

# **NOISE AND VIBRATION IMPACT ANALYSIS**

**HILLWOOD CENTER STREET INDUSTRIAL PROJECT  
CITY OF COLTON, SAN BERNARDINO COUNTY, CALIFORNIA**

**LSA**

October 2017

# **NOISE AND VIBRATION IMPACT ANALYSIS**

## **HILLWOOD CENTER STREET INDUSTRIAL PROJECT CITY OF COLTON, SAN BERNARDINO COUNTY, CALIFORNIA**

Submitted to:

Mr. Mario Suarez, Planning Division  
City of Colton Development Services Dept.  
659 La Cadena Drive  
Colton, California 92324

Prepared by:

LSA  
7086 N. Maple, Suite 104  
Fresno, California 93720  
(559) 490-1210

Project No. CLT1702



October 2017

## TABLE OF CONTENTS

TABLE OF CONTENTS .....	i
LIST OF ABBREVIATIONS AND ACRONYMS .....	iii
<b>INTRODUCTION .....</b>	<b>1</b>
Project Location .....	1
Project Site and Surrounding Area Existing Setting .....	1
Project Description .....	1
<b>METHODOLOGY .....</b>	<b>5</b>
<b>CHARACTERISTICS OF SOUND .....</b>	<b>5</b>
Measurement of Sound .....	5
Physiological Effects of Noise .....	7
<b>FUNDAMENTALS OF VIBRATION .....</b>	<b>9</b>
<b>REGULATORY SETTING .....</b>	<b>11</b>
Federal Regulations .....	11
State Regulations .....	12
Local Regulations .....	13
<b>THRESHOLDS OF SIGNIFICANCE .....</b>	<b>15</b>
Thresholds of Significance for Noise .....	15
Thresholds of Significance for Vibration .....	16
<b>EXISTING SETTING .....</b>	<b>16</b>
Short-Term Construction Noise Impacts .....	20
Short-Term Construction Vibration Impacts .....	22
Long-Term Aircraft Noise Impacts .....	23
Long-term Traffic Noise Impacts .....	24
Long-Term Stationary Noise Impacts .....	26
Short-Term Construction Noise and Vibration Impacts .....	28
Long-Term Aircraft Noise Impacts .....	28
Long-Term Traffic Noise Impacts .....	28
Long-Term Stationary Noise Impacts .....	28
Level of Significance after Mitigation .....	28
<b>REFERENCES .....</b>	<b>29</b>

## APPENDICES

- A: NOISE MONITORING SURVEY SHEETS
- B: FHWA HIGHWAY TRAFFIC NOISE MODEL PRINTOUTS
- C: SOUNDPLAN NOISE MODEL PRINTOUTS

---

## FIGURES AND TABLES

### FIGURES

Figure 1: Project Location.....	3
Figure 2: Site Plan.....	4
Figure 3: Noise Monitoring Locations .....	18

### TABLES

Table A: Definitions of Acoustical Terms.....	7
Table B: Common Sound Levels and Their Noise Sources.....	8
Table C: Human Response to Different Levels of Ground-Borne Noise and Vibration .....	10
Table D: Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment.....	11
Table E: Construction Vibration Damage Criteria .....	12
Table F: City of Riverside Sound Level Limits (dBA).....	15
Table G: Existing Noise Level Measurements.....	17
Table H: Existing Traffic Noise Levels Without Project.....	19
Table I: Typical Maximum Construction Equipment Noise Levels (Lmax).....	22
Table J: Vibration Source Amplitudes for Construction Equipment.....	23
Table K: Off-Site Traffic Noise Analysis.....	25

## LIST OF ABBREVIATIONS AND ACRONYMS

$\mu\text{in}/\text{sec}$	microinches per second
$\mu\text{Pa}$	micropascal
ADT	average daily traffic
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	decibels
dBA	A-weighted decibels
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
ft	foot/feet
FTA	Federal Transit Administration
HP	horsepower
HVAC	heating, ventilation, and air conditioning
Hz	Hertz
in/sec	inches per second
$L_{\text{dn}}$	day-night average noise level
$L_{\text{eq}}$	equivalent continuous sound level
$L_{\text{max}}$	maximum instantaneous noise level
LSA	LSA Associates, Inc.
$L_v$	velocity in decibels
mi	miles
N/A	not applicable
PPV	peak particle velocity
project	Hillwood Center Street Industrial Project
RCNM	Roadway Construction Noise Model
RIR	Flabob Airport
RMS	root-mean-square (velocity)
sf	square feet
Spec.	specification
VdB	vibration velocity decibels
VMS	variable message sign
$V_{\text{ref}}$	reference velocity amplitude

## INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and mitigation measures associated with the proposed Hillwood Center Street Industrial Project located in the City of Colton, County of San Bernardino, California. Because the proposed project is located immediately north of the City of Colton and City of Riverside border, this report is intended to satisfy the requirements applicable for each City for a project-specific noise and vibration impact analysis by examining the impacts of the proposed project on noise-sensitive uses in the project area and evaluating the mitigation measures incorporated as part of the project design.

The proposed Hillwood Center Street Industrial Project and associated discretionary actions collectively are the “project” assessed in this noise impact analysis. Unless otherwise noted, the terms “Hillwood Center Street Industrial Project” and “project” are used interchangeably. The project proposes construction of 268,939 square feet of warehousing in one large building on 13.5 acres.

### Project Location

The project site is located east of Main Street and north of Placentia Lane in the south west area of the City of Colton. The project site is within part of the City of Colton’s Light Industrial zone. South of Placentia Lane, across the street from the southern border of the project, is the City of Riverside’s City limits. The project site would be on two parcels, Assessor’s Parcel Numbers (APNs) 0277-022-67 and 0277-02-68. The project site is approximately 1 mile west of Interstate 215 (I-215) and 1.8 miles north of State Route 60 (SR-60).

### Project Site and Surrounding Area Existing Setting

The project site is relatively flat with little to no vegetation. The proposed project site is currently vacant and undeveloped. Figure 1 indicates the project location and Figure 2 is the project site plan.

The following describes the adjacent land uses:

- **North:** Junk car lots, undeveloped land
- **East:** Light industrial properties, single family residences are located approximately 1,900 feet southeast
- **South:** Vacant lot, AB Brown Sports Complex
- **West:** Various light industry businesses, Santa Ana River

### Project Description

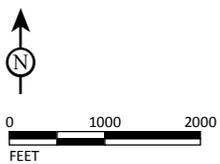
The project would consist of the development of 268,939 square feet of warehousing, along with approximately 192 standard parking stalls and 50 trailer stalls, shown in Figure 2.

Access to the project site would consist of two driveways via Center Street, which would also be used for emergency vehicles. For this analysis, these driveways will be referred to as driveway 1 and driveway 2. Driveway 1 would be located adjacent to the existing intersection of Placentia Lane and Center Street. Driveway 2 would be located approximately 500 feet east of driveway 1 with full-access ingress/egress movements.



FIGURE 1

LSA



SOURCE: Bing Aerial, 2016; ESRI Streetmap, 2013/Riverside County, 2015.

I:\CLT1702\Reports\Environ\IS\_MND\fig1\_RegLoc.mxd (6/28/2017)

Center Street Industrial Project  
Regional and Project Location

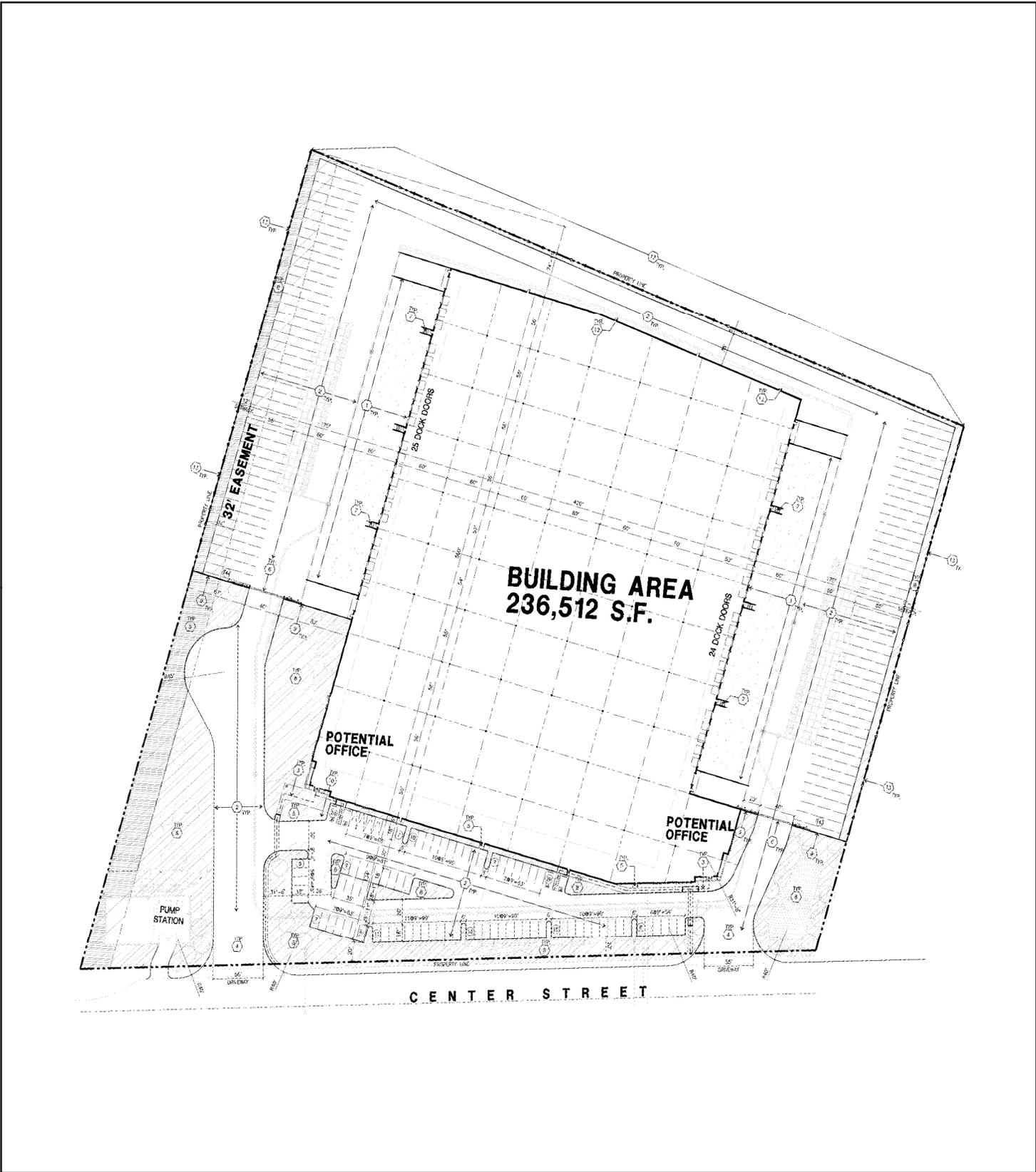
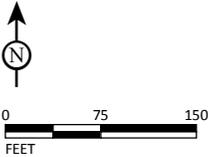


FIGURE 2

LSA



Center Street Industrial Project  
Proposed Site Plan

## METHODOLOGY

Evaluation of noise and vibration impacts associated with the project includes the following:

- Determination of the short-term construction noise and vibration impacts on off-site noise-sensitive uses
- Determine the long-term noise and vibration impacts, including off-site vehicular traffic and on-site stationary noise sources, on the proposed on existing off-site noise-sensitive uses; and
- Determine the required mitigation measures to reduce long-term noise and vibration impacts, if any, from all sources.

## CHARACTERISTICS OF SOUND

Sound is increasing to such disagreeable levels in the environment that it can threaten quality of life. Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

### Measurement of Sound

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds) decibels are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 decibels (dB) is 10 times more intense than 1 dB, 20 dB is 100 times more intense than 1 dB, and 30 dB is 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. For a single point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations) the sound decreases 3 dB for each doubling of distance in a hard site environment. Line source (noise in a relatively flat environment with absorptive vegetation) decreases 4.5 dB for each doubling of distance.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous sound level ( $L_{eq}$ ) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the  $L_{eq}$  and Community Noise Equivalent Level (CNEL) or the day-night average noise level ( $L_{dn}$ ) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly  $L_{eq}$  for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours), and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours).  $L_{dn}$  is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and  $L_{dn}$  are within 1 dBA of each other and are normally interchangeable. The City uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level ( $L_{max}$ ), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by  $L_{max}$ , which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the  $L_{10}$  noise level represents the noise level exceeded 10 percent of the time during a stated period. The  $L_{50}$  noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The  $L_{90}$  noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the  $L_{eq}$  and  $L_{50}$  are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

## Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear (the threshold of pain). A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed area. Table A lists definitions of acoustical terms, and Table B shows common sound levels and their sources.

**Table A: Definitions of Acoustical Terms**

Term	Definitions
Decibel, dB	A unit of measurement that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes the very low- and very high-frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. (All sound levels in this report are A-weighted, unless reported otherwise.)
$L_{01}$ , $L_{10}$ , $L_{50}$ , $L_{90}$	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period.
Equivalent Continuous Noise Level, $L_{eq}$	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dBA to sound levels occurring in the evening from 7:00 PM to 10:00 PM and after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.
Day/Night Noise Level, $L_{dn}$	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.
$L_{max}$ , $L_{min}$	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time; usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.

**Table A: Definitions of Acoustical Terms**

Term	Definitions
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: *Handbook of Acoustical Measurements and Noise Control* (Harris 1991).

**Table B: Common Sound Levels and Their Noise Sources**

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	—
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	—
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	—
Near Freeway Auto Traffic	70	Moderately Loud	—
Average Office	60	Quiet	One-half as loud
Suburban Street	55	Quiet	—
Light Traffic; Soft Radio Music in Apartment	50	Quiet	One-quarter as loud
Large Transformer	45	Quiet	—
Average Residence without Stereo Playing	40	Faint	One-eighth as loud
Soft Whisper	30	Faint	—
Rustling Leaves	20	Very Faint	—
Human Breathing	10	Very Faint	Threshold of Hearing
—	0	Very Faint	—

Source: Compiled by LSA (2015).

## FUNDAMENTALS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 vibration velocity decibels (VdB) or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet (ft) from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (FTA 2006). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, both construction of a project and freight train operations on railroad tracks could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than ground-borne noise. Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration to cause even cosmetic building damage, it is not uncommon for heavy duty construction processes (e.g., blasting and pile driving) to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2006). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

$$L_v = 20 \log_{10} [V/V_{ref}]$$

Where  $L_v$  is the VdB, “V” is the RMS velocity amplitude, and “ $V_{ref}$ ” is the reference velocity amplitude, or  $1 \times 10^{-6}$  inches/second (in/sec) used in the United States. Table C illustrates human response to various vibration levels, as described in the *Transit Noise and Vibration Impact Assessment* (FTA 2006).

**Table C: Human Response to Different Levels of Ground-Borne Noise and Vibration**

Vibration Velocity Level	Noise Level		Human Response
	Low-Frequency <sup>1</sup>	Mid-Frequency <sup>2</sup>	
65 VdB	25 dBA	40 dBA	Approximate threshold of perception for many humans. Low-frequency sound usually inaudible; mid-frequency sound excessive for quiet sleeping areas.
75 VdB	35 dBA	50 dBA	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying. Low-frequency noise acceptable for sleeping areas, mid-frequency noise annoying in most quiet occupied areas.
85 VdB	45 dBA	60 dBA	Vibration acceptable only if there are an infrequent number of events per day. Low-frequency noise annoying for sleeping areas, mid-frequency noise annoying even for infrequent events with institutional land uses such as schools and churches.

Source: *Transit Noise and Vibration Impact Assessment* (FTA 2006).

<sup>1</sup> Approximate noise level when vibration spectrum peak is near 30 Hz.

<sup>2</sup> Approximate noise level when vibration spectrum peak is near 60 Hz.

dBA = A-weighted decibels

Hz = Hertz

FTA = Federal Transit Administration

VdB = vibration velocity decibels

Factors that influence ground-borne vibration and noise include the following:

- **Vibration Source.** Vehicle suspension, wheel types and condition, railroad track/roadway surface, railroad track support system, speed, transit structure, and depth of vibration source
- **Vibration Path.** Soil type, rock layers, soil layering, depth to water table, and frost depth
- **Vibration Receiver.** Foundation type, building construction, and acoustical absorption

Among the factors listed above, there are significant differences in the vibration characteristics when the source is underground compared to at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock.

Experience with ground-borne vibration indicates: (1) vibration propagation is more efficient in stiff, clay soils than in loose, sandy soils; and (2) shallow rock seems to concentrate the vibration energy close to the surface and can result in ground-borne vibration problems at large distances from a railroad track. Factors including layering of the soil and the depth to the water table can have significant effects on the propagation of ground-borne vibration. Soft, loose, sandy soils tend to attenuate more vibration energy than hard, rocky materials. Vibration propagation through groundwater is more efficient than through sandy soils.

## REGULATORY SETTING

### Federal Regulations

Vibration standards included in the Federal Transit Administration’s (FTA) *Transit Noise and Vibration Impact Assessment* (FTA 2006) are used in this analysis for ground-borne vibration impacts on human annoyance, as shown in Table D. The criteria presented in Table D account for variation in project types as well as the frequency of events, which differ widely among projects. It is intuitive that when there will be fewer events per day, it should take higher vibration levels to evoke the same community response. This is accounted for in the criteria by distinguishing between projects with frequent and infrequent events, in which the term “occasional events” is defined as between 30 and 70 events per day.

**Table D: Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment**

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 $\mu\text{in}/\text{sec}$ )			Ground-Borne Noise Impact Levels (dB re 20 $\mu\text{Pa}$ )		
	Frequent <sup>1</sup> Events	Occasional <sup>2</sup> Events	Infrequent <sup>3</sup> Events	Frequent <sup>1</sup> Events	Occasional <sup>2</sup> Events	Infrequent <sup>3</sup> Events
<b>Category 1:</b> Buildings where low ambient vibration is essential for interior operations.	65 VdB <sup>4</sup>	65 VdB <sup>4</sup>	65 VdB <sup>4</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>
<b>Category 2:</b> Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
<b>Category 3:</b> Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: *Transit Noise and Vibration Impact Assessment* (FTA 2006).

<sup>1</sup> Frequent events are defined as more than 70 events per day.

<sup>2</sup> Occasional events are defined as between 30 and 70 events per day.

<sup>3</sup> Infrequent events are defined as fewer than 30 events per day.

<sup>4</sup> This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.

<sup>5</sup> Vibration-sensitive equipment is not sensitive to ground-borne noise.

$\mu\text{in}/\text{sec}$  = microinches per second

$\mu\text{Pa}$  = micropascals

dB = decibels

dBA = A-weighted decibels

FTA = Federal Transit Administration

HVAC = heating, ventilation, and air conditioning

VdB = vibration velocity decibels

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table E lists the potential vibration building damage criteria associated with construction activities, as suggested in the *Transit Noise and Vibration Impact Assessment* (FTA 2006).

FTA guidelines show that a vibration level of up to 102 VdB (equivalent to 0.5 in/sec in PPV) (FTA 2006) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For a nonengineered timber and masonry building, the construction building vibration damage criterion is 94 VdB (0.2 in/sec in PPV).

**Table E: Construction Vibration Damage Criteria**

Building Category	PPV (in/sec)	Approximate L <sub>v</sub> (VdB) <sup>1</sup>
Reinforced concrete, steel, or timber (no plaster)	0.50	102
Engineered concrete and masonry (no plaster)	0.30	98
Non-engineered timber and masonry buildings	0.20	94
Buildings extremely susceptible to vibration damage	0.12	90

Source: *Transit Noise and Vibration Impact Assessment* (FTA 2006).

<sup>1</sup> RMS vibration velocity in decibels (VdB) re 1 μin/sec.

μin/sec = inches per second

PPV = peak particle velocity

FTA = Federal Transit Administration

RMS = root-mean-square

in/sec = inches per second

VdB = vibration velocity decibels

L<sub>v</sub> = velocity in decibels

## State Regulations

The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the *State Noise Insulation Standard*, it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. State regulations include requirements for the construction of new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor ceiling assemblies must block or absorb sound. For limiting noise from exterior noise sources, the noise insulation standards set an interior standard of 45 dBA CNEL in any habitable room with all doors and windows closed. In addition, the standards require preparation of an acoustical analysis demonstrating the manner in which dwelling units have been designed to meet this interior standard, where such units are proposed in an area with exterior noise levels greater than 60 dBA CNEL.

The State has also established land use compatibility guidelines for determining acceptable noise levels for specified land uses. The City has adopted and modified the State’s land use compatibility guidelines, as discussed below.

## Local Regulations

### *City of Colton General Plan Noise Element*

The Noise Element of the General Plan (1992) contains noise standards for mobile noise sources. These standards address the impacts of noise from adjacent roadways and airports. The City of Colton lists the following noise standards in its Noise Element Policy Plan: Residential structures should be constructed to maintain interior noise levels of not greater than 45 dBA (CNEL), through the use of sound barrier improvements, building design, construction materials and/or insulating techniques.

- Residential growth in Community Noise Exposure Areas greater than 70 dBA (CNEL) should be discouraged, unless on-site noise levels can be reduced to 60 dBA or lower via on- and off-site noise alleviating improvements.
- Exterior noise levels should not exceed 65 dBA (Leq) during the day or 55 dBA (Leq) at night for commercial land uses, including general business and general merchandising.
- Exterior noise levels should not exceed 60 dBA (Lmax) at any time for such areas important to public need, and where the preservation of serenity and quietness is essential if the area is to continue to serve its intended purpose. Such areas could include parks, open spaces, amphitheaters, and other areas dedicated for activities requiring special quality of serenity.

A CNEL value of 65 dBA is the upper limit of what is considered a “normally acceptable” noise environment for multifamily residential uses, although a CNEL as high as 70 dBA is considered “conditionally acceptable.” New development should generally be discouraged within the “unacceptable” category. However, if new development does proceed, a detailed analysis of the noise reduction requirements must be made, and the necessary noise insulation features must be included in the design.

### *City of Colton Municipal Code*

The City of Colton Noise Standards for stationary sources are provided in Section 18.42.040, Noise, of the City of Colton Municipal Code. The maximum sound level radiated by any Use of Facility, when measured at the boundary line of the Property on which the sound is generated, Shall not be obnoxious by reason of its intensity, pitch or dynamic characteristics as determined by the City, and Shall not exceed 65 dBA.

The City of Colton’s Municipal Code has not adopted time periods in which exterior construction activities would not be permitted nor any maximum noise level associated specifically with construction noise.

### *City of Riverside General Plan Noise Element*

The City of Riverside in its General Plan Noise Element has established noise/land use noise compatibility criteria. Schools and libraries are normally acceptable in areas up to 60 dBA CNEL, conditionally acceptable in areas between 60 and 70 dBA CNEL, and normally unacceptable in areas higher than 70 dBA CNEL. Single-family and multifamily residences are normally acceptable in exterior noise environments up to 60 dBA CNEL and conditionally acceptable in exterior noise environments of up to 65 dBA CNEL. Infill residential uses are normally acceptable in exterior noise

environments up to 65 dBA CNEL and conditionally acceptable in exterior noise environments of up to 75 dBA CNEL. Interior noise levels within residential structures are acceptable up to 45 dBA CNEL. Commercial uses are normally acceptable in exterior noise environments of up to 65 dBA CNEL. Industrial uses are normally acceptable up to 70 dBA CNEL. For the purposes of this noise and vibration impact analysis, schools and libraries with outdoor active use areas (e.g., passive outdoor educational space) exposed to noise levels exceeding 60 dBA CNEL would need to be mitigated.

#### *City of Riverside Municipal Code Noise Ordinance*

The City of Riverside has incorporated the following measures in its Municipal Code to control loud, unnecessary, and unusual nuisance noises:

- **Exterior Sound Level Limits.** Unless a variance has been granted it shall be unlawful for any person to cause or allow the creation of any noise which exceeds the following:
  - The exterior noise standard of the applicable land use category (see Table E), up to 5 dB (up to 60 dBA during the day and up to 50 dBA during the night), for a cumulative period of more than 30 minutes in an hour; or
  - The exterior noise standard of the applicable land use category, plus 5 dB (60 dBA during the day and 50 dBA during the night), for a cumulative period of more than 15 minutes in any hour; or
  - The exterior noise standard of the applicable land use category, plus 10 dB (65 dBA during the day and 55 dBA during the night), for a cumulative period of more than 5 minutes in any hour; or
  - The exterior noise standard of the applicable land use category, plus 15 dB (70 dBA during the day and 65 dBA during the night), for a cumulative period of more than 1 minute in any hour; or
  - The exterior noise standard of the applicable land use category, plus 20 dB (75 dBA during the day and 70 dBA during the night) or the maximum measured ambient noise level, for any period of time.
- **Interior Sound Level Limits.** No person shall operate or cause to be operated, any source of sound indoors that causes the noise level, when measured inside another dwelling unit, school or hospital, to exceed:
  - The interior noise standard for the applicable noise category (see Table F), up to 5 dB (up to 50 dBA during the day and up to 40 dBA during the night), for a cumulative period of more than 5 minutes in any hour; or
  - The interior noise standard for the applicable land use category, plus 5 dB (55 dBA during the day and 45 dBA during the night), for a cumulative period of more than 1 minute in any hour; or
  - The interior noise standard for the applicable land use category, plus 10 dB (60 dBA during the day and 50 dBA during the night) or the maximum measured ambient noise level, for any period of time.

Based on Table F and Sections 7.25.010 and 7.30.015 of the City Municipal Code, the maximum exterior noise level for residential uses is 75 dBA  $L_{max}$  (55 dB + 20 dB) during daytime hours and 65 dBA  $L_{max}$  (45 dB + 20 dB) during nighttime hours, or the maximum measured ambient noise level for any period of time. Similarly, the maximum interior nuisance noise level for residential uses is 55 dBA  $L_{max}$  (45 dB + 10 dB) during daytime hours and 45 dBA  $L_{max}$  (35 dB + 10 dB) during nighttime hours, or the maximum measured ambient noise level for any period of time.

Based on Table F, the maximum interior noise level for a public school facility is 55 dBA  $L_{max}$  (45 dBA + 10 dBA) during daytime hours, or the maximum measured ambient noise level for any period of time. There is no maximum exterior nuisance noise level for a school facility since the building shell provides shielding effect for the educational space.

Construction activities are restricted within the City to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and 8:00 a.m. to 5:00 p.m. on Saturdays, and are prohibited on Sundays and federal holidays.

**Table F: City of Riverside Sound Level Limits (dBA)**

Land Use Category	Time Period	Exterior Noise Standard	Interior Noise Standard
Residential	Night (10:00 PM to 7:00 AM)	45	35
	Day (7:00 AM to 10:00 PM)	55	45
School	7:00 AM to 10:00 PM (while school is in session)	N/A <sup>1</sup>	45
Hospital	Anytime	N/A	45
Office/Commercial	Anytime	65	N/A
Industrial	Anytime	70	N/A
Community Support	Anytime	60	N/A
Public Recreation Facility	Anytime	65	N/A
Nonurban	Anytime	70	N/A

Source: Municipal Code (City of Riverside 2005).

<sup>1</sup> N/A = Not Applicable. The City of Riverside has not established a sound level limit for this land use.  
dBA = A-weighted decibels

## THRESHOLDS OF SIGNIFICANCE

### Thresholds of Significance for Noise

The *California Environmental Quality Act (CEQA) Guidelines* (ACEC 2015) do not define the levels at which temporary and permanent increases in ambient noise are considered “substantial.” A noise level increase of 3 dBA is barely perceptible to most people, a 5 dBA increase is readily noticeable, and a difference of 10 dBA would be perceived as a doubling of loudness. Based on this information, the following generally acceptable standards would apply to the operation activities of the proposed project:

- Less than 3 dBA difference in noise levels would not be discernable; therefore, the difference would not be significant.

- Noise level differences between 3 dBA and 5 dBA would be noticeable, but not significant, if noise levels were to remain below the noise level standards recommended by the Cities of Colton or Riverside.
- A noise level difference of 5 dBA or greater would be readily noticeable and therefore considered significant.

In addition to the 3 dBA definition of a potentially significant change in noise levels, the applicable noise standards governing the project site have to be considered. Although a change in noise of 3 dBA or greater is considered substantial, it is not significant unless the total noise (background plus project) exceeds either of the city's noise standards. A significant impact regarding peak noise levels would occur if a project were to generate noise levels, measured in dBA  $L_{max}$  or dBA  $L_{eq}$ , that exceed the standards contained in either of the City of Riverside or City of Colton Municipal Code.

### Thresholds of Significance for Vibration

No quantified vibration levels were established by either city for vibration standards. As such, policies and guidelines from the California Department of Transportation (Caltrans) and the Federal Transit Administration (FTA) are utilized to assess impacts due to ground-borne vibration. Ground-borne vibration impacts are evaluated based on (a) potential building damage, (b) potential human annoyance, and (c) potential effect on vibration-sensitive equipment. Caltrans and the FTA have adopted guidelines and recommendations to limit ground-borne vibration based on the age and/or condition of the structures located in close proximity to construction activity. Caltrans and FTA studies show vibration velocity levels greater than 0.04 in/sec PPV are distinctly perceptible to humans and become strongly perceptible when they reach 0.10 in/sec PPV

Based on the FTA *Transit Noise and Vibration Impact Assessment* (2006) and depending on the building category of the nearest buildings adjacent to the project site, the potential vibration damage criteria vary. Table D (criteria in terms of VdB) and Table E (criteria in terms of in/sec and VdB) are used to evaluate the effects of vibration on human response and structural damage.

## EXISTING SETTING

### *Overview of the Existing Noise Environment*

The existing noise environment includes traffic noise, mostly on Riverside Avenue and Main Street in the project vicinity. Noise from motor vehicles is generated by engine vibrations, interaction between tires and the road, and exhaust systems. Since the project is located within the City's light industrial zone, there is a higher volume of 3-axle vehicles, which additionally contributes to existing noise environment. Riverside Avenue, Main Street, and other local streets comprise the dominant source of traffic noise contributing to ambient levels in the project vicinity.

### *Sensitive Land Uses in the Project Vicinity*

Certain land uses are considered more sensitive to noise than others. Examples of these include residential areas, educational facilities, hospitals, childcare facilities, and senior housing. The closest

sensitive receptors would be single family residences approximately 1,900 feet southeast of the project site. There are also existing residences to the east on the east side of Orange Street. There is also an outdoor soccer complex, AB Brown Sports Complex (56 acres), approximately a 1/8<sup>th</sup> mile (660 feet) to the south and an outdoor sports complex, Reid Park (45 acres), approximately half a mile to the southeast. Both of these complexes, including residences, are within the City limits of Riverside.

*Existing Noise Level Measurements*

Noise levels at the Project site are dominated by traffic on the surrounding streets. In order to assess the existing noise conditions in the project study area. Three short-term measurements were gathered on August 29, 2017. The location of the noise measurements are shown on Figure 3 with the results shown in Table G and the survey sheet are shown in Appendix A.

**Table G: Existing Noise Level Measurements**

Location	Description	Average Noise Levels (dBA L <sub>eq</sub> )	Maximum Noise Levels (dBA L <sub>max</sub> )
ST-1	In front of 3765 Bartlett Avenue	50.0	63.6
ST-2	AB Brown Soccer Complex, North of soccer field, Center of Complex	48.8	59.0
ST-3	AB Brown Soccer Complex, Southeast Corner	51.0	75.5

Source: LSA, August 29, 2017  
 dBA = A-weighted decibel  
 L<sub>eq</sub> = average noise level  
 L<sub>max</sub>=maximum noise level

*Existing Aircraft Noise*

Airport related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. The closest airports include Flabob Airport (RIR), which is located approximately 3.5 miles southwest of the project site, and San Bernardino International Airport (SBD), which is located approximately 7.8 miles northeast of the project site. Aircraft noise is rarely audible at the project site; however, no portion of the project site lies within the 65 dBA CNEL noise contours of these airports.



FIGURE 3

LSA

LEGEND

- Project Site
- - Noise Monitoring Location



SOURCE: Google Earth, 2017

I:\CLT1702\G\Noise\_Monitor\_Locs.cdr (8/30/2017)

Hillwood Center Street Industrial  
Noise Monitoring Locations

### Existing Traffic Noise

The guidelines included in the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (1977; FHWA RD-77-108) were used to evaluate highway traffic-related noise conditions along roadway segments in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24 hour periods to determine the CNEL values. The standard vehicle mix for Southern California roadways was used for traffic on these roadway segments. Traffic volumes were used to assess the existing traffic noise impacts. Table H provides the traffic noise levels for the Existing without Project scenario. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Appendix A provides the specific assumptions used in developing these noise levels and model printouts.

Table H shows that traffic noise levels along Riverside Avenue and Main Street west of the project site approach 70 dBA CNEL, however, all uses along those segment are non-noise sensitive. For all other segments in the study area, the noise level at a distance of 50 feet from the outermost lane is less than 58 dBA CNEL.

**Table H: Existing Traffic Noise Levels Without Project**

Roadway	#	Roadway Segment	ADT	Centerline to 70 dBA CNEL (ft)	Centerline to 65 dBA CNEL (ft)	Centerline to 60 dBA CNEL (ft)	CNEL (dBA) 50 ft from Centerline of Outermost Lane
<b>Riverside Ave</b>	<b>1</b>	North of Placentia Lane	22,200	74	153	325	70.0
<b>Main St</b>	<b>2</b>	South of Placentia Lane	20,100	70	143	305	69.6
<b>Placentia Lane</b>	<b>3</b>	East of Riverside Ave	5,200	< 50	< 50	< 50	57.9
	<b>4</b>	West of Driveway 1	4,900	< 50	< 50	< 50	57.6
<b>Center Street</b>	<b>5</b>	Driveway 1 to Driveway 2	4,200	< 50	< 50	< 50	57.0
	<b>6</b>	East of Driveway 2	4,200	< 50	< 50	< 50	57.0
	<b>7</b>	West of Orange St	4,100	< 50	< 50	< 50	56.9
<b>Orange St</b>	<b>8</b>	North of Center Street	370	< 50	< 50	< 50	46.4
	<b>9</b>	South of Center Street	2,700	< 50	< 50	< 50	55.0

Source: Compiled by LSA (August 2017).

Note: Traffic noise within 50 ft of the roadway centerline should be evaluated with site-specific information.

ADT = average daily traffic

CNEL = Community Noise Equivalent Level

dBA = A-weighted decibels

ft = feet

## IMPACTS AND MITIGATION MEASURES

Noise levels on and in the vicinity of the project site would change as a result of the proposed project. Potential noise impacts associated with the project include noises created from construction and during the operation phase of the project.

### Short-Term Construction Noise Impacts

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. West Center Street would be used to access the project site. Although there would be high single-event noise exposure potential at a maximum level of 75 dBA  $L_{max}$  from trucks passing at 50 ft, the effect on longer-term (hourly or daily) ambient noise levels would be small when compared to existing hourly and daily traffic volumes. Because construction-related vehicle trips would not approach the hourly and daily traffic volumes mentioned above, traffic noise would not increase by 3 dBA. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment.

Therefore, short-term, construction-related impacts associated with worker commute and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during demolition, site preparation, grading, building construction, architectural coating, and paving on the project site. Construction is undertaken 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 on the project site. Therefore, the noise levels vary 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 I lists the maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 ft between the equipment and a noise receptor. Typical operating cycles for these types of construction equipment may involve 1 to 2 minutes of full power operation followed by 3 to 4 minutes at lower power settings.

In addition to the reference maximum noise level, the usage factor provided in Table I is utilized to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right)$$

- where:  $L_{eq}(equip)$  =  $L_{eq}$  at a receiver resulting from the operation of a single piece of equipment over a specified time period
- E.L. = noise emission level of the particular piece of equipment at a reference distance of 50 ft
- U.F. = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time
- D = distance from the receiver to the piece of equipment

Each piece of construction equipment operates as an individual point source. Utilizing the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq (composite) = 10 * \log_{10} \left( \sum_1^n 10^{\frac{Ln}{10}} \right)$$

The composite noise level of the two loudest pieces of equipment, the forklift and tractor, during construction, as required by the FTA criteria, would be 82 dBA  $L_{eq}$  at a distance of 50 ft from the construction area.

Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq (at distance X) = Leq (at 50 feet) - 20 * \log_{10} \left( \frac{X}{50} \right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA. It is expected that noise levels at the park to the south would approach 60 dBA  $L_{eq}$  while the noise levels at the closest residential receptor would approach 51 dBA  $L_{eq}$  which are potentially higher than existing noise levels experienced.

Implementation of Mitigation Measure NOI-1 would be required to reduce potential construction noise impacts. Mitigation Measure NOI-1 would limit construction hours and require the construction contractor to implement noise reducing measures during construction. Construction-related short-term noise levels would be higher than existing ambient noise levels in the project area today, but would no longer occur once project construction is completed. Therefore, no construction noise impacts would occur, and no mitigation measures are required.

**Table I: Typical Maximum Construction Equipment Noise Levels (L<sub>max</sub>)**

Type of Equipment	Acoustical Usage Factor	Suggested Maximum Sound Levels for Analysis (dBA L <sub>max</sub> at 50 ft)
Air Compressor	40	80
Backhoe	40	80
Cement Mixer	50	80
Concrete/Industrial Saw	20	90
Crane	16	85
Excavator	40	85
Forklift	40	85
Generator	50	82
Grader	40	85
Loader	40	80
Pile Driver	20	101
Paver	50	85
Roller	20	85
Rubber Tire Dozer	40	85
Scraper	40	85
Tractor	40	84
Truck	40	84
Welder	40	73

Source: Federal Highway Administration, *Highway Construction Noise Handbook* (2006).

dBA = A-weighted decibel

ft = feet

L<sub>max</sub> = maximum noise level

### Short-Term Construction Vibration Impacts

This construction vibration impact analysis discusses the level of human annoyance using vibration levels in VdB and will assess the potential for building damages using vibration levels in PPV (in/sec) because vibration levels calculated in RMS are best for characterizing human response to building vibration while vibration level in PPV is best used to characterize potential for damage. As shown in Table E, the FTA guidelines indicate that a vibration level up to 102 VdB (an equivalent to 0.5 in/sec in PPV) (FTA 2006) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For a non-engineered timber and masonry building, the construction vibration damage criterion is 94 VdB (0.2 in/sec in PPV).

Table J shows the PPV and VdB values at 25 ft from the construction vibration source. As shown in Table J, bulldozers and other heavy-tracked construction equipment (except for pile drivers and vibratory rollers) generate approximately 87 VdB of ground-borne vibration when measured at 25 ft, based on the Transit Noise and Vibration Impact Assessment (FTA 2006). This level of ground-borne vibration levels would result in potential annoyance to residences and workers located adjacent to the project site, but would not cause any damage to the buildings. Construction vibration, similar to vibration from other sources, would not have any significant effects on outdoor activities (e.g., those outside of residences and commercial/office buildings in the project vicinity). Outdoor site

**Table J: Vibration Source Amplitudes for Construction Equipment**

Equipment	Reference PPV/L <sub>v</sub> at 25 ft	
	PPV (in/sec)	L <sub>v</sub> (VdB) <sup>1</sup>
Pile Driver (Impact), Typical	0.644	104
Pile Driver (Sonic), Typical	0.170	93
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
<b>Large Bulldozer<sup>2</sup></b>	<b>0.089</b>	<b>87</b>
Caisson Drilling	0.089	87
<b>Loaded Trucks</b>	<b>0.076</b>	<b>86</b>
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Sources: *Transit Noise and Vibration Impact Assessment* (FTA 2006).

<sup>1</sup> RMS vibration velocity in decibels (VdB) is 1 μin/sec.

<sup>2</sup> Equipment shown in **bold** is expected to be used on site.

μin/sec = micro-inches per second

L<sub>v</sub> = velocity in decibels

ft = feet

PPV = peak particle velocity

FTA = Federal Transit Administration

RMS = root-mean-square

in/sec = inches per second

VdB = vibration velocity decibels

preparation for the project is expected to use a bulldozer and loaded truck. The greatest levels of vibration are anticipated to occur during the site preparation phase. All other phases are expected to result in lower vibration levels. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project boundary (assuming the construction equipment would be used at or near the project boundary) because vibration impacts occur normally within the buildings. The formula for vibration transmission is provided below.

$$L_{v\text{dB}}(D) = L_{v\text{dB}}(25 \text{ ft}) - 30 \text{ Log}(D/25)$$

$$\text{PPV}_{\text{equip}} = \text{PPV}_{\text{ref}} \times (25/D)^{1.5}$$

For typical construction activity, the equipment with the highest vibration generation potential is the large bulldozer, which would generate 87 VdB at 25 ft. The closest residential structure from the project site is approximately 1,900 ft from the project construction boundary. The closest industrial building from the project site from is approximately 25 ft to the north. Utilizing the information in Table J, the closest residences from both Sites A and B would experience vibration levels of up to 31 VdB (0.0001 PPV [in/sec]). The closest industrial building to the north of the project site would experience vibration levels of 87 VdB (0.089 PPV [in/sec]). This range of vibration levels from construction equipment or activity would be below the FTA 94 VdB (0.2 in/sec PPV) threshold and would not exceed the 80 VdB threshold for residences due to infrequent events. No significant construction vibration impacts would occur; therefore, no mitigation measures are required.

### Long-Term Aircraft Noise Impacts

The project would develop a warehouse within the City, and would not contribute to any aircraft activity. There currently is no airport located within the city. The closest airport to the project would be Flabob Airport (RIR) located approximately 3.6 miles to the southeast in Riverside. According to

the County of Riverside's General Plan, the project is located outside of the airport's influence area. Therefore, no measurable long-term aircraft or airport noise impacts would occur and no mitigation measures are required.

### Long-term Traffic Noise Impacts

The guidelines included in the FHWA Highway Traffic Noise Prediction Model (1977; FHWA RD-77-108) were used to evaluate highway traffic-related noise conditions along roadway segments in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24 hour periods to determine the CNEL values. The standard vehicle mix for Southern California roadways was used for traffic on these roadway segments. Traffic volumes in the project's traffic study (RAJU, June 2017) were used to assess the existing and future traffic noise impacts. Table K provides the traffic noise levels for the existing and future scenarios, respectively. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Appendix A provides the specific assumptions used in developing these noise levels and model printouts.

Table K shows the existing and future with and without project traffic noise levels along with the project-related traffic noise increase. As discussed above, these noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Table K shows the project-related traffic noise increase would be up to 0.4 dBA. This noise level increase would not be perceptible to the human ear in an outdoor environment. Therefore, no significant traffic noise impacts from project-related traffic would occur to off-site sensitive receptors.

**Table K: Off-Site Traffic Noise Analysis**

Roadway Segment	2017 Existing Traffic Volumes					2018 Opening Year Traffic Volumes				
	Without Project		With Project			Without Project		With Project		
	ADT	L <sub>dn</sub> (dBA) 50 feet from Centerline of Outermost Lane	ADT	L <sub>dn</sub> (dBA) 50 feet from Centerline of Outermost Lane	Increase from Baseline Conditions	ADT	L <sub>dn</sub> (dBA) 50 feet from Centerline of Outermost Lane	ADT	L <sub>dn</sub> (dBA) 50 feet from Centerline of Outermost Lane	Increase from Baseline Conditions
Riverside Avenue - North of Placentia Lane	22,200	70.0	22,200	70.0	0.0	24,300	70.4	24,400	70.4	0.0
Main Street - South of Placentia Lane	20,100	69.6	20,100	69.6	0.0	22,900	70.1	23,000	70.1	0.0
Placentia Lane - East of Riverside Avenue	5,200	57.9	5,300	58.0	0.1	8,200	59.9	8,300	59.9	0.0
Placentia Lane - West of Driveway 1	4,900	57.6	5,000	57.7	0.1	7,900	59.7	8,000	59.8	0.1
Center Street - Driveway 1 to Driveway 2	4,200	57.0	4,400	57.2	0.2	7,200	59.3	7,500	59.5	0.2
Center Street - East of Driveway 2	4,200	57.0	4,500	57.3	0.3	7,200	59.3	7,600	59.5	0.2
Center Street - West of Orange Street	4,100	56.9	4,500	57.3	0.4	8,700	60.1	9,100	60.3	0.2
Orange Street - North of Center Street	370	46.4	370	46.4	0.0	3,200	55.8	3,200	55.8	0.0
Orange Street - South of Center Street	2,700	55.0	2,800	55.2	0.2	3,700	56.4	3,800	56.5	0.1

Source: LSA (October 2017).

Note: Traffic noise within 50 ft of the roadway centerline should be evaluated with site-specific information.

ADT = average daily traffic

CNEL = Community Noise Equivalent Level

dBA = A-weighted decibels

## Long-Term Stationary Noise Impacts

As part of the proposed project, the proposed on-site operational noise-generating uses have the potential to impact surrounding uses. In order to calculate the expected impacts due to long-term operational stationary source activities, the software SoundPlan was used. SoundPlan is a noise modeling program that allows 3-D calculations to be made taking into account topography, ground attenuation, and shielding from structures and walls. Within the model, the noise library allows for the input of many noise sources and calculates the composite noise levels experienced at any receptor necessary. The locations of the sources are shown in Appendix B. In order to model the potential noise impact when all sources are operating simultaneously, the sound-pressure levels associated with each piece of equipment were converted to A-weighted sound power levels (L<sub>WA</sub>). Specific details of the proposed project are not currently available, therefore reference noise levels measured from similar properties and uses gathered by LSA are utilized for the purposes of this analysis. A description of the sources modeled and their respective sound power level included in the analysis is as follows:

- **Heating, Ventilation, and Air Conditioning Units:** The heating, ventilation, and air conditioning (HVAC) units would be used in order to properly maintain a desired temperature inside the building. The sound-power level for this piece of equipment is 85.7 L<sub>WA</sub>.
- **Container Refrigeration Units (Local):** The external refrigeration units on the semi-containers the operate locally and are used to keep the interior temperatures at a fixed temperature. The sound-power level for this piece of equipment is 103.5 L<sub>WA</sub>.
- **Container Refrigeration Units (Overseas):** The external refrigeration units on the semi-containers used for overseas deliveries that are used to keep the interior temperatures at a fixed temperature. The sound-power level for this piece of equipment is 90.7 L<sub>WA</sub>.
- **Forklift:** The forklifts are used on-site to load and un-load trailers and move materials. The sound-power level for this piece of equipment is 92.3 L<sub>WA</sub>.
- **Semi-Truck Arrival and Departure:** Impacts associated with the arrival and departure of the semi-trucks with trailer include air brakes release, back-up beeper and engine noise. The sound-power level for this activity is 101.2 L<sub>WA</sub>.

Per the specifics presented in the project description, it was assumed that a maximum of half of the loading docks would be in operation at any given time with trailers evenly split between local and overseas containers. In addition to loading dock and truck activities, approximate locations of HVAC units were modeled which are assuming to run continuously.

The surrounding noise sensitive receptors are located within the City of Riverside, therefore, the impacts are determined based on comparison to the City of Riverside noise standards. The results of the noise modeling using the assumptions and reference noise levels above, indicate that noise levels along the northernmost portion of the park will range from 43 to 45 dBA L<sub>eq</sub>, while the noise levels at the nearest single-family home will approach 42 dBA L<sub>eq</sub>. These predicted exterior noise levels associated with operations at peak conditions would not exceed the City of Riverside's

daytime or nighttime standards for both park, 65 dBA  $L_{eq}$  at anytime, and residential land use, 55  $L_{eq}$  dBA during daytime hours and 45 dBA  $L_{eq}$  during nighttime hours, categories. Though this analysis is conservative and nature and utilizes reference noise levels from equipment similar to that of the proposed project, it is possible that a significant impact could occur based on project specifics that have not yet been defined. In order to confirm a less than significant impact or to provide further information on unexpected impacts, as presented in Mitigation Measure NOI-2, prior to issuance of final permits of future tenants, an acoustical consultant shall confirm the operations that are proposed to occur on site for both daytime and nighttime hours. Specific information utilized will be provided by the manufacturer of the HVAC equipment as well as any other exterior equipment that has yet to be designed. Based on the current operation assumptions, noise levels generated by the project operations would be less than significant.

## MITIGATION MEASURES

### Short-Term Construction Noise and Vibration Impacts

**NOI-1: Construction Noise.** Prior to issuance of demolition permits, the City of Colton Planning Staff shall verify that all construction plans include notes stipulating the following:

- Construction activities are restricted to conform with the City of Riverside requirements to the hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, and 8:00 a.m. to 5:00 p.m. on Saturdays, and are prohibited on Sundays and federal holidays.
- Grading and construction contractors shall use equipment that generates lower vibration levels such as rubber-tired equipment rather than metal-tracked equipment.
- Construction haul truck and materials delivery traffic shall avoid residential areas whenever feasible.
- The construction contractor shall place noise and vibration-generating construction equipment and locate construction staging areas away from sensitive uses, whenever feasible.

### Long-Term Aircraft Noise Impacts

No mitigation measures are required.

### Long-Term Traffic Noise Impacts

No mitigation measures are required.

### Long-Term Stationary Noise Impacts

**NOI-2: Operational Noise Impacts.** Prior to issuance of an operation permit, the City of Colton Planning Department shall have an acoustical engineer verify that the operations of the proposed project and associated equipment is in compliance with both the daytime and nighttime noise ordinance requirements.

### Level of Significance after Mitigation

No significant noise impacts from short-term construction or long-term traffic will result after implementation of the mitigation measures listed above.

---

## REFERENCES

City of Colton. 2013 General Plan Noise Element. August.

\_\_\_\_\_. 1992. Municipal Code, Code of Ordinance.

City of Riverside. 2007a. Riverside General Plan 2025 Noise Element, *Noise/Land Use Noise Compatibility Criteria*. November.

\_\_\_\_\_. 2005. Municipal Code.

Federal Highway Administration (FHWA). 1977. Highway Traffic Noise Prediction Model, FHWA RD-77-108.

\_\_\_\_\_. 2006. *Highway Construction Noise Handbook*. Roadway Construction Noise Model, FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. NTIS No. PB2006-109012. August.

Federal Transit Administration (FTA). 2006. Office of Planning and Environment. *Transit Noise and Vibration Impact Assessment*. FTA-VA-90-1003-06. August.

Harris, Cyril M., editor. 1991. *Handbook of Acoustical Measurements and Noise Control*, Third Edition.

Transtech Engineers, Inc. *Traffic Impact Analysis for the Proposed Tropica Warehouse Project Colton*. July 2017.

United States Environmental Protection Agency (EPA). 1978. *Protective Noise Levels, Condensed Version of EPA Levels Document*, EPA 550/9-79-100. November.

## **APPENDIX A**

### **NOISE SURVEY SHEETS**

# Noise Measurement Survey

Project Number: CLT1702  
 Project Name: Hillwood Center St Industrial

Test Personnel: Daniel Kaufman  
 Equipment: LDA 4

Site Number: ST-1 Date: 8/29

Time: From 12:21 PM To 12:44 PM

Site Location: In front of 3765 Bartlett Avenue.

Primary Noise Sources: Traffic on Main St, Machinery at site to SW South west industrial use, buzzing noise

Comments: 3765 appears to be home. JR Towing RV auto Repair & Storage to NW  
Light Industrial use is to SW, small Towing & Auto Repair  
filtered talking, filtered aircraft 12:36, 12:37 field spike & manufacturing  
12:39, 42

Adjacent Roadways: Bartlett Avenue and Main Street

File #99

File:	
L <sub>eq</sub>	50.0
L <sub>max</sub>	63.6
L <sub>min</sub>	43.5
L <sub>peak</sub>	85.7
L <sub>2</sub>	55.6
L <sub>8</sub>	52.7
L <sub>25</sub>	50.5
L <sub>50</sub>	48.6
L <sub>90</sub>	45.9
L <sub>99</sub>	44.6
SEL	80.8

Atmospheric Conditions	
Average Wind Velocity (mph)	4.0
Maximum Wind Velocity (mph)	9.7
Temperature (F)	107.3
Relative Humidity (%)	27.6

# Noise Measurement Survey

Project Number: CLT1702  
 Project Name: Hillwood Center St Industrial

Test Personnel: Daniel Kaufman  
 Equipment: LDR24

Site Number: ST-2 Date: 8/29

Time: From 1:03 PM To 1:25 PM

Site Location: AB Brown Soccer Complex, North of soccer fields center of complex

Primary Noise Sources: Traffic on Main St, Placentia Dr, & Center St  
industrial use at SW      buzzing from

Comments: filtered airplane @ 50 ft 1:05 PM, 1:15 PM, 1:18  
train horn 1:07 PM, 1:08 PM      File # 100

Paint buzzing from generator in sand parking lot

Adjacent Roadways: Placentia Lane

File:	
L <sub>eq</sub>	48.8
L <sub>max</sub>	59.0
L <sub>min</sub>	42.9
L <sub>peak</sub>	80.3
L <sub>2</sub>	53.0
L <sub>8</sub>	51.0
L <sub>25</sub>	49.3
L <sub>50</sub>	48.1
L <sub>90</sub>	46.0
L <sub>99</sub>	44.3
SEL	79.6

Atmospheric Conditions	
Average Wind Velocity (mph)	3.7
Maximum Wind Velocity (mph)	8.7
Temperature (F)	104.4
Relative Humidity (%)	26.2

# Noise Measurement Survey

Project Number: CLT1702  
 Project Name: Hillwood Center St Industrial

Test Personnel: \_\_\_\_\_  
 Equipment: CD824

Site Number: ST-3 Date: 8/29

Time: From 1:37 PM To 2:01 PM

Site Location: Southeast - corner of AB Brown Spicer  
Complex

Primary Noise Sources: Machinery at Guzzing at "Calderon  
Walking Floor Trailer Repair", traffic on Main St (distant)

Comments: Filtered plane 1:40, filtered plane 1:42 (low-flying small plane), 1:49, 1:52, 1:55  
heavy truck on Sieck 50-52 a BA arrival idle, airbrakes 6:05 1:48  
1:54 heavy truck delivery 6:02 max

Adjacent Roadways: Sieck Rd, Placentia Ln

File 101

File:	
L <sub>eq</sub>	51.0
L <sub>max</sub>	75.5
L <sub>min</sub>	41.3
L <sub>peak</sub>	87.9
L <sub>2</sub>	59.1
L <sub>8</sub>	53.2
L <sub>25</sub>	51.3
L <sub>50</sub>	46.7
L <sub>90</sub>	44.2
L <sub>99</sub>	42.3
SEL	81.8

Atmospheric Conditions	
Average Wind Velocity (mph)	2.9
Maximum Wind Velocity (mph)	9.8
Temperature (F)	110.3
Relative Humidity (%)	21.8

**APPENDIX B**

**FHWA HIGHWAY TRAFFIC NOISE MODEL PRINTOUTS**

Volumes-01

TABLE Existing Peak Hour Traffic

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017

ROADWAY SEGMENT: Riverside Avenue - North of Placntia Lane

NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

---

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 22200      SPEED (MPH): 50      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

---

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.99

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
73.9	152.5	325.3	699.2

TABLE Existing Peak Hour Traffic

Volumes-02

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017

ROADWAY SEGMENT: Main Street - South of Placentia Lane

NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 20100      SPEED (MPH): 50      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.56

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
69.7	143.0	304.6	654.5

Volumes-03

TABLE Existing Peak Hour Traffic

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - East of Riverside Avenue  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 5200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.89

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	86.9

Volumes-04

TABLE Existing Peak Hour Traffic

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - West of Driveway 1  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4900      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.63

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	83.5

TABLE Existing Peak Hour Traffic  
 Volumes-05  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - Driveway 1 to Driveway 2  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4200      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.96

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	75.4

TABLE Existing Peak Hour Traffic  
 Volumes-06  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - East of Driveway 2  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4200      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.96

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	75.4

TABLE Existing Peak Hour Traffic  
 Volumes-07  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - West of Orange Street  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4100      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.85

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	74.2

TABLE Existing Peak Hour Traffic  
 Volumes-08  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - North of Center Street  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 370      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 46.41

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	0.0

TABLE Existing Peak Hour Traffic  
 Volumes-09  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - South of Center Street  
 NOTES: Tidewater Crossing - Existing Peak Hour Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 2700      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.04

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	56.3

TABLE Existing Plus Project Peak  
Traffic Volumes-01  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Riverside Avenue - North of Placntia Lane  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 22200      SPEED (MPH): 50      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.99

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
73.9	152.5	325.3	699.2

TABLE Existing Plus Project Peak  
Traffic Volumes-02  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Main Street - South of Placentia Lane  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 20100      SPEED (MPH): 50      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.56

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
69.7	143.0	304.6	654.5

TABLE Existing Plus Project Peak  
Traffic Volumes-03  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Placentia Lane - East of Riverside Avenue  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 5300      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.97

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	88.0

TABLE Existing Plus Project Peak  
Traffic Volumes-04  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Placentia Lane - West of Driveway 1  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 5000      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.71

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	84.7

TABLE Existing Plus Project Peak  
Traffic Volumes-05  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Center Street - Driveway 1 to Driveway 2  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4400      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.16

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	77.8

TABLE Existing Plus Project Peak  
 Traffic Volumes-06  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - East of Driveway 2  
 NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4500      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.26

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	78.9

TABLE Existing Plus Project Peak  
Traffic Volumes-07  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Center Street - West of Orange Street  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 4500      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.26

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	78.9

TABLE Existing Plus Project Peak  
 Traffic Volumes-08  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - North of Center Street  
 NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 370      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 46.41

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	0.0

TABLE Existing Plus Project Peak  
Traffic Volumes-09  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Orange Street - South of Center Street  
NOTES: Tidewater Crossing - Existing Plus Project Peak Traffic Volumes

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 2800      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.20

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	57.7

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-01  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Riverside Avenue - North of Placntia Lane  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 24300      SPEED (MPH): 50      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 70.39

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
78.0	161.8	345.4	742.6

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-02  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Main Street - South of Placentia Lane  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 22900      SPEED (MPH): 50      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 70.13

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
75.3	155.6	332.1	713.8

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-03  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - East of Riverside Avenue  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 8200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.86

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	54.8	117.6

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-04  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - West of Driveway 1  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 7900      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.70

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	53.5	114.7

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-05  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - Driveway 1 to Driveway 2  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 7200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.30

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	107.8

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-06  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - East of Driveway 2  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 7200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.30

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	107.8

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-07  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - West of Orange Street  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 8700      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 60.12

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	57.0	122.3

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-08  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - North of Center Street  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 3200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.78

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	63.0

TABLE Opening Year Peak Hour Traffic  
 Volumes (2018)-09  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - South of Center Street  
 NOTES: Tidewater Crossing - Opening Year Peak Hour Traffic  
 Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 3700      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.41

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	69.3

TABLE Opening Year with Project Peak  
Hour Traffic Volumes (2018)-01  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Riverside Avenue - North of Placntia Lane  
NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 24400      SPEED (MPH): 50      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 70.40

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
78.2	162.2	346.3	744.6

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-02  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Main Street - South of Placentia Lane  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 23000      SPEED (MPH): 50      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 24      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 70.15

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
75.5	156.1	333.0	715.9

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-03  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - East of Riverside Avenue  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 8300      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.92

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	55.3	118.5

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-04  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Placentia Lane - West of Driveway 1  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 8000      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.76

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	54.0	115.6

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-05  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - Driveway 1 to Driveway 2  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 7500      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.48

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	51.7	110.8

TABLE Opening Year with Project Peak  
Hour Traffic Volumes (2018)-06  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Center Street - East of Driveway 2  
NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 7600      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 59.53

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	52.2	111.8

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-07  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Center Street - West of Orange Street  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 9100      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 60.32

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	58.7	126.0

TABLE Opening Year with Project Peak  
Hour Traffic Volumes (2018)-08  
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
ROADWAY SEGMENT: Orange Street - North of Center Street  
NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 3200      SPEED (MPH): 25      GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
	---	-----	-----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.78

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
-----	-----	-----	-----
0.0	0.0	0.0	63.0

TABLE Opening Year with Project Peak  
 Hour Traffic Volumes (2018)-09  
 FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/17/2017  
 ROADWAY SEGMENT: Orange Street - South of Center Street  
 NOTES: Tidewater Crossing - Opening Year with Project Peak Hour  
 Traffic Volumes (2018)

\* \* ASSUMPTIONS \* \*

AVERAGE DAILY TRAFFIC: 3800      SPEED (MPH): 25      GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY ---	EVENING -----	NIGHT -----
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 6      SITE CHARACTERISTICS: SOFT

\* \* CALCULATED NOISE LEVELS \* \*

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.52

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL -----	65 CNEL -----	60 CNEL -----	55 CNEL -----
0.0	0.0	0.0	70.6

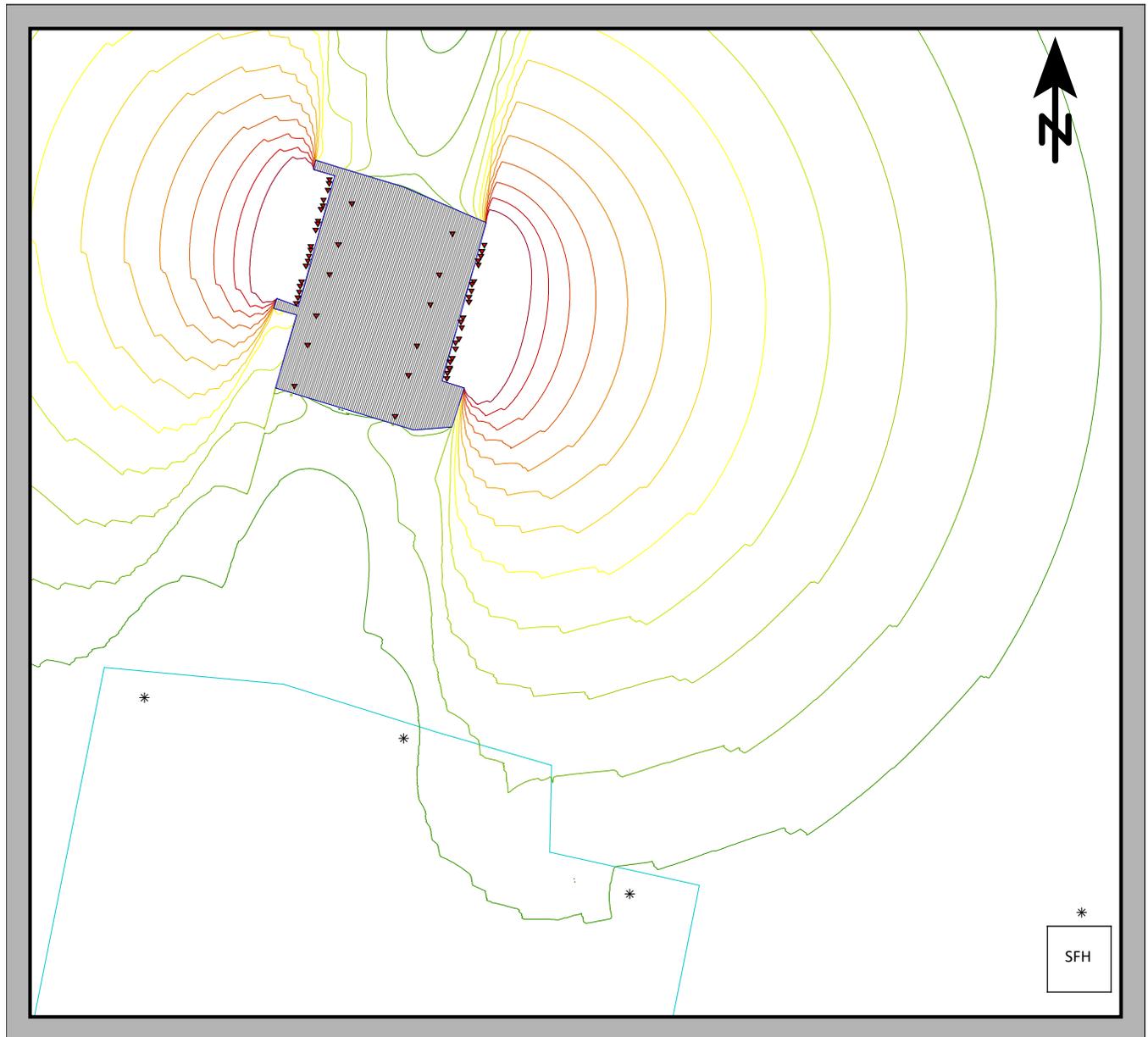
## **APPENDIX C**

### **SOUNDPLAN NOISE MODEL PRINTOUTS**

# Hillwood Distribution Noise and Vibration Analysis

Project No. CLT1702

Busiest Hour



<b>Signs and symbols</b>	<b>Levels LrD</b> in dB(A)	<b>Customer:</b>																										
<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: gray; border: 1px solid black;"></span> Surface</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: transparent; border: 1px solid black; position: relative; top: -5px;">▼</span> Point source</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: gray; border: 1px solid black; background-image: linear-gradient(to right, gray 48%, transparent 48%, transparent 52%, gray 52%);"></span> Main building</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: gray; border: 1px solid black; background-image: linear-gradient(to right, gray 48%, transparent 48%, transparent 52%, gray 52%); background-size: 4px 4px;"></span> Auxiliary building</li> <li><span style="display: inline-block; width: 10px; height: 10px; border: 1px solid black; text-align: center; vertical-align: middle;">*</span> Point receiver</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 1px solid cyan;"></span> Park</li> </ul>	<table border="1"> <tr><td style="background-color: #008000;"></td><td>&lt; 45</td></tr> <tr><td style="background-color: #00b050;"></td><td>45 - 47</td></tr> <tr><td style="background-color: #00c040;"></td><td>47 - 49</td></tr> <tr><td style="background-color: #00e030;"></td><td>49 - 51</td></tr> <tr><td style="background-color: #90ee90;"></td><td>51 - 53</td></tr> <tr><td style="background-color: #ffff00;"></td><td>53 - 55</td></tr> <tr><td style="background-color: #ffcc00;"></td><td>55 - 57</td></tr> <tr><td style="background-color: #ff9900;"></td><td>57 - 59</td></tr> <tr><td style="background-color: #ff6600;"></td><td>59 - 61</td></tr> <tr><td style="background-color: #ff3300;"></td><td>61 - 63</td></tr> <tr><td style="background-color: #ff0000;"></td><td>63 - 65</td></tr> <tr><td style="background-color: #ff0000;"></td><td>65 - 67</td></tr> <tr><td style="background-color: #990000;"></td><td>&gt;= 67</td></tr> </table>		< 45		45 - 47		47 - 49		49 - 51		51 - 53		53 - 55		55 - 57		57 - 59		59 - 61		61 - 63		63 - 65		65 - 67		>= 67	<b>Supplier</b>
	< 45																											
	45 - 47																											
	47 - 49																											
	49 - 51																											
	51 - 53																											
	53 - 55																											
	55 - 57																											
	57 - 59																											
	59 - 61																											
	61 - 63																											
	63 - 65																											
	65 - 67																											
	>= 67																											
		<b>Length scale 1:4736</b>																										
		Date: 10/17/2017 Project engineer:																										