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March 10, 2023 **Job No. 4-423-0090**

Ms. Tenea Davis
Manteca 18, LLC
1925 Village Center Circle, Suite 150
Las Vegas, NV 89314

SUBJECT: **NOISE IMPACT STUDY**
Proposed Crossroads Plaza
2064 North Union Road
Manteca, California

Dear Ms. Davis:

A Noise Impact Study for the above-referenced project located at 2064 North Union Road in the City of Manteca, California (subject property) was conducted. The proposed project involves the construction of an approximately 5,200 square-foot convenience store with a 6-pump fueling dispensers, a 6,816 square-foot retail space and includes parking for 48 spaces.

The Noise Impact Study is an analysis of the proposed project's potential noise and vibration impacts associated with the construction of the project, as well as long-term noise impacts associated with the operation of the proposed project. The Noise Study was prepared utilizing the City of Manteca General Plan Safety Element, and Noise Ordinance from the Municipal Code.

Please refer to Section 7.0 Future Noise Environmental Impacts and Mitigation, and Section 8.0 Construction Noise Impacts for detailed information pertaining to the proposed project temporary construction noise impacts, as well as long-term operational noise impacts. However, based on the noise impact analysis, impacts associated with off-site traffic noise, on-site traffic noise, off-site receptors from stationary noise sources, and construction noise and vibration are not significant, and mitigation is not required.

We appreciate the opportunity to assist you with this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (909) 980-6455.

Respectfully submitted,

SALEM Engineering Group, Inc.

Maria G. Ruvalcaba, EP
Project Manager

Crossroads Plaza
Noise Impact Study
City of Manteca, CA

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Date: 3/10/2023

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1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate the potential noise impacts for the project study area and to recommend noise mitigation measures, if necessary, to minimize the potential noise impacts. The assessment was conducted and compared to the noise standards set-forth by the Federal, State and Local agencies. Consistent with the City's Noise Guidelines, the project must demonstrate compliance to the applicable noise criterion as outlined within the City of Manteca Noise Element and Municipal Code.

The following is provided in this report:

- A description of the study area and the proposed project;
- Information regarding the fundamentals of noise;
- A description of the local noise guidelines and standards;
- An analysis of traffic noise impacts to the sensitive receptors and the project site; and
- An analysis of construction noise impacts.

1.2 Site Location and Study Area

The Crossroads Plaza Commercial Development (Project) site is located at 2064 North Union Road in the City of Manteca, CA. See Exhibit A for the location. Land zoning directly surrounding the Project site include residential to the east, south, and southwest, commercial to the west, and Specific Plan to the north. W Lathrop Rd is to the north and North Union Rd is to the west.

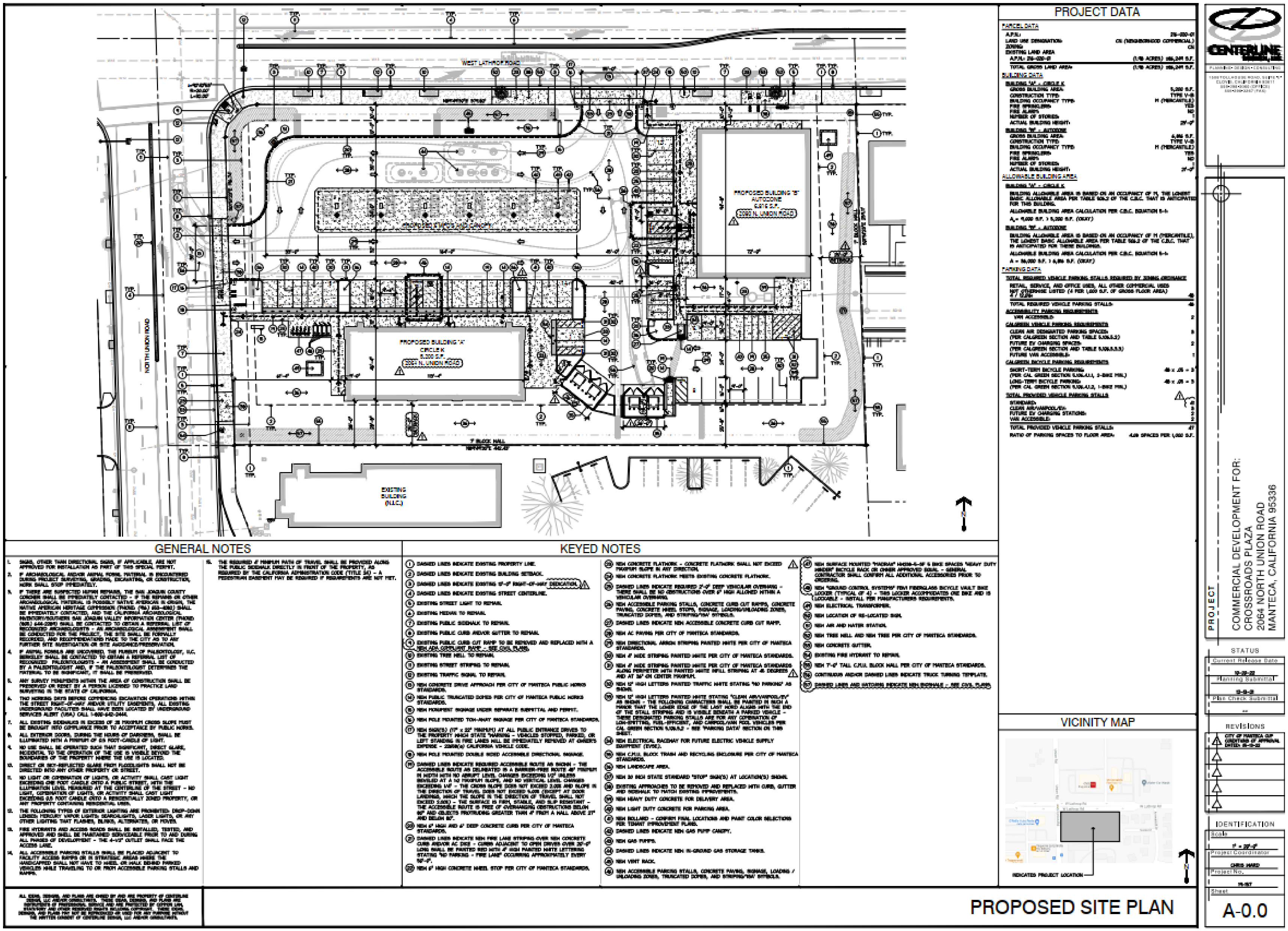
1.3 Proposed Project Description

The proposed Project consists of the construction and operation of a commercial development. The Project proposes to construct a 5,200 square foot convenience store with 6-pump fueling dispensers, a 6,816 square foot retail space (AutoZone) and approximately 48 parking spaces on 1.98 acres. The site plan is shown in Exhibit B.

Exhibit A

Location Map

Exhibit B
Site Plan



2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

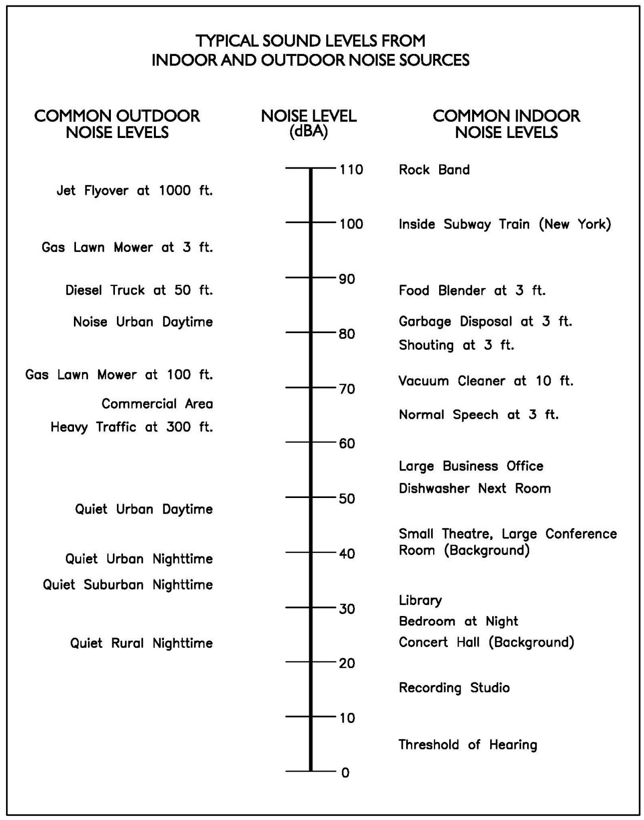
2.1 Sound, Noise and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic, or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.

2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding) and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting out at 20 Hz all the way to the high pitch of 20,000 Hz.

Exhibit C: Typical A-Weighted Noise Levels



2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines it loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measure in units of micro-Newton per square inch meter (N/m2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels abbreviated dB. Exhibit C illustrates references sound levels for different noise sources.

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Sensitive Receptors

Noise-sensitive land uses include residential (single and multi-family dwellings, mobile home parks, dormitories, and similar uses); transient lodging (including hotels, motels, and similar uses); hospitals, nursing homes, convalescent hospitals, and other facilities for long-term medical care; public or private educational facilities, libraries, churches, and places of public assembly.

2.6 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, (A-weighted scale) and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive the change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g. doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

Table 1: Decibel Changes and Loudness

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud
Source: https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm	

2.7 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00

PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly, L50, L90 and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

2.8 Traffic Noise Prediction

Noise levels associated with traffic depends on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2 axle) and heavy truck percentage (3 axle and greater), and sound propagation. The greater the volume of traffic, higher speeds and truck percentages equate to a louder volume in noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.9 Sound Propagation

As sound propagates from a source it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity and turbulence can further impact have far sound can travel.

3.0 Ground-Bourne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV) which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation. As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

4.0 Regulatory Setting

The proposed project is located in the City of Manteca and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible to regulate noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible to regulate noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdiction use their land use regulatory authority to arrange new development in such a way that “noise sensitive” uses are either prohibited from being constructed adjacent to a highway or, or alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the City is restricted to regulating the noise generated by the transportation system through nuisance abatement Codes and land use planning.

4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix.” The matrix allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24 and the Uniform Building Code (UBC) which in some cases requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan.

The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable.

4.3 City of Manteca Noise Regulations

The City of Manteca outlines their noise regulations and standards within the Safety Element from the General Plan and the Noise Ordinance from the Municipal Code.

City of Manteca General Plan

Applicable policies and standards governing environmental noise in the City of Manteca are set forth in the General Plan Safety Element. The land use compatibility guidelines are shown in Exhibit D.

Exhibit D: Land Use Compatibility Guidelines

Table S-1: Maximum Allowable Noise Exposure from Mobile Noise Sources

Land Use[1]	Outdoor Activity Areas[2,3]	Interior Spaces	
		Ldn/ CNEL, dBA	Leq, dBA[4]
Residential	60	45	-
Motels/Hotels	65	45	-
Mixed-Use	65	45	
Hospitals, Nursing Homes	60	45	-
Theaters, Auditoriums	-	-	35
Churches	60	-	40
Office Buildings	65	-	45
Schools, Libraries, Museums	70	-	45
Playgrounds, Neighborhood Parks	70	-	-
Industrial	75	-	45
Golf Courses, Water Recreation	70	-	-

[1]Where a proposed use is not specifically listed, the use shall comply with the standards for the most similar use as determined by the City.

[2]Outdoor activity areas for residential development are considered to be the back yard patios or decks of single family units and the common areas where people generally congregate for multi-family developments. Where common outdoor activity areas for multi-family developments comply with the outdoor noise level standard, the standard will not be applied at patios or decks of individual units provided noise-reducing measures are incorporated (e.g., orientation of patio/deck, screening of patio with masonry or other noise-attenuating material). Outdoor activity areas for non-residential developments are the common areas where people generally congregate, including pedestrian plazas, seating areas, and outside lunch facilities; not all residential developments include outdoor activity areas.

[3]In areas where it is not possible to reduce exterior noise levels to achieve the outdoor activity area standard w using a practical application of the best noise-reduction technology, an increase of up to 5 Ldn over the standard will be allowed provided that available exterior noise reduction measures have been implemented and interior noise levels are in compliance with this table

[4]Determined for a typical worst-case hour during periods of use.

In addition to the noise standards, the City has outlined goals, policies and implementation measures to reduce potential noise impacts and are presented below:

Goals, Policies, and Implementation Measures

The City utilizes the following General Plan Noise Element goal, policies and implementation measures to assess evaluate the project's suitability in light of noise impacts.

Goal S-6 Protect the quality of life by protecting the community from harmful and excessive noise.

Policies

S-6.3 Areas within Manteca exposed to existing or projected exterior noise levels from mobile noise sources exceeding the performance standards in Table S-1 (Exhibit D in this report) shall be designated as noise-impacted areas.

S-6.4 Require residential and other noise-sensitive development projects to satisfy the noise level criteria in Tables S-1 and S-2 (Table 2 in this report).

Table 2: Performance Standards for Stationary Noise Sources, Including Affected Projects

Noise Level Descriptor	Daytime 7 am to 10 pm	Nighttime 10 pm to 7 am
Hourly Leq, dBA	55	45
Notes: 1. Each of the noise levels specified above should be lowered by 5 dB for simple noise tones, noises consisting primarily of speech or music, or recurring impulsive noises. Such noises are generally considered to be particularly annoying and are a primary source of noise complaints.		

S-6.5 Require new stationary noise sources proposed adjacent to noise sensitive uses to incorporate noise-attenuating measures so as to not exceed the noise level performance standards in Table S-2, or a substantial increase in noise levels established through a detailed ambient noise survey.

S-6.6 Regulate construction-related noise to reduce impacts on adjacent uses to the criteria identified in Table S-2 or, if the criteria in Table S-2 cannot be met, to the maximum level feasible using best management practices and complying with the MMC Chapter 9.52.

S-6.7 Where the development of residential or other noise-sensitive land use is proposed for a noise-impacted area or where the development of a stationary noise source is proposed in the vicinity of noise sensitive uses, an acoustical analysis is required as part of the development review process so that noise mitigation may be considered in the project design. The acoustical analysis shall:

- Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources.
- Estimate existing and projected (20 years) noise levels in terms of the standards of Table S-1 or Table S-2, and compare those levels to the adopted policies of the Noise Element.
- Recommend appropriate mitigation measures to achieve compliance with the adopted policies and standards of the Noise Element.
- Estimate noise exposure after the prescribed mitigation measures have been implemented.

S-6.8 Apply noise level criteria applied to land uses other than residential or other noise-sensitive uses consistent with noise performance levels of Table S-1 and Table S-2.

S-6.15 Recognizing that existing noise-sensitive uses may be exposed to increase noise levels due to circulation improvement projects associated with development under the General Plan and that it may not be feasible to reduce increased traffic noise levels to the criteria identified in Table S-1, the following criteria may be used to determine the significance of noise impacts associated with circulation improvement projects:

- Where existing traffic noise levels are less than 60 dB Ldn at the outdoor activity areas of noise-sensitive uses, a +5 dB Ldn increase in noise levels due to roadway improvement projects will be considered significant; and
- Where existing traffic noise levels range between 60 and 65 dB Ldn at the outdoor activity areas of noise-sensitive uses, a +3 dB Ldn increase in noise levels due to roadway improvement projects will be considered significant; and
- Where existing traffic noise levels are greater than 65 dB Ldn at the outdoor activity areas of noise-sensitive uses, a + 1.5 dB Ldn increase in noise levels due to roadway improvement projects will be considered significant.

Implementation

S-6a Require an acoustical analysis that complies with the requirements of S-6.7 where:

- Noise sensitive land uses are proposed in areas exposed to existing or projected noise levels exceeding the levels specified in Table S-1 or S-2.
- Proposed transportation projects are likely to produce noise levels exceeding the levels specified in Table S-1 or S-2 at existing or planned noise sensitive uses.

S-6c Update the City's Noise Ordinance (Chapter 9.52) to reflect the noise standards established in this Noise Safety Element and proactively enforce the City's Noise Ordinance, including requiring the following measures for construction:

- Restrict construction activities to the hours of 7:00 a.m. to 7:00 p.m. on Monday through Friday, and 8:00 a.m. to 6:00 p.m. on Saturdays. No construction shall be permitted outside of these hours or on Sundays or federal holidays, without a specific exemption issued by the City. No exemption shall be issued for construction within 200 feet of residential uses.
- A Construction Noise Management Plan shall be submitted by the applicant for construction projects that exceed ambient noise levels by more than 12dBA or produce perceptible vibrations at any off-site structures. The Construction Noise Management Plan shall include proper posting of construction schedules, appointment of a noise disturbance coordinator, methods for assisting in noise reduction measures, and shall establish allowed truck routes to access the site that minimize exposure of residential areas to heavy truck traffic.
- Noise reduction measures shall include, but are not limited to, the following:
    a. Equipment and trucks used for project construction shall utilize the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically attenuating shields or shrouds) wherever feasible.
    b. Except as provided herein, impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically or electrically powered to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used. This muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves shall be used, if such jackets are commercially available. This would achieve a reduction of up to 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
    c. Temporary power poles or zero-emission power sources shall be used instead of generators where feasible.

d. Stationary noise sources shall be located as far from adjacent properties as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the City to provide equivalent noise reduction.

e. The noisiest phases of construction shall be limited to less than 10 days at a time. Exceptions may be allowed if the City determines an extension is necessary and all available noise reduction controls are implemented.

f. Delivery of materials shall observe the hours of operation described above.

g. Truck traffic shall avoid residential areas to the greatest extent feasible.

S-6d In making a determination of impact under the California Environmental Quality Act (CEQA), a substantial increase will occur if ambient noise levels have a substantial increase. Generally, a 3 dB increase in noise levels is barely perceptible, and a 5 dB increase in noise levels is clearly perceptible. Therefore, increases in noise levels shall be considered to be substantial when the following occurs:

Transportation Noise

- When existing noise levels are less than 60 dB, a 5 dB increase in noise will be considered substantial;
- When existing noise levels are between 60 dB and 65 dB, a 3 dB increase in noise will be considered substantial;
- When existing noise levels exceed 65 dB, a 1.5 dB increase in noise will be considered substantial.

Non-Transportation Noise

- A 5 dB increase in noise will be considered substantial.

Construction Noise

- An increase in 12 dB in noise in noise will be considered substantial.

S-6e Control noise at the source through use of insulation, berms, building design and orientation, buffer space, staggered operating hours, and similar techniques. Where such techniques would not meet acceptable levels, use noise barriers to attenuate noise associated with new noise sources to acceptable levels.

S-6f Require that all noise-attenuating features, including soundwalls and quieter pavements, are designed to be attractive and to minimize maintenance.

City of Manteca Municipal Code

Section 17.58.050 and Chapter 9.52 of the City's Municipal Code outlines the City's exterior noise limits as it relates to stationary noise sources.

9.52.040. Specific prohibited noises.

J. Commercial Establishments Adjacent to Residential Property. Notwithstanding any provision of this code to the contrary, continuous, repeated or sustained noise from the premises of any commercial establishment which is adjacent to one or more residential dwelling units, including any outdoor area part of or under the control of the establishment, between the hours of ten p.m. and eight a.m. that is plainly audible from the residential dwelling unit's property line.

K. Construction Equipment. The use or operation of any construction equipment between the hours of eight p.m. and seven a.m. and is sufficiently loud as to be plainly audible at the property line of the property from which the sound is emanating.

17.58.050. Noise Standards.

B. Noise Standards. The maximum sound level generated by any use or activity as measured at the point of measurement shall not exceed the levels established in Table 17.58.050-1 (Table 3 in this report) based on the use that is receiving the noise (e.g., residential use receiving noise generated by an industrial use).

Table 3: Maximum Permissible Sound Pressure Levels

Receiving Land Use Category	Maximum Allowable Noise Levels (Ldn/CNEL, dB)	
	10 pm - 7 am	7 am - 10 pm
Single-Family and Limited Multiple-Family	50	60
Multiple-Family, Public Institution, and Neighborhood Commercial	55	60
Medium and Heavy Commercial	60	65
Light Industrial	70	70
Heavy Industrial	75	75

C. Calculation. Exterior noise levels shall be measured with a sound level meter and associated octave band analyzer meeting the American National Standards Institute's standards S1.4-1971 for Type 1 or Type 2 sound level meters or an instrument and the associated recording and analyzing equipment that will provide equivalent data. When measuring the noise level, the corrections provided in Table 17.58.050-2 (Table 4 in this report) shall be applied.

Table 4: Noise Level Corrections

Category	Correction (dB)
Daytime operation only (7 a.m. - 7 p.m.)	+5
Noise source operates less than:	-
20% of any one-hour period	+5
5% of any one-hour period	+10
1% of any one-hour period	+15
Noise of impulsive character (e.g., hammering)	-5
Noise rising or falling in pitch or volume (e.g., hum, screech)	-5

E. Prohibited Activities. The following acts shall be a violation of this Chapter.

1. Construction Noise. Operating or causing the operation of tools or equipment on private property used in alteration, construction, demolition, drilling, or repair work daily between the hours of 7:00 p.m. and 7:00 a.m., so that the sound creates a noise disturbance across a residential property line, except for emergency work of public service utilities.

2. Loading and Unloading Activities. Loading, unloading, opening, closing, or other handling of boxes, crates, containers, building materials, garbage cans, or similar objects on private property between the hours of 10:00 p.m. and 7:00 a.m. in a manner to cause a noise disturbance.

3. Sweepers and Associated Equipment. Operating or allowing the operation of sweepers or associated sweeping equipment (e.g., blowers) on private property between the hours of 10:00 p.m. and 7:00 a.m. the following day in, or adjacent to, a Residential Zoning District.

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance to the Caltrans TeNS manual. All measurements equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). MD noise measurement procedures are presented below:

- Microphones for sound level meters were placed 5-feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of equipment, a wind screen was placed over the microphone
- Frequency weighting was set on “A” and slow response
- Results of the noise measurements were recorded on field data sheets
- During any short-term noise measurements any noise contaminations such as barking dogs, local traffic, lawn mowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Location

The noise monitoring location was selected to obtain a baseline of the existing noise environment. Two short-term noise measurement was conducted at the Project site. Appendix A includes photos, field sheet, and measured noise data. Exhibit E illustrates the location of the measurement.

5.3 SoundPLAN Noise Model (Operational Noise)

SoundPLAN acoustical modeling software was utilized to model project operational noise at nearby sensitive receptors. The SoundPLAN software utilizes algorithms (based on the inverse square law) to calculate noise level projections. It allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations. It also calculates noise level increases due to the reflection of noise from hard surfaces.

Measured and referenced sound level data was utilized to model the various stationary on-site noise sources associated with project operation, (i.e. idling trucks and parking movements).

Noise associated with proposed truck and automobile parking areas was modeled using the SoundPLAN parking tool. The AutoZone parking lot was modeled with a lot-wide average of 1 movement per space per hour. The pump and service station parking lot was modeled with a lot-wide average of 6 movements per space per hour. The model assumes that each building has a 12.5 ton HVAC rooftop unit. Modeling assumptions are summarized in Table 5. SoundPLAN noise modeling input and results are provided in Appendix B.

Table 5: SoundPLAN Modeling Assumptions

Noise Source	Source Type	Reference Level	Descriptor
Idling Truck	Point Source	74	Lp @ 10’
Car Start Up	Point Source	95	Lw
HVAC	Point Source	83	Lw
Pump/Service Station Parking	Area (Parking Tool)	6	Movements per hr
Auto Zone Parking	Area (Parking Tool)	1	Movements per hr
Source: See Appendix B.			

MD also calculated the impact of a backup beeper, assuming a beeper of 107 dBA Lw.

5.4 Traffic Noise Prediction Modeling

The FHWA Traffic Noise Prediction Model (FHWA-RD-77-108) was utilized to model future traffic noise levels on the project site and existing and existing plus project traffic noise volumes along roadways affected by project generated vehicle traffic. The FHWA model arrives at the predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL).

Project generated vehicle traffic will result in an incremental increase in ambient noise levels. To determine the project’s noise impact to the surrounding land uses, MD generated noise contours for existing ADT, and existing plus project conditions. Table 3 indicates the roadway parameters and vehicle distribution utilized for the modeling. Existing ADT data was taken from the Manteca General Plan November 2022 Environmental Impact Report from De Novo Planning Group. The existing traffic counts were provided by Fehr & Peers from 2020. Project ADT data was based on the CalEEMod prepared for this project. Noise contours are used to provide a characterization of sound levels experienced at a set distance from the centerline of a subject roadway. They are intended to represent a worst-case scenario and do not take into account structures, sound walls, topography, and/or other sound attenuating features which may further reduce the actual noise level. Noise contours are developed for comparative purposes and are used to demonstrate potential increases/decreases along subject roadways as a result of a project. The referenced traffic data and traffic noise calculation worksheets outputs are located in Appendix C.

- Roadway classification – (e.g. freeway, major arterial, arterial, secondary, collector, etc.),
- Roadway Active Width – (distance between the center of the outer most travel lanes on each side of the roadway)
- Average Daily Traffic Volumes (ADT), Speeds, Percentages of autos, medium and heavy trucks
- Roadway grade and angle of view
- Site Conditions (e.g. soft vs. hard)
- Percentage of total ADT which flows each hour through-out a 24-hour period

Table 6: Roadway Parameters and Vehicle Distribution

Roadway	Existing ADT[1]	Existing + Project ADT[2]	Speed (MPH)	Site Conditions
Lathrop Ave west of Sherwood Ave	19,300	21,426	45	Hard
Union Rd north of Crom St	17,500	19,626	45	Hard
Motor-Vehicle Type[3]	**Daytime % (7 AM to 7 PM)**	**Evening % (7 PM to 10 PM)**	**Night % (10 PM to 7 AM)**	**Total % of Traffic Flow**
Automobiles	77.5	12.9	9.6	89.4
Medium Trucks	84.8	4.9	10.3	2
Heavy Trucks	86.5	2.7	10.8	8.6

Notes:
[1] 2020 Fehr & Peers traffic counts.
[2] Project trip generation from the CalEEMod prepared for the Project.
[3] https://dot.ca.gov/programs/traffic-operations/census

5.5 Construction Noise Modeling

Construction noise associated with the proposed project was calculated utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Construction activities are anticipated to include four phases site preparation, grading, building construction, and paving.

Construction noise levels were calculated for each phase based on CalEEMod Air Quality Model assumptions provided by the project proponent. All equipment was assumed to be situated at the edge of the Project site closest to the sensitive receptor. Construction equipment typically moves back and forth across the site, so this is a conservative assumption. Construction worksheets are provided in Appendix D.

6.0 Existing Noise Environment

Two (2) 15-minute noise measurements were conducted at the project site in order to document the existing noise environment. The measurements include the Leq, Lmin, Lmax and other statistical data (e.g. L2, L8). The results of the noise measurements are presented in Table 7. Noise measurement field sheets are provided in Appendix A.

Table 7: Short-Term Noise Measurement Data (dBA)[1]

Location	Start Time	Stop Time	L_{EQ}	L_{MAX}	L_{MIN}	L_2	L_8	L_{25}	L_{50}	L_{90}
ST1	5:34 PM	5:49 PM	58.1	69.1	48.0	65.5	61.9	58.4	55.8	52.1
ST2	5:52 PM	6:07 PM	60.5	76.8	51.7	68.3	64.1	59.5	57.1	54.5

Notes:
1. Short-term noise monitoring locations are illustrated in Exhibit E.

The data presented in Table 7 and the field notes provided in Appendix A indicate that ambient noise levels in the project vicinity range 58 to 61 dBA Leq. The field data indicates that traffic on N Union Road and W Lathrop Road is the dominant source of noise.

Exhibit D

Measurement Locations

X = Measurement location

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts to sensitive receptors and to the project and compares the results to the City's Noise Standards. The analysis details the estimated exterior noise levels associated with traffic from adjacent roadway sources. The City has established different significance thresholds for different types of noise impacts.

7.1 Off-Site Traffic Noise Impact

The potential off-site noise impacts caused by the increase in vehicular traffic as a result of the project were calculated at a distance of 40 feet from affected road segments. Lathrop Avenue and Union Road are anticipated to have the largest increase in traffic due to the project. The total number of project trips was added to each road segment to calculate the worst-case change in noise level. The noise level at 40 feet both with and without project generated vehicle traffic was compared and the increase calculated. The distance to the 55, 60, 65, and 70 dBA CNEL noise contours are also provided for reference (Appendix C). Noise contours were calculated for the following scenarios and conditions:

- Existing Condition: This scenario refers to the existing traffic noise condition and is demonstrated in Table 8.
- Existing + Project Condition: This scenario refers to the existing plus project traffic noise condition and is demonstrated in Table 8.

As shown in Table 8, the addition of project generated vehicle traffic to Lathrop Avenue and Union Road would result in negligible increases in ambient noise levels and would not be significant.

Table 8: Change in Existing Noise Levels as a Result of Project Generated Traffic

Roadway	Segment	Modeled Noise Levels (dBA CNEL) at 40 feet from the Centerline			
		Existing without Project	Existing with Project	Change in Noise Level	Increase of 1.5 dB or more[2]
Lathrop Ave	West of Sherwood Ave	75.8	76.3	0.5	No
Union Rd	North of Crom St	75.2	75.7	0.5	No

Notes:
[1] FHWA roadway noise modeling worksheets provided in Appendix C.
[2] SP EIR significance threshold for existing levels greater than 65 dBA.

7.2 On-Site Traffic Noise Impact

Future noise levels associated with traffic were measured as shown in Table 8 in order to evaluate the project in light of the City's land use compatibility guidelines presented in Exhibit D of this report as they apply to future traffic noise impacts to the proposed project. The Project is currently within normally unacceptable for commercial uses. It will not change due to the increase in traffic levels due to the project. The proposed use is not noise sensitive as there are no proposed outdoor uses for employees or patrons. The impact is less than significant.

7.3 Noise Impacts to Off-Site Receptors Due to Stationary Noise Sources

Worst-case operational noise was modeled using SoundPLAN acoustical modeling software. Four (4) receptors representing adjacent residential uses and one (1) receptor representing commercial uses were modeled using the SoundPLAN noise model to evaluate the proposed project's operational impact. The model assumes that every fueling position is occupied with an idling truck. A receptor is denoted by a yellow dot. All yellow dots represent either an existing building, a property line, or a sensitive receptor. The results are in Table 9.

Project Operational Noise Levels

Worst-case "project only" exterior operational noise is presented on Exhibit F. Operational noise levels are expected to be 47 to 48 dBA at single-family residential receptors and will meet the City's 50 dBA nighttime noise limit (see Table 2). Operational noise levels at multiple-family residential receptors are expected to be 52 to 53 dBA and meets the City's 55 dBA nighttime noise limit. Noise levels are expected to be 60 dBA at the commercial receptor and will meet the City's nighttime noise standard of 60 dBA.

Project Plus Ambient Operational Noise Levels

Existing plus project noise level projections are anticipated to be 59 dBA Leq at multi-family residential receptors, 61 dBA at single-family residential receptors, and 62 dBA at the commercial receptor. Project generated operational noise is expected to result in a 1 dB increase in ambient noise levels at the south residential uses, a 0 dB increase at the east residential uses, and a 3 dB increase at the north commercial uses. A change in 1 dB is not perceptible, and a change of 3 dB is just perceptible (see Table 2). Thus, this impact would be less than significant. No mitigation is required.

Table 9: Operational Noise Levels (dBA Leq)

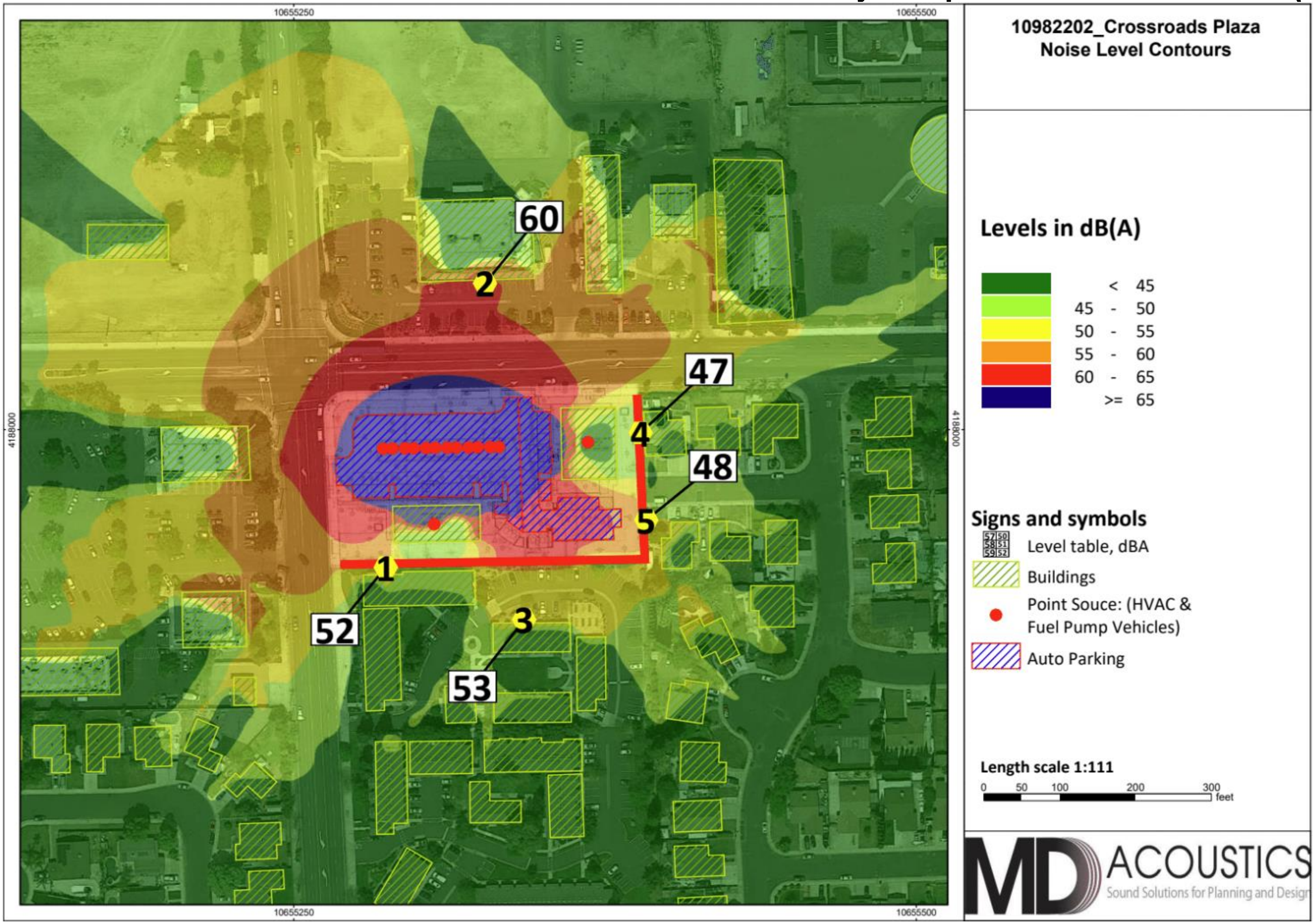
Receptor[1]	Existing Ambient Noise Level (dBA)[2]	Project Noise Level (dBA)[3]	Nighttime (10 p.m. - 7 a.m.) Non Transp. Noise Limit (dBA, Leq)	Total Combined Noise Level (dBA)	Change in Noise Level as Result of Project
R1	58	52	**55**	59	1
R2	61	60	**60**	64	3
R3	58	53	**55**	59	1
R4	61	47	**50**	61	0
R5	61	48	**50**	61	0

Notes:
1. Receptors 1 and 3 are single-family residential, Receptor 2 is commercial, and Receptors 4 and 5 are multiple-family residential.
2. See Appendix A for noise measurement field sheet.
3. See Exhibit F for the operational noise level projections at said receptors.

Loading and unloading activities can only take place during the day according to 17.58.050(E)(2) of the municipal code. Backup beepers will be less than 1% of an hour period. A backup beeper will have an Lmax level of 64 dBA, which is below the 75 dBA L1 limit for daytime residential uses.

Exhibit E

Project Operational Noise Levels (CNEL)



8.0 Construction Noise and Vibration Impacts

The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. Project construction will occur in five phases, site preparation, grading, building construction, paving, and architectural coating. This section summarizes discusses noise and ground-borne vibration modeling efforts, impact analysis, and mitigation, if necessary.

8.1 Construction Noise

Typical construction equipment noise levels are presented in Table 10.

Table 10: Typical Construction Equipment Noise Levels[1]

EQUIPMENT POWERED BY INTERNAL COMBUSTION ENGINES

Type	Noise Levels (dBA) at 50 Feet
Earth Moving	
Compactors (Rollers)	73 - 76
Front Loaders	73 - 84
Backhoes	73 - 92
Tractors	75 - 95
Scrapers, Graders	78 - 92
Pavers	85 - 87
Trucks	81 - 94
Materials Handling	
Concrete Mixers	72 - 87
Concrete Pumps	81 - 83
Cranes (Movable)	72 - 86
Cranes (Derrick)	85 - 87
Stationary	
Pumps	68 - 71
Generators	71 - 83
Compressors	75 – 86

IMPACT EQUIPMENT

Type	Noise Levels (dBA) at 50 Feet
Saws	71 - 82
Vibrators	68 - 82

Notes:
[1] Referenced Noise Levels from the Environmental Protection Agency (EPA)

Construction noise associated with each phase of the project was calculated at the residences to the south utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Construction equipment typically moves back and forth across the site; and it is an industry standard to use the acoustical center of the site to model average construction noise levels.

Construction activities are anticipated to include five phases site preparation, grading, building construction, paving, and architectural coating. Noise levels associated with each phase are shown in Table 11. The construction noise calculation output worksheet is located in Appendix D.

Table 11: Construction Noise Level by Phase (dBA, Leq)

Activity	Noise Levels at Nearest Sensitive Receptor	
	Leq	Lmax
Site Preparation	77	93
Grading	78	93
Building Construction	75	92
Paving	76	98
Architectural Coating	66	86
Notes: Construction Modeling Worksheets are provided in Appendix D.		

As shown in Table 11, project construction noise will range between 66 to 78 dBA Leq and 86 to 98 dBA Lmax at the nearest sensitive receptor.

The Project will be required to adhere to the allowed times for construction outlined in the Municipal Code in Section 17.58.050(E)(1). This impact is less than significant. No mitigation is required.

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. The primary vibration source during construction may be from a bull dozer. A large bull dozer has a vibration impact of 0.089 inches per second peak particle velocity (PPV) at 25 feet which is perceptible but below any risk to architectural damage.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref}\ (100/D_{rec})^n$$

Where: PPV_{ref} = reference PPV at 100ft.
D_{rec} = distance from equipment to receiver in ft.
n = 1.1 (the value related to the attenuation rate through ground)

The thresholds from the Caltrans Transportation and Construction Induced Vibration Guidance Manual in Table 12 (below) provides general thresholds and guidelines as to the vibration damage potential from vibratory impacts.

Table 12: Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Table 19, Transportation and Construction Vibration Guidance Manual, Caltrans, Sept. 2013.
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 13 gives approximate vibration levels for particular construction activities. This data provides a reasonable estimate for a wide range of soil conditions.

Table 13: Vibration Source Levels for Construction Equipment

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Pile driver (impact)	1.518 (upper range)	112
	0.644 (typical)	104
Pile driver (sonic)	0.734 upper range	105
	0.170 typical	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill	0.008 in soil	66
(slurry wall)	0.017 in rock	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2018.

The nearest existing building is 20 feet east of the project site. At this distance, a large bulldozer would yield a worst-case 0.114 PPV (in/sec) which may be perceptible but will not result in architectural damage. The impact is not significant and no mitigation is required. The ground-borne vibration worksheet is provided in Appendix E.

9.0 References

City of Manteca
2022 General Plan
2022 Municipal Code

California Department of Transportation (Caltrans)
2013 Transportation and Construction Induced Vibration Guidance Manual.
2018 Technical Noise Supplement to the Traffic Noise Analysis Protocol. Sept.

Federal Highway Administration (FHWA)
2010 Highway Traffic Noise Analysis and Abatement Policy and Guidance.
https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

Federal Transit Administration (FTA)
2018 Transit Noise and Vibration Impact Assessment Manual

Governor's Office of Planning and Research
State of California General Plan Guidelines, 1998

De Novo Planning Group
Environmental Impact Report – Volume IV

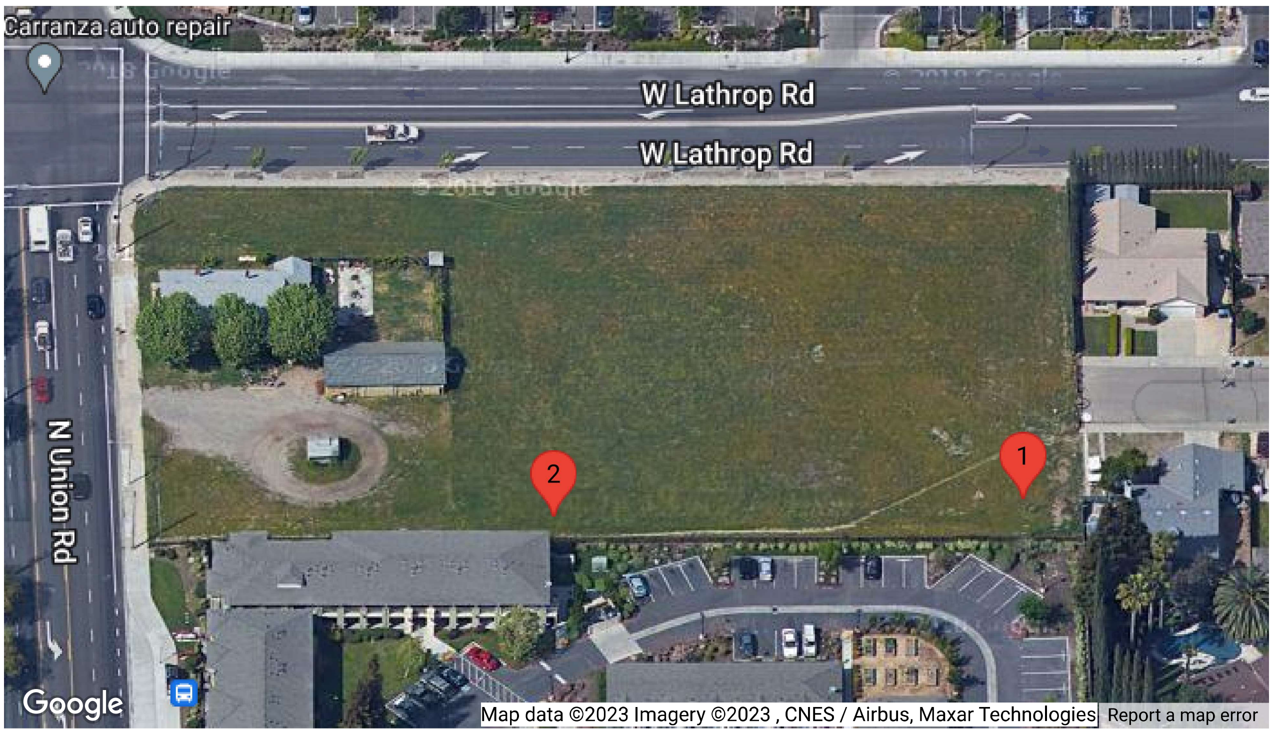
SoundPLAN International, LLC
2016 SoundPLAN Essential 4.0 Manual. May.

Appendix A:
Field Measurement Data

15-Minute Continuous Noise Measurement Datasheet

Project Name:	Crossroads Plaza	**Site Observations:**	
Project: #/Name:	1098-2022-002	51°, winds 0 to 5 mph, partial clearing with clouds, moderate to heavy traffic	
Site Address/Location:	2064 North Union Road		
Date:	02/03/2023		
Field Tech/Engineer:	Dennis Jordan / Claire Pincock		

Sound Meter:	XL2, NTI	**SN:**	A2A-05967-E0
Settings:	A-weighted, slow, 1-sec, 15-minute interval		
Site Id:	ST-1, ST-2		



MD ACOUSTICS

15-Minute Continuous Noise Measurement Datasheet - Cont.

Project Name: Crossroads Plaza

Site Address/Location: 2064 North Union Road

Site Id: ST-1, ST-2

Figure 1: ST-1 209 ft from Lathrop Rd

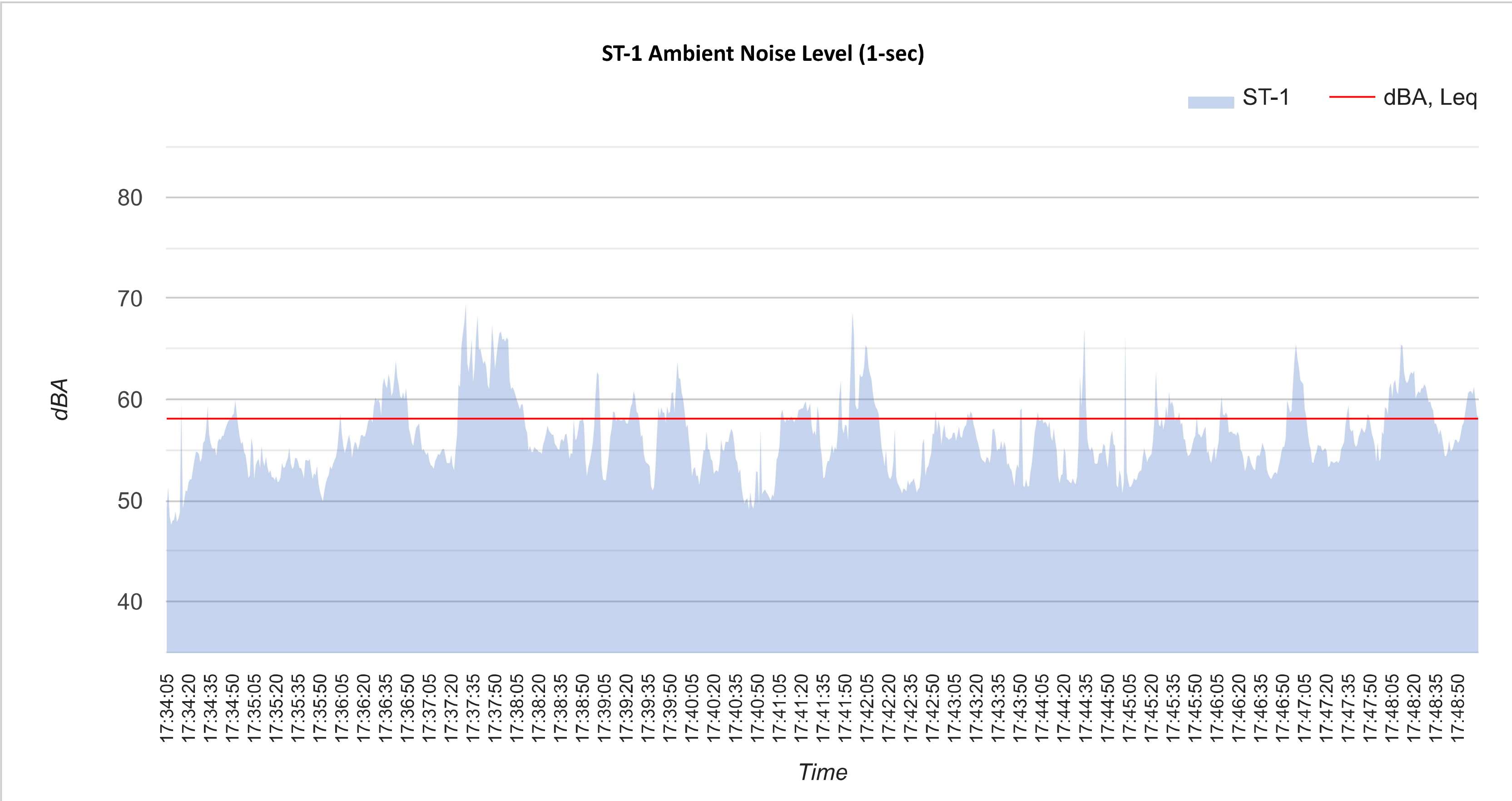
Figure 2: ST-2 232 ft from Lathrop Rd

Table 1: Baseline Noise Measurement Summary

Location	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
ST-1	5:34 PM	5:49 PM	58.1	69.1	48.0	65.5	61.9	58.4	55.8	52.1
ST-2	5:52 PM	6:07 PM	60.5	76.8	51.7	68.3	64.1	59.5	57.1	54.5

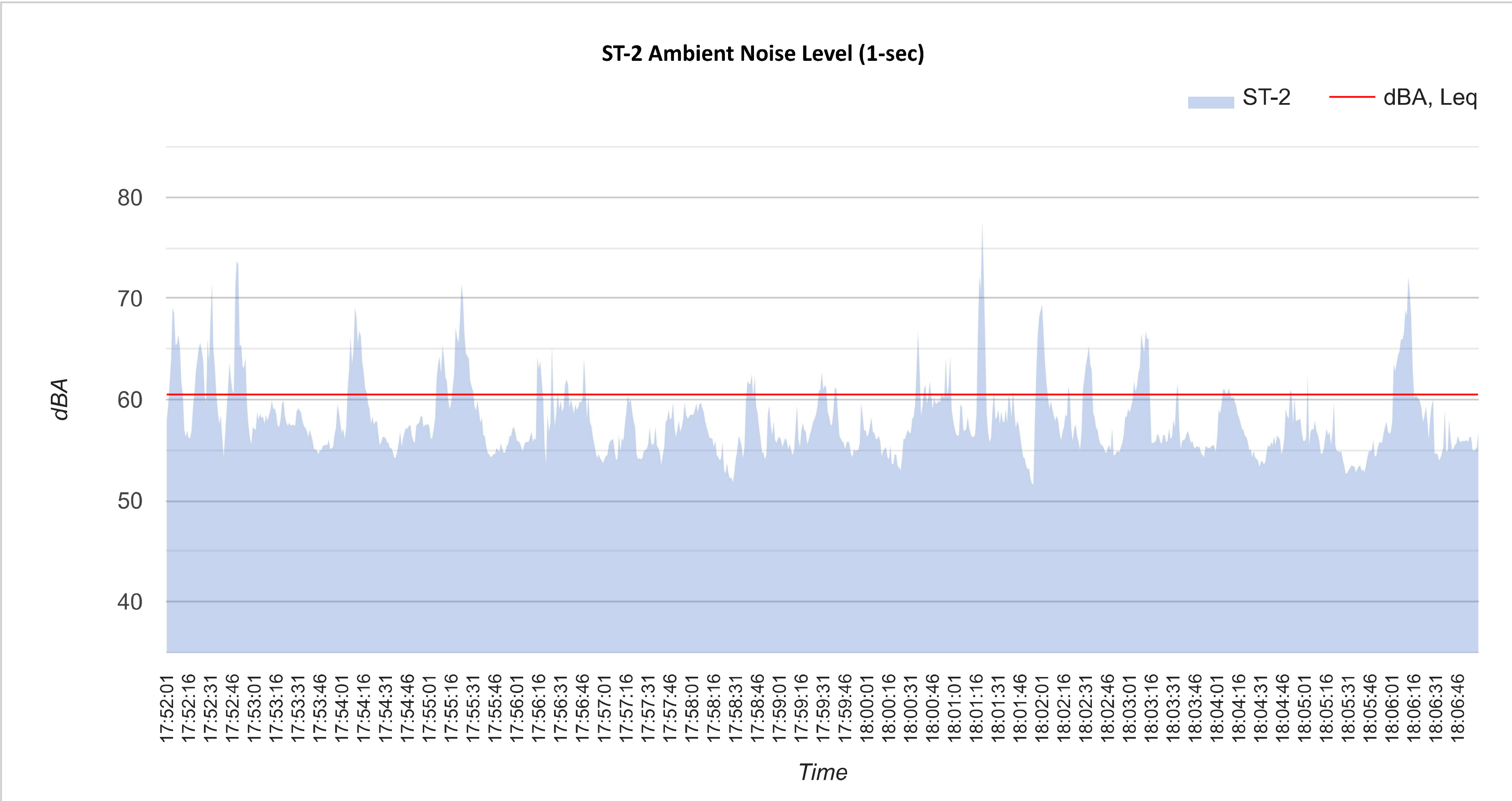
15-Minute Continuous Noise Measurement Datasheet - Cont.

Project Name:	Crossroads Plaza	**Site Topo:**	Single/Two story housing	**Noise Source(s) w/ Distance:**
Site Address/Location:	2064 North Union Road	**Meteorological Cond.:**	51°, winds 0 to 5 mph, partial clearing with clouds	Road Noise / 209 ft from Lathrop, 395 ft from Union Blvd
Site Id:	ST-1	**Ground Type:**	Housing, Dirt and Vegetation	



15-Minute Continuous Noise Measurement Datasheet - Cont.

Project Name:	Crossroads Plaza	**Site Topo:**	Housing 1 to 2 stories tall	**Noise Source(s) w/ Distance:**
Site Address/Location:	2064 North Union Road	**Meteorological Cond.:**	51°, winds 0 to 5 mph, partial clearing with clouds	Road Noise / 232 ft from Lathrop, 186 ft from Union Blvd
Site Id:	ST-2	**Ground Type:**	Housing, Dirt and Vegetation	



Appendix B:
SoundPLAN Noise Modeling Data

Crossroads Plaza
Assessed receiver spectra in dB(A) - 001 - Crossroads Plaza: Outdoor SP

Time slice	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)	16kHz dB(A)
Receiver 10655287,4187945 Fl GF Lr,lim dB(A) Leq,d 52.0 dB(A)									
Leq,d	40.5	48.3	39.9	43.3	43.3	43.2	38.7	26.4	-0.2
Receiver 10655327,4188059 Fl GF Lr,lim dB(A) Leq,d 60.2 dB(A)									
Leq,d	47.0	56.0	42.1	46.4	52.2	54.4	49.9	37.3	7.0
Receiver 10655342,4187924 Fl GF Lr,lim dB(A) Leq,d 52.3 dB(A)									
Leq,d	40.0	47.9	38.4	41.9	44.7	45.6	39.8	26.0	-3.1
Receiver 10655389,4187999 Fl GF Lr,lim dB(A) Leq,d 47.3 dB(A)									
Leq,d	37.4	44.3	33.7	36.6	38.6	37.9	30.9	17.7	-5.5
Receiver 10655392,4187964 Fl GF Lr,lim dB(A) Leq,d 48.4 dB(A)									
Leq,d	37.4	45.2	35.5	38.1	39.1	39.3	35.9	19.7	-9.7

Crossroads Plaza
Contribution level - 001 - Crossroads Plaza: Outdoor SP

Source	Source type	Tr. lane	Leq,d dB(A)	A dB
Receiver 10655287,4187945 Fl GF Lr,lim dB(A) Leq,d 52.0 dB(A)				
Auto Fuel Pump	Point		46.9	0.0
Auto Fuel Pump	Point		46.8	0.0
Auto Parking	PLot		41.4	0.0
HVAC	Point		38.6	0.0
Auto Fuel Pump	Point		37.4	0.0
Auto Fuel Pump	Point		37.1	0.0
Auto Fuel Pump	Point		36.5	0.0
Auto Fuel Pump	Point		36.4	0.0
Auto Fuel Pump	Point		36.1	0.0
Auto Fuel Pump	Point		35.9	0.0
Auto Fuel Pump	Point		35.7	0.0
Auto Fuel Pump	Point		35.5	0.0
Auto Fuel Pump	Point		34.8	0.0
Auto Fuel Pump	Point		34.5	0.0
Auto Parking	PLot		26.0	0.0
HVAC	Point		24.4	0.0
Receiver 10655327,4188059 Fl GF Lr,lim dB(A) Leq,d 60.2 dB(A)				
Auto Fuel Pump	Point		49.6	0.0
Auto Fuel Pump	Point		49.6	0.0
Auto Fuel Pump	Point		49.5	0.0
Auto Fuel Pump	Point		49.4	0.0
Auto Fuel Pump	Point		49.3	0.0
Auto Fuel Pump	Point		49.2	0.0
Auto Fuel Pump	Point		49.2	0.0
Auto Fuel Pump	Point		49.2	0.0
Auto Fuel Pump	Point		49.0	0.0
Auto Fuel Pump	Point		48.9	0.0
Auto Fuel Pump	Point		48.6	0.0
Auto Fuel Pump	Point		48.4	0.0
Auto Parking	PLot		47.3	0.0
Auto Parking	PLot		37.3	0.0
HVAC	Point		33.0	0.0
HVAC	Point		32.6	0.0
Receiver 10655342,4187924 Fl GF Lr,lim dB(A) Leq,d 52.3 dB(A)				
Auto Fuel Pump	Point		44.7	0.0
Auto Fuel Pump	Point		43.7	0.0
Auto Fuel Pump	Point		43.6	0.0
Auto Fuel Pump	Point		43.3	0.0
Auto Parking	PLot		40.1	0.0
Auto Fuel Pump	Point		39.3	0.0
Auto Fuel Pump	Point		38.7	0.0
Auto Fuel Pump	Point		38.2	0.0
Auto Fuel Pump	Point		37.8	0.0

Source	Source type	Tr. lane	Leq,d dB(A)	A dB
Auto Fuel Pump	Point		37.7	0.0
Auto Fuel Pump	Point		37.6	0.0
Auto Fuel Pump	Point		37.5	0.0
Auto Fuel Pump	Point		37.2	0.0
HVAC	Point		36.7	0.0
Auto Parking	PLot		36.3	0.0
HVAC	Point		32.8	0.0
Receiver 10655389,4187999 Fl GF Lr,lim dB(A) Leq,d 47.3 dB(A)				
HVAC	Point		37.1	0.0
Auto Fuel Pump	Point		36.9	0.0
Auto Fuel Pump	Point		36.7	0.0
Auto Fuel Pump	Point		36.7	0.0
Auto Fuel Pump	Point		36.2	0.0
Auto Fuel Pump	Point		35.7	0.0
Auto Fuel Pump	Point		35.6	0.0
Auto Fuel Pump	Point		35.4	0.0
Auto Fuel Pump	Point		35.1	0.0
Auto Fuel Pump	Point		35.0	0.0
Auto Fuel Pump	Point		34.8	0.0
Auto Fuel Pump	Point		34.7	0.0
Auto Fuel Pump	Point		34.7	0.0
Auto Parking	PLot		34.2	0.0
Auto Parking	PLot		31.8	0.0
HVAC	Point		24.8	0.0
Receiver 10655392,4187964 Fl GF Lr,lim dB(A) Leq,d 48.4 dB(A)				
Auto Fuel Pump	Point		38.6	0.0
Auto Fuel Pump	Point		38.5	0.0
Auto Fuel Pump	Point		38.4	0.0
Auto Fuel Pump	Point		38.2	0.0
Auto Fuel Pump	Point		37.5	0.0
Auto Fuel Pump	Point		37.1	0.0
Auto Fuel Pump	Point		36.4	0.0
Auto Fuel Pump	Point		36.3	0.0
Auto Fuel Pump	Point		35.6	0.0
Auto Fuel Pump	Point		35.4	0.0
Auto Parking	PLot		35.3	0.0
Auto Fuel Pump	Point		35.1	0.0
Auto Parking	PLot		35.0	0.0
Auto Fuel Pump	Point		34.8	0.0
HVAC	Point		31.3	0.0
HVAC	Point		25.8	0.0

Crossroads Plaza
Octave spectra of the sources in dB(A) - 001 - Crossroads Plaza: Outdoor SP

Name	Source type	I or A m,m²	Li dB(A)	R'w dB	L'w dB(A)	Lw dB(A)	KI dB	KT dB	LwMax dB(A)	DO-Wall dB	Time histogram	Emission spectrum	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)	16kHz dB(A)
Auto Parking	PLot	989.37			54.3	84.2	0.0	0.0		0	100%/24h	Typical spectrum	67.6	79.2	71.7	76.2	76.3	76.7	74.0	67.8	55.0
Auto Parking	PLot	2385.62			51.5	85.3	0.0	0.0		0	6 events per hour	Typical spectrum	68.6	80.2	72.7	77.2	77.3	77.7	75.0	68.8	56.0
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
Auto Fuel Pump	Point				94.7	94.7	0.0	0.0		0	100%/24h	Car start up	78.0	89.6	82.1	86.6	86.7	87.1	84.4	78.2	65.4
HVAC	Point				83.0	83.0	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	60.1	68.6	71.0	75.3	77.6	77.2	74.2	69.3	57.0
HVAC	Point				83.0	83.0	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	60.1	68.6	71.0	75.3	77.6	77.2	74.2	69.3	57.0

Appendix C:

FHWA Roadway Noise Modeling Worksheets

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT: CROSSROADS PLAZA
ROADWAY: LATHROP AVENUE - EXISTING
LOCATION: WEST OF SHERWOOD AVE

JOB #: 1098-2022-00
DATE: ########
ENGINEER R.Edelman

NOISE INPUT DATA - EXISTING

ROADWAY CONDITIONS

ADT = 19,300
SPEED = 45
PK HR % = 10
NEAR LANE/FAR LANE DI: 48
ROAD ELEVATION = 0.0
GRADE = 1.0 %
PK HR VOL = 1,930

RECEIVER INPUT DATA

RECEIVER DISTANCE = 40
DIST C/L TO WALL = 0
RECEIVER HEIGHT = 5.0
WALL DISTANCE FROM RECEIVEF 40
PAD ELEVATION = 0.5
ROADWAY VIEW: LF ANGLE= -90
RT ANGLE= 90
DF ANGLE= 180

SITE CONDITIONS

AUTOMOBILES = 10
MEDIUM TRUCKS = 10 (10 = HARD SITE, 15 = SOFT SITE)
HEAVY TRUCKS = 10

WALL INFORMATION

HTH WALL 0.0
AMBIENT= 0.0
BARRIER = 0 (0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.775	0.129	0.096	0.8940
MEDIUM TRUCK	0.848	0.049	0.103	0.0200
HEAVY TRUCKS	0.865	0.027	0.108	0.0860

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	32.19	- -
MEDIUM TRUCKS	4.0	32.04	- -
HEAVY TRUCKS	8.0	32.10	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.7	69.8	68.1	62.0	70.6	71.2
MEDIUM TRUCKS	63.5	62.0	55.6	54.1	62.6	62.8
HEAVY TRUCKS	74.4	72.9	63.9	65.2	73.5	73.6
NOISE LEVELS (dBA)	76.5	74.9	69.6	67.1	75.5	75.8

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.7	69.8	68.1	62.0	70.6	71.2
MEDIUM TRUCKS	63.5	62.0	55.6	54.1	62.6	62.8
HEAVY TRUCKS	74.4	72.9	63.9	65.2	73.5	73.6
NOISE LEVELS (dBA)	76.5	74.9	69.6	67.1	75.5	75.8

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	153	484	1530	4840
LDN	143	452	1431	4525

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT: CROSSROADS PLAZA
ROADWAY: LATHROP AVENUE - EXISTING + PROJECT
LOCATION: WEST OF SHERWOOD AVE

JOB #: 1098-2022-00?
DATE: ########
ENGINEER R.Edelman

NOISE INPUT DATA - EXISTING + PROJECT

ROADWAY CONDITIONS

ADT = 21,426
SPEED = 45
PK HR % = 10
NEAR LANE/FAR LANE DI: 48
ROAD ELEVATION = 0.0
GRADE = 1.0 %
PK HR VOL = 2,143

RECEIVER INPUT DATA

RECEIVER DISTANCE = 40
DIST C/L TO WALL = 0
RECEIVER HEIGHT = 5.0
WALL DISTANCE FROM RECEIVER 40
PAD ELEVATION = 0.5
ROADWAY VIEW: LF ANGLE= -90
RT ANGLE= 90
DF ANGLE= 180

SITE CONDITIONS

AUTOMOBILES = 10
MEDIUM TRUCKS = 10 (10 = HARD SITE, 15 = SOFT SITE)
HEAVY TRUCKS = 10

WALL INFORMATION

HTH WALL 0.0
AMBIENT= 0.0
BARRIER = 0 (0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.775	0.129	0.096	0.8940
MEDIUM TRUCK	0.848	0.049	0.103	0.0200
HEAVY TRUCKS	0.865	0.027	0.108	0.0860

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	32.19	- -
MEDIUM TRUCKS	4.0	32.04	- -
HEAVY TRUCKS	8.0	32.10	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	72.2	70.3	68.5	62.5	71.1	71.7
MEDIUM TRUCKS	64.0	62.5	56.1	54.6	63.0	63.2
HEAVY TRUCKS	74.8	73.4	64.4	65.6	74.0	74.1
NOISE LEVELS (dBA)	76.9	75.3	70.1	67.5	76.0	76.3

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	72.2	70.3	68.5	62.5	71.1	71.7
MEDIUM TRUCKS	64.0	62.5	56.1	54.6	63.0	63.2
HEAVY TRUCKS	74.8	73.4	64.4	65.6	74.0	74.1
NOISE LEVELS (dBA)	76.9	75.3	70.1	67.5	76.0	76.3

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	170	537	1699	5373
LDN	159	502	1588	5023

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT:	CROSSROADS PLAZA	JOB #:	1098-2022-00
ROADWAY:	UNION RD - EXISTING	DATE:	########
LOCATION:	NORTH OF CROM STREET	ENGINEER	R.Edelman

NOISE INPUT DATA - EXISTING

ROADWAY CONDITIONS

ADT =	17,500	
SPEED =	45	
PK HR % =	10	
NEAR LANE/FAR LANE DI	44	
ROAD ELEVATION =	0.0	
GRADE =	1.0	%
PK HR VOL =	1,750	

RECEIVER INPUT DATA

RECEIVER DISTANCE =		40
DIST C/L TO WALL =		0
RECEIVER HEIGHT =		5.0
WALL DISTANCE FROM RECEIVEF		40
PAD ELEVATION =		0.5
ROADWAY VIEW:	LF ANGLE=	-90
	RT ANGLE=	90
	DF ANGLE=	180

SITE CONDITIONS

AUTOMOBILES =	10
MEDIUM TRUCKS =	10
HEAVY TRUCKS =	10

(10 = HARD SITE, 15 = SOFT SITE)

WALL INFORMATION

HTH WALL	0.0	
AMBIENT=	0.0	
BARRIER =	0	(0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.775	0.129	0.096	0.8940
MEDIUM TRUCK	0.848	0.049	0.103	0.0200
HEAVY TRUCKS	0.865	0.027	0.108	0.0860

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	33.59	- -
MEDIUM TRUCKS	4.0	33.44	- -
HEAVY TRUCKS	8.0	33.50	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.1	69.2	67.4	61.4	70.0	70.6
MEDIUM TRUCKS	62.9	61.4	55.0	53.5	62.0	62.2
HEAVY TRUCKS	73.7	72.3	63.3	64.5	72.9	73.0
NOISE LEVELS (dBA)	75.9	74.3	69.0	66.5	74.9	75.2

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.1	69.2	67.4	61.4	70.0	70.6
MEDIUM TRUCKS	62.9	61.4	55.0	53.5	62.0	62.2
HEAVY TRUCKS	73.7	72.3	63.3	64.5	72.9	73.0
NOISE LEVELS (dBA)	75.9	74.3	69.0	66.5	74.9	75.2

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	133	420	1330	4205
LDN	124	393	1243	3931

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT:	CROSSROADS PLAZA	JOB #:	1098-2022-00
ROADWAY:	UNION RD - EXISTING + PROJECT	DATE:	########
LOCATION:	NORTH OF CROM STREET	ENGINEER	R.Edelman

NOISE INPUT DATA - EXISTING + PROJECT

ROADWAY CONDITIONS

ADT =	19,626
SPEED =	45
PK HR % =	10
NEAR LANE/FAR LANE DI:	44
ROAD ELEVATION =	0.0
GRADE =	1.0 %
PK HR VOL =	1,963

RECEIVER INPUT DATA

RECEIVER DISTANCE =		40
DIST C/L TO WALL =		0
RECEIVER HEIGHT =		5.0
WALL DISTANCE FROM RECEIVEF		40
PAD ELEVATION =		0.5
ROADWAY VIEW:	LF ANGLE=	-90
	RT ANGLE=	90
	DF ANGLE=	180

SITE CONDITIONS

AUTOMOBILES =	10
MEDIUM TRUCKS =	10
HEAVY TRUCKS =	10

(10 = HARD SITE, 15 = SOFT SITE)

WALL INFORMATION

HTH WALL	0.0
AMBIENT=	0.0
BARRIER =	0 (0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.775	0.129	0.096	0.8940
MEDIUM TRUCK	0.848	0.049	0.103	0.0200
HEAVY TRUCKS	0.865	0.027	0.108	0.0860

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	33.59	- -
MEDIUM TRUCKS	4.0	33.44	- -
HEAVY TRUCKS	8.0	33.50	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.6	69.7	67.9	61.9	70.5	71.1
MEDIUM TRUCKS	63.4	61.9	55.5	54.0	62.4	62.7
HEAVY TRUCKS	74.2	72.8	63.8	65.0	73.4	73.5
NOISE LEVELS (dBA)	76.4	74.8	69.5	67.0	75.4	75.7

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	71.6	69.7	67.9	61.9	70.5	71.1
MEDIUM TRUCKS	63.4	61.9	55.5	54.0	62.4	62.7
HEAVY TRUCKS	74.2	72.8	63.8	65.0	73.4	73.5
NOISE LEVELS (dBA)	76.4	74.8	69.5	67.0	75.4	75.7

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	149	472	1491	4716
LDN	139	441	1394	4409

Appendix D:

Construction Noise Modeling Output

Receptor - Residences to the South

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Edge of Site to Receptor, feet	Center of Site to Receptor, feet	Item Usage Percent[1]	Ground Factor[2]	Usage Factor	Receptor Item Lmax, dBA	Recptor. Item Leq, dBA
SITE PREP									
Tractor	1	84	25	100	40	0.66	0.40	92.0	72.0
Dozer	1	82	25	100	40	0.66	0.40	90.0	70.0
Grader	1	85	25	100	40	0.66	0.40	93.0	73.0
							Log Sum	93.0	76.6
GRADE									
Dozer	1	82	25	100	40	0.66	0.40	90.0	70.0
Grader	1	85	25	100	40	0.66	0.40	93.0	73.0
Tractor	2	84	25	100	40	0.66	0.40	92.0	72.0
								93.0	77.9
BUILD									
Crane	1	81	25	100	16	0.66	0.16	89.0	65.0
Man lift	1	75	25	100	20	0.66	0.20	83.0	60.0
Generator	1	81	25	100	50	0.66	0.50	89.0	70.0
Tractor	1	84	25	100	40	0.66	0.40	92.0	72.0
Welder/Torch	3	74	25	100	40	0.66	0.40	82.0	62.0
								92.0	75.4
PAVE									
Paver	1	77	25	100	50	0.66	0.50	85.0	66.0
Pavement Scarifier	1	90	25	100	20	0.66	0.20	98.0	75.0
Roller	1	80	25	100	20	0.66	0.20	88.0	65.0
Tractor	1	84	25	100	40	0.66	0.40	92.0	72.0
Concrete Mixer Truck	1	79	25	100	40	0.66	0.40	87.0	67.0
								98.0	76.4
ARCH COAT									
Compressor (air)	1	78	25	100	40	0.66	0.40	86.0	66.0
								86.0	66.0

[1]FHWA Construction Noise Handbook: Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors

Appendix E:

Construction Vibration Modeling Output

VIBRATION LEVEL IMPACT

Project:	Crossroads Plaxa		Date: 3/10/23
Source:	Large Bulldozer		
Scenario:	Unmitigated		
Location:	Adjacent residences		
Address:	2064 North Union Road		

PPV = PPVref(25/D)^n (in/sec)

DATA INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN BLUE
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	20.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.114**	IN/SEC	OUTPUT IN RED