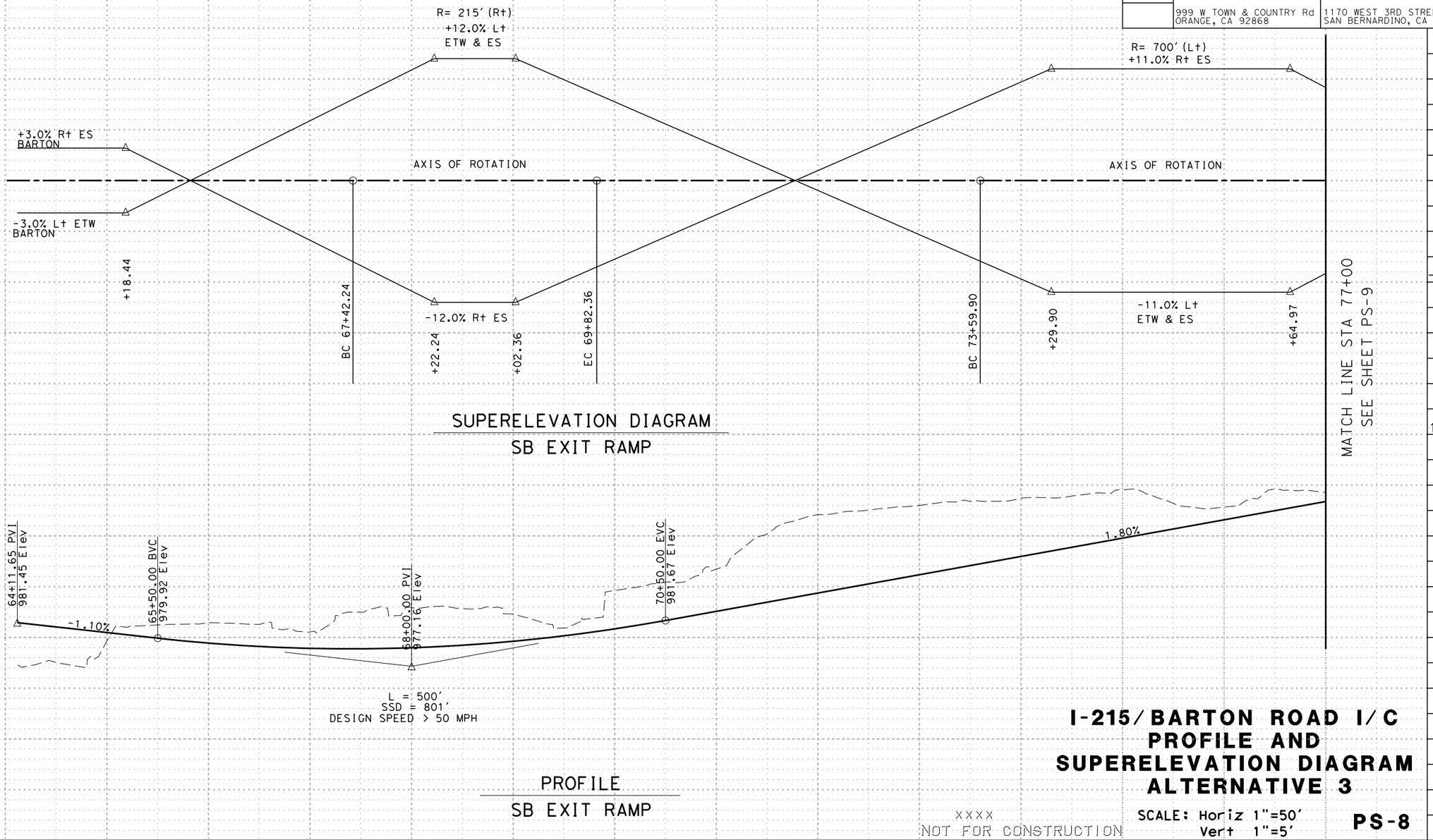


SUPERELEVATION DIAGRAM
SB EXIT RAMP

PROFILE
SB EXIT RAMP

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-8**

| STATION | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | |

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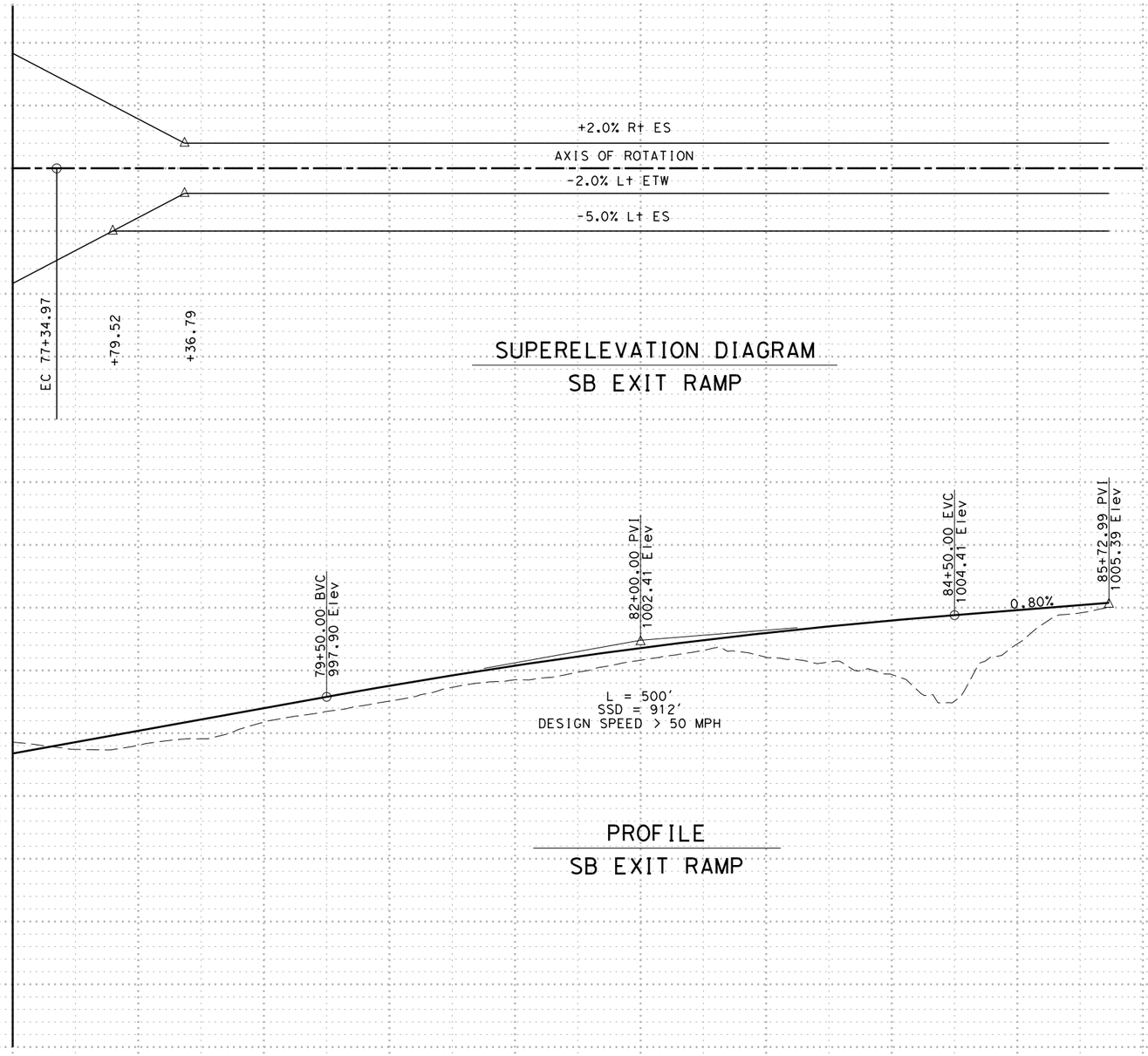
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282




## SUPERELEVATION DIAGRAM
## SB EXIT RAMP

## PROFILE
## SB EXIT RAMP

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
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# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-9**

XXXX
NOT FOR CONSTRUCTION

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UNIT 0000

PROJECT NUMBER & PHASE 0800000282

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|---|---|---|---|---|---|
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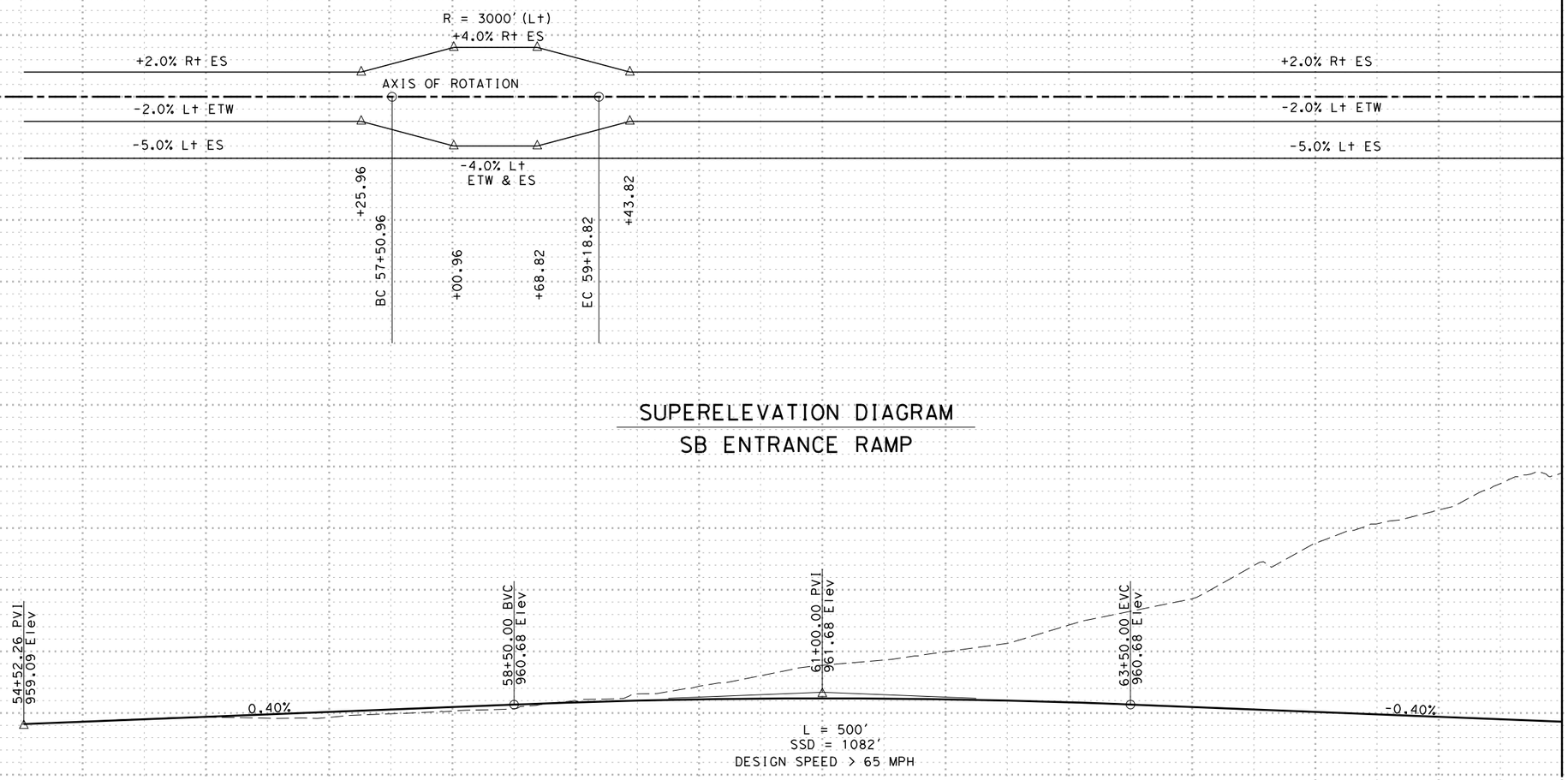
SAN BERNARDINO, CA 92410


SUPERELEVATION DIAGRAM
SB ENTRANCE RAMP




PROFILE
SB ENTRANCE RAMP

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-10**

| STATION | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | |

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

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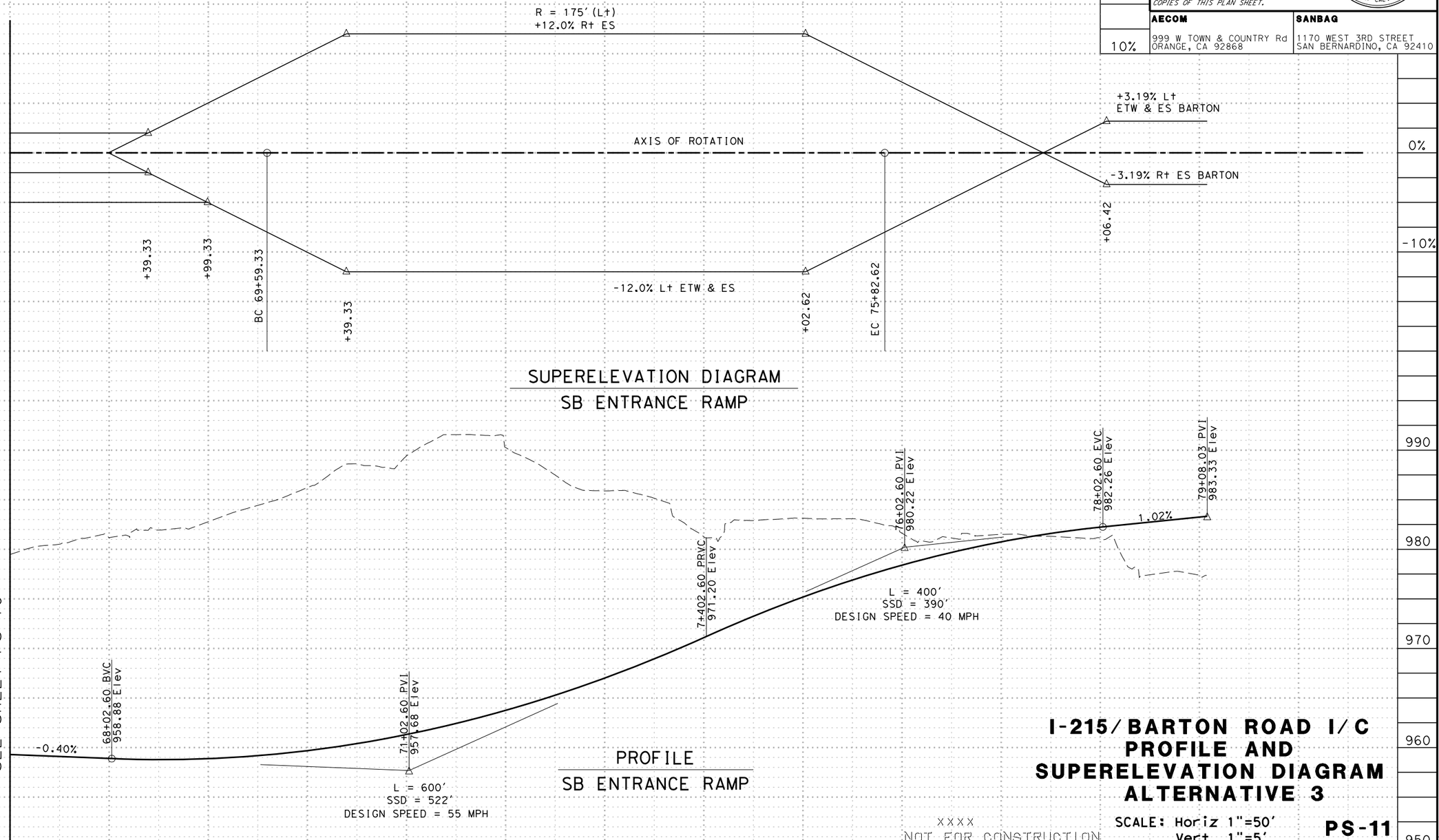


# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 3

XXXX
NOT FOR CONSTRUCTION

SCALE: Horiz 1"=50'
Vert 1"=5'

**PS-11**

| REVISED BY | DATE REVISED |
|---|---|
| | |

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — FUN P. ONG — No. 70543 — Exp. 12/31/12 — CIVIL — STATE OF CALIFORNIA

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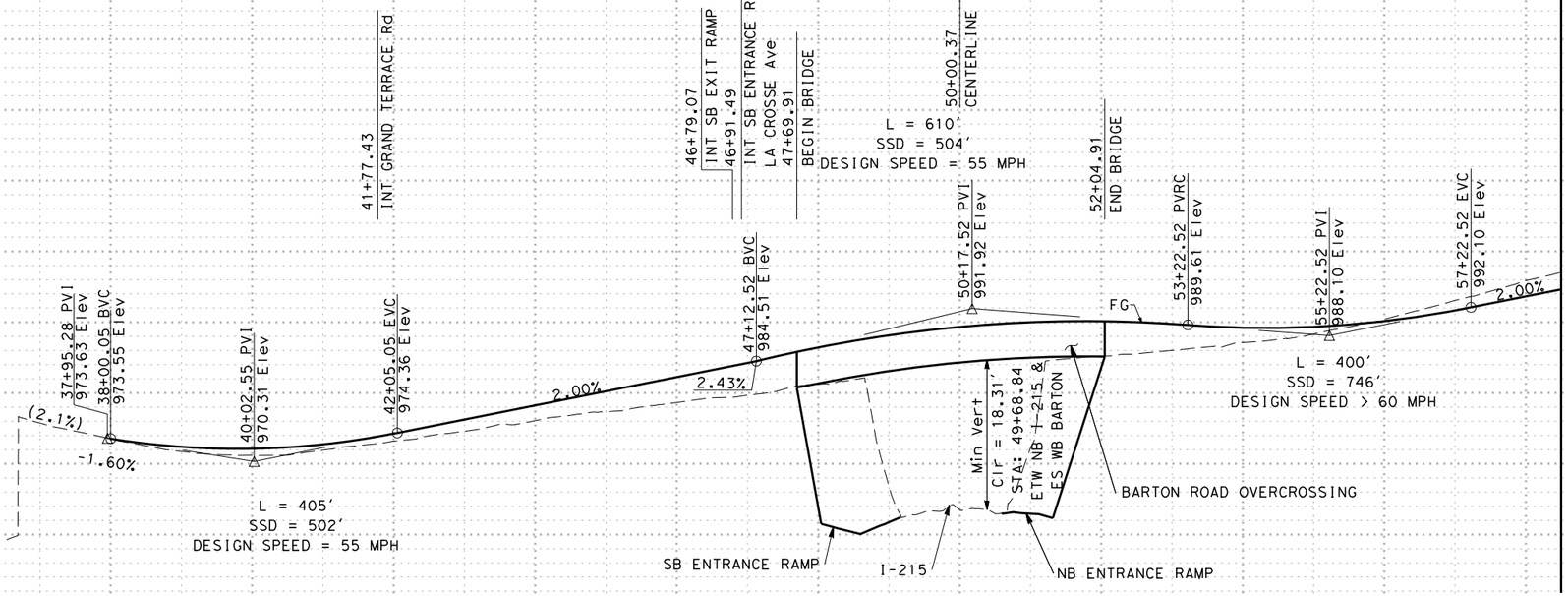
AXIS OF ROTATION

-2% Lt & Rt ETW AND ES

## SUPERELEVATION DIAGRAM
## BARTON ROAD




## PROFILE
## BARTON ROAD

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

SCALE: NTS

**PS-1**

XXXX
NOT FOR CONSTRUCTION

| STATION | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | | | | | | | | |

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| DATE REVISED | REVISED BY |
|---|---|

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BORDER LAST REVISED 7/2/2010

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DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 6\80J070fb001.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
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STATE OF CALIFORNIA

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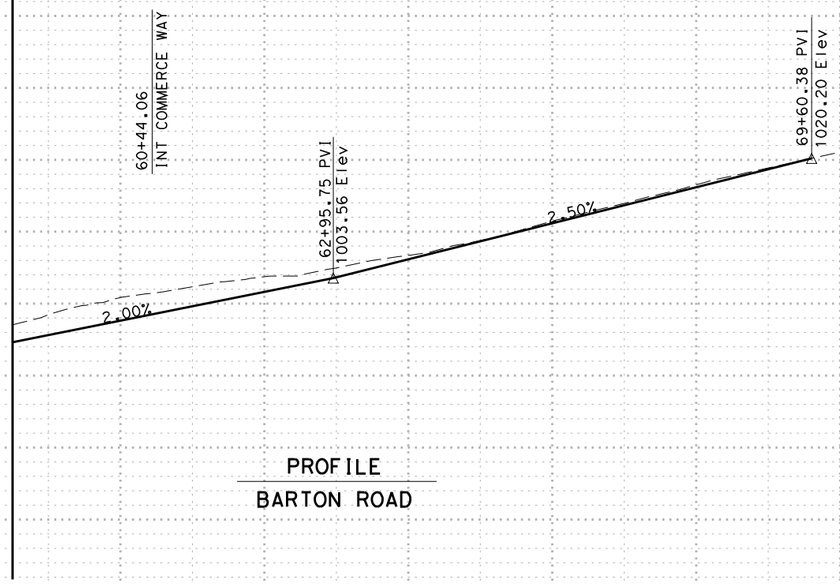
## SUPERELEVATION DIAGRAM
## BARTON ROAD




## PROFILE
## BARTON ROAD

0% | -10%

1030 | 1020 | 1010 | 1000 | 990 | 980

STATION: 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | TOTAL

CY: Exc | Emb

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

XXXX
NOT FOR CONSTRUCTION

SCALE: NTS

**PS-2**

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
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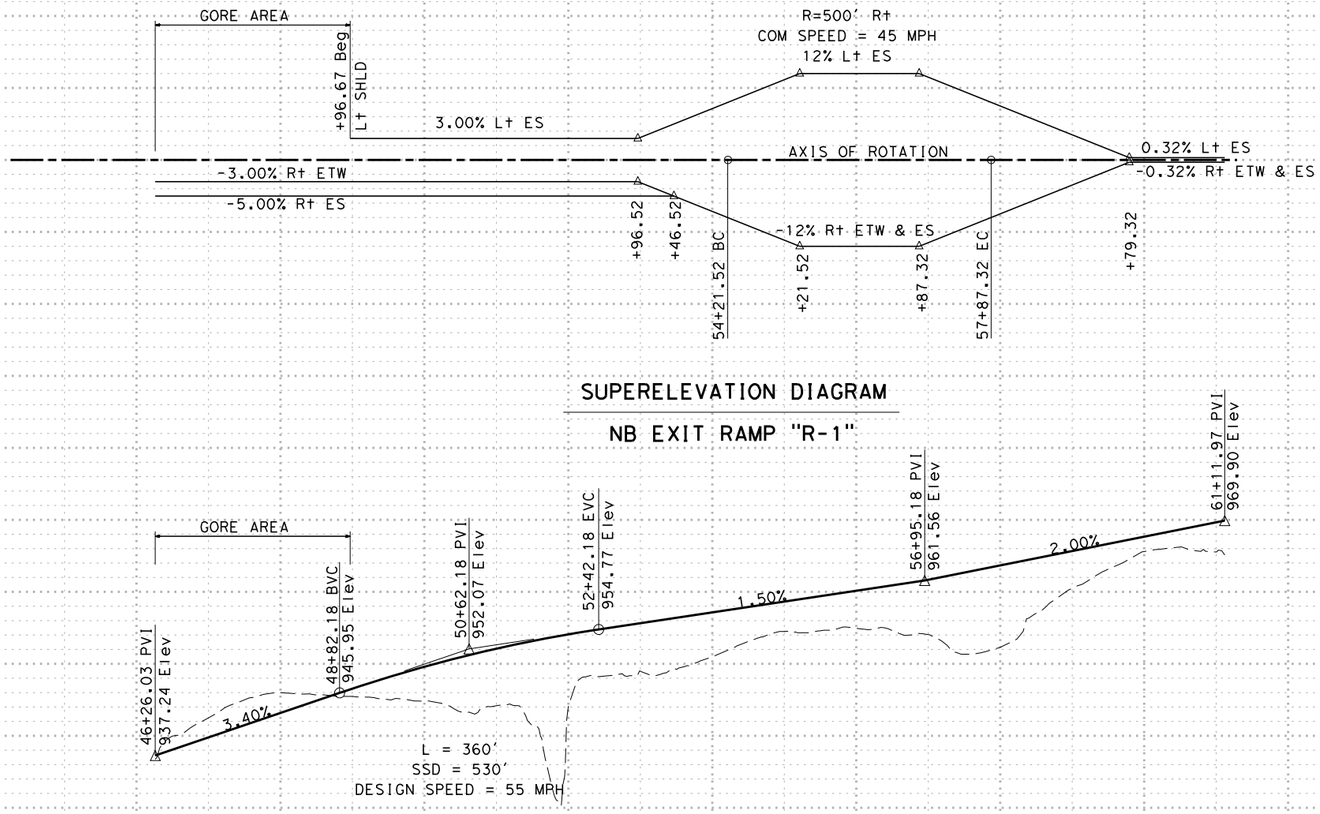


## SUPERELEVATION DIAGRAM
## NB EXIT RAMP "R-1"




## PROFILE
## NB EXIT RAMP "R-1"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

XXXX
NOT FOR CONSTRUCTION

SCALE: NTS

**PS-3**

+10% | 0% | -10%

990 | 980 | 970 | 960 | 950 | 940 | 930 | 920

STATION: 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 TOTAL

CY Exc | Emb

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER — FUN P. ONG — No. 70543 — Exp. 12/31/12 — CIVIL — STATE OF CALIFORNIA

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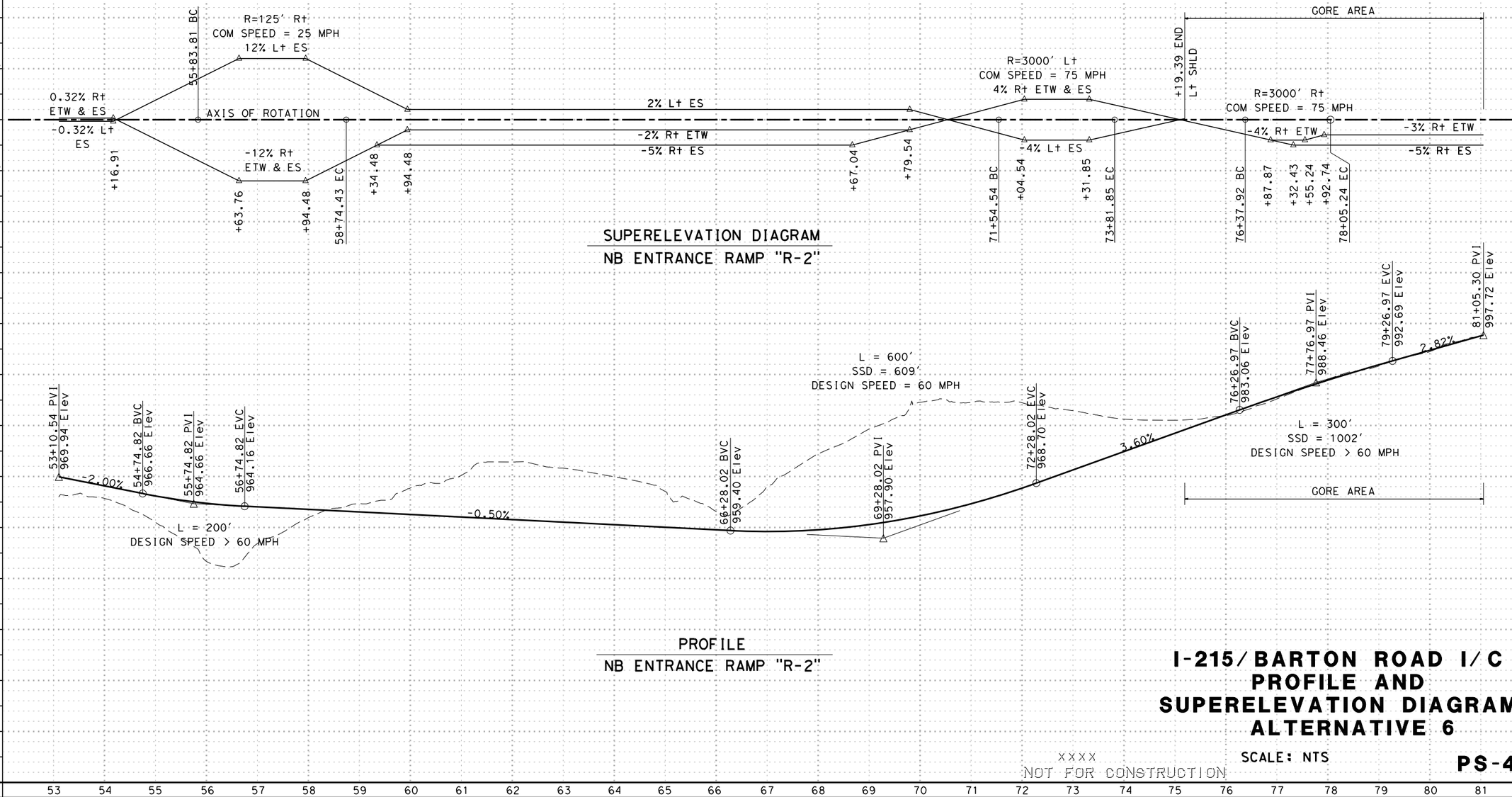


## SUPERELEVATION DIAGRAM
## NB ENTRANCE RAMP "R-2"




## PROFILE
## NB ENTRANCE RAMP "R-2"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-4**

| STATION | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 6\80J070fb004.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
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No. 70543
Exp. 12/31/12
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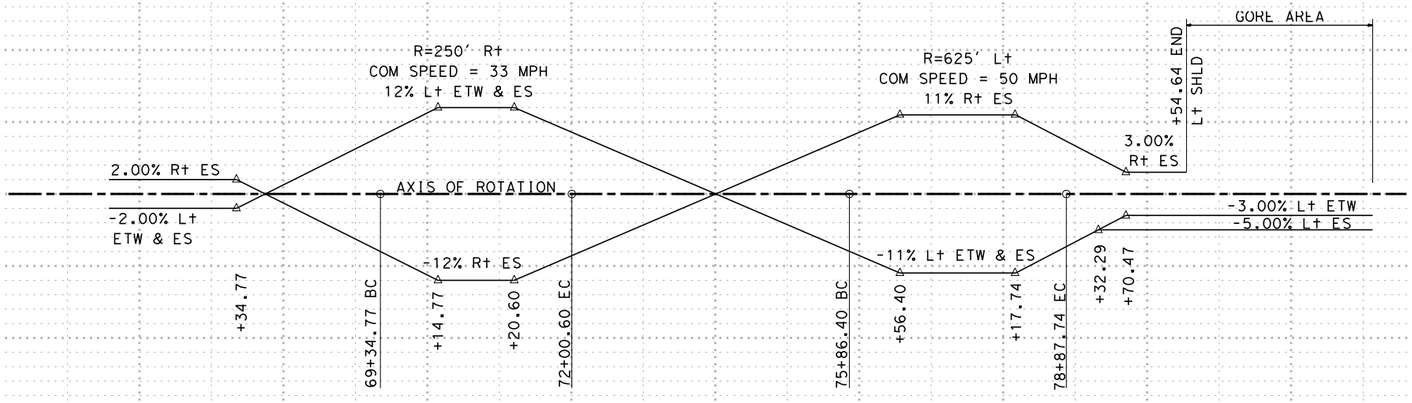
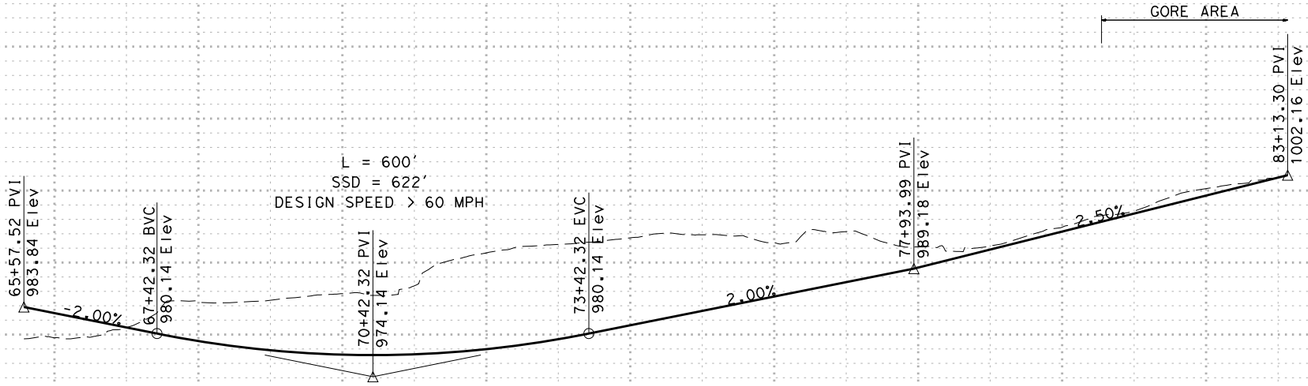



SUPERELEVATION DIAGRAM

SB EXIT RAMP "R-3"




PROFILE

SB EXIT RAMP "R-3"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

XXXX
NOT FOR CONSTRUCTION

SCALE: NTS

**PS-5**

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Caltrans

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REVISED BY | DATE REVISED

| STATION | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | | | | | | | | |

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
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No. 70543
Exp. 12/31/12
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STATE OF CALIFORNIA

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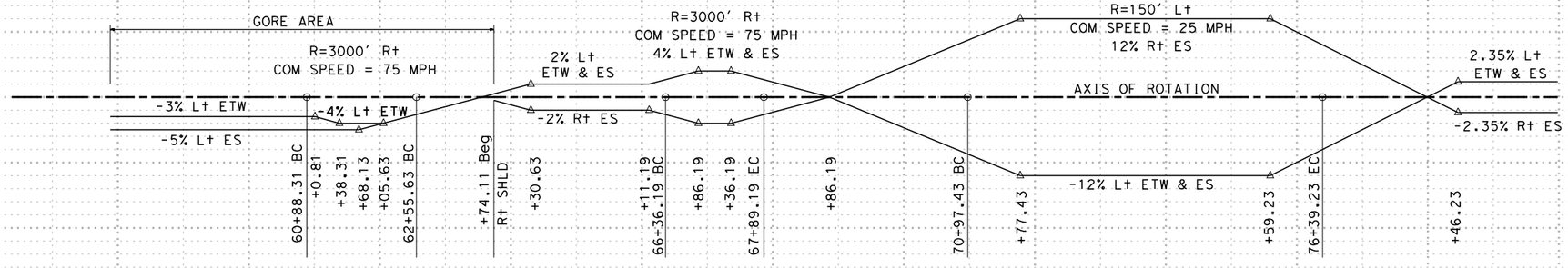
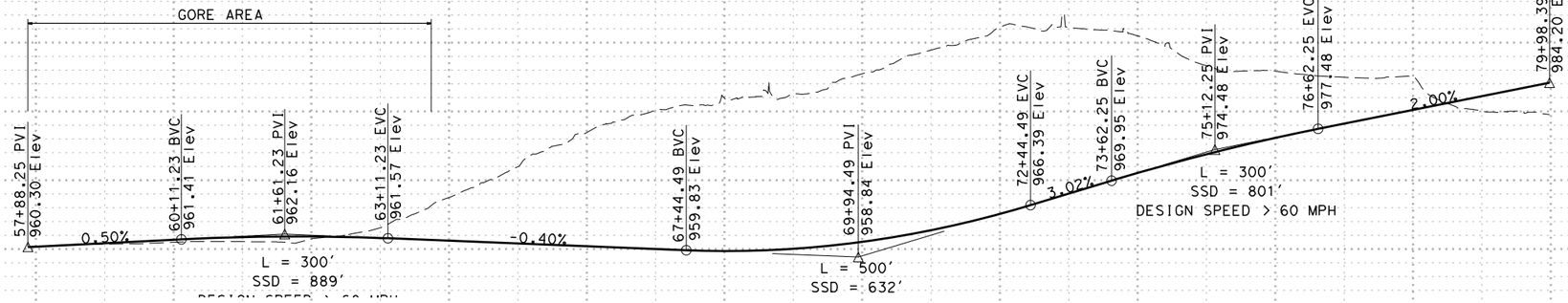



SUPERELEVATION DIAGRAM
SB ENTRANCE RAMP "R-4"




PROFILE
SB ENTRANCE RAMP "R-4"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-6**

STATION: 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 TOTAL

CY Exc
CY Emb

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TIME PLOTTED => 5:13:58 PM

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DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 6\80J070fb006.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
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No. 70543
Exp. 12/31/12
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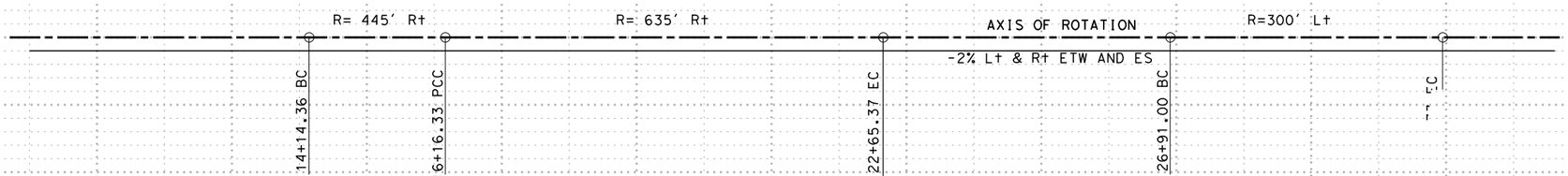
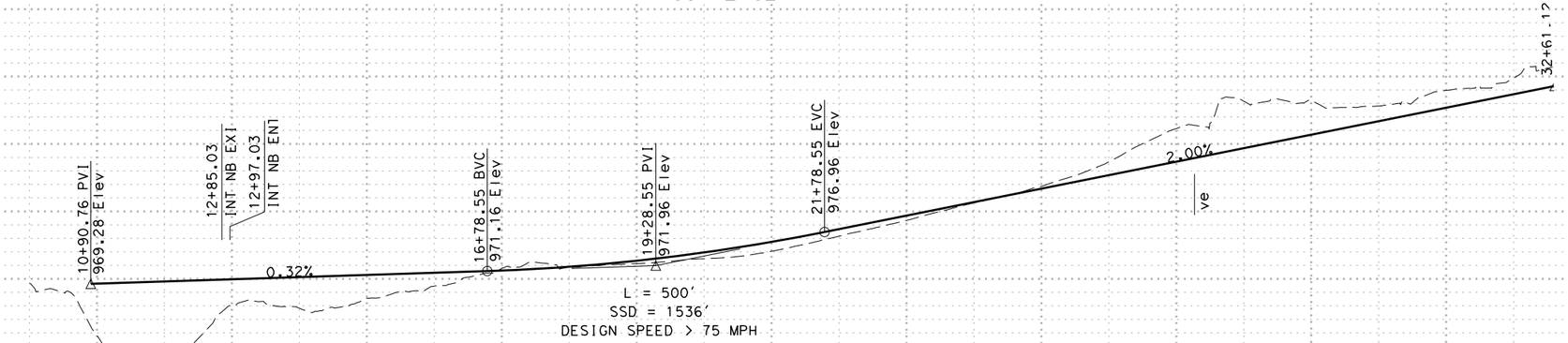



SUPERELEVATION DIAGRAM
COMMERCE WAY




PROFILE
COMMERCE WAY

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 6

XXXX
NOT FOR CONSTRUCTION

SCALE: NTS

**PS-7**

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REVISED BY | DATE REVISED

STATION: 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 TOTAL

CY Exc
CY Emb

LAST REVISION 00-00-00
DATE PLOTTED => 6/7/2011
TIME PLOTTED => 5:14:02 PM

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
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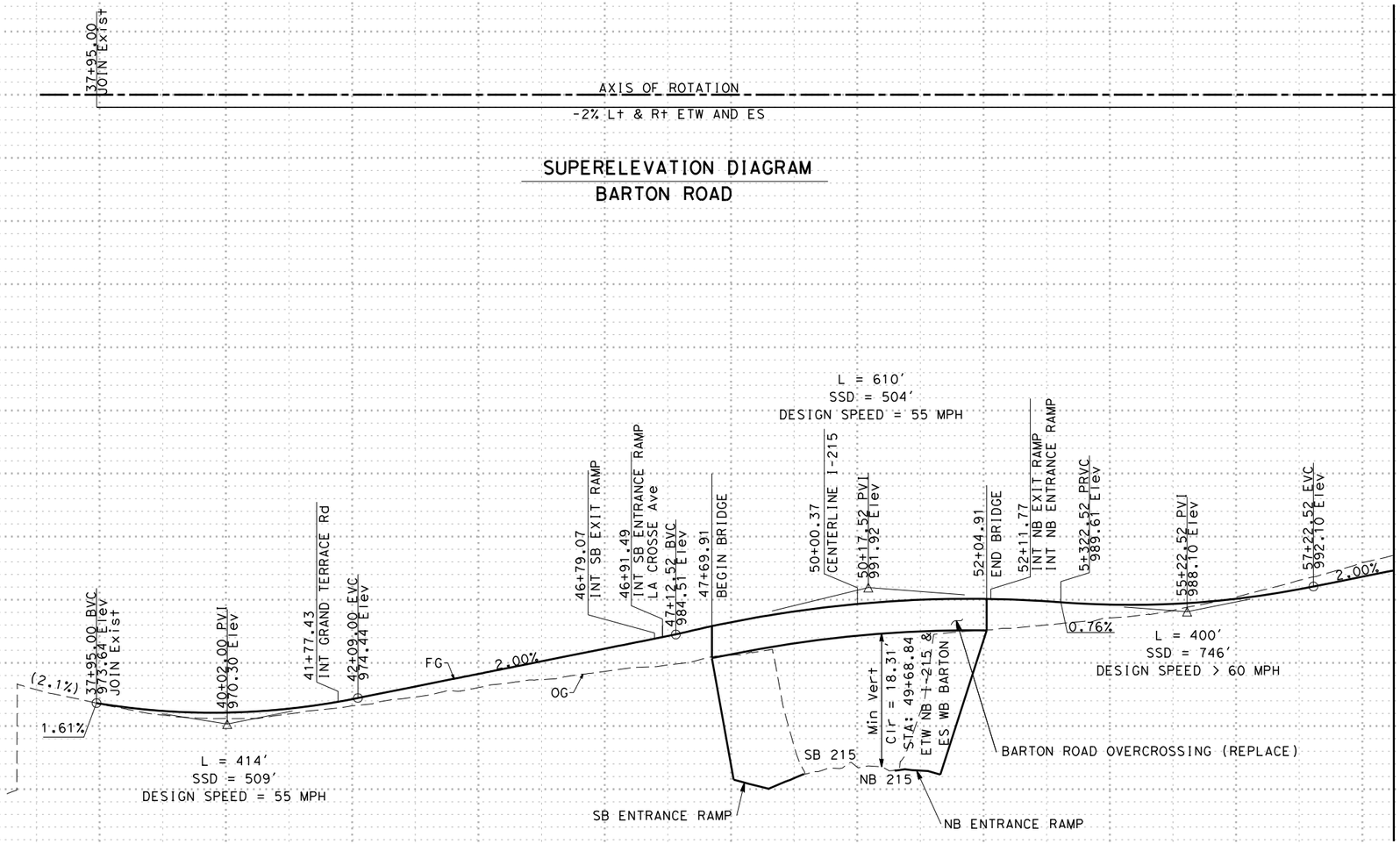
## SUPERELEVATION DIAGRAM
## BARTON ROAD




## PROFILE
## BARTON ROAD

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

SCALE: NTS

**PS-1**

XXXX
NOT FOR CONSTRUCTION

| STATION | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | | | | | | | | |

1000 990 980 970 960 950

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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

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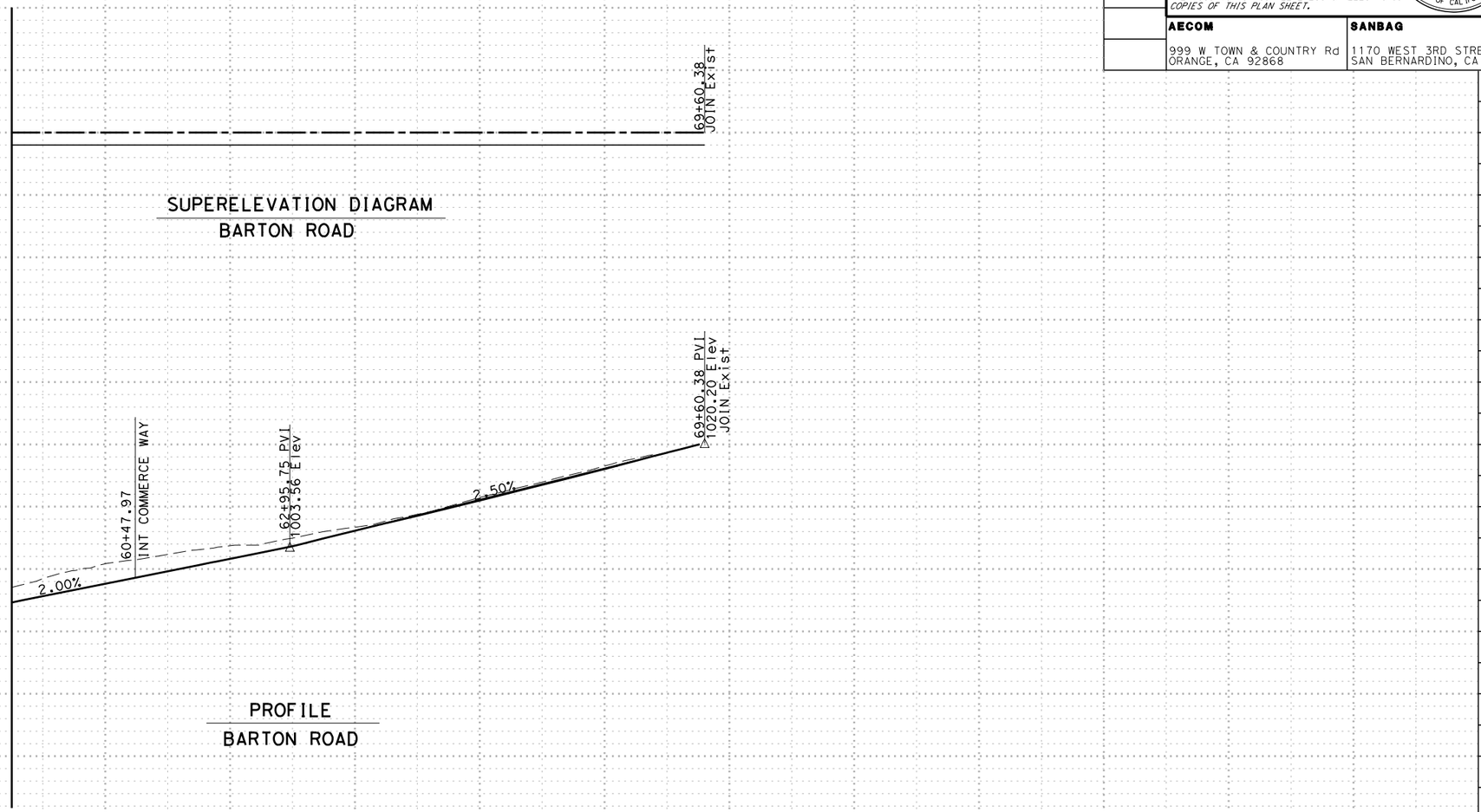


# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-2**

| STATION | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | |

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb002.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

LAST REVISION 00-00-00

DATE PLOTTED => 6/8/2011
TIME PLOTTED => 2:30:59 PM

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

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


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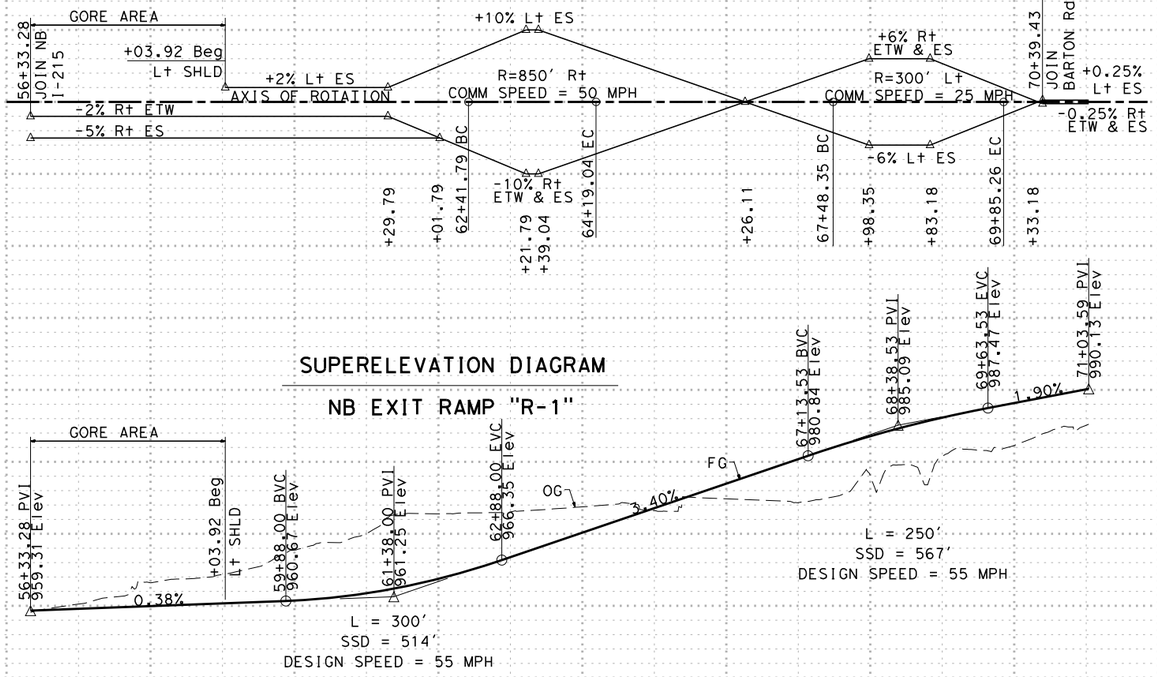


# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM ALTERNATIVE 7

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-3**

| STATION | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | |

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: GREG HEFTER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DATE PLOTTED => 6/7/2011
TIME PLOTTED => 5:21:31 PM
LAST REVISION 00-00-00

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb003.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

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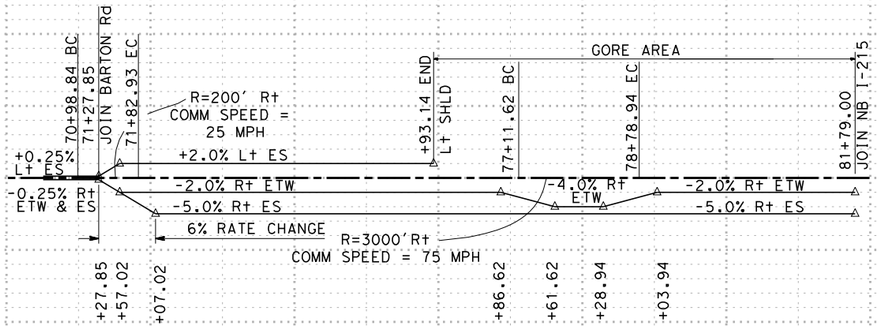
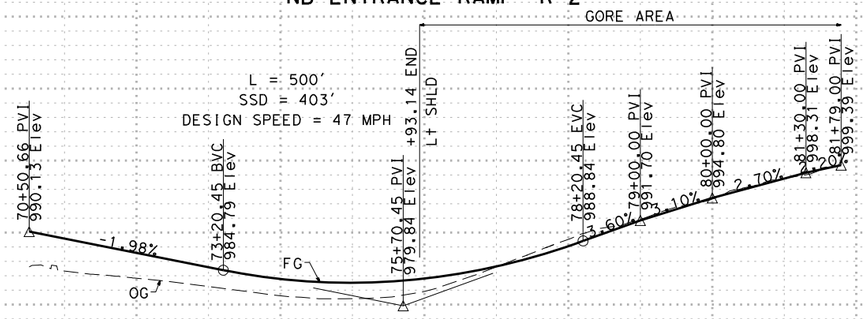



SUPERELEVATION DIAGRAM
NB ENTRANCE RAMP "R-2"




PROFILE
NB ENTRANCE RAMP "R-2"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-4**

| STATION | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | |

+10% 0% -10%

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: GREG HEFTER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => 6/7/2011 TIME PLOTTED => 5:21:35 PM

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb004.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

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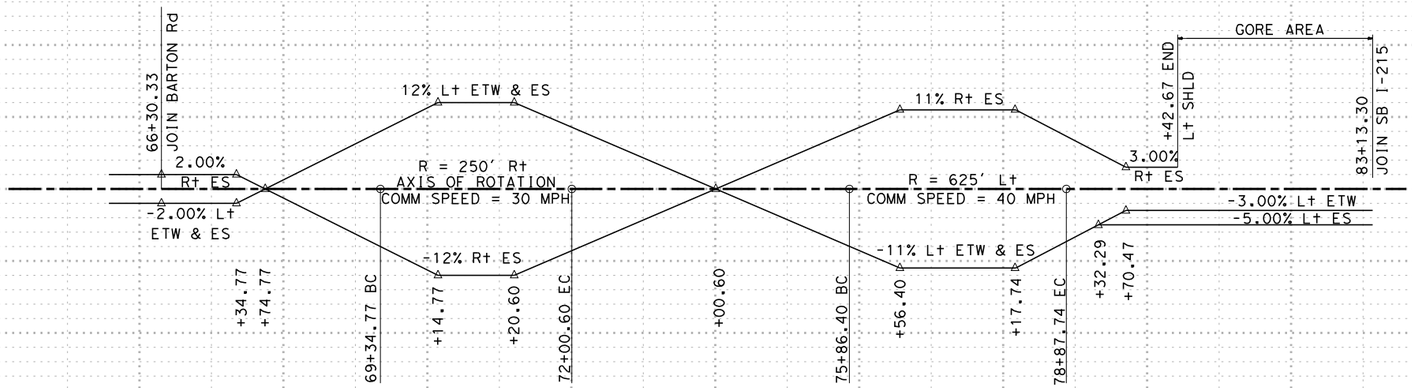
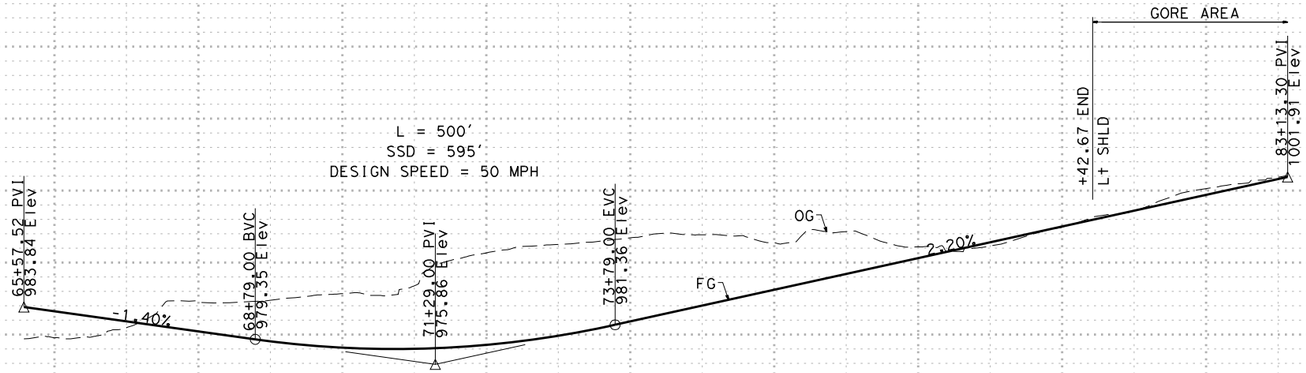



SUPERELEVATION DIAGRAM
SB EXIT RAMP "R-3"




PROFILE
SB EXIT RAMP "R-3"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-5**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: GREG HEFTER

CALCULATED-DESIGNED BY
CHECKED BY

REVISED BY | DATE REVISED

+10% 0% -10%

1020 1010 1000 990 980 970 960

STATION: 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 TOTAL

CY Exc
CY Emb

LAST REVISION 00-00-00
DATE PLOTTED => 6/7/2011
TIME PLOTTED => 5:21:38 PM

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb005.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

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**SANBAG**
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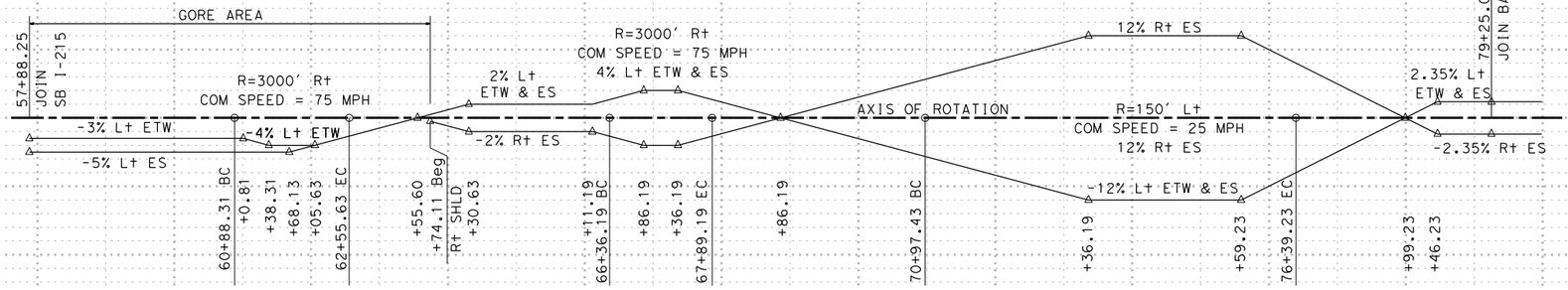
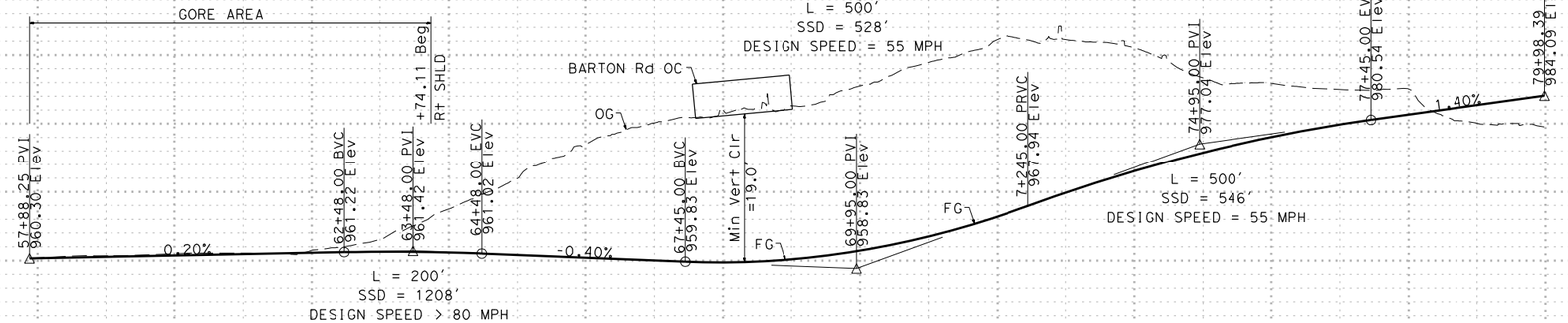
SAN BERNARDINO, CA 92410


SUPERELEVATION DIAGRAM
SB ENTRANCE RAMP "R-4"




PROFILE
SB ENTRANCE RAMP "R-4"

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

XXXX SCALE: NTS
NOT FOR CONSTRUCTION

**PS-6**

| STATION | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY Exc | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CY Emb | | | | | | | | | | | | | | | | | | | | | | | | | | | |

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: GREG HEFTER

CALCULATED-DESIGNED BY | CHECKED BY

REVISED BY | DATE REVISED

LAST REVISION: 00-00-00

DATE PLOTTED => 6/8/2011
TIME PLOTTED => 2:43:32 PM

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb006.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 08 | SBd | 215 | 0.58/1.95 | | |

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
FUN P. ONG
No. 70543
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA



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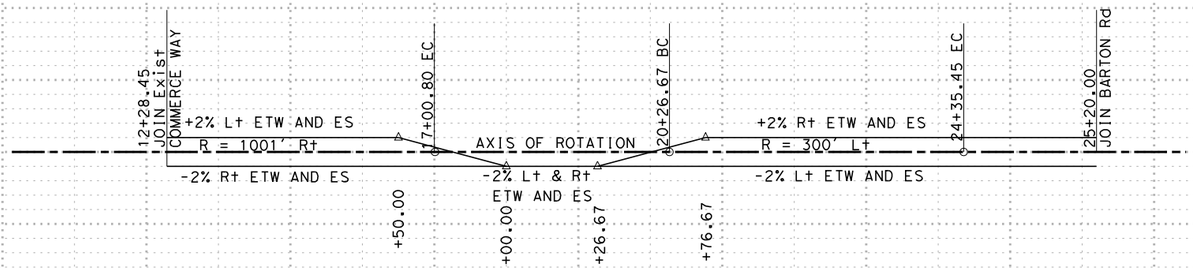
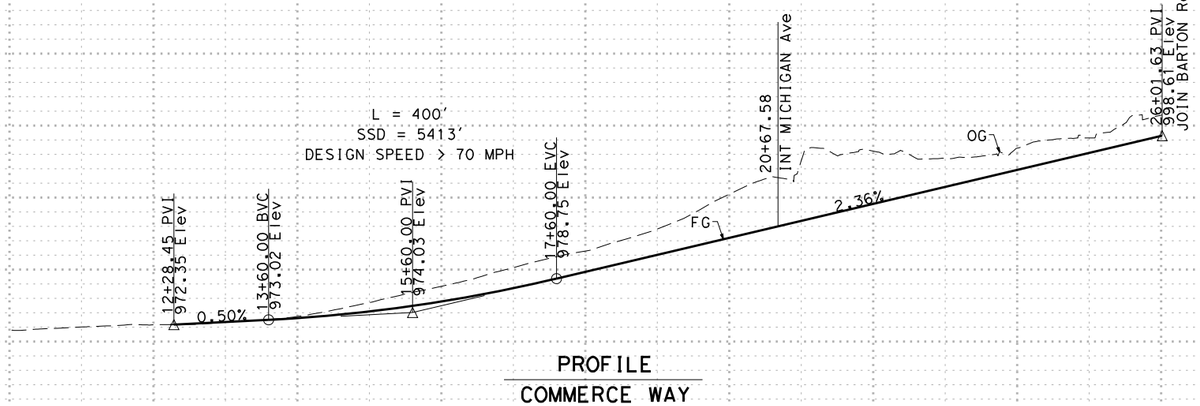
999 W TOWN & COUNTRY Rd
ORANGE, CA 92868

**SANBAG**
1170 WEST 3RD STREET
SAN BERNARDINO, CA 92410




SUPERELEVATION DIAGRAM
COMMERCE WAY




PROFILE
COMMERCE WAY

# I-215/BARTON ROAD I/C
# PROFILE AND SUPERELEVATION DIAGRAM
# ALTERNATIVE 7

SCALE: NTS

XXXX
NOT FOR CONSTRUCTION

**PS-7**

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: GREG HEFTER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

+10% 0% -10%

1020 1010 1000 990 980 970

STATION 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 TOTAL

CY Exc
Emb

LAST REVISION 00-00-00
DATE PLOTTED => 6/7/2011
TIME PLOTTED => 5:21:46 PM

BORDER LAST REVISED 7/2/2010

USERNAME => AECOM
DGN FILE => R:\SNBG0702-I-215 Barton\Plans\DGN\Alternative 7\80J070fb007.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0800000282

# Appendix B. TNM 2.5 Printouts for Calibration Runs

This appendix contains the input/output data for the modeled calibration runs.

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**REFER TO CD-ROM**

# Appendix C. TNM 2.5 Printouts for Future No Build Conditions

This appendix contains the input/output data for future No Build conditions.

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**REFER TO CD-ROM**

# Appendix D. TNM 2.5 Printouts for Alternative 3 Conditions

This appendix contains the input/output data for Alternative 3 conditions.

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**REFER TO CD-ROM**

# Appendix E. TNM 2.5 Printouts for Alternative 6 Conditions

This appendix contains the input/output data for Alternative 6 conditions.

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**REFER TO CD-ROM**

# Appendix F. TNM 2.5 Printouts for Alternative 7 Conditions

This appendix contains the input/output data for Alternative 7 conditions.

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**REFER TO CD-ROM**

# Appendix G. Sound Level Meter Calibration Certifications

This appendix contains the sound level meter calibration certifications.

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# CALIBRATION CERTIFICATE FOR LARSON DAVIS 824

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48475-1 | **Bar Code #** | |
| **Date Received** | FRIDAY, FEBRUARY 27, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 824A1612 |
| **Model #** | 824 | **Asset #** | NAN |
| **Description** | SOUND LEVEL METER | | |

**Date Calibrated** 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

**Maintenance Procedure** 4226

**Temperature** 20 ° C **Humidity** 40 % **Calibration Performed By** 28

**Accuracy** ANSI Type 1

Received In Tolerance

**Remarks**

Returned In Tolerance

**Remarks** Meets ANSI type 1 specifications under laboratory conditions.

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 878 | BRUEL & KJAER | 4226 | SLM CALIBRATOR | 1/28/2010 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 7/11/2009 |

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.



**Approved By**

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48475-2 | **Bar Code #** | |
| **Date Received** | FRIDAY, FEBRUARY 27, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 7977 |
| **Model #** | 2541 | **Asset #** | NAN |
| **Description** | MICROPHONE | | |

**Date Calibrated** 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

**Maintenance Procedure** 1371

**Temperature** 20 ° C **Humidity** 40 % **Calibration Performed By** 29

**Accuracy** ±1.2dB

Received In Tolerance

**Remarks** Sensitivity = -26.85dB re lv /PE

See attached frequency response chart.

Returned In Tolerance

**Remarks**

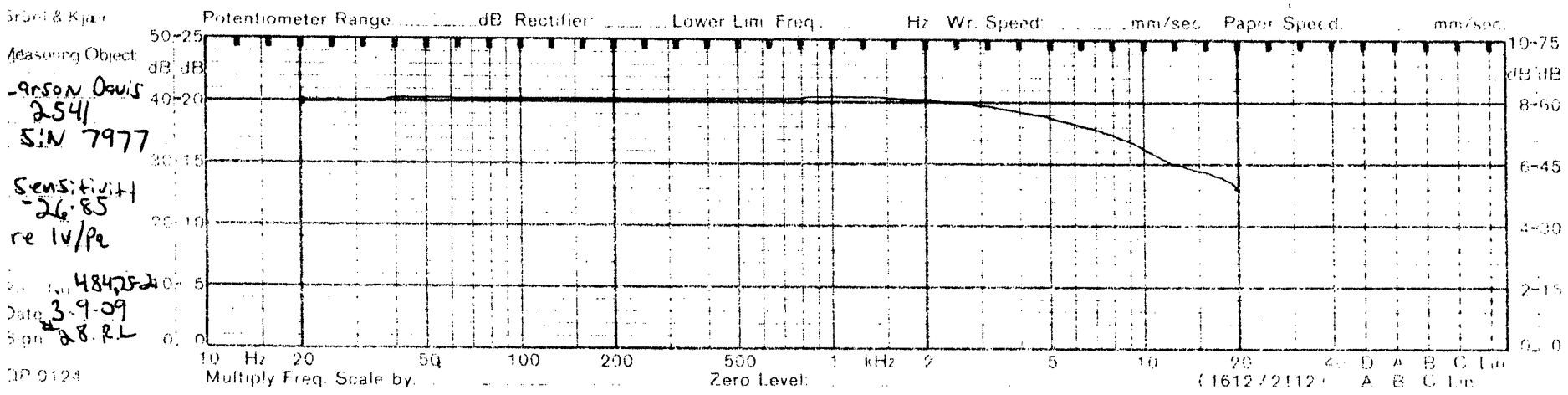
| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 610 | BRUEL & KJAER | 4228 | PISTONPHONE | 1/30/2010 |
| 051 | BRUEL & KJAER | 2639 | MICROPHONE PREAMPLIFIER | 2/3/2010 |
| 043 | BRUEL & KJAER | 4190 | 1/2" CONDENSER MICROPHONE | 6/10/2009 |
| 941 | BRUEL & KJAER | 1049 | SINE & NOISE GENERATOR | 12/5/2009 |
| 949 | BRUEL & KJAER | 2636 | MEASURING AMPLIFIER | 2/3/2010 |
| 305 | AGILENT | 8903B | AUDIO ANALYZER | 5/30/2009 |
| 923 | BRUEL & KJAER | 2706 | POWER AMPLIFIER | 7/11/2009 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 7/11/2009 |
| 654 | BRUEL & KJAER | 2307 | LEVEL RECORDER | 7/15/2009 |

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.



MAR 5 2009

**Approved By**


Brüel & Kjær
Potentiometer Range dB Rectifier Lower Lim. Freq. Hz Wr. Speed: mm/sec Paper Speed: mm/sec
Measuring Object
-Brüel Davis
2541
S:N 7977
Sensitivity
-26.85
re 1V/Pa
Date 3-9-09
50-25
40-20
30-15
20-10
10-5
0-0
dB dB
10-75
8-60
6-45
4-30
2-15
0-0
10 Hz 20 50 100 200 500 1 kHz 2 5 10 20 40
Multiply Freq. Scale by
Zero Level
A B C Lin
A B C Lin

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48475-3 | **Bar Code #** | |
| **Date Received** | FRIDAY, FEBRUARY 27, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 3228 |
| **Model #** | CAL200 | **Asset #** | NAN |
| **Description** | PRECISION ACOUSTIC CALIBRATOR | | |

**Date Calibrated** 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12
**Maintenance Procedure** 1211
**Temperature** 20 ° C **Humidity** 40 % **Calibration Performed By** 28
**Accuracy** ± .2 dB

Received Out Of Tolerance
**Remarks** Spl out of tolerance

Returned In Tolerance
**Remarks** Adjsted SPL to less than 0.1 dB of nominal.

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 610 | BRUEL & KJAER | 4228 | PISTONPHONE | 1/30/2010 |
| 051 | BRUEL & KJAER | 2639 | MICROPHONE PREAMPLIFIER | 2/3/2010 |
| 043 | BRUEL & KJAER | 4190 | 1/2" CONDENSER MICROPHONE | 6/10/2009 |
| 949 | BRUEL & KJAER | 2636 | MEASURING AMPLIFIER | 2/3/2010 |
| 305 | AGILENT | 8903B | AUDIO ANALYZER | 5/30/2009 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 7/11/2009 |

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.



**Approved By**

*EXCALIBUR ENGINEERING*
*EQUIPMENT SPECIFICATION SHEET*

**Manufacturer:** LARSON DAVIS **Model:** CAL200 **Procedure:** 1211
**Work Order:** 48475-3 **Serial:** 3228 **Asset:** NAN

| RANGE/FUNCTION | APPLIED | AS FOUND | AS LEFT | TOLERANCE |
|---|---|---|---|---|
| | | | | |
| S.P.L. | 94.0 dB | 94.55 dB | 94.07 dB | ±0.2 dB |
| | 114.0 dB | 114.61 dB | 114.03 dB | ±0.2 dB |
| | | | | |
| FREQUENCY | 1000 Hz | 1000.2 Hz | 1000.2 Hz | ±1% IV |
| | | | | |
| DISTORTION | | .254% | .254% | <1% |
| | | | | |
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*** Denotes out of tolerance condition.**

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48475-4 | **Bar Code #** | |
| **Date Received** | FRIDAY, FEBRUARY 27, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 2104 |
| **Model #** | PRM902 | **Asset #** | NAN |
| **Description** | MICROPHONE PRE AMP | | |

**Date Calibrated** 3/9/2009 **Calibration Due Date** 3/9/2010 **Calibration Interval** 12

**Maintenance Procedure** M.F.I.B

**Temperature** 20 ° C **Humidity** 40 % **Calibration Performed By** 28

**Accuracy** ± 0.10 dB (10 Hz-126 KHz)

Received In Tolerance

**Remarks**

Returned In Tolerance

**Remarks**

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 878 | BRUEL & KJAER | 4226 | SLM CALIBRATOR | 1/28/2010 |
| 941 | BRUEL & KJAER | 1049 | SINE & NOISE GENERATOR | 12/5/2009 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 7/11/2009 |

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.



MAR 2 ? 2009

**Approved By**

# CALIBRATION CERTIFICATE FOR LARSON DAVIS 820

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48750-1 | **Bar Code #** | |
| **Date Received** | THURSDAY, APRIL 23, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 1584 |
| **Model #** | 820 | **Asset #** | NAN |
| **Description** | SOUND LEVEL METER | | |

**Date Calibrated** 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12
**Maintenance Procedure** 4226
**Temperature** 21 ° C **Humidity** 34 % **Calibration Performed By** 28
**Accuracy** ANSI Type 1

Received In Tolerance
**Remarks** Meets ANSI Type 1 specifications undre laboratory conditions.

Returned In Tolerance
**Remarks**

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 878 | BRUEL & KJAER | 4226 | SLM CALIBRATOR | 1/28/2010 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 4/16/2010 |

Excalibur Engineering, Inc. certifies that the instrument specified above meets the manufacturer's specifications and has been calibrated using Standards and Instruments also listed above whose accuracies are traceable to the National Institute of Standards and Technology(NIST), and the calibration systems and records are in compliance to ISO-10012 and ANSI Z540-1-1994.



4/30/2009

**Approved By**

**Excalibur Engineering**
9201 Irvine Blvd
Irvine, CA 92618
Phone : (949) 454-6603
Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48750-2 | **Bar Code #** | |
| **Date Received** | THURSDAY, APRIL 23, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 4973 |
| **Model #** | CAL200 | **Asset #** | NAN |
| **Description** | PRECISION ACOUSTIC CALIBRATOR | | |

## Calibration Information

**Date Calibrated** 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

**Maintenance Procedure** 1211

**Temperature** 21 ° C **Humidity** 34 % **Calibration Performed By** 28

**Accuracy** ±0.5 dB

## Condition

Received Out Of Tolerance

**Remarks** See attached data sheet for out of tolerance data.

## Calibration Data

Returned In Tolerance

**Remarks** Adjusted SPL to less than 0.1dB of nominal

## Standards Employed

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 610 | BRUEL & KJAER | 4228 | PISTONPHONE | 1/30/2010 |
| 051 | BRUEL & KJAER | 2639 | MICROPHONE PREAMPLIFIER | 2/3/2010 |
| 043 | BRUEL & KJAER | 4190 | 1/2" CONDENSER MICROPHONE | 6/10/2009 |
| 949 | BRUEL & KJAER | 2636 | MEASURING AMPLIFIER | 2/3/2010 |
| 305 | AGILENT | 8903B | AUDIO ANALYZER | 5/30/2009 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 4/16/2010 |

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5/5/2009

**Approved By**

*EXCALIBUR ENGINEERING*
*EQUIPMENT SPECIFICATION SHEET*

**Manufacturer:** LARSON DAVIS **Model:** CAL200 **Procedure:** 1211
**Work Order:** 48750-2 **Serial:** 4973 **Asset:** NAN

| RANGE/FUNCTION | APPLIED | AS FOUND | AS LEFT | TOLERANCE |
|---|---|---|---|---|
| | | | | |
| S.P.L | 94.0dB | 93.73dB* | 93.91dB* | ±0.2dB |
| | 114.0dB | 113.75dB* | 113.90dB* | ±0.2dB |
| | | | | |
| FREQUENCY | 1000 Hz | 1000.2 Hz | 1000.2 Hz | ±1%IV |
| | | | | |
| DISTORTION | | .381% | .381% | <1% |
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* Denotes out of tolerance condition.

**Excalibur Engineering**
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Fax : (949) 454-6642

# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48750-3 | **Bar Code #** | |
| **Date Received** | THURSDAY, APRIL 23, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | PCB PIEZOTRONICS | **Serial #** | 101355 |
| **Model #** | 377A60 | **Asset #** | NAN |
| **Description** | MICROPHONE | | |

## Calibration Data

**Date Calibrated** 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

**Maintenance Procedure** 1371

**Temperature** 21 ° C **Humidity** 32 % **Calibration Performed By** 28

**Accuracy** ± 2 dB

## Calibration Results

Received In Tolerance

**Remarks** Sensitivity = -26.211000.2 Hz

## Calibration Results

Returned In Tolerance

**Remarks**

## Standards Employed

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 051 | BRUEL & KJAER | 2639 | MICROPHONE PREAMPLIFIER | 2/3/2010 |
| 610 | BRUEL & KJAER | 4228 | PISTONPHONE | 1/30/2010 |
| 043 | BRUEL & KJAER | 4190 | 1/2" CONDENSER MICROPHONE | 6/10/2009 |
| 654 | BRUEL & KJAER | 2307 | LEVEL RECORDER | 7/15/2009 |
| 941 | BRUEL & KJAER | 1049 | SINE & NOISE GENERATOR | 12/5/2009 |
| 949 | BRUEL & KJAER | 2636 | MEASURING AMPLIFIER | 2/3/2010 |
| 305 | AGILENT | 8903B | AUDIO ANALYZER | 5/30/2009 |
| 655 | BRUEL & KJAER | 4142 | MICRPHN CALIB APPARATUS | 6/1/2010 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 4/16/2010 |

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**Approved By** 4/30/2009

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# Certificate Of Calibration

| | | | |
|---|---|---|---|
| **Customer** | LSA | **Dept.** | N/A |
| **Report #** | 48750-4 | **Bar Code #** | |
| **Date Received** | THURSDAY, APRIL 23, 2009 | **P.O. #** | CREDIT CARD |
| **Manufacturer** | LARSON DAVIS | **Serial #** | 2484 |
| **Model #** | PRM828 | **Asset #** | NAN |
| **Description** | PRE AMP | | |

## Calibration Information

**Date Calibrated** 4/30/2009 **Calibration Due Date** 4/30/2010 **Calibration Interval** 12

**Maintenance Procedure** MFIB

**Temperature** 21 ° C **Humidity** 33 % **Calibration Performed By** 28

**Accuracy** ±.10dB (10 Hz -126 KHz)

## Condition Received

Received In Tolerance

**Remarks**

## Condition Returned

Returned In Tolerance

**Remarks**

## Standards Employed

| ID # | Manufacturer | Model # | Description | Calibration Expires |
|---|---|---|---|---|
| 941 | BRUEL & KJAER | 1049 | SINE & NOISE GENERATOR | 12/5/2009 |
| 713 | FLUKE | 8920A | 20 MHZ TRUE RMS VOLTMETER | 4/16/2010 |

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5/5/2009

**Approved By**