# Appendix H

## Noise Technical Report

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# FIRESTONE BOULEVARD WIDENING PROJECT

## Noise and Vibration Technical Report

Prepared for
City of Norwalk
12700 Norwalk Boulevard
Norwalk, California 90650

September 2019

Draft

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## Noise and Vibration Technical Report

Prepared for

City of Norwalk
12700 Norwalk Boulevard
Norwalk, California 90650

September 2019

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# ACRONYMS AND ABBREVIATIONS

| Acronym | Description |
|---|---|
| ANSI | American National Standard Institute |
| Caltrans | California Department of Transportation |
| CEQA | California Environmental Quality Act |
| City | City of Norwalk |
| CNEL | Community Noise Equivalent Level |
| COG | Council of Governments |
| dB | decibel |
| dBA | A-weighted dB scale |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| I | Interstate |
| LA | Los Angeles |
| $L_{eq}$ | Equivalent Sound Level |
| $L_{max}$ | Maximum Noise Level |
| $L_{min}$ | Minimum Noise Level |
| NB | northbound |
| PPV | peak particle velocity |
| Project | Firestone Boulevard Widening Project |
| RCNM | Roadway construction noise model |
| ROW | Right-of-way |
| SLM | Sound Level Meter |
| TeNS | Caltrans Technical Noise Supplement |
| TIA | Traffic Impact Analysis |
| UPRR | Union Pacific Railroad |
| USEPA | U.S. Environmental Protection Agency |

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# EXECUTIVE SUMMARY

The purpose of this Noise and Vibration Technical Report is to assess and discuss the impacts of potential noise and vibration impacts that may occur with the implementation of the proposed widening of Firestone Boulevard in the City of Norwalk (City). The City has identified the need to widen Firestone Boulevard between Hoxie Avenue/northbound (NB) Interstate 605 (I-605) Freeway Ramps to the west and Imperial Highway to the east. The Firestone Boulevard Widening Project (Project or Proposed Project) would be located partially within the State's right-of-way (ROW) at the western limits with most of the project located within the City of Norwalk.

The analysis describes the existing noise environment in the vicinity of the Project limits, estimates future noise and vibration levels at surrounding land uses resulting from construction and operation of the Project, and identifies the potential for significant noise impacts based on applicable noise and vibration threshold of significance. Noise worksheets and technical data used in this analysis are provided in Appendices A-D of this report. The findings of the analyses are as follows:

- Construction activities would be required to comply with the City of Norwalk's allowable construction hours of between the hours of 7:00 a.m. and 6:00 p.m. or sunset, whichever is later. Through compliance with the City's allowable construction hours, Mitigation Measures MM-NOISE-1, noise impacts related to on-site construction activities would be less than significant at noise sensitive receptor locations.

- Off-site haul truck trip would not substantially increase noise levels over the ambient condition. In addition, construction activities would occur only during daytime hours within the allowable hours specified in the City's Municipal Code. Therefore, noise impacts from off-site construction traffic would be less than significant, and no mitigation measures are required.

- Project operational traffic would not significantly increase noise levels at off-site noise-sensitive uses in the Project area. Operational traffic-related noise impacts would be less than significant.

- Project operation would not generate excessive vibration levels at nearby sensitive receptor locations. Thus, long-term vibration impacts would be less than significant.

- Temporary construction-related vibration would exceed the established threshold for building damage and human annoyance to the adjacent residential uses adjacent to the Project area. However, vibration generated by on-site construction activities would have a less than significant impact on surrounding and on-site uses with incorporation of Mitigation Measures MM-NOISE-2.

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# SECTION 1
Introduction

The City of Norwalk (City) has identified the need to widen Firestone Boulevard between Hoxie Avenue/northbound (NB) Interstate 605 (I-605) Freeway Ramps to the west and Imperial Highway to the east. The Firestone Boulevard Widening Project (Project or Proposed Project) would be located partially within the State's Right-of-way (ROW) at the western limits with most of the project located within the City of Norwalk.

An acoustical study has been conducted with respect to potential noise and vibration impacts from construction activities, surface transportation, and other aspects of Project operations that are noise and vibration intensive and that have the potential to impact existing off-site noise sensitive land uses and existing on- and off-site vibration-sensitive land uses. The objectives of this noise study are to:

1. Quantify the existing ambient noise environment at the Project site;
2. Evaluate construction-related noise and vibration impacts and the traffic and operational noise and vibration impacts to noise sensitive receptors;
3. Provide noise mitigation measures, as required, to meet applicable noise regulations and standards including interior sound level standards as specified by the City of Norwalk.

## 1.1 Project Location

The Project Site is located in the City of Norwalk, as shown in **Figure 1**, *Project Location Map*. The western limits of the Proposed Project are located within the State's ROW at the intersection of Hoxie Avenue/NB I-605 Freeway Ramps and the eastern limits are located at Imperial Highway. Surrounding land uses include the following:

**Hoxie Avenue/NB I-605 Ramps to Studebaker Road**

Located east of Hoxie Avenue/NB I-605 Ramps and north of Firestone Boulevard is a community of multi-family residence, a car dealership, and a business center with commercial/retail businesses. Located east of Hoxie Avenue/NB-I-605 Ramps is a car dealership, a hotel (Best Western), and a storage facility.

**Studebaker Road to Imperial Highway**

Located north of Firestone Boulevard and east of Studebaker Road are a commercial/retail businesses and single- family residences. Land uses located south of Firestone Boulevard and east of Studebaker Road are primarily commercial and retail businesses.

## 1.2 Existing Site Conditions

The existing Firestone Boulevard serves as a vital corridor to move goods and people, supporting the Norwalk economy. It provides a necessary link between the I-5 Freeway and the I-605 Freeway. Currently, this segment of Firestone Boulevard consists of 4-lanes of traffic (2 in each direction) and a landscaped raised median, in an urbanized area of the City with businesses on both sides of the road.

Previously the Cities of Norwalk and Downey, under a joint agreement, widened Firestone Boulevard to the west from the City of Downey limits to the I-605 Freeway ramps. Los Angeles (LA) Metro and Gateway Cities Council of Governments (COG) are currently planning the improvements to the I-605 Freeway/Firestone Boulevard interchange. This project has been identified as an early action project of the larger I-605 Freeway Improvements project.

## 1.3 Project Description

The Firestone Boulevard Widening project would upgrade the existing section to be consistent with the wider section to the west and the planned 6-lane cross section under the I-605 freeway. This project widens the roadway east of the I-605 freeway for three (3) lanes in each direction including at an existing overpass of the Union Pacific Railroad (UPRR) line. The project will also provide multi-modal improvements with the installation of on-street (class II and class III) bicycle facilities. Other improvements that are part of the Firestone Boulevard Widening project include, but are not limited to, a bridge widening over a UPRR active line, traffic signal improvements, retaining walls, pavement reconstruction, landscape and irrigation improvements, and pedestrian (ADA) improvements.

The project is anticipated to be constructed within existing City Right-of-way, except the westerly 200 feet of the Project's limits, which are located within the State's Right-of-Way.


SOURCE: ESRI

Firestone Blvd Widening Project

**Figure 1**
Project Location Map

# 1.4 Noise and Vibration Basics

## Noise

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). Noise is generally defined as unwanted sound (i.e., loud, unexpected, or annoying sound). Acoustics is defined as the physics of sound. In acoustics, the fundamental scientific 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. Acoustics primarily addresses the propagation and control of sound.

Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) that is measured in decibels (dB), which is the standard unit of sound amplitude measurement. The dB scale is a logarithmic scale that describes the physical intensity of the pressure vibrations that make up any sound, with 0 dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of feeling and pain, respectively. Pressure waves traveling through air exert a force registered by the human ear as sound.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude, with audible frequencies of the sound spectrum ranging from 20 to 20,000 Hz. The typical human ear is not equally sensitive to this frequency range. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that deemphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to these extremely low and extremely high frequencies. This method of frequency filtering or weighting is referred to as A-weighting, expressed in units of A-weighted decibels (dBA), which is typically applied to community noise measurements. Some representative common outdoor and indoor noise sources and their corresponding A-weighted noise levels are shown in **Figure 2**, *Decibel Scale and Common Noise Sources.*

### Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time; a noise level is a measure of noise at a given instant in time, as presented in Figure 3. However, noise levels rarely persist at that level over a long period of time. Rather, community noise varies continuously over a period of time with respect to the sound sources contributing to the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with many of the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources, such as changes in traffic volume. What makes community noise variable throughout a day, besides the slowly changing background noise, is the addition of short-duration, single-event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

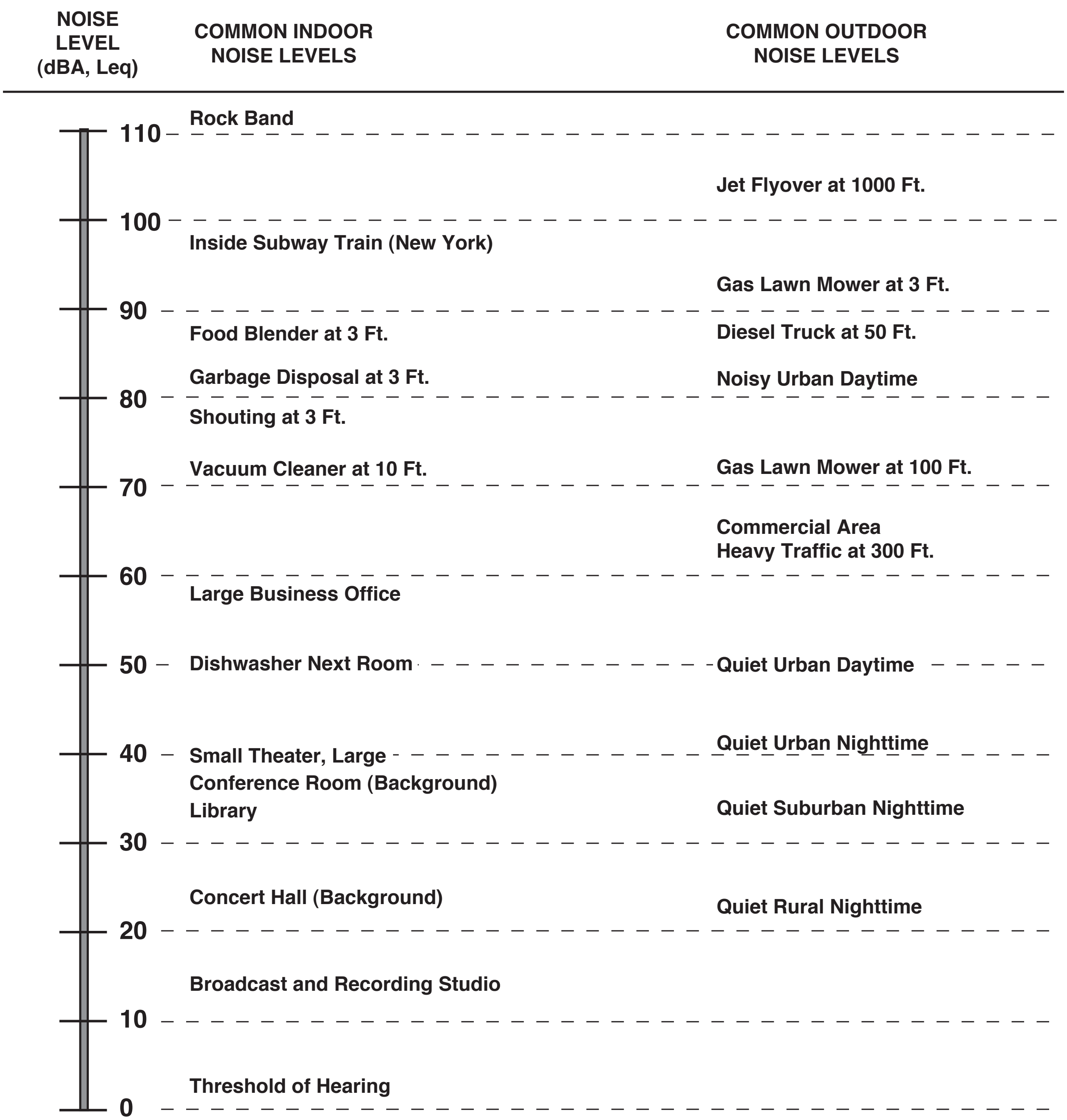
These successive additions of sound to the community noise environment change the community noise level from instant to instant, requiring the noise exposure to be measured over periods of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. The following noise descriptors are used to characterize environmental noise levels over time, which are applicable to the Project.

$L_{eq}$: The equivalent sound level over a specified period of time, typically, 1 hour ($L_{eq}(1)$). The Leq may also be referred to as the average sound level.

$L_{max}$: The maximum, instantaneous noise level experienced during a given period of time.

$L_{min}$: The minimum, instantaneous noise level experienced during a given period of time.

CNEL: The Community Noise Equivalent Level (CNEL) is the average A-weighted noise level during a 24-hour day that includes an addition of 5 dB to measured noise levels between the hours of 7:00 a.m. to 10:00 p.m. and an addition of 10 dB to noise levels between the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively.

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SOURCE: State of California, Department of Transportation (Caltrans), Technical Noise Supplement (TeNS). October 1998. Available: http://www.dot.ca.gov/hq/env/noise/pub/Technical Noise Supplement.pdf

Firestone Blvd Widening Project

**Figure** 2
Decibel Scale and Common Noise Sources

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## Effects of Noise on People

Noise is generally loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity that is a nuisance or disruptive. The effects of noise on people can be placed into four general categories:

- Subjective effects (e.g., dissatisfaction, annoyance)
- Interference effects (e.g., communication, sleep, and learning interference)
- Physiological effects (e.g., startle response)
- Physical effects (e.g., hearing loss)

Although exposure to high noise levels has been demonstrated to cause physical, psychological, and physiological effects, the principal human responses to typical environmental noise exposure are related to subjective effects and interference with activities. Interference effects interrupt daily activities and include interference with human communication activities, such as normal conversations, watching television, telephone conversations, and interference with sleep. Sleep interference effects can include both awakening and arousal to a lesser state of sleep.

With regard to the subjective effects, the responses of individuals to similar noise events are diverse and influenced by many factors, including the type of noise, the perceived importance of the noise, the appropriateness of the noise to the setting, the duration of the noise, the time of day and the type of activity during which the noise occurs, and individual noise sensitivity. Overall, there is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction on people. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted (i.e., comparison to the ambient noise environment). In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships generally occur[1]:

- Except in carefully controlled laboratory experiments, a change of 1 dBA in ambient noise levels cannot be perceived.
- Outside of the laboratory, a 3 dBA change in ambient noise levels is considered to be a barely perceivable difference.
- A change in ambient noise levels of 5 dBA is considered to be a readily perceivable difference.
- A change in ambient noise levels of 10 dBA is subjectively heard as doubling of the perceived loudness.

[1] California Department of Transportation (Caltrans), Technical Noise Supplement (TeNS), Section 2.2.1, September, 2013.

These relationships occur in part because of the logarithmic nature of sound and the decibel scale. The human ear perceives sound in a non-linear fashion; therefore, the dBA scale was developed. Because the dBA scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. Under the dBA scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two sources are each producing sound of the same loudness, the resulting sound level at a given distance would be approximately 3 dBA higher than one of the sources under the same conditions. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. Under the dBA scale, three sources of equal loudness together produce a sound level of approximately 5 dBA louder than one source, and ten sources of equal loudness together produce a sound level of approximately 10 dBA louder than the single source. [2]

## Noise Attenuation

When noise propagates over a distance, the noise level reduces with distance depending on the type of noise source and the propagation path. Noise from a localized source (i.e., point source) propagates uniformly outward in a spherical pattern, referred to as "spherical spreading." Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (i.e., reduce) at a rate of between 6 dBA for acoustically "hard" sites and 7.5 dBA for "soft" sites for each doubling of distance from the reference measurement, as their energy is continuously spread out over a spherical surface (e.g., for hard surfaces, 80 dBA at 50 feet attenuates to 74 at 100 feet, 68 dBA at 200 feet, etc.). Hard sites are those with a reflective surface between the source and the receiver, such as asphalt or concrete surfaces or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the reduction in noise levels with distance (i.e., distance loss) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, which in addition to geometric spreading, provides an excess ground attenuation value of 1.5 dBA (per doubling distance).[3] Most sites are a combination of both hard and soft surfaces; therefore, using the hard site criteria of 6 dBA is the more conservative approach.

Roadways and highways consist of several localized noise sources on a defined path, and hence are treated as "line" sources, which approximate the effect of several point sources. Noise from a line source propagates over a cylindrical surface, often referred to as "cylindrical spreading." Line sources (e.g., traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement.[4] Therefore, noise due to a line source attenuates less with distance than that of a point source with increased distance.

Additionally, receptors located downwind from a noise source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Atmospheric temperature inversion (i.e., increasing temperature with elevation) can increase

2 Caltrans, Technical Noise Supplement (TeNS), Section 2.2.1.1, September, 2013.

3 Caltrans, Technical Noise Supplement (TeNS), Section 2.1.4.2, September, 2013.

4 Caltrans, Technical Noise Supplement (TeNS), Section 2.1.4.1, September, 2013.

sound levels at long distances (e.g., more than 500 feet). Other factors such as air temperature, humidity, and turbulence can also have significant effects on noise levels. [5]

## Vibration

Vibration can be interpreted as energy transmitted in waves through the ground or man-made structures, which generally dissipate with distance from the vibration source. Because energy is lost during the transfer of energy from one particle to another, vibration becomes less perceptible with increasing distance from the source.

As described in the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment*, groundborne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard.[6] In contrast to airborne noise, groundborne vibration is not a common environmental problem, as it is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of groundborne vibration are trains, heavy trucks traveling on rough roads, and construction activities, such as blasting, pile-driving, and operation of heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal in inches per second (in/sec), and is most frequently used to describe vibration impacts to buildings.

The effects of groundborne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most Projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration levels exceed the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV.[7]

In residential areas, the background vibration velocity level is usually around 0.0013 in/sec PPV, which is well below the vibration velocity level threshold of perception for humans, which is approximately 0.035 in/sec PPV.[8]

5 Caltrans, Technical Noise Supplement (TeNS), Section 2.1.4.3 September, 2013.
6 FTA, Transit Noise and Vibration Impact Assessment, Section 7.1.3, May, 2006.
7 FTA, Transit Noise and Vibration Impact Assessment, Section 12.2.2, May. 2006 .
8 Caltrans, Transportation and Construction Vibration Guidance Manual, Chapter 6.B, June, 2004.

## 1.5 Existing Noise Environment

### Noise-Sensitive Receptor Locations

Some land uses are considered more sensitive to noise than others due to the amount of noise exposure and the types of activities typically involved at the receptor location. Residences, schools, motels and hotels, libraries, religious institutions, hospitals, nursing homes, and parks are generally more sensitive to noise than commercial and industrial land uses. Existing noise sensitive uses within 500 feet of the Project Area include the following:

- Multi-family residences located northwest of the Hoxie Avenue/I-605 NB Freeway Ramps and Firestone Boulevard intersection;
- Hotel (Best Western) located south of Firestone Boulevard between Hoxie Avenue/I-605 NB Freeway Ramps and Studebaker Road;
- Multi- and single-family residences located north of Firestone Boulevard between Elmcroft Avenue and Orr and the UPRR line;
- Single- family residences located north of Firestone Boulevard between the UPRR line and Day Road;
- School (New Harvest Christian School) located southwest of the intersection of Firestone Boulevard and Imperial Highway.

All other noise-sensitive uses are located at greater distances and/or shielded from construction and operation activity by buildings immediately surrounding the Project Area and would experience lower noise levels associated with the Project. Therefore, additional sensitive receptors beyond those identified above are not evaluated.

### Ambient Noise Levels

The existing noise environment within the Project Area is comprised primarily of vehicle traffic including trucks, buses, etc. on Firestone Boulevard, I-605 and Imperial Highway. Secondary noise sources include nearby commercial and residential activities. To quantify the existing noise environment, short-term (15-minute) measurements were conducted at four locations, identified as R1 through R4 in **Figure 3**, *Noise Measurement and Sensitive Receiver Locations*. A 15-minute measurement is a reasonable duration for sampling ambient noise levels where street traffic is the dominant source, as traffic noise generally does not vary significantly within an hour. Ambient sound measurements were conducted on Tuesday, August 12, 2019, to characterize the existing daytime noise environment in the Project vicinity.

- Measurement Location M1: The noise measuring device (sound level meter) was placed on the southern border of the Porto Bella Apartments, approximately 10 feet north of the westbound lanes of Firestone Boulevard. Location R1 represents the existing general noise environment at nearby multi-family residential uses along the northern and southern sides of Firestone Boulevard between Hoxie Avenue/I-605 NB Freeway Ramps and Studebaker Road.

- Measurement Location M2: This measurement location represents the noise environment of the multi- and single-family residences located along the northern side of Firestone Boulevard, along Ringwood Avenue, between Elmcroft Avenue and the UPRR line. The residences located here are at a lower elevation than Firestone Boulevard. The sound level meter was placed near the southwestern border of a multi-family residence, approximately 55 feet north of Firestone Boulevard.

- Measurement Location M3: This measurement location represents the noise environment of the single-family residences located north of Firestone Boulevard, along Crew Street and Graystone Avenue, between the UPRR line and Orr and Day Road. The residences here are located a lower elevation than Firestone Boulevard. Private property walls, approximately 6 feet in height are located along the southern borders of the first row of residences to Firestone Boulevard. The sound level meter was placed between the single-family residences and Firestone Boulevard, directly to the west of the Hertz Car Sales lot, approximately 20 feet from Firestone Boulevard.

- Measurement Location M4: This measurement location represents the noise environment of the New Harvest Christian School located at the southwest corner of the intersection of Firestone Boulevard and Imperial Highway. The sound level meter was placed between the school and Imperial Highway, approximately 12 feet from Firestone Boulevard.

Noise measurements were conducted using a Larson-Davis LxT Sound Level Meter (SLM), which is a Type 1 standard instrument, as defined in the American National Standard Institute (ANSI) S1.4. All instruments were calibrated and operated according to the applicable manufacturer specification. The recording microphone was placed at a height of 5 feet above the local grade elevation. The SLM was setup to collect the hourly average noise level (Leq).

The results of the ambient sound measurements are summarized in **Table 1**, *Summary of Ambient Noise Measurements*. As shown therein, the measured noise levels ranged from 65 dBA Leq at R2 to 73 dBA Leq at R4 in which the primary source of noise was traffic along the roadways.

**TABLE 1**
**SUMMARY OF AMBIENT NOISE MEASUREMENTS**

| Location, Duration, Existing Land Uses, and, Date of Measurements | Measured Ambient Noise Levels, dBA |
|---|---|
| R1<br>8/13/19(7:56 a.m. to 8:11 a.m.)/Tuesday | 68 |
| R2<br>8/13/19(8:19 a.m. to 8:34 a.m.)/Tuesday | 65 |
| R3<br>8/13/19(8:40 a.m. to 8:55 a.m.)/Tuesday | 71 |
| R4<br>8/13/19(9:02 a.m. to 9:17 a.m.)/Tuesday | 73 |

SOURCE: ESA 2019.

## Vibration-Sensitive Receptor Locations

Typically, ground-borne vibration generated by man-made activities (i.e., rail and roadway traffic, operation of mechanical equipment, and typical construction equipment) diminishes rapidly with distance from the vibration source. FTA uses a screening distance of 50 feet for residential uses and historic buildings. When vibration-sensitive uses are within these distances from a project site, vibration impact analysis is required. Multi- and single-family residences located along Firestone Boulevard could be affected by vibration caused by short-term construction. All other sensitive land uses are located more than 50 feet away and across existing roadways.


SOURCE: Mapbox 2018

Firestone Blvd Widening Project

**Figure 3**
Noise Measurement and Sensitive Receiver Locations

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## 1.6 Regulatory Setting

Many government agencies have established noise standards and guidelines to protect citizens from potential hearing damage and various other adverse physiological and social effects associated with noise and ground-borne vibration. Federal and local policies and/or standards such as those of FTA, U.S. Environmental Protection Agency (USEPA), and regulations in the City of Norwalk General Plan Noise Element, and the Norwalk Municipal Code would be applicable to the Project, as summarized below.

### City of Norwalk General Plan Noise Element (1996)

As shown in **Table 2**, *Guidelines for Noise Compatible Land Use*, the City has also established noise guidelines in the Noise Element of the City's General Plan that are used for planning purposes. These guidelines are based, in part, on the community noise compatibility guidelines established by the California State Governor's Office of Planning and Research and are intended for use in assessing the compatibility of various land use types with a range of noise levels. Page 5F.8 of the Noise Element provides the guidelines of land use compatibility for community noise sources. The CNEL noise levels for specific land uses are classified into four categories: (1) "clearly acceptable" (2) "normally acceptable" (3) "normally unacceptable" and (4) "clearly unacceptable." A CNEL value of 70 dBA is considered the dividing line between a "conditionally acceptable" and "normally unacceptable" noise environment for noise sensitive land uses, including residences, transient lodgings, schools, and libraries.

**TABLE 2**
**GUIDELINES FOR NOISE COMPATIBLE LAND USE**

| | Day-Night Average Exterior Sound Level (CNEL, dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Land Use Categories** | **50** | **55** | **60** | **65** | **70** | **75** | **80** |
| Residential Low Density Single-Family, Duplex, Mobile Homes | C | C/A | A | A | N | U | U |
| Residential Multi- Family | C | C | C/A | A | N | U | U |
| Transient Lodging, Hotel, Motel | C | C | C/A | A | N | N | U |
| School, Library, Church, Hospital, Nursing Home | C | C | C/A | A | N | N | U |
| Auditorium, Concert Hall, Amphitheater | A | A | A | A/U | U | U | U |
| Sports Arena, Outdoor Spectator Sports | A | A | A | A | A/U | U | U |
| Playground, Neighborhood Park | C | C | C | C/N | N/U | U | U |
| Golf Course, Riding Stable, Water Recreation, Cemetery | C | C | C | C | C/N | N | U |
| Office Building, Business, Commercial, Professional | C | C | C | C/A | A | A/N | N |
| Agriculture, Industrial, Manufacturing, Utilities | C | C | C | C | C/A | A/N | N |

Based on the Governor's Office of Planning and Research, "General Plan Guidelines", 1990. To help guide determination of appropriate land use and mitigation measures vis-a-vis existing or anticipated ambient noise levels.
C = Clearly Acceptable: Specified land use is satisfactory, based upon the assumption buildings involved are conventional construction, without any special noise insulation.
A = Conditionally Acceptable: New construction or development only after a detailed analysis of noise mitigation is made and needed noise insulation features are included in project design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will suffice.
N – Normally Unacceptable: New construction or development generally should be discouraged. A detailed analysis of the noise reduction requirements must be made and noise insulation features included in the design of a project.
U – Clearly Unacceptable: New construction or development should generally not be undertaken.

SOURCE: City of Norwalk General Plan, Noise Element, 1996.

Additionally, the Proposed Project is subject to the following policies provided in the Noise Element of the General Plan:

- Encourage compliance with state and federal legislation designed to abate and control noise pollution.
- Discourage truck traffic from using local residential streets.
- Ensure that proposed noise sources are reduced below a level of significance and properly muffled to prevent noise impacts on neighboring properties.

## City of Norwalk Municipal Code

Pursuant to Municipal Code Section 9.04.140, General Noise Regulations, it shall be unlawful for any person to willfully make or continue, or cause or permit to be made or continued, any loud, unnecessary, or unusual noise which unreasonably disturbs the peace and quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitiveness residing in the area. An average noise level reading which exceeds the ambient noise level at the property line of any residential land by more than five decibels shall be deemed a violation of these standards.

Section 9.04.120, Ambient Noise Level, of the City of Norwalk Municipal Code presumes specific ambient noise levels in a given environment within the City, unless sound level meter readings determine the ambient noise levels are higher. These ambient noise levels are summarized in **Table 3**, *City of Norwalk Ambient Noise Levels*.

Furthermore, construction (including excavation), demolition, alteration, or repair of any building shall only occur between the hours of 7:00 a.m. and 6:00 p.m. or sunset, whichever is later.

**TABLE 3**
**CITY OF NORWALK AMBIENT NOISE LEVELS**

| Decibels | Time | Zone |
|---|---|---|
| 45 dBA | Night (10:00 p.m. to 7:00 a.m.) | Residential |
| 55 dBA | Day (7:00 a.m. to 10:00 p.m.) | Residential |
| 60 dBA | Anytime | Commercial |
| 65 Dba | Anytime | All other zones |

Notes:
a) Unless sound-level meter readings determine the ambient noise level in a given environment to be higher, the ambient noise levels in Norwalk are presumed to be as provided in this table.

Source: Norwalk 2017

## Ground-Borne Vibration

The City of Norwalk does not address vibration either in the municipal code or in the Noise Element of the General Plan. With respect to ground-borne vibration from construction activities, Caltrans has adopted guidelines/recommendations to limit ground-borne vibration based on the age and/or condition of the structures that are located in close proximity to construction activity. With respect to residential and commercial structures, Caltrans' technical publication, titled *Transportation- and Construction-Induced Vibration Guidance Manual*,[9] provides a vibration damage potential threshold criteria. In addition, the guidance also provides a human response to transient vibration. Caltrans vibration damage and annoyance thresholds are provided in **Table 4,** *Human Reaction and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels.*

9 Transportation- and Construction-Induced Vibration Guidance Manual, September 2013.

**TABLE 4**
**HUMAN REACTION AND DAMAGE TO BUILDINGS FOR CONTINUOUS OR FREQUENT INTERMITTENT VIBRATION**

| Peak Particle Velocity | Human Reaction | Effect on Buildings |
|---|---|---|
| 0.006-0.019 | Range of threshold of perception | Vibrations unlikely to cause damage of any type |
| 0.08 | Vibrations readily perceptible | Recommended upper level to which ruins and ancient monuments should be subjected |
| 0.1 | Level at which continuous vibrations may begin to annoy people, particularly those involved in vibration sensitive activities | Virtually no risk of architectural damage to normal buildings |
| 0.2 | Vibrations may begin to annoy people in buildings | Threshold at which there is a risk of architectural damage to normal dwellings |
| 0.4-0.6 | Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges | Architectural damage and possibly minor structural damage |

Notes:
Source: Caltrans, Transportation and Construction Vibration Guidance Manual, September 2013.

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# SECTION 2
# Thresholds of Significance

The significance thresholds below are derived from the Environmental Checklist questions in Appendix G of the State CEQA Guidelines. Accordingly, a significant impact associated with noise would occur based on the following thresholds described below:

**NOI-1:** Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

**NOI-2:** Generation of excessive groundborne vibration or groundborne noise levels?

**NOI-3:** For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

The following significance criteria are used to evaluate potential noise and vibration impacts of the Project based on the regulatory framework described above. The Project would result in potentially significant impacts under the following circumstances:

- Project construction activities occur between the hours of 6:00 p.m. (or sunset, whichever is later) and 7:00 a.m.

- The Project-related operations would cause ambient noise levels to increase by 5 dBA $L_{eq}$ or more as stated Section 9.04.120 of the City's Municipal Code.

- Potential Building Damage – Project construction activities cause ground-borne vibration levels to exceed 0.2 in/sec PPV at the nearest residential buildings.

- Potential Human Annoyance – Project construction activities cause ground-borne vibration levels to exceed 0.2 in/sec PPV at nearby residential uses.

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# SECTION 3
# Impact Analysis

## 3.1 Methodology

### On-Site Construction Noise

On-site construction noise impacts were evaluated by determining the noise levels generated by the different types of construction activity anticipated, calculating the construction-related noise level at nearby sensitive receptor locations, and comparing these construction-related noise levels to existing ambient noise levels (i.e., noise levels without construction noise) at those receptors. More, specifically, the following steps were undertaken to assess construction-period noise impacts.

1. Ambient noise levels at surrounding sensitive receptor locations were estimated based on field measurement data (see Table 1)

2. Typical noise levels for each type of construction equipment were obtained from the FHWA roadway construction noise model (RCNM);

3. Distances between construction site locations (noise sources) and surrounding sensitive receptors were measured using Project architectural drawings and site plans and Google Earth;

4. The construction noise level was then calculated, in terms of hourly $L_{eq}$, for sensitive receptor locations based on the standard point source noise-distance attenuation factor of 6.0 dBA for each doubling of distance; and

5. Construction noise levels were then compared to the construction noise significance thresholds identified below.

### Off-Site Roadway Noise (Construction and Operations)

Roadway noise impacts have been evaluated using the Caltrans Technical Noise Supplement (TeNS) method based on the traffic data provided in the Project's Transportation Impact Analysis (TIA) (Kittelson 2019). The Caltrans TeNS method allows for the definition of roadway configurations, barrier information (if any), and receiver locations. Roadway noise attributable to Project development was calculated and compared to baseline noise levels that would occur under the "Without Project" condition.

## Ground-Borne Vibration (Construction and Operations)

Ground-borne vibration impacts were evaluated by identifying potential vibration sources, measuring the distance between vibration sources and surrounding structure locations, and making a significance determination based on the significance thresholds described below.

# 3.2 Project Characteristics and Project Design

## Project Characteristics

The Project would upgrade the existing section to be consistent with the wider section to the west and the planned 6-lane cross section under the I-605 freeway.  This project widens the roadway east of the I-605 freeway for three (3) lanes in each direction including at an existing overpass of the UPRR line. The project will also provide multi-modal improvements with the installation of on-street (class II and class III) bicycle facilities. Other improvements that are part of the Firestone Boulevard Widening project include, but are not limited to, a bridge widening over a UPRR active line, traffic signal improvements, retaining walls, pavement reconstruction, landscape and irrigation improvements, and pedestrian (ADA) improvements.

The project is anticipated to be constructed within existing City Right-of-way, except the westerly 200 feet of the Project's limits, which are located within the State's Right-of-Way.

Applicable regulations with which the Project must comply include the following:

- Project construction activities would not occur between the hours of 6:00 p.m. (or sunset, whichever is later) and 7:00 a.m

# 3.3 Noise Standards Impacts

## Construction Noise

### On-Site Construction Noise

Construction of the Project would require the use of heavy equipment during the various construction phases at the Project Site. During each stage of development, there would be a different mix of equipment. As such, construction activity noise levels at and near the Project Area would fluctuate depending on the particular type, number, and duration of use of the various pieces of construction equipment.

Individual pieces of construction equipment anticipated during Project construction could produce maximum noise levels of 75 dBA to 90 dBA $L_{max}$ at a reference distance of 50 feet from the noise source, as shown in **Table 5**, *Construction Equipment Noise Levels*. These maximum noise levels would occur when equipment is operating at full power. The estimated usage factor for the equipment is also shown in Table 5, which are based on FHWA's RCNM User's Guide.[10]

**TABLE 5**
**CONSTRUCTION EQUIPMENT NOISE LEVELS**

| Construction Equipment | Estimated Usage Factor, % | Noise Level at 50 Feet (dBA, Lmax) |
|---|---|---|
| Backhoes | 25% | 80 |
| Bore/Drill Rigs | 20% | 79 |
| Concrete Industrial Saw | 20% | 90 |
| Compactor | 20% | 83 |
| Cranes | 16% | 81 |
| Dozer | 40% | 82 |
| Excavator | 40% | 81 |
| Forklifts, rough terrain | 10% | 75 |
| Grader | 40% | 85 |
| Rubber Tired Loaders | 40% | 79 |
| Pavers | 50% | 77 |
| Pavement Breakers | 20% | 89 |
| Rollers | 20% | 80 |
| Scraper | 40% | 84 |
| Trenchers | 20% | 85 |

SOURCE: FHWA, 2006

During Project construction, the nearest and most affected off-site noise sensitive receptors that would be exposed to increased noise levels would be the existing residential uses located in proximity to the Project Area, as well as the Best Western Hotel and New Harvest Christian School. Construction activity would result in the loudest noise levels at ground-level sensitive land uses that have a direct line-of-sight to the Project Area. This is because the first tier of buildings immediately surrounding the Project Site would act as a noise barrier to other sensitive receptors located beyond these buildings. Therefore, construction-related noise levels are only presented for receptors closest to the Project Area. If sensitive uses are not close enough (within 500 feet) to the Project Area to be affected by the Proposed Project, they were not analyzed. Specifically, the nearest off-site noise sensitive receptors include the following:

- R1: Multi-family residences located northwest of the Hoxie Avenue/I-605 NB Freeway Ramps and Firestone Boulevard intersection, noise measurement M1 was taken at to identify ambient noise levels experienced at this location;
- R2: Hotel (Best Western) located south of Firestone Boulevard between Hoxie Avenue/I-605 NB Freeway Ramps and Studebaker Road, no noise measurements were taken at this

[10] Federal Highway Administration, Roadway Construction Noise Model User's Guide, P. 3, 2006.

location, however, due to the close proximity to noise measurement M1, existing noise levels are similar to R1;

- R3: Multi- and single-family residences located north of Firestone Boulevard between Elmcroft Avenue and the UPRR line, noise measurement M2 was taken at to identify ambient noise levels experienced at this location;
- R4: Single-family residences located north of Firestone Boulevard between the UPRR line and Orr and Day Road, noise measurement M3 was taken at to identify ambient noise levels experienced at this location.
- R5: School (New Harvest Christian School) located southwest of the intersection of Firestone Boulevard and Imperial Highway, noise measurement M4 was taken at to identify ambient noise levels experienced at this location.

Construction of the Project would last approximately three years and is projected to be operational in 2023. Noise from construction activities would be generated by the operation of vehicles and equipment involved during various stages of construction: demolition/pavement breaking, site excavation, grading, utility trenching, facilities construction and paving. The noise levels generated by construction equipment would vary depending on factors such as the type and number of equipment, the specific model (horsepower rating), the construction activities being performed, and the maintenance condition of the equipment. Construction noise associated with the Project was analyzed using a mix of typical construction equipment, estimated durations, and construction phasing, based on construction equipment data provided by the Applicant and assumptions derived from similar projects. **Table 6**, *Estimate of Construction Noise levels ($L_{eq}$) at Existing Off-Site Sensitive Receptor Locations,* shows the estimated construction noise levels that would occur at the nearest off-site sensitive uses during a peak day of construction activity at the Project Site. Details are provided in Appendix A.

**TABLE 6**
**ESTIMATE OF CONSTRUCTION NOISE LEVELS ($L_{EQ}$) AT EXISTING OFF-SITE SENSITIVE RECEIVER LOCATIONS**

| Off-site Sensitive Land Uses | Nearest Distance from Construction Activity to Noise Receptor (ft.) | Estimated Maximum Construction Noise Levels (dBA $L_{eq}$) |
|---|---|---|
| R1 | 10 | 98 |
| R2 | 13 | 96 |
| R3 | 10 | 98 |
| R4[A] | 8 | 90 |
| R5 | 100 | 78 |

Notes:

A) A 6-foot high private property wall provides 10 dB abatement for the sensitive land uses.

SOURCE: ESA 2019.

As shown in Table 6, construction noise levels are estimated to reach a maximum of 98 dBA $L_{eq}$ at the nearest sensitive receptor (namely R1 and R2). Existing residences in the vicinity of the Project Area would be exposed to temporary and sporadic increased noise from nearby construction activities. Overall construction would last for approximately three years. However, since equipment operates intermittently and moves around the site, noise from operation of construction equipment would be sporadic and temporary during the construction period. Construction noise would be noticeable during the operation of heavy grading equipment working at the site (sporadically over the duration of construction), especially during the demolition, grading, and trenching period.

The City has not established numerical thresholds for construction noise; however, per the City Municipal Code, Section 9.04.150(E), construction (including excavation), demolition, alteration, or repair of any building shall only occur between the hours of 7:00 a.m. and 6:00 p.m. or sunset, whichever is later. While the implementation of the proposed project would result in a temporary increase in ambient noise resulting from the use of construction equipment, any daily increase in noise levels would cease upon completion of construction. Due to the proximity of the Project Area to sensitive receptors, mitigation measure MM-NOISE-1 requires various construction noise reduction measures to ensure that staging areas are located as far as possible from sensitive receptors, construction equipment include all required noise attenuation devices, and that the City's construction hour limitations are adhered to. With implementation of mitigation measure MM-NOISE-1 and because noise from construction activities would comply with the hours allowed by the City of Norwalk, and because the duration of construction would be short term, a significant noise impact would not occur during project construction. Therefore, construction of the project would result in a less than significant impact.

## Off-Site Construction Noise

Delivery and haul truck trips would occur throughout the construction period. Trucks traveling to and from the Project Area would be required to travel along the haul route approved by the City of Norwalk for the Project. An estimated maximum of approximately 50 haul truck trips would occur per day. Haul truck traffic would take the most direct route to the appropriate freeway ramp. Haul trucks would enter and exit the Project Area from the I-605. The trucks are assumed to continue onto Firestone Boulevard and travel no farther than Imperial Highway.

As previously shown in Table 1, existing noise levels near the Project Site are approximately 65 and 73 dBA, the haul truck route will traverse through dense commercial areas that already experience high volumes of commuter and truck traffic. Sensitive noise receptors along the haul route are located approximately 50 to 170 feet from the center line of the roadways. Construction traffic noise levels generated by truck trips would range from approximately 58.1 dBA, $L_{eq}$ to 63.1 dBA, $L_{eq}$, which is far below the existing noise levels experienced around the Project Site. Details are provided in Appendix B.

As discussed above in Section 1.4, a 3 dBA change in ambient noise levels is considered to be a barely perceivable difference. Therefore, the noise levels generated by truck trips would not substantially increase the existing noise levels in the surrounding environment. Construction truck trips would be required to comply with the City's allowable hours as described above and would be temporary in nature. Therefore, construction activities would comply with the City's noise standard, and impacts would be less than significant.

# Project-Related Operational Noise Impacts

## Operational Traffic Noise Compared to Existing Traffic Conditions

Vehicle trips attributed to operation of the Project would increase average daily traffic (ADT) volumes along the major thoroughfares within the Project vicinity, which was analyzed to determine if any traffic-related noise impacts would result from operation of the Project. The street segments chosen for this analysis have residential land uses which are the most affected by traffic increases generated by the Project.

Roadway noise impacts were evaluated using a spreadsheet model developed based on the methodologies provided in FHWA's TNM Technical Manual (FHWA, 1998). Project specific traffic volume data is provided in the traffic study prepared for the Project (Kittelson 2019). Roadway noise attributable to operation of the Project was calculated and compared to existing and future noise levels that would occur under the "Without Project" condition.

**Table 7,** *2019 Traffic Noise Impacts,* presents the change in mobile source noise resulting from Project implementation on existing conditions. As shown in **Table 7**, the roadway traffic volumes associated with the operation of the Project would result in a maximum increase in 0.5 dBA $L_{eq}$ along the segments of Firestone Boulevard, between Hoxie Avenue/I-605 Ramps and Studebaker Road.

**Table 8,** *2040 Traffic Noise Impacts,* presents the change in mobile source noise resulting from Project implantation on future conditions. As shown in Table 9, the traffic volumes associated with the Project would result in a maximum increase in 1.4 dBA $L_{eq}$ along the segments of Firestone Boulevard, between Hoxie Avenue/I-605 Ramps and Studebaker Road. The noise level increase on local roadways due to the operation of the Proposed Project would not exceed the 5 dBA threshold, and impacts would be less than significant and no mitigation measures are necessary.

**TABLE 7**
**2019 TRAFFIC NOISE IMPACTS**

| Roadway Segment | Calculated Traffic Noise Levels, dBA Leq | | | |
|---|---|---|---|---|
| | Existing (A) | Existing Plus Project (B) | Project Increment (B-A) | Exceeds Significant Threshold? |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | 74.0 | 74.5 | 0.5 | No |
| Studebaker Road & Firestone Boulevard | 69.6 | 69.8 | 0.2 | No |
| Stater Bros Driveway & Firestone Boulevard | 68.9 | 69.2 | 0.3 | No |
| Orr and Day Road & Firestone Boulevard | 69.2 | 69.4 | 0.2 | No |
| Imperial Highway & Firestone Boulevard | 69.3 | 69.4 | 0.1 | No |

NOTES:

Noise calculations are provided in Appendix C.

SOURCE: ESA, 2019

**TABLE 8**
**2040 TRAFFIC NOISE IMPACTS**

| Roadway Segment | Calculated Traffic Noise Levels, dBA Leq | | | | |
|---|---|---|---|---|---|
| | Existing (A) | Future 2040 | Future (2040) Plus Project (B) | Project Increment (B-A) | Exceeds Significant Threshold? |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | 74.0 | 75.0 | 75.4 | 1.4 | No |
| Studebaker Road & Firestone Boulevard | 69.6 | 70.6 | 70.7 | 1.1 | No |
| Stater Bros Driveway & Firestone Boulevard | 68.9 | 69.8 | 70.1 | 1.2 | No |
| Orr and Day Road & Firestone Boulevard | 69.2 | 70.1 | 70.4 | 1.2 | No |
| Imperial Highway & Firestone Boulevard | 69.3 | 70.3 | 70.4 | 1.1 | No |

NOTES:

Noise calculations are provided in Appendix C.

SOURCE: ESA, 2019

## 3.4 Groundbourne Vibration or Groundborne Noise Impacts

### Construction Vibration

Construction activities for the Project have the potential to generate low levels of groundborne vibration as the operation of heavy equipment (i.e., backhoe, dozer, grader, loader, and haul trucks, etc.) generates vibrations that propagate though the ground and diminish in intensity with distance from the source. No high-impact activities, such as pile driving or blasting, would be used during Project construction. The nearest off-site sensitive buildings to the Project Area are residential buildings approximately from 20 feet from the Project Area. Groundborne vibrations from construction activities very rarely reach the levels that can damage structures, but they may be perceived in buildings very close to a construction site.

The PPV vibration velocities for several types of construction equipment that can generate perceptible vibration levels are identified in **Table 9**, *Vibration Source Levels for Construction Equipment*. Based on the information presented in Table 9, vibration velocities could range from 0.004 to 0.2807 in/sec PPV at 20 feet from the source of activity. Details are provided in Appendix D.

**TABLE 9**
**VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT**

| | Approximate PPV (in/sec) | | | | | | |
|---|---|---|---|---|---|---|---|
| Equipment | 20 Feet | 25 Feet | 30 Feet | 50 Feet | 60 Feet | 75 Feet | 100 Feet |
| Vibratory Roller | 0.2807 | 0.2100 | 0.1657 | 0.0853 | 0.0673 | 0.0503 | 0.0346 |
| Large Bulldozer | 0.1190 | 0.0890 | 0.0702 | 0.0361 | 0.0285 | 0.0213 | 0.0147 |
| Caisson Drilling | 0.1190 | 0.0890 | 0.0702 | 0.0361 | 0.0285 | 0.0213 | 0.0147 |
| Loaded Trucks | 0.1016 | 0.0760 | 0.0600 | 0.0309 | 0.0244 | 0.0182 | 0.0125 |
| Jackhammer | 0.0468 | 0.0350 | 0.0276 | 0.0142 | 0.0112 | 0.0084 | 0.0058 |
| Small Bulldozer | 0.0040 | 0.0030 | 0.0024 | 0.0012 | 0.0010 | 0.0007 | 0.0005 |

SOURCE: FTA 2018; ESA 2019.

Proposed construction activities would occur throughout the Project Area and would not be concentrated at the point closest to the nearest structure. Based on the vibration levels presented in Table 9, at a distance of 20 feet from the Project Area, the maximum vibration level would be up to approximately 0.2807 in/sec PPV for a vibratory roller, which would exceed the significance threshold of 0.2 in/sec PPV. Therefore, the use of some construction equipment could result in a groundborne vibration velocity level above 0.2 inches per second at the nearest off-site structure. Therefore, impacts would be potentially significant in this regard. Although this would be a temporary impact that would cease completely when construction ends, the implementation of mitigation measure MM-NOISE-2 is required during construction activities. As indicated in Table 9, vibration levels at 30 feet would be below the 0.2 inches per second standard. Mitigation measure MM-NOISE-2 is required and would prohibit the use of vibratory rollers on the project site within 30 feet of occupied residential structures and institutional structures. Implementation of mitigation measure MM-NOISE-2 would reduce construction vibration impacts to less than significant levels.

With respect to human annoyance, the nearest residential uses located within 30 feet from the Project Area would be exposed to vibration levels exceeding 0.2 in/sec PPV. Under Caltrans vibration annoyance potential criteria (refer to Table 4), vibration levels exceeding 0.2 in/sec PPV may begin to annoy people in buildings. Residential buildings located within 30 feet of the Project Site would experience potentially significant vibration impacts from Project construction. Although this would be a temporary impact that would cease completely when construction ends, the implementation of mitigation measure MM-NOISE-2 is required during construction activities. As indicated in Table 9, vibration levels at 30 feet would be below the 0.2 inches per second standard. Mitigation measure MM-NOISE-2 is required and would prohibit the use of vibratory rollers on the project site within 30 feet of occupied residential structures and institutional structures. Implementation of mitigation measure MM-NOISE-2 would reduce construction vibration impacts to less than significant levels.

## 3.5 Airport and Airstrip Noise Impacts

The nearest public airport to the Project Area is the Fullerton Municipal Airport, located approximately 6.8 miles to the southeast. Additionally, there are no private airstrips located within 2 miles of the Project Area. Therefore, the Project would have no impact related to public or private airport/airstrip noise levels.

## 3.6 Cumulative Impacts

CEQA Guidelines require a discussion of cumulative impacts of a project “when the project’s incremental effect is cumulatively considerable” (2011 CEQA Guidelines, Section 15130). As defined by Section 15065 (a)(3) “cumulatively considerable” means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (2011 CEQA Guidelines, Section 15065 (a)(3)). These cumulative impacts are defined as “two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts” (CEQA Guidelines Section 15355).

As described in Section 3.3, the Project construction and operation would comply with the City's noise standard, and impacts would be less than significant. There would be no impact related to airport noise since the Project is not located within two miles of a public airport or private airstrip.  With regard to groundborne vibration, mitigation measure NOI-2 prohibits the operation of construction equipment that generates high levels of vibration within 30 feet of existing residential structures. Therefore, construction and operation of the Project would not cause a cumulatively considerable noise impact.

# SECTION 4
# Mitigation Measures

## 4.1 Construction Noise and Vibration

Construction-related vibration has the potential to result in potential significant vibration impacts on the surrounding area. Thus, the following mitigation measures are required to reduce construction-related vibration impacts and to minimize the generation of construction noise:

**MM-NOISE-1:** Prior to initiation of grading, the City shall incorporate the following measures as a note on the grading plan cover sheet to ensure that the greatest distance between noise sources and sensitive receptors during construction activities has been achieved, and that construction noise has been reduced.

- During construction activities, all construction equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers, consistent with manufacturers' standards. All stationary construction equipment shall be placed so that emitted noise is directed away from the noise-sensitive receptors nearest the Proposed Project Area boundaries.
- Equipment shall be staged in areas that will create the greatest distance between construction-related noise sources and the noise-sensitive receptors nearest the proposed project site during all project construction.
- All construction-related activities shall be restricted to the construction hours outlined in the City's Noise Ordinance (Municipal Code Section 9.04.120).
- Haul truck and other construction-related trucks traveling to and from the proposed project site shall be restricted to the same hours specified for the operation of construction equipment.

**MM-NOISE-2:** Prior to construction, all applicable project plans and specifications shall include the following and that these measures are implemented during construction:

- All large bulldozers, large loaded trucks, and vibratory compactor/rollers shall be prohibited from being operated on the project site within 30 feet of a residence and/or institutional structure. This restriction does not apply to trucks on a public right-of-way.

- All construction equipment on construction sites shall be operated as far away from vibration-sensitive sites is reasonably feasible.

## 4.2 Operational Noise and Vibration

As discussed above, the Project would result in less than significant impacts associated with operational noise and vibration. Therefore, no operational noise and vibration mitigation measures would be required.

# Appendix A
## Construction Noise

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## Project: Firestone Boulevard Widening Project

**Construction Noise Impact on Sensitive Receptors**

***Parameters***

| | | |
|---|---|---|
| **Construction Hours:** | 9 | Daytime hours (7 am to 7 pm) |
| | 0 | Evening hours (7 pm to 10 pm) |
| | 0 | Nighttime hours (10 pm to 7 am) |
| **Leq to L10 factor** | 3 | |

| | | | | R1 | | | | | R2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Construction Phase*** **Equipment Type** | **No. of Equip.** | **Reference Noise Level at 50ft, Lmax** | **Acoustical Usage Factor** | **Distance (ft)** | **Lmax** | **Leq** | **L10** | **Estimated Noise Shielding, dBA** | **Distance (ft)** | **Lmax** | **Leq** | **L10** | **Estimated Noise Shielding, dBA** |
| ***Demolition*** | | | | | **99** | ***95*** | | | | **97** | ***93*** | | |
| Crawler Tractors | 2 | 82 | 40% | 10 | 99 | 95 | 98 | 0 | 13 | 97 | 93 | 96 | 0 |
| Crushing/Proc. Equipment | 2 | 82 | 40% | 110 | 78 | 74 | 77 | 0 | 113 | 78 | 74 | 77 | 0 |
| Pavement Breakers | 1 | 89 | 20% | 210 | 77 | 70 | 73 | 0 | 213 | 76 | 69 | 72 | 0 |
| ***Site Excavation*** | | | | | **93** | ***86*** | | | | **91** | ***84*** | | |
| Bore/Drill Rig | 1 | 79 | 20% | 10 | 93 | 86 | 89 | 0 | 13 | 91 | 84 | 87 | 0 |
| Excavator | 2 | 81 | 40% | 110 | 77 | 73 | 76 | 0 | 113 | 77 | 73 | 76 | 0 |
| Dozer | 2 | 82 | 40% | 210 | 73 | 69 | 72 | 0 | 213 | 72 | 68 | 71 | 0 |
| Tractor/Loader/Backhoe | 2 | 80 | 25% | 210 | 71 | 65 | 68 | 0 | 213 | 70 | 64 | 67 | 0 |
| ***Grading*** | | | | | **99** | ***95*** | | | | **97** | ***93*** | | |
| Crawler Tractors | 2 | 82 | 40% | 10 | 99 | 95 | 98 | 0 | 13 | 97 | 93 | 96 | 0 |
| Excavator | 2 | 81 | 40% | 110 | 77 | 73 | 76 | 0 | 113 | 77 | 73 | 76 | 0 |
| Grader | 2 | 85 | 40% | 210 | 76 | 72 | 75 | 0 | 213 | 75 | 71 | 74 | 0 |
| Rollers | 1 | 80 | 20% | 310 | 64 | 57 | 60 | 0 | 313 | 64 | 57 | 60 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 410 | 64 | 60 | 63 | 0 | 413 | 64 | 60 | 63 | 0 |
| Scraper | 1 | 84 | 40% | 510 | 64 | 60 | 63 | 0 | 513 | 64 | 60 | 63 | 0 |
| Trenchers | 1 | 85 | 20% | 610 | 63 | 56 | 59 | 0 | 613 | 63 | 56 | 59 | 0 |
| ***Utility Trenching*** | | | | | **102** | ***98*** | | | | **100** | ***96*** | | |
| Grader | 2 | 85 | 40% | 10 | 102 | 98 | 101 | 0 | 13 | 100 | 96 | 99 | 0 |
| Compactor | 2 | 83 | 20% | 110 | 79 | 72 | 75 | 0 | 113 | 79 | 72 | 75 | 0 |
| Forklifts, rough terrain | 2 | 75 | 10% | 210 | 66 | 56 | 59 | 0 | 213 | 65 | 55 | 58 | 0 |
| Scraper | 1 | 84 | 40% | 310 | 68 | 64 | 67 | 0 | 313 | 68 | 64 | 67 | 0 |
| Crawler Tractors | 2 | 82 | 40% | 410 | 67 | 63 | 66 | 0 | 413 | 67 | 63 | 66 | 0 |
| Trenchers | 1 | 85 | 20% | 510 | 65 | 58 | 61 | 0 | 513 | 65 | 58 | 61 | 0 |
| ***Paving*** | | | | | **91** | ***88*** | | | | **89** | ***86*** | | |
| Paver | 1 | 77 | 50% | 10 | 91 | 88 | 91 | 0 | 13 | 89 | 86 | 89 | 0 |
| Compactor | 2 | 83 | 20% | 110 | 79 | 72 | 75 | 0 | 113 | 79 | 72 | 75 | 0 |
| Rollers | 1 | 80 | 20% | 210 | 68 | 61 | 64 | 0 | 213 | 67 | 60 | 63 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 310 | 66 | 62 | 65 | 0 | 313 | 66 | 62 | 65 | 0 |

Source for Ref. Noise Levels: LA CEQA Guides, 2006 & FHWA RCNM, 2005

## Project: Firestone Boulevard Widening Project

**Construction Noise Impact on Sensitive Receptors**

***Parameters***

| | | |
|---|---|---|
| **Construction Hours:** | 9 | Daytime hours (7 am to 7 pm) |
| | 0 | Evening hours (7 pm to 10 pm) |
| | 0 | Nighttime hours (10 pm to 7 am) |
| **Leq to L10 factor** | 3 | |

| | | | | R3 | | | | | R4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Construction Phase*** Equipment Type | No. of Equip. | Reference Noise Level at 50ft, Lmax | Acoustical Usage Factor | Distance (ft) | Lmax | Leq | L10 | Estimated Noise Shielding, dBA | Distance (ft) | Lmax | Leq | L10 | Estimated Noise Shielding, dBA |
| ***Demolition*** | | | | | **99** | ***95*** | | | | **91** | ***87*** | | |
| Crawler Tractors | 2 | 82 | 40% | 10 | 99 | 95 | 98 | 0 | 8 | 91 | 87 | 90 | 10 |
| Crushing/Proc. Equipment | 2 | 82 | 40% | 110 | 78 | 74 | 77 | 0 | 108 | 78 | 74 | 77 | 0 |
| Pavement Breakers | 1 | 89 | 20% | 210 | 77 | 70 | 73 | 0 | 208 | 77 | 70 | 73 | 0 |
| ***Site Excavation*** | | | | | **93** | ***86*** | | | | **85** | ***79*** | | |
| Bore/Drill Rig | 1 | 79 | 20% | 10 | 93 | 86 | 89 | 0 | 8 | 85 | 78 | 81 | 10 |
| Excavator | 2 | 81 | 40% | 110 | 77 | 73 | 76 | 0 | 108 | 77 | 73 | 76 | 0 |
| Dozer | 2 | 82 | 40% | 210 | 73 | 69 | 72 | 0 | 208 | 73 | 69 | 72 | 0 |
| Tractor/Loader/Backhoe | 2 | 80 | 25% | 210 | 71 | 65 | 68 | 0 | 208 | 71 | 65 | 68 | 0 |
| ***Grading*** | | | | | **99** | ***95*** | | | | **91** | ***87*** | | |
| Crawler Tractors | 2 | 82 | 40% | 10 | 99 | 95 | 98 | 0 | 8 | 91 | 87 | 90 | 10 |
| Excavator | 2 | 81 | 40% | 110 | 77 | 73 | 76 | 0 | 108 | 77 | 73 | 76 | 0 |
| Grader | 2 | 85 | 40% | 210 | 76 | 72 | 75 | 0 | 208 | 76 | 72 | 75 | 0 |
| Rollers | 1 | 80 | 20% | 310 | 64 | 57 | 60 | 0 | 308 | 64 | 57 | 60 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 410 | 64 | 60 | 63 | 0 | 408 | 54 | 50 | 53 | 10 |
| Scraper | 1 | 84 | 40% | 510 | 64 | 60 | 63 | 0 | 508 | 64 | 60 | 63 | 0 |
| Trenchers | 1 | 85 | 20% | 610 | 63 | 56 | 59 | 0 | 608 | 63 | 56 | 59 | 0 |
| ***Utility Trenching*** | | | | | **102** | ***98*** | | | | **94** | ***90*** | | |
| Grader | 2 | 85 | 40% | 10 | 102 | 98 | 101 | 0 | 8 | 94 | 90 | 93 | 10 |
| Compactor | 2 | 83 | 20% | 110 | 79 | 72 | 75 | 0 | 108 | 79 | 72 | 75 | 0 |
| Forklifts, rough terrain | 2 | 75 | 10% | 210 | 66 | 56 | 59 | 0 | 208 | 66 | 56 | 59 | 0 |
| Scraper | 1 | 84 | 40% | 310 | 68 | 64 | 67 | 0 | 308 | 68 | 64 | 67 | 0 |
| Crawler Tractors | 2 | 82 | 40% | 410 | 67 | 63 | 66 | 0 | 408 | 57 | 53 | 56 | 10 |
| Trenchers | 1 | 85 | 20% | 510 | 65 | 58 | 61 | 0 | 508 | 65 | 58 | 61 | 0 |
| ***Paving*** | | | | | **91** | ***88*** | | | | **83** | ***81*** | | |
| Paver | 1 | 77 | 50% | 10 | 91 | 88 | 91 | 0 | 8 | 83 | 80 | 83 | 10 |
| Compactor | 2 | 83 | 20% | 110 | 79 | 72 | 75 | 0 | 108 | 79 | 72 | 75 | 0 |
| Rollers | 1 | 80 | 20% | 210 | 68 | 61 | 64 | 0 | 208 | 68 | 61 | 64 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 310 | 66 | 62 | 65 | 0 | 308 | 66 | 62 | 65 | 0 |

Source for Ref. Noise Levels: LA CEQA Guides, 2006 & FHWA RCNM, 2005

## Project: Firestone Boulevard Widening Project

**Construction Noise Impact on Sensitive Receptors**

ESA

***Parameters***

| | | |
|---|---|---|
| **Construction Hours:** | 9 | Daytime hours (7 am to 7 pm) |
| | 0 | Evening hours (7 pm to 10 pm) |
| | 0 | Nighttime hours (10 pm to 7 am) |
| **Leq to L10 factor** | 3 | |

| | | | | R5 | | | | |
|---|---|---|---|---|---|---|---|---|
| ***Construction Phase*** **Equipment Type** | **No. of Equip.** | **Reference Noise Level at 50ft, Lmax** | **Acoustical Usage Factor** | **Distance (ft)** | **Lmax** | **Leq** | **L10** | **Estimated Noise Shielding, dBA** |
| ***Demolition*** | | | | | **79** | ***76*** | | |
| Crawler Tractors | 2 | 82 | 40% | 100 | 79 | 75 | 78 | 0 |
| Crushing/Proc. Equipment | 2 | 82 | 40% | 200 | 73 | 69 | 72 | 0 |
| Pavement Breakers | 1 | 89 | 20% | 300 | 73 | 66 | 69 | 0 |
| ***Site Excavation*** | | | | | **73** | ***72*** | | |
| Bore/Drill Rig | 1 | 79 | 20% | 100 | 73 | 66 | 69 | 0 |
| Excavator | 2 | 81 | 40% | 200 | 72 | 68 | 71 | 0 |
| Dozer | 2 | 82 | 40% | 300 | 69 | 65 | 68 | 0 |
| Tractor/Loader/Backhoe | 2 | 80 | 25% | 300 | 67 | 61 | 64 | 0 |
| ***Grading*** | | | | | **79** | ***77*** | | |
| Crawler Tractors | 2 | 82 | 40% | 100 | 79 | 75 | 78 | 0 |
| Excavator | 2 | 81 | 40% | 200 | 72 | 68 | 71 | 0 |
| Grader | 2 | 85 | 40% | 300 | 72 | 68 | 71 | 0 |
| Rollers | 1 | 80 | 20% | 400 | 62 | 55 | 58 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 500 | 62 | 58 | 61 | 0 |
| Scraper | 1 | 84 | 40% | 600 | 62 | 58 | 61 | 0 |
| Trenchers | 1 | 85 | 20% | 700 | 62 | 55 | 58 | 0 |
| ***Utility Trenching*** | | | | | **82** | ***78*** | | |
| Grader | 2 | 85 | 40% | 100 | 82 | 78 | 81 | 0 |
| Compactor | 2 | 83 | 20% | 200 | 74 | 67 | 70 | 0 |
| Forklifts, rough terrain | 2 | 75 | 10% | 300 | 62 | 52 | 55 | 0 |
| Scraper | 1 | 84 | 40% | 400 | 66 | 62 | 65 | 0 |
| Crawler Tractors | 2 | 82 | 40% | 500 | 65 | 61 | 64 | 0 |
| Trenchers | 1 | 85 | 20% | 600 | 63 | 56 | 59 | 0 |
| ***Paving*** | | | | | **74** | ***71*** | | |
| Paver | 1 | 77 | 50% | 100 | 71 | 68 | 71 | 0 |
| Compactor | 2 | 83 | 20% | 200 | 74 | 67 | 70 | 0 |
| Rollers | 1 | 80 | 20% | 300 | 64 | 57 | 60 | 0 |
| Rubber Tired Loaders | 2 | 79 | 40% | 400 | 64 | 60 | 63 | 0 |

Source for Ref. Noise Levels: LA CEQA Guides, 2006 & FHWA RCNM, 2005

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# Appendix B
## Construction Traffic

ESA

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## TRAFFIC NOISE ANALYSIS TOOL

**Project Name:** **Firestone Boulevard Widening Project**
**Analysis Scenario:**
**Source of Traffic Volumes:** **Applicant**

| Roadway Segment | Ground Type | Distance from Roadway to Receiver (feet) | Speed (mph) | | | Peak Hour Volume | | | Peak Hour Noise Level (Leq(h) dBA) | Noise Level dBA CNEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Auto | MT | HT | Auto | MT | HT | | |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Bo | Hard | 50 | 0 | 0 | 35 | 0 | 0 | 50 | 63.1 | 63.4 |
| Studebaker Road & Firestone Boulevard | Hard | 125 | 0 | 0 | 35 | 0 | 0 | 50 | 59.1 | 59.4 |
| Stater Bros Driveway & Firestone Boulevard | Hard | 78 | 0 | 0 | 35 | 0 | 0 | 50 | 61.2 | 61.5 |
| Orr and Day Road & Firestone Boulevard | Hard | 85 | 0 | 0 | 35 | 0 | 0 | 50 | 60.8 | 61.1 |
| Imperial Highway & Firestone Boulevard | Hard | 170 | 0 | 0 | 35 | 0 | 0 | 50 | 57.8 | 58.1 |

Model Notes:
The calculation is based on the methodology described in FHWA Traffic Noise Model Technical Manual (1998).
The peak hour noise level at 50 feet was validated with the results from FHWA Traffic Noise Model Version 2.5.
Accuracy of the calculation is within ±0.1 dB when comparing to TNM results.
Noise propagation greater than 50 feet is based on the following assumptions:
For hard ground, the propagation rate is 3 dB per doubling the distance.
For soft ground, the propagation rate is 4.5 dB per doubling the distance.
Vehicles are assumed to be on a long straight roadway with cruise speed.
Roadway grade is less than 1.5%.
CNEL levels were obtained based on Figure 2-19, on page 2-58 Caltran's TeNS 2013.

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# Appendix C
## Operation Traffic

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## TRAFFIC NOISE ANALYSIS TOOL

**Project Name: Firestone Boulevard Widening Project**
**Analysis Scenario: Existing**
**Source of Traffic Volumes: Kittelson & Associates, 2019**

| Roadway Segment | Ground Type | Distance from Roadway Center to Receiver (feet) | Speed (mph) | | | Peak Hour Volume | | | Peak Hour Noise Level (Leq(h) dBA) | Noise Level dBA CNEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Auto | MT | HT | Auto | MT | HT | | |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | Hard | 50 | 45 | 45 | 35 | 4095 | 84 | 42 | 74.0 | 74.3 |
| Studebaker Road & Firestone Boulevard | Hard | 125 | 45 | 45 | 35 | 3700 | 76 | 38 | 69.6 | 69.9 |
| Stater Bros Driveway & Firestone Boulevard | Hard | 78 | 45 | 45 | 35 | 1957 | 40 | 20 | 68.9 | 69.2 |
| Orr and Day Road & Firestone Boulevard | Hard | 85 | 45 | 45 | 35 | 2279 | 47 | 23 | 69.2 | 69.5 |
| Imperial Highway & Firestone Boulevard | Hard | 170 | 45 | 45 | 35 | 4699 | 97 | 48 | 69.3 | 69.6 |

Model Notes:
The calculation is based on the methodology described in FHWA Traffic Noise Model Technical Manual (1998).
The peak hour noise level at 50 feet was validated with the results from FHWA Traffic Noise Model Version 2.5.
Accuracy of the calculation is within ±0.1 dB when comparing to TNM results.
Noise propagation greater than 50 feet is based on the following assumptions:
For hard ground, the propagation rate is 3 dB per doubling the distance.
For soft ground, the propagation rate is 4.5 dB per doubling the distance.
Vehicles are assumed to be on a long straight roadway with cruise speed.
Roadway grade is less than 1.5%.
CNEL levels were obtained based on Figure 2-19, on page 2-58 Caltran's TeNS 2013.

## TRAFFIC NOISE ANALYSIS TOOL

**Project Name:** Firestone Boulevard Widening Project
**Analysis Scenario:** Existing with Project
**Source of Traffic Volumes:** Kittelson & Associates, 2019

| Roadway Segment | Ground Type | Distance from Roadway Center to Receiver (feet) | Speed (mph) | | | Peak Hour Volume | | | Peak Hour Noise Level (Leq(h) dBA) | Noise Level dBA CNEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Auto | MT | HT | Auto | MT | HT | | |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | Hard | 45 | 45 | 45 | 35 | 4095 | 84 | 42 | 74.5 | 74.8 |
| Studebaker Road & Firestone Boulevard | Hard | 120 | 45 | 45 | 35 | 3700 | 76 | 38 | 69.8 | 70.1 |
| Stater Bros Driveway & Firestone Boulevard | Hard | 73 | 45 | 45 | 35 | 1957 | 40 | 20 | 69.2 | 69.5 |
| Orr and Day Road & Firestone Boulevard | Hard | 80 | 45 | 45 | 35 | 2279 | 47 | 23 | 69.4 | 69.7 |
| Imperial Highway & Firestone Boulevard | Hard | 165 | 45 | 45 | 35 | 4699 | 97 | 48 | 69.4 | 69.7 |

Model Notes:
The calculation is based on the methodology described in FHWA Traffic Noise Model Technical Manual (1998).
The peak hour noise level at 50 feet was validated with the results from FHWA Traffic Noise Model Version 2.5.
Accuracy of the calculation is within ±0.1 dB when comparing to TNM results.
Noise propagation greater than 50 feet is based on the following assumptions:
For hard ground, the propagation rate is 3 dB per doubling the distance.
For soft ground, the propagation rate is 4.5 dB per doubling the distance.
Vehicles are assumed to be on a long straight roadway with cruise speed.
Roadway grade is less than 1.5%.
CNEL levels were obtained based on Figure 2-19, on page 2-58 Caltran's TeNS 2013.

## TRAFFIC NOISE ANALYSIS TOOL

**Project Name: Firestone Boulevard Widening Project**
**Analysis Scenario: Future 2040 without Project**
**Source of Traffic Volumes: Kittelson & Associates, 2019**

| Roadway Segment | Ground Type | Distance from Roadway Center to Receiver (feet) | Speed (mph) | | | Peak Hour Volume | | | Peak Hour Noise Level (Leq(h) dBA) | Noise Level dBA CNEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Auto | MT | HT | Auto | MT | HT | | |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | Hard | 50 | 45 | 45 | 35 | 5098 | 105 | 53 | 75.0 | 75.3 |
| Studebaker Road & Firestone Boulevard | Hard | 125 | 45 | 45 | 35 | 4605 | 95 | 47 | 70.6 | 70.9 |
| Stater Bros Driveway & Firestone Boulevard | Hard | 78 | 45 | 45 | 35 | 2437 | 50 | 25 | 69.8 | 70.1 |
| Orr and Day Road & Firestone Boulevard | Hard | 85 | 45 | 45 | 35 | 2836 | 58 | 29 | 70.1 | 70.4 |
| Imperial Highway & Firestone Boulevard | Hard | 170 | 45 | 45 | 35 | 5850 | 121 | 60 | 70.3 | 70.6 |

Model Notes:
The calculation is based on the methodology described in FHWA Traffic Noise Model Technical Manual (1998).
The peak hour noise level at 50 feet was validated with the results from FHWA Traffic Noise Model Version 2.5.
Accuracy of the calculation is within ±0.1 dB when comparing to TNM results.
Noise propagation greater than 50 feet is based on the following assumptions:
- For hard ground, the propagation rate is 3 dB per doubling the distance.
- For soft ground, the propagation rate is 4.5 dB per doubling the distance.

Vehicles are assumed to be on a long straight roadway with cruise speed.
Roadway grade is less than 1.5%.
CNEL levels were obtained based on Figure 2-19, on page 2-58 Caltran's TeNS 2013.

## TRAFFIC NOISE ANALYSIS TOOL

**Project Name:** Firestone Boulevard Widening Project
**Analysis Scenario:** Future 2040 with Project
**Source of Traffic Volumes:** Kittelson & Associates, 2019

| Roadway Segment | Ground Type | Distance from Roadway Center to Receiver (feet) | Speed (mph) | | | Peak Hour Volume | | | Peak Hour Noise Level (Leq(h) dBA) | Noise Level dBA CNEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Auto | MT | HT | Auto | MT | HT | | |
| Hoxie Avenue/I-605 Northbound Ramps & Firestone Boulevard | Hard | 45 | 45 | 45 | 35 | 5098 | 105 | 53 | 75.4 | 75.7 |
| Studebaker Road & Firestone Boulevard | Hard | 120 | 45 | 45 | 35 | 4605 | 95 | 47 | 70.7 | 71.0 |
| Stater Bros Driveway & Firestone Boulevard | Hard | 73 | 45 | 45 | 35 | 2437 | 50 | 25 | 70.1 | 70.4 |
| Orr and Day Road & Firestone Boulevard | Hard | 80 | 45 | 45 | 35 | 2836 | 58 | 29 | 70.4 | 70.7 |
| Imperial Highway & Firestone Boulevard | Hard | 165 | 45 | 45 | 35 | 5850 | 121 | 60 | 70.4 | 70.7 |

Model Notes:
The calculation is based on the methodology described in FHWA Traffic Noise Model Technical Manual (1998).
The peak hour noise level at 50 feet was validated with the results from FHWA Traffic Noise Model Version 2.5.
Accuracy of the calculation is within ±0.1 dB when comparing to TNM results.
Noise propagation greater than 50 feet is based on the following assumptions:
For hard ground, the propagation rate is 3 dB per doubling the distance.
For soft ground, the propagation rate is 4.5 dB per doubling the distance.
Vehicles are assumed to be on a long straight roadway with cruise speed.
Roadway grade is less than 1.5%.
CNEL levels were obtained based on Figure 2-19, on page 2-58 Caltran's TeNS 2013.

# Appendix D
## Construction Vibration

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**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| **Construction Equipment** | **Project Equipment** | **Equipment Peak Particle Velocity @ 25 Feet* (inches/second)** | **Distance to Receptor (Feet)** | **Estimated Peak Particle Velocity @ Distance*** (inches/second)** |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 20 | 0.2807 |
| Large Bulldozer | Yes | 0.089 | 20 | 0.1190 |
| Caisson Drilling | **Yes** | 0.089 | 20 | 0.1190 |
| Loaded Trucks | Yes | 0.076 | 20 | 0.1016 |
| Jackhammer | **Yes** | 0.035 | 20 | 0.0468 |
| Small Bulldozer | Yes | 0.003 | 20 | 0.0040 |
| Maximum Vibration Level | | | | 0.2807 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.
** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.
*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.
N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| Construction Equipment | Project Equipment | Equipment Peak Particle Velocity @ 25 Feet* (inches/second) | Distance to Receptor (Feet) | Estimated Peak Particle Velocity @ Distance*** (inches/second) |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 25 | 0.2100 |
| Large Bulldozer | Yes | 0.089 | 25 | 0.0890 |
| Caisson Drilling | **Yes** | 0.089 | 25 | 0.0890 |
| Loaded Trucks | Yes | 0.076 | 25 | 0.0760 |
| Jackhammer | **Yes** | 0.035 | 25 | 0.0350 |
| Small Bulldozer | Yes | 0.003 | 25 | 0.0030 |
| Maximum Vibration Level | | | | 0.2100 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.

** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.

*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.

N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| **Construction Equipment** | **Project Equipment** | **Equipment Peak Particle Velocity @ 25 Feet* (inches/second)** | **Distance to Receptor (Feet)** | **Estimated Peak Particle Velocity @ Distance*** (inches/second)** |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 30 | 0.1657 |
| Large Bulldozer | Yes | 0.089 | 30 | 0.0702 |
| Caisson Drilling | **Yes** | 0.089 | 30 | 0.0702 |
| Loaded Trucks | Yes | 0.076 | 30 | 0.0600 |
| Jackhammer | **Yes** | 0.035 | 30 | 0.0276 |
| Small Bulldozer | Yes | 0.003 | 30 | 0.0024 |
| Maximum Vibration Level | | | | 0.1657 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.

** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.

*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.

N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| Construction Equipment | Project Equipment | Equipment Peak Particle Velocity @ 25 Feet* (inches/second) | Distance to Receptor (Feet) | Estimated Peak Particle Velocity @ Distance*** (inches/second) |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 50 | 0.0853 |
| Large Bulldozer | Yes | 0.089 | 50 | 0.0361 |
| Caisson Drilling | **Yes** | 0.089 | 50 | 0.0361 |
| Loaded Trucks | Yes | 0.076 | 50 | 0.0309 |
| Jackhammer | **Yes** | 0.035 | 50 | 0.0142 |
| Small Bulldozer | Yes | 0.003 | 50 | 0.0012 |
| Maximum Vibration Level | | | | 0.0853 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.

** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.

*** Based on the formula $PPV(D) = PPV(25\ ft) \times (25/D)^N$, where D is equal to the distance.

N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| Construction Equipment | Project Equipment | Equipment Peak Particle Velocity @ 25 Feet* (inches/second) | Distance to Receptor (Feet) | Estimated Peak Particle Velocity @ Distance*** (inches/second) |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 60 | 0.0673 |
| Large Bulldozer | Yes | 0.089 | 60 | 0.0285 |
| Caisson Drilling | **Yes** | 0.089 | 60 | 0.0285 |
| Loaded Trucks | Yes | 0.076 | 60 | 0.0244 |
| Jackhammer | **Yes** | 0.035 | 60 | 0.0112 |
| Small Bulldozer | Yes | 0.003 | 60 | 0.0010 |
| Maximum Vibration Level | | | | 0.0673 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.
** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.
*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.
N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| Construction Equipment | Project Equipment | Equipment Peak Particle Velocity @ 25 Feet* (inches/second) | Distance to Receptor (Feet) | Estimated Peak Particle Velocity @ Distance*** (inches/second) |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 75 | 0.0503 |
| Large Bulldozer | Yes | 0.089 | 75 | 0.0213 |
| Caisson Drilling | **Yes** | 0.089 | 75 | 0.0213 |
| Loaded Trucks | Yes | 0.076 | 75 | 0.0182 |
| Jackhammer | **Yes** | 0.035 | 75 | 0.0084 |
| Small Bulldozer | Yes | 0.003 | 75 | 0.0007 |
| Maximum Vibration Level | | | | 0.0503 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.
** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.
*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.
N = soil type classification factor (typically ranges from 1 to 1.5)

**Athens Material Recovery Facility**
**Vibration Source Levels**
**Based on Federal Transit Administration, Office of Planning and Environment**

**Firestone Boulevard Widening Project** N = 1.3

| Construction Equipment | Project Equipment | Equipment Peak Particle Velocity @ 25 Feet* (inches/second) | Distance to Receptor (Feet) | Estimated Peak Particle Velocity @ Distance*** (inches/second) |
|---|---|---|---|---|
| Vibratory Roller | **Yes** | 0.210 | 100 | 0.0346 |
| Large Bulldozer | Yes | 0.089 | 100 | 0.0147 |
| Caisson Drilling | **Yes** | 0.089 | 100 | 0.0147 |
| Loaded Trucks | Yes | 0.076 | 100 | 0.0125 |
| Jackhammer | **Yes** | 0.035 | 100 | 0.0058 |
| Small Bulldozer | Yes | 0.003 | 100 | 0.0005 |
| Maximum Vibration Level | | | | 0.0346 |

Source:

U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)* , (2006).

Notes:

* Values taken from Table 12-2.

** Based on the formula VdB(D) = VdB(25 ft) - 30 x LOG10 (D/25), where D is equal to the distance.

*** Based on the formula PPV(D) = PPV(25 ft) x $(25/D)^N$, where D is equal to the distance.

N = soil type classification factor (typically ranges from 1 to 1.5)