853 LINCOLN WAY, SUITE 208
AUBURN, CALIFORNIA 95603
T 530.887.8500 F 530.887.1250

TECHNICAL MEMORANDUM

To:	Sunny Goyal, THBA Trucking
From:	Michael Carr, INCE
Subject:	Railroad Avenue Fright Terminal – Noise Analysis
Date:	April 2, 2020
Attachment(s):	Appendices A through C

THBA Trucking is proposing to renovate an existing commercial site and construct a truck freight terminal in Morgan Hill, California. This memorandum provides a summary of the potential noise impacts related to the proposed Railroad Avenue Freight Terminal Project (Project). Appendix A provides an introduction to acoustical fundamental and terminology used throughout this memorandum.

1 Project Information

The proposed site for the Railroad Avenue Freight Terminal is located at 16500 Railroad Avenue in the City of Morgan Hill, California; between Tennant Avenue and San Pedro Avenue. The proposed project site is bounded to the north by a light industrial complex and the location of THBA Trucking's current freight terminal operations. To the East of the proposed project site are the Loma Clara Senior Living facility and the Huntington Apartment complex. To the south of the proposed Project site are commercial and light industrial uses. The proposed Project site plan is provide in Figure 2.

The proposed Project would construct two buildings on the proposed Project site, identified on the plans as "Building A" and "Building B". Building A would house the truck freight terminal operations and on-site fleet maintenance, with a covered truck wash station along the southern building façade and 12 truck parking stalls along the eastern property boundary. Building B would be built-out as a secondary phase and provide two units available for future light industrial/commercial tenants.

Activities associated with Building A will include general office work, and light mechanical work in the truck maintenance bays (i.e., tire rotation and replacement, minor electrical and lighting system maintenance, etc.). Air compressors and pumps used to support the light mechanical and truck maintenance activities within the building, will be housed within a mechanical equipment room to maintain a controlled environment and limit noise exposure in the surrounding community. The covered truck wash station will be limited in use as a hand wash and is not proposed to incorporate any mechanical or automated components that may generate noise.

The current THBA trucking operations include 6 to 8 trucks, with plans to expand operations to between 10 and 12 trucks at the new facility. Operation of the 12 trucks and the associated parking activities along the eastern property boundary have the potential to generate noise at the property line of the nearby residential uses and will be the focus of this noise analysis. Based on communication with the Vice President of Operations for THBA Trucking, each truck will be utilized during two to three (2-3) shifts throughout a 24-hour period, with one of the shift changes typically occurring during nighttime hours (10 PM to 7 AM).

Activities associated with Building B will include light industrial operations interior to the tenant spaces and will likely receive minor delivery activity. However, this activity will be located more than 400 feet west of the residential property line, adjacent to Railroad Avenue, and partially shielded by the structure of Building A. As such, delivery activities associated with the future Building B light industrial operations would not be a significant contributor to the noise environment at the residential property line.

2 Regulatory Setting

The City of Morgan Hill has developed and adopted goals and policies with the intent of controlling and diminish environmental noise and to protect its inhabitants from exposure to excessive noise levels. Local noise standards applicable to the proposed Project are contained in the City of Morgan Hill General Plan and Morgan Hill Municipal Code.

The City of Morgan Hill General Plan

Applicable noise standards in the City of Morgan Hill General Plan are contained within the Safety, Services and Infrastructure section of the General Plan. The section contains specific goals, policies and standards for use in planning and land compatibility determinations within the City of Morgan Hill. Policy SSI-8.1 establishes a "maximum exterior noise level" of 60 dBA Ldn in outdoor activity areas of residential uses; additionally, the policy establishes a maximum instantaneous noise level of 50 dBA within bedrooms and 55 dBA and all other habitable rooms. Policy SSI-8.6 discusses stationary noise sources being considered significant if the stationary noise levels substantially exceed the existing ambient noise environment; however, what constitutes "substantially exceed" is not expressly addressed within the policy. Policy SSI-8.5 establishes significant increase thresholds for traffic noise levels of 5 dBA Ldn for areas exposed to noise levels below 60 dBA Ldn, or a noise level increase of 3 dBA Ldn in areas exposed to noise levels above 60 dBA Ldn. These significant increase thresholds are also assumed to apply to the stationary noise level standards of policy SSI-8.6, as SSI-8.6 does not define "significant".

The City of Morgan Hill Code of Ordinances

The City of Morgan Hill includes provisions for noise enforcement throughout the Code of Ordinances. However, the municipal code noise ordinance (Title 8 - Health and Safety, Chapter 8.28 - Noise) does not contain any quantitative limits. Chapter 8.28 does establish noise policy for construction projects within the City. The policy prohibits noise generated by construction activity, with minor exceptions, outside of the hours of 7:00 AM and 8:00 PM, and on Saturday from 9:00 AM and 6:00 PM; construction activities are prohibited on Sundays and federal holidays.

The City of Morgan Hill Zoning Ordinance, contained in Title 18, Chapter 18.76 establishes performance standards to protect the community, assist with land use compatibility and protection of environmental resources. The Zoning Ordinance established establishes a maximum noise level standard at the lot line of residential or public/quasi public land uses of 60 dBA. The Zoning Ordinance does not identify the noise level metric which is intended for use with the performance standards. Based on conversations with the City, the performance standards are interpreted to use the hourly Leq noise level metric.

3 Existing Conditions

An ambient noise survey was conducted by Dudek from November 19th, 2019 through November 20th, 2019 to document the existing ambient noise in the vicinity of the proposed Project. Long-term unattended ambient noise monitoring was performed at one (1) location in the Project vicinity with concurrent short-term noise level monitoring performed at four (4) locations in the Project vicinity on November 20th, 2019. Locations of the noise monitoring sites are presented on an aerial photograph of the area on Figure 1, with the long-term noise measurement site represented as LT-1 and short-term measurement locations shown as ST-1 through ST-4. The following sections discuss the overall monitoring results for the long-term and short-term measurements.

Noise measurements were performed using Larson Davis Laboratories (LDL) Model 831 precision integrating sound level meters (SLMs). Field calibrations were performed on the SLM with an acoustic calibrator before and after the measurements. Equipment meets all pertinent specifications of ANSI S1.4-1983 (R2006) for Type 1 SLMs. All instrumentation components, including microphones, preamplifiers and field calibrators have laboratory certified calibrations traceable to the National Institute of Standards and Technology (NIST). The microphones were located at a minimum height of 5-6 ft. above the ground, an average height for a person standing, and located a sufficient distance away from reflective surfaces in the monitoring area. Noise measurements were performed in accordance with American National Standards Institute (ANSI) and American Standards for Testing and Measurement (ASTM) guidelines.

The noise monitoring equipment was configured to catalog all noise metrics pertinent to identification and evaluation of noise levels (i.e., Leq, Lmax, Ln, etc.) in the study area. Monitoring data was collected for the overall measurement period and each hourly period.

Meteorological conditions during the ambient monitoring periods were stable with temperatures ranging from 99 to 66 degrees Fahrenheit (F), light winds from 0 mph to 7 mph during most of the period with occasional gusts up to 14 mph, and cloudy skies. No precipitation was experienced during the monitoring period.

3.1 Ambient Monitoring

3.1.1 Long-Term Monitoring

Long-term noise monitoring data collected during the noise monitoring program serves to establish a baseline for ambient noise levels in the project vicinity. Additionally, the noise levels cataloged illustrate the diurnal pattern experienced at the site; and allow for correlation of hourly noise levels collected at the short-term monitoring locations with the 24-hour day-night noise levels. Long-term noise monitoring data is presented below for the monitoring period beginning on Tuesday, November 19th, 2019.

During the long-term monitoring, the primary background noise source affecting the monitoring location was vehicular traffic on the local roadway network (Butterfield Blvd and US 101). Additional noise sources experienced during the long-term noise monitoring period included light industrial noise, emergency vehicle pass-bys and general community noise. Ambient noise level exposure at the monitoring location was dependent on the relative exposure to nearby transportation noise sources.

Noise monitoring data is summarized below Table 1 for the long-term noise monitoring location in; with detailed noise level data provided in tabular and graph form in Appendix B. The average day-night (Ldn) noise level measured

during the long-term ambient noise monitoring survey was approximately 61 dBA Ldn at the long-term monitoring location. Maximum hourly noise levels (Lmax) documented during the long-term monitoring ranged from approximately 58 to 85 dBA Lmax, with average maximum noise levels from approximately 69 to 70 dBA Lmax.

3.1.2 Short-Term Monitoring

Short-term attended monitoring was performed by Dudek staff at two (2) locations in the Project vicinity on November 20th, 2019. Detailed observations about the measurement environment, existing noise sources, and other elements with the potential to affect the measurement or the project analysis were documented throughout the monitoring program. The short-term monitoring locations ST-1 and 2 were intended to characterize traffic noise levels; ST-1 also provides insight into noise level exposure at the residential land uses to the east of the Project. As such, noise experienced at the short-term monitoring locations was predominately due to vehicular traffic on the local roadway network.

Overall noise levels measured at the short-term monitoring locations ranged from approximately 51 to 59 dBA Leq. Maximum noise levels documented during the monitoring survey were approximately 60 dBA Lmax at ST-1 and ST-2, with maximum noise levels reaching approximately 70 dBA Lmax at ST-3. Table 1 presents the overall monitoring results for each of the short-term monitoring locations.

Table 1. Summary of Ambient Noise Measurements

Site	Location	Dates	Ldn	Average Noise Levels, dBA						Noise Sources/ Notes
				Daytime (7am to 10pm)			Nighttime (10pm to 7am)			
				Leq	Lmax	L90	Leq	Lmax	L90	
Long-Term Monitoring										
LT-1	Eastern property line of Project site	11/19/19 to 11/20/19	61.1	55.0	70.3	48.6	54.6	68.8	51.5	
Short-Term Monitoring										
ST-1	Western property line of The Huntington Apartments	11/20/19	-	51.6	60.2	46.7	-	-	-	Butterfield Blvd traffic, pedestrian/community activity, vehicles parking
ST-2	Western property line of Loma Clara	11/20/19	-	51.6	60.6	47.4	-	-	-	
ST-3	140-feet from Butterfield Blvd centerline	11/20/19	-	59.0	69.6	50.6	-	-	-	Butterfield Blvd traffic

Notes:
dBA = A-weighted decibels; Ldn = Day Night noise level; Leq = average equivalent noise level; Lmax = maximum noise level; L90 = sound level exceeded 90 percent of the period.
Locations of noise monitoring sites are shown on Figure 1.

3.2 Source Noise Characterization

Dudek performed additional sound pressure measurements during the November 20th, 2019 short-term monitoring survey to document source levels generated by activities at the existing truck freight terminal. During the monitoring period, detailed observations and recordings were cataloged for the truck arrivals and departures. Reference measurements were attempted for the fleet maintenance activities being performed within the facility; however, while audible at occasion, sounds associated with the maintenance activities were at or below ambient background noise levels.

During an arrival event, trucks were observed to pull into the parking area and perform a large three-point turn to properly position the truck and trailers for backing into the parking stalls. Sound levels associated with arrival events were documented from the existing property line; at a distance of 30 to 70 feet during the maneuvering and parking. The arrival events were documented to be completed and the trucks engines turned off approximately 2:30 minutes after arrival on the existing site. Sound levels associated with the arrival events had an average of 52.5 dBA Leq and maximum noise levels of 60.4 dBA Lmax; resulting in a single event sound exposure level (SEL) of 76 dBA at a distance of 50-feet from the center of on-site truck movements.

Departure events were observed to be briefer, only consisting of doors closing, the engine starting and the truck pulling out. The trucks were not observed to idle the vehicles for any significant period of time prior to departure. Departure events were documented to generate noise for approximately 1-minute. Sound levels associated with the departure events had an average of 60.2 dBA Leq and maximum noise levels of 62.4 dBA Lmax; resulting in a single event sound exposure level (SEL) of 78 dBA, at a distance of 50-feet from the engine/exhaust of the departing truck.

4 Project Analysis

The proposed Railroad Avenue Truck Freight Terminal renovate an existing commercial/industrial parcel and construct a truck freight terminal building and a light industrial building. Elements of the proposed Project that would have the potential to impact the existing noise environment would include light mechanical work and truck maintenance activities within the truck freight terminal building and on-site truck movement.

The Project applicant has indicated that construction of the proposed Project will be performed in accordance with the City of Morgan Hill limits on construction activity hours and is therefore not discussed further in this analysis.

4.1 Fleet Maintenance

As discussed in Section 3, during the ambient noise monitoring survey and source characterization measurements, sounds generated by the light mechanical and fleet maintenance activities within the existing facility were audible for brief periods of time; however, they were at below the background noise levels of the ambient noise environment. The background noise environment near the existing maintenance activities was measured to be approximately 51 dBA. The location of the maintenance bays within the new freight terminal is set back 172 feet from the eastern property line, in comparison to the existing bays which are approximately 110 feet from the property line. Accounting for an attenuation rate of 6 dB per doubling of distance (6 dBA/DD), the additional distance would result in an approximate 3 to 4 dB reduction of the sound levels. Furthermore, the property line noise barrier (approximately 5-feet in height) currently in place at the eastern property line of the proposed Project

site would provide 5 dB of insertion loss, for a combined noise level reduction of 8 to 9 dB in comparison to existing maintenance operations.

As the fleet maintenance activities and light mechanical repairs performed at the new facility are expected to be similar to those performed at the existing facility, fleet maintenance activities are calculated to be less than 43 dBA at the eastern property line of the proposed Project site. The lowest average hourly noise level cataloged during the 24-hour ambient noise monitoring survey was 48 dBA Leq, which occurred at 8:00 AM. As such, the maintenance operations would comply with the City of Morgan Hill Code of Ordinances 60 dBA Leq property line criteria.

If maintenance activity were to occur consistently throughout daytime and nighttime hours, the maintenance operations would have a day/night noise level of 49.4 dBA Ldn at the eastern property line. The outdoor activity areas associated with the adjacent noise-sensitive uses are located between 130 and 375 feet east of the proposed project boundary which would further attenuate project noise levels to between approximately 41 dBA and 32 dBA Ldn. Proposed project noise levels would be further reduced by the shielding provided by the intervening structures, as the outdoor activity areas are located interior to the complexes. Therefore, light mechanical and maintenance activities performed in the freight terminal bays are anticipated to comply the City of Morgan Hill General Plan noise level standards.

As previously discussed, Policy SSI-8.6 applicable to stationary noise sources requires the consideration of noise sources if they substantial exceed the existing ambient environment. Based on Policy SSI-8-5 and the existing ambient noise level of 61.1 dBA Ldn, as cataloged during the noise monitoring survey, the project would be considered to cause a significant increase if it resulted in a 3 dBA Ldn increase in the ambient noise level. Fleet maintenance activities have been calculated to be less than 41 dBA Ldn at the outdoor activity areas of the adjacent noise-sensitive land uses, which would result in an increase of less than one-tenth of a decibel at the outdoor activity area. Therefore, the fleet maintenance operations associated with the proposed project would comply with the City of Morgan Hill significant increase criteria, as outlined in Policies SSI-8.5 and SSI-8.6 of the General Plan.

4.2 On-Site Truck Movement

Current trucking operations performed at the existing THBA facility include 6 to 8 trucks arriving and departing 2 to 3 times per day. The proposed Project site plan provides 12 truck parking stalls along the eastern property line. As such, to provide a conservative analysis of potential on-site truck movement noise levels, this analysis will assume 12 trucks would arrive and depart within a peak 1-hour time period. Based on the source characterization measurements performed for arrival and departure events, single-event sound exposure levels (SEL) for an arrival are 76 dBA and 78 dBA for a departure (at a distance of 50 feet). Using the measured SELs, 12 arrivals occurring during a peak 1-hour period would result in an hourly equivalent noise level of 51 dBA Leq; 12 departure events would result in a noise level of 53 dBA Leq. Overall on-site truck movement noise levels, assuming 12 arrivals and 12 departures, during a peak 1-hour time period are calculated to be 55 dBA Leq at a distance of 50 feet. Assuming a 6 dBA/DD attenuation rate, noise associated with on-site truck movements would be approximately 53 dBA Leq at the eastern project boundary. Therefore, the proposed project's on-site truck movements would comply with the City of Morgan Hill Code of Ordinance 60 dBA Leq property line criteria.

Based on communication with the Vice President of Operations for THBA Trucking, each truck will be utilized during two to three (2-3) shifts throughout a 24-hour period. Conservatively assuming that each of the 12 trucks will be arriving and departing three (3) times per day, within one of the shift changes occurring during nighttime hours

(10:00 PM to 7:00 AM), on-site truck movement noise levels are calculated to be approximately 52 dBA Ldn at a distance of 50-feet from the engine/exhaust (i.e., cab of the truck). With the site configuration including a 10-foot setback at the eastern property line and the length of the tractor-trailer, the engine/exhaust would be located at least 65-feet from the eastern property line. An attenuation rate of 6 dB /DD would result in on-site truck movement sound pressure levels ranging from approximately 33 to 41 dBA Ldn within the outdoor activity area of the adjacent noise-sensitive uses. Proposed project noise levels would be further reduced by the shielding provided by the intervening structures, as the outdoor activity areas are located interior to the complexes. Therefore, on-site truck movement are predicted to comply with the City of Morgan Hill maximum noise level standards as presented in Policy SSI-8.1 of the General Plan.

On-site truck movements associated with the proposed project have been calculated to produce sound pressure levels less than 41 dBA Ldn at the outdoor activity areas of the adjacent noise-sensitive land uses. Based on the existing ambient noise level of 61.1 dBA Ldn, the proposed project would result in an increase of less than one-tenth of a decibel at the outdoor activity area. Therefore, the fleet maintenance operations associated with the proposed project would comply with the City of Morgan Hill significant increase criteria, as outlined in Policies SSI-8.5 and SSI-8.6 of the General Plan.

4.3 Off-Site Traffic Noise Levels

Current trucking operations performed at the existing THBA facility include 6 to 8 trucks arriving and departing 2 to 3 times per day, generating approximately 24 to 48 one-way heavy truck trips per day on area roadways. The proposed project would have the potential to facilitate 12 heavy trucks operating out of the facility, potentially generating up to 72 one-way heavy truck trips per day on area roadways. Conservatively, this analysis will assume that the proposed project would have the potential to generate 48 additional heavy truck trips on area roadways per day.

During the ambient noise monitoring survey the ambient noise environment was notably dominated by vehicular traffic noise generated from Butterfield Boulevard, resulting in a day-night noise level of 61.1 dBA Ldn at the eastern project boundary. Traffic noise levels in the project area were modeled based on the Federal Highway Administration (FHWA) traffic noise prediction model algorithms (TNM 2.5) and City of Morgan Hill average daily traffic volumes (Morgan Hill 2015). Based on the City of Morgan Hill average daily traffic volumes for Butterfield Boulevard, and standardized vehicle mix assumptions, 48 additional heavy truck trips would result in a 0.2 dBA Ldn increase in traffic noise. Therefore, the proposed project is not predicted to generate a significant increase in traffic noise levels on project area roadways and is predicted to comply with the City of Morgan Hill General Plan Policy SSI-8.5.

4.4 Groundborne Vibration

Construction activities on the project site may result in varying degrees of temporary groundborne vibration or noise, depending on the specific construction equipment used and operations involved. Representative groundborne vibration levels for various types of construction equipment, developed by FTA, are summarized below in the Table 2. Pile driving and blasting is not currently expected to be utilized in the construction of the elements of the proposed project. As shown in Table 2, heavier pieces of construction equipment, such as a bulldozer that may be expected on the project site, have been documented to generate peak particle velocities of approximately 0.089 in./sec. PPV or less at a reference distance of 25 feet (DOT 2006).

Groundborne vibration attenuates rapidly, even over short distances. The attenuation of groundborne vibration as it propagates from source to receptor through intervening soils and rock strata can be estimated with expressions found in FTA and Caltrans guidance. Using standard FTA vibration attenuation formulas, non-pile driving construction activities would exceed the FTA/Caltrans recommended threshold of significance of 0.2 in/sec. PPV at a distance of 15-feet or less. It is unlikely that heavy construction equipment would operate within 15 feet of any sensitive receptor, as buildings associated with the existing sensitive receptors are located approximately 70-feet or more from their respective property lines, proposed project boundaries and construction areas.

It is notable that ground-borne vibrations from construction activities do not often reach the levels that can damage structures or affect activities that are not vibration sensitive, although the vibrations may be felt by nearby persons in close proximity and result in annoyance (FTA 2018).

Table 2. Representative Vibration Levels for Construction Equipment

Equipment		PPV at 25 feet (in/sec)[1,3]	Approximate Lv (VdB) at 25 feet[2]
Pile Driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile Driver (vibratory/sonic)	Upper range	0.734	105
	Typical	0.170	93
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Heavy-duty Trucks (Loaded)		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

Notes:
1. Where PPV is the peak particle velocity.
2. Where Lv is the RMS velocity expressed in vibration decibels (VdB), assuming a crest factor of 4.
3. Vibration levels can be approximated at other locations and distances using the above reference levels and the following equation: $PPVequip = PPVref\ (25/D)^{1.5}$ (in/sec); where "PPV ref" is the given value in the above table, "D" is the distance for the equipment to the new receiver in feet.

Source: DOT 2006

Long-term operation of the proposed project does not include elements or equipment that are known to generate ground-borne vibration. Heavy truck traffic can generate groundborne vibration, which varies considerably depending on vehicle type, weight, and pavement conditions. However, provided that roadway surfaces are maintained in good repair, groundborne vibration levels generated from vehicular traffic are not typically perceptible outside of the roadway right-of-way. As such, groundborne vibration associated with the proposed project is considered less than significant.

5 Conclusion

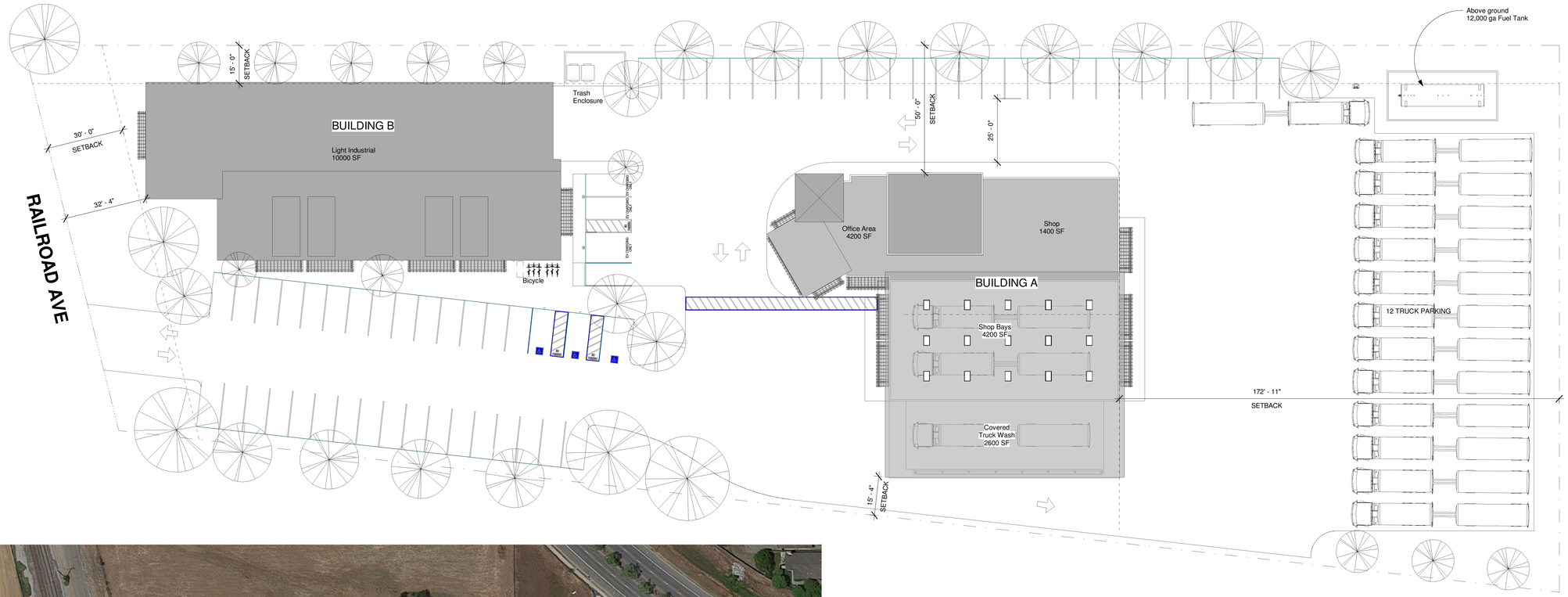
THBA Trucking is proposing to renovate a commercial/industrial parcel located at 16500 Railroad Avenue in Morgan Hill, CA. The proposed Project would construct a truck freight terminal and light industrial building on the parcel. THBA Trucking would operate the truck freight terminal in "Building A" on the eastern portion of the proposed Project site. Dudek performed an acoustical analysis to address concerns with the proposed Project's effect on the existing noise environment and surrounding noise-sensitive receptors.

As part of the analysis, Dudek conducted an existing ambient noise monitoring survey to characterize the existing noise environment in the Project vicinity and to quantify source noise levels from the existing truck freight terminal operations, located immediately adjacent to the norther project boundary. Traffic noise levels were found to be the primary source of ambient noise in the existing noise environment of the proposed Project area. Existing ambient noise levels measured adjacent to the neighboring residential property line were approximately 52 dBA during the short-term monitoring period, with 24-hour hourly average noise levels ranging from 48 to 61 at the long-term monitoring location.

Primary noise sources associated with the operation of the proposed Project are anticipated to include fleet maintenance and light mechanical work inside the Building A maintenance bays and on-site truck movement and parking activities. Sound levels associated with fleet maintenance and light mechanical activities were documented to be less than 51 dBA at the existing truck freight terminal. Due to the proposed Project's site configuration and property line noise barrier, the fleet maintenance and light mechanical activity sound levels are calculated to be reduced by 8 to 9 dB in comparison to existing operations; resulting in noise levels calculated to be less than 43 dBA at the noise-sensitive residential property line. Therefore, fleet maintenance and light mechanical operations are predicted to comply with the City of Morgan Hill maximum noise level standards as presented in General Plan Policy SSI-8.1 and the Code of Ordinance Performance Standards.

The proposed Project site plan provides parking stalls for 12 trucks along the eastern property line. Sound pressure levels generated by arrival and departure of the THBA Truck fleet were measured to have an SEL of 76 dBA and 78 dBA respectively. Assuming all 12 trucks arrive and depart in three (3) shifts across a 24-hour period, on-site truck movements and parking activities are calculated to generate a day-night average noise level of 39 dBA Ldn at the noise-sensitive residential property line. Therefore, on-site truck movement are predicted to comply with the City of Morgan Hill maximum noise level standards as presented in General Plan Policy SSI-8.1 and the Code of Ordinance Performance Standards.

Given the limited duration and intermittent nature of both of the primary noise generating components of the proposed Project, the likelihood for the separate elements to result in a combined elevated level is minimal; however, if the noise sources were to become coincident, cumulative project noise levels are calculated to be approximately 45 dBA Ldn or less at the noise-sensitive residential property line. Therefore, the overall proposed Project is predicted to comply with the City of Morgan Hill maximum noise level standards as presented in General Plan Policy SSI-8.1 and the Code of Ordinance Performance Standards



Parking Analysis	
Type	Count
Accessible Space - Standard	2
Accessible Space - Van	1
EVCS - Standard	2
EVCS - Van	1
Parking Space	60
66	

LOT AREA: 115, 728 SF (2.66 AC)
BLDG AREA: 20,490 SF
FAR : 19.36 %

hpc architecture, inc.
Steven M. Cox, A.I.A., Architect
2216 The Alameda
Santa Clara, California 95050-6034
408. 297. 5454 / www.hpc-arch.com

SITE PLAN

For AU Energy

AU Energy

16500 Railroad Ave,
Morgan Hill, CA

SD1

9/6/2019 1:19:42 PM

INTENTIONALLY LEFT BLANK

Appendix A

Acoustic Fundamental and Terminology

Acoustic Fundamentals

Acoustics is the scientific study that evaluates perception, propagation, absorption, and reflection of sound waves. Sound is a mechanical form of radiant energy, transmitted by a pressure wave through a solid, liquid, or gaseous medium. Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise; consequently, the perception of sound is subjective in nature, and can vary substantially from person to person. Common sources of environmental noise and relative noise levels are shown in Figure A-1.

A sound wave is initiated in a medium by a vibrating object (e.g., vocal chords, the string of a guitar, the diaphragm of a radio speaker). The wave consists of minute variations in pressure, oscillating above and below the ambient atmospheric pressure. The number of pressure variation cycles occurring per second is referred to as the frequency of the sound wave and is expressed in hertz (Hz), which is equivalent to one complete cycle per second.

Directly measuring sound pressure fluctuations would require the use of a very large and cumbersome range of numbers. To avoid this and have a more useable numbering system, the decibel (dB) scale was introduced. Sound level expressed in decibels (dB) is the logarithmic ratio of two like pressure quantities, with one pressure quantity being a reference sound pressure and the second pressure being that of the sound source of concern. For sound pressure in air, the standard reference quantity is generally considered to be 20 micropascals, which directly corresponds to the threshold of human hearing. The use of the decibel is a convenient way to handle the million-fold range of sound pressures to which the human ear is sensitive. A decibel is logarithmic; it does not follow normal algebraic methods and cannot be directly added. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound level increase of 10 dB corresponds to 10 times the acoustical energy, and an increase of 20 dB equates to a 100-fold increase in acoustical energy.

The loudness of sound perceived by the human ear depends primarily on the overall sound pressure level and frequency content of the sound source. The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed. The standard weighting networks are identified as A through E. There is a strong correlation between the way humans perceive sound and A-weighted sound levels (dBA). For this reason, the dBA can be used to predict community response to noise from the environment, including noise from transportation and stationary sources. Sound levels expressed as dB in this section are A-weighted sound levels, unless noted otherwise.

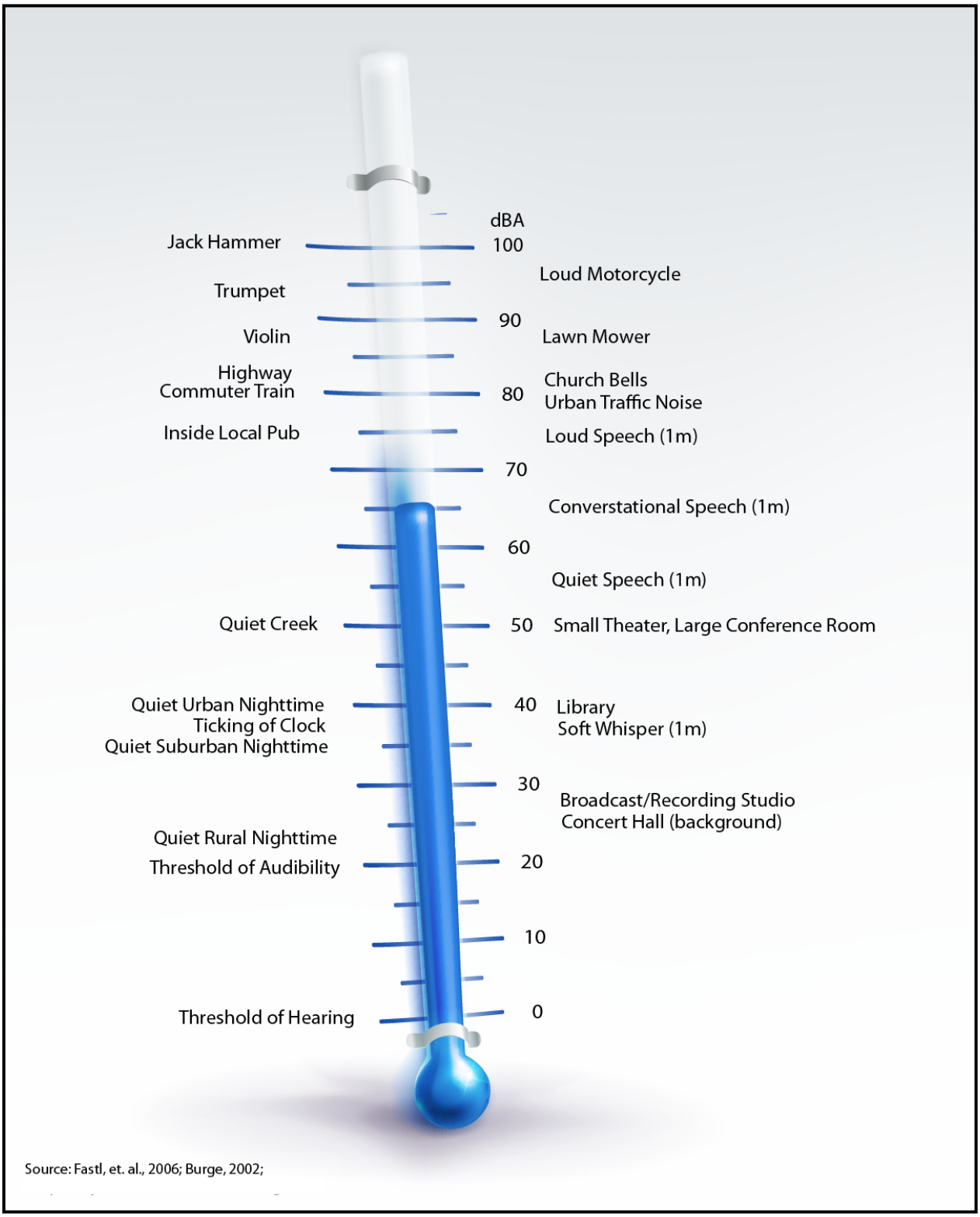


Figure A-1 -Common Noise Sources and Levels.

Noise can be generated by a number of sources, including mobile sources (transportation noise) such as automobiles, trucks, and airplanes and stationary sources (non-transportation noise) such as construction sites, machinery, and commercial and industrial operations. As acoustic energy spreads through the atmosphere from the source to the receiver, noise levels attenuate (decrease) depending on ground absorption characteristics, atmospheric conditions, and the presence of physical barriers (e.g., walls, building façades, berms). Noise generated from mobile sources generally attenuate at a rate of 3dBA (typical for hard surfaces, such as asphalt) to 4.5 dBA (typical for soft surfaces, such as grasslands) per doubling of distance, depending on the intervening ground type. Stationary noise sources spread with more spherical dispersion patterns that attenuate at a rate of 6 to 7.5 dBA per doubling of distance for hard and soft sites, respectively.

Atmospheric conditions such as wind speed, turbulence, temperature gradients, and humidity may additionally alter the propagation of noise and affect levels at a receiver. Furthermore, the presence of a large object (e.g., barrier, topographic features, and intervening building façades) between the source and the receptor can provide significant attenuation of noise levels at the receiver. The amount of noise level reduction or "shielding" provided by a barrier primarily depends on the size of the barrier, the location of the barrier in relation to the source and receivers, and the frequency spectra of the noise. Natural barriers such as berms, hills, or dense woods as well as man-made features such as buildings, berms and walls may be effective barriers for the reduction of source noise levels.

Noise Level Descriptors

The intensity of environmental noise levels can fluctuate greatly over time and as such, several different descriptors of time-averaged noise levels may be used to provide the most effective means of expressing the noise levels. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the environment near the receptor(s). Noise descriptors most often used to describe environmental noise are defined below.

Lmin (Minimum Noise Level): The minimum noise level during a specific period of time, while accounting for the appropriate weighting curve and response setting (i.e., A-weighted, slow).

Lmax (Maximum Noise Level): The maximum instantaneous noise level during a specific period of time, while accounting for the appropriate weighting curve and response setting (i.e., A-weighted, slow).

SEL (Sound Exposure Level): The cumulative exposure to sound energy over a stated period of time.

Ln (Statistical Descriptor): The noise level exceeded "n"% of a specific period of time. For example, L50 is the median noise level, or level exceeded 50% of the time (typically equated to the noise level exceeded 30-minutes out of the hour).

Leq (Equivalent Noise Level): The energy-average noise level or exposure, from all noise events that occur in a specified period; such as one-minute, one-hour, 24-hours, etc. Leq can be used to report results of short-term noise measurements, usually ranging between 15 minutes and 1 hour, to supplement longer term measurements.

Ldn (Day-Night Average Noise Level): The 24-hour Leq with a 10-dBA "penalty" for noise events that occur during the noise-sensitive hours between 10 p.m. and 7 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours, and this generates a higher reported noise level when determining compliance with noise standards. The Ldn attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

CNEL (Community Noise Equivalent Level): The CNEL is similar to the Ldn described above, but with an additional 5-dBA "penalty" added to noise events that occur during the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. When the same 24-hour noise data are used, it is typical for the reported CNEL to be approximately 0.5 dBA higher than the Ldn.

Community noise is commonly described in terms of the ambient noise level which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent sound level (Leq)which corresponds to the steady-state A-weighted sound level containing the same total energy as the time-varying signal over a given time period (usually one hour). The Leq is the foundation of the composite noise descriptors such as Ldn and CNEL, as defined above, and shows very good correlation with community response to noise. Use of these descriptors along with the maximum noise level occurring during a given time period provides a great deal of information about the ambient noise environment in an area.

Effect of Noise on Humans

Excessive and chronic exposure to elevated noise levels can result in auditory and non-auditory effects on humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavioral and physiological effects. The non-auditory behavioral effects of noise on humans are associated primarily with the subjective effects of annoyance, nuisance and dissatisfaction, which lead to interference with activities such as communications, sleep and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research infers that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise environments is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment an individual has become accustomed to, the less tolerable the new noise source will be to an individual.

With respect to how humans perceive and react to changes in noise levels, a 1 dBA increase is generally imperceptible outside of a laboratory environment, a 3 dBA increase is barely perceptible, a 6 dBA increase is clearly noticeable, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). These subjective reactions to changes in noise levels was developed on the basis of test subjects' reactions to changes in the levels of steady-state, pure tones or broad-band noise and to changes in levels of a given noise source. Perception and reaction to changes in noise levels in this manner is thought to be most applicable in the range of 50 to 70 dBA, as this is the usual range of voice and interior noise levels.

Vibration Fundamentals

Vibration is similar to noise in that it is a pressure wave traveling through an elastic medium involving a periodic oscillation relative to a reference point. Vibration is most commonly described in respect to the excitation of a structure or surface, such as in buildings or the ground. Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions, impacts). Vibration levels can be depicted in terms of amplitude and frequency; relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal, or the quantity of displacement measured from peak to trough of the vibration wave. Root-mean-square is defined as the positive and negative statistical measure of the magnitude of a varying quantity. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a period of one second. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (Federal Transit Administration [FTA] 2006, California Department of Transportation [Caltrans] 2004). PPV and RMS vibration velocity are nominally described in terms of inches per second (in/sec). However, as with airborne sound, vibration velocity can also be expressed using decibel notation as vibration decibels (VdB). The logarithmic nature of the decibel serves to compress the broad range of numbers required to describe vibration and allow for the presentation of vibration levels in familiar terms.

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. Human response to vibration has been found to correlate well to average vibration amplitude; therefore, vibration impacts on humans are evaluated in terms of RMS vibration velocity.

Typical outdoor sources of perceptible groundborne vibration include construction equipment, steel-wheeled trains, and traffic on rough roads. Although the effects of vibration may be imperceptible at low levels, effects may result in detectable vibrations and slight damage to nearby structures at moderate and high levels, respectively. At the elevated levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely results in damage to structural components. The range of vibration relevant to this analysis occurs from approximately 60 VdB, which is the typical background vibration-velocity level; to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings (FTA 2006).

Appendix B

Monitoring Data

Appendix B-1
Long-Term 24 Hour Continuous Noise Monitoring

Project: **Railroad Avenue Truck Freight Terminal**
Date: November 19, 2019 to November 20, 2019
Site: LT-01

Hour	Leq	Lmax	L50	L90
9:00	52.1	72.6	50.3	47.3
10:00	55.2	78.4	50.6	47.7
11:00	52.2	67.5	51.5	48.5
12:00	54.3	63.5	53.8	51.6
13:00	54.3	72.7	52.7	49.6
14:00	54.6	68.8	53.3	49.7
15:00	53.2	66.5	52.1	48.8
16:00	59.0	83.2	52.3	48.5
17:00	53.3	69.0	51.2	47.3
18:00	52.0	68.9	49.3	45.7
19:00	53.2	65.9	51.5	46.4
20:00	60.7	84.9	54.7	51.8
21:00	55.0	58.4	54.9	54.5
22:00	54.8	64.7	54.7	53.9
23:00	54.7	69.8	54.5	53.9
0:00	57.2	84.5	54.4	53.6
1:00	55.4	73.9	54.2	53.4
2:00	54.2	61.6	54.1	52.9
3:00	53.1	62.3	52.9	49.7
4:00	53.2	68.7	52.6	49.7
5:00	53.7	67.7	52.5	48.6
6:00	53.1	66.0	51.7	48.0
7:00	50.4	69.2	49.0	46.6
8:00	48.0	64.3	46.9	45.3

Lowermost Level

	Leq	Lmax	L50	L90
Daytime (7 a.m. - 10 p.m.)	48.0	58.4	46.9	45.3
Nighttime (10 p.m. - 7 a.m.)	53.1	61.6	51.7	48.0

Average Level

	Leq	Lmax	L50	L90
Daytime (7 a.m. - 10 p.m.)	55.0	70.3	51.6	48.6
Nighttime (10 p.m. - 7 a.m.)	54.6	68.8	53.5	51.5

Uppermost-Level

	Leq	Lmax	L50	L90
Daytime (7 a.m. - 10 p.m.)	60.7	84.9	54.9	54.5
Nighttime (10 p.m. - 7 a.m.)	57.2	84.5	54.7	53.9

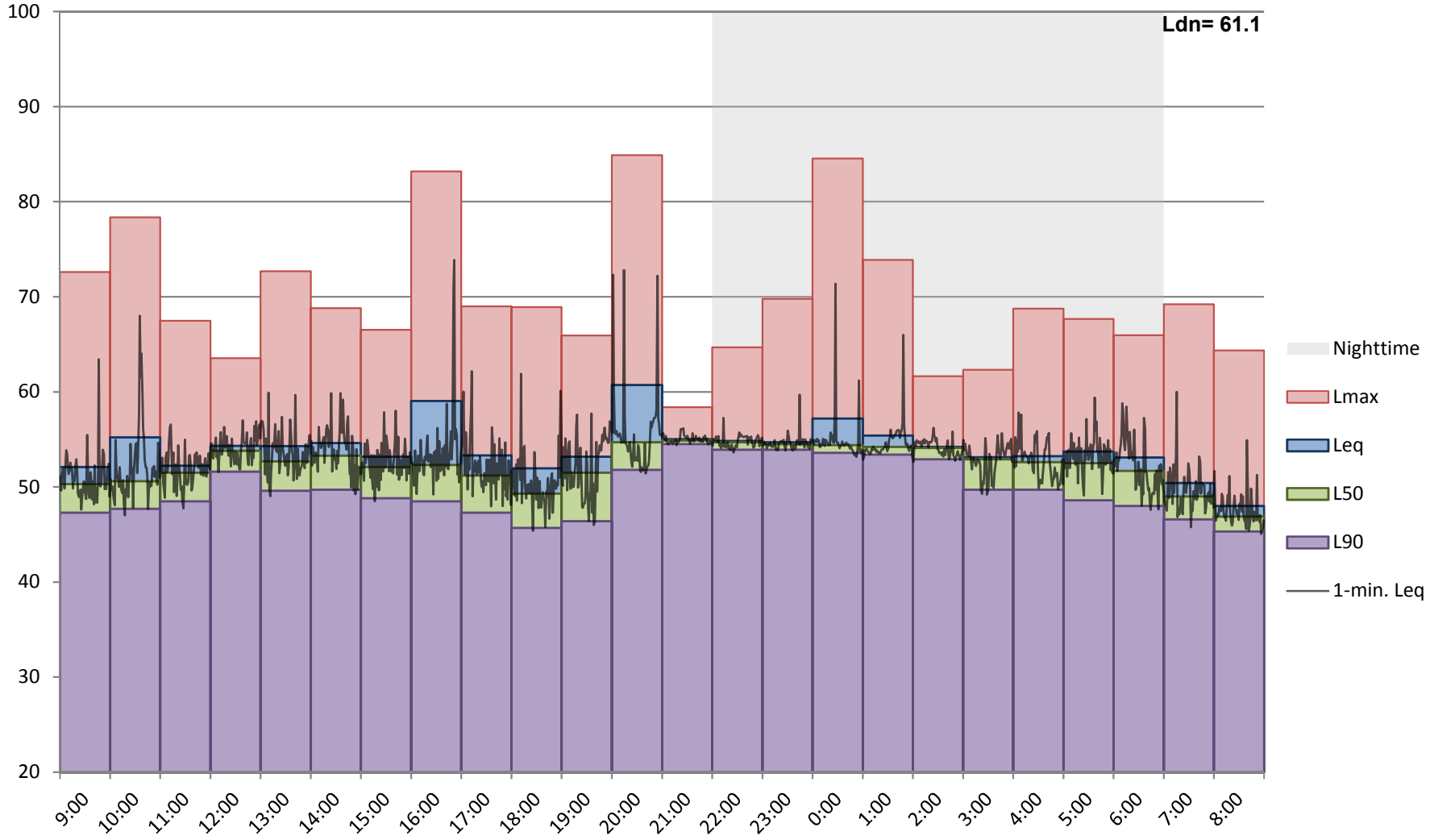
Energy Distribution

Daytime	65%
Nighttime	35%

Calculated L_{dn}, dBA

61.1

Appendix B-1

Railroad Avenue Truck Freight Terminal - LT-01

November 19, 2019 to November 20, 2019