Carkel San Marcos Commercial

Technical Appendices

Appendix I

Noise Report

NOISE ASSESSMENT

Carkel San Marcos Commercial Project
City of San Marcos

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COMMON TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref}).

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (Ldn): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for nighttime noise. Typically, Ldn's are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise and vibration impacts to and from the proposed project. The Carkel San Marcos Commercial project proposes to construct a 2,128-square foot (s.f.) Starbucks with drive-thru. The Starbucks will have 1,797 s.f. of interior space and 331 s.f. of exterior seating. The proposed project site is located in the City of San Marcos in North San Diego County, south of SR-78. The project site is undeveloped. The project site is bounded on the north by San Marcos Boulevard, on the west by Bent Avenue, on the south by an existing self-storage facility, and on the east by an existing auto service center.

Construction Noise

The grading equipment will be spread out over the project site from distances near the occupied property lines to distances of 100 feet or more away. Based upon the site plan the construction activities, on average, will occur 100 feet from the property lines. At an average distance of 100 feet from the construction activities to the nearest property line, noise levels will comply with the 75 dBA Leq standard over 8 hours at the property lines. Therefore, no impacts are anticipated and no mitigation is required during construction of the proposed Project. Additionally, all equipment should be properly fitted with mufflers and all staging and maintenance should be conducted as far away for the existing uses as possible.

Construction Vibration

The nearest vibration-sensitive uses are the commercial uses adjacent to the site. The average vibration levels that would be experienced at the nearest vibration sensitive land uses to the south and east from temporary construction activities.

The Federal Transit Administration (FTA) has determined vibration levels that would cause annoyance to a substantial number of people and potential damage to building structures. The FTA criterion for vibration induced structural damage is 0.20 in/sec for the peak particle velocity (PPV). Project construction activities would result in PPV levels below the FTA's criteria for vibration induced structural damage. Therefore, Project construction activities would not result in vibration induced structural damage to buildings near the construction areas. The FTA criterion for infrequent vibration induced annoyance is 83 Vibration Velocity (VdB) for commercial uses. Construction activities would generate levels of vibration that would not exceed the FTA criteria for nuisance for nearby commercial uses. Therefore, vibration impacts would be less than significant.

Onsite Transportation Noise

The outdoor seating area at the restaurant was modeled to determine if shielding/mitigation is required to reduce the noise levels below the City's 65 dBA CNEL threshold. The Project is proposing a 4-foot-high planter/sound wall encompassing the outdoor seating area. These Project design features were incorporated into the noise modeling and the outdoor areas at the restaurant will comply with the City of San Marcos Noise standards of 65 dBA CNEL.

The City also require interior noise levels in retail/commercial buildings be reduced to 50 dBA CNEL. Basic calculations show that a windows open condition will only reduce the interior noise levels roughly 15 dBA CNEL and not provide adequate interior noise mitigation. To meet the 50 dBA CNEL interior noise standard at the retail uses, an interior noise level reduction of minimum 20-25 dBA CNEL is needed for the proposed project. Therefore, with the incorporation of standard dual pane windows and mechanical ventilation as a project design feature the project will achieve the necessary interior noise reductions to meet the City's 50 dBA CNEL standard.

Offsite Transportation Noise

The Project does not create a direct and cumulative noise increase of more than 3 dBA CNEL on any roadway segment. Therefore, the Project's contributions to off-site roadway noise increases will not cause any significant impacts to any existing or future noise sensitive land uses.

Operational Noise

As stated in Chapter 20.300 Site Planning and General Development Standards of the City Municipal Code, the project site and all surrounding uses are commercial. Therefore, a 65 dBA hourly noise standard during the daytime hours between 7 a.m. and 7 p.m. and a 55 dBA standard during the evening hours of 7 p.m. and 10 p.m. would apply for the commercial land uses exterior uses. Exterior noise level is defined as noise measured at the exterior area provided for public use. No existing exterior uses are located nearby the proposed site. The commercial structures located adjacent to the drive-thru would provide 20-25 decibels of reduction to the indoor uses, resulting in exterior and interior noise levels below 40 dBA. This is well below the City's commercial exterior nighttime hourly noise threshold of 55 dBA and the interior noise threshold of 50 dBA hourly. Therefore, the proposed development related operational noise levels comply with the noise standards and no impacts are anticipated and no mitigation is required.

1.0 PROJECT INTRODUCTION

1.1 Purpose of this Study

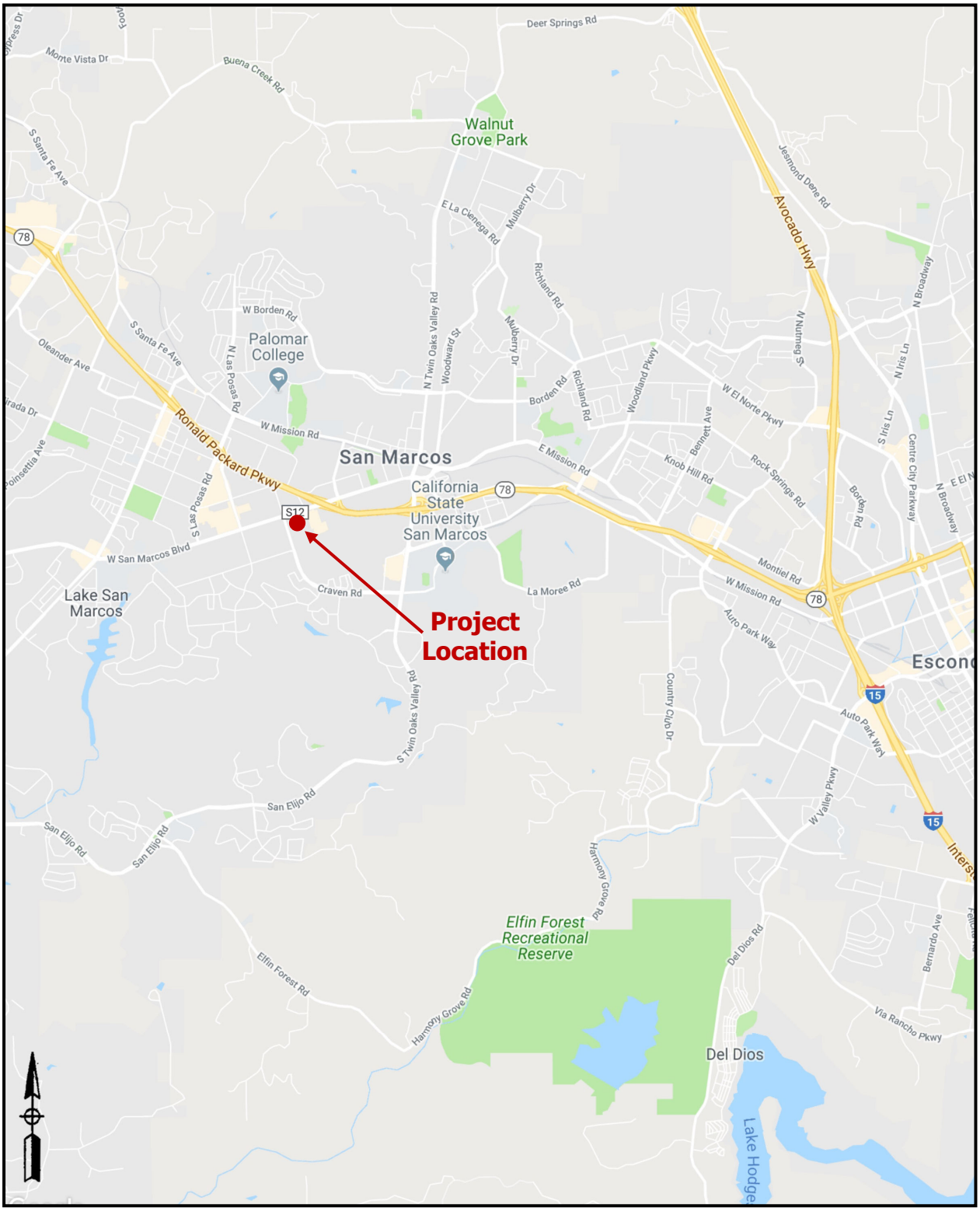
The purpose of this Noise study is to determine potential noise impacts (if any) created from the proposed construction and operations and to determine potential noise impacts (if any) to the site generated from offsite sources. Should impacts be determined, the intent of this study would be to recommend suitable mitigation measures to bring those impacts to a level that would be considered less then significant.

1.2 Project Location and Description

The 0.55-acre project site is located on the southeast corner of W. San Marcos Boulevard and Bent Avenue in the City of San Marcos in northern San Diego County. The project site is surrounded by commercial land uses which include an automotive service center to the east and a self-serve storage facility to the south. Access to the project site would be via W. San Marcos Boulevard. A project vicinity map is shown in Figure 1-A.

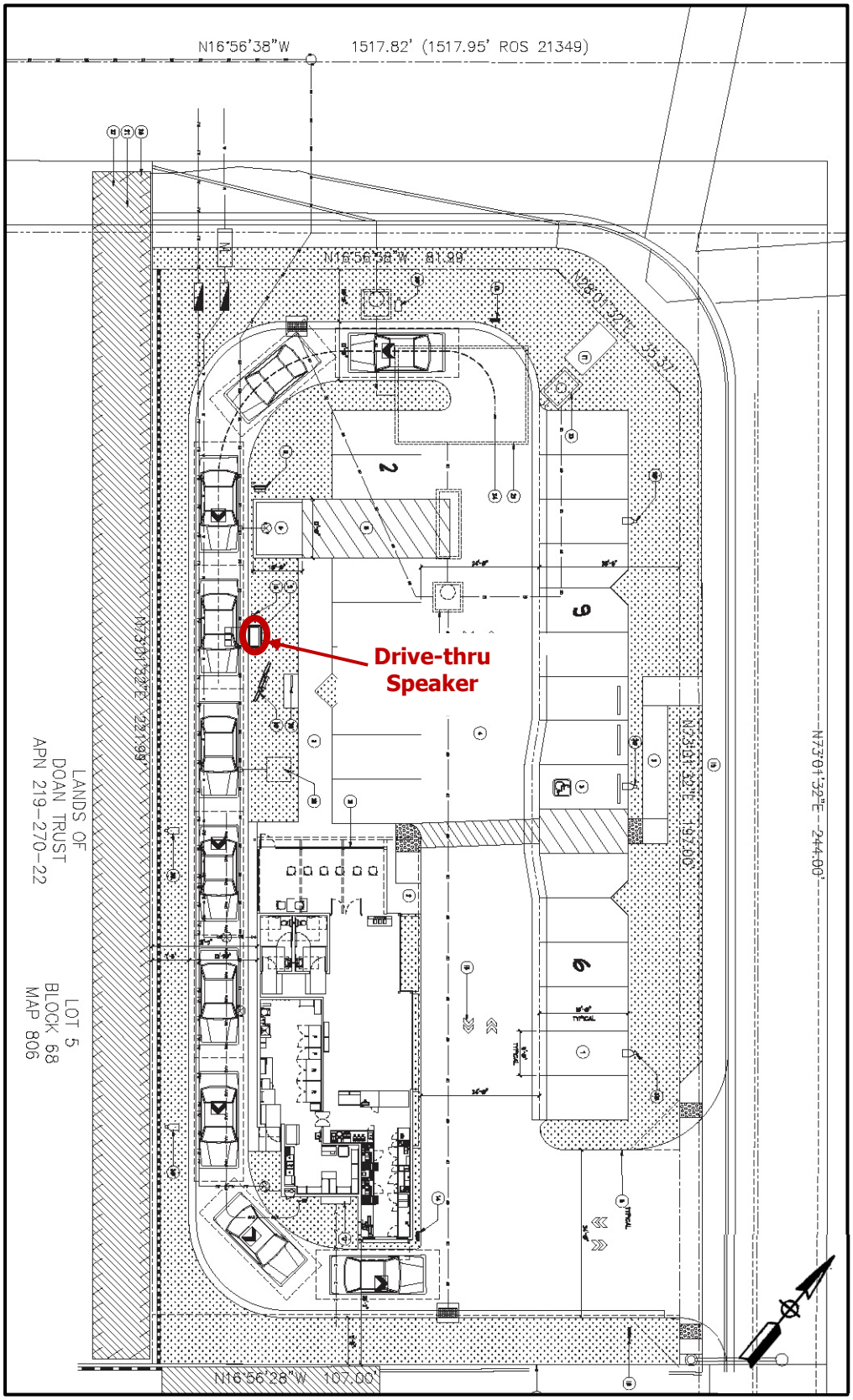
The project applicant is requesting approval of a Specific Plan Amendment, General Plan Amendment, Rezone, and Conditional Use Permit to construct a restaurant with a drive-thru. The project proposes to construct a 2,128-square foot (s.f.) Starbucks with drive thru. The Starbucks will have 1,797 s.f. of interior space and 331 s.f. of exterior seating. The exterior seating will have a planter wall surrounding it and the drive-thru lane and speaker will be located along the southern boundary of the project site. The project site plan is provided in Figure 1-B.

Figure 1-A: Project Vicinity Map



Source: Google Maps, 2021

Figure 1-B: Development Site Plan



2.0 FUNDAMENTALS

2.1 Acoustical Fundamentals

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is based on the sensitivity of that individual, the type of noise that occurs and when the noise occurs. Sound is measured on a logarithmic scale consisting of sound pressure levels known as a decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as Leq represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections or penalties for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sounds appears louder.

A vehicles noise level is from a combination of the noise produced by the engine, exhaust and tires. The cumulative traffic noise levels along a roadway segment are based on three primary factors: the amount of traffic, the travel speed of the traffic, and the vehicle mix ratio or number of medium and heavy trucks. The intensity of traffic noise is increased by higher traffic volumes, greater speeds and increased number of trucks.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore, the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiate in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. On the other hand, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source, blocking the noise transmission with barriers or relocating the receiver. Any or all of these methods may be required to reduce noise levels to an acceptable level.

2.2 Vibration Fundamentals

Vibration is a trembling or oscillating motion of the ground. Like noise, vibration is transmitted in waves, but in this case through the ground or solid objects. Unlike noise, vibration is typically felt rather than heard. Vibration can be either natural as in the form of earthquakes, volcanic eruptions; or manmade as from explosions, heavy machinery, or trains. Both natural and manmade vibration may be continuous, such as from operating machinery; or infrequent, as from an explosion.

As with noise, vibration can be described by both its amplitude and frequency. Amplitude may be characterized in three ways: displacement, velocity, and acceleration. Particle displacement is a measure of the distance that a vibrated particle travels from its original position and for the purposes of soil displacement is typically measured in inches or millimeters. Particle velocity is the rate of speed at which soil particles move in inches per second or millimeters per second. Particle acceleration is the rate of change in velocity with respect to time and is measured in inches per second or millimeters per second. Typically, particle velocity (measured in inches or millimeters per second) and/or acceleration (measured in gravities) are used to describe vibration. Table 2-1 shows the human reaction to various levels of peak particle velocity.

Vibrations also vary in frequency and this affects perception. Typical construction vibrations fall in the 10 to 30 Hz range and usually occurring around 15 Hz. Traffic vibrations exhibit a similar range of frequencies; however, due to their suspension systems, it is less common, to measure traffic frequencies above 30 Hz.

Propagation of ground-borne vibrations is complicated and difficult to predict because of the endless variations in the soil through which the waves travel. 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 dropping an object into water. P-waves, or compression waves, are waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal. 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 energy is spread over an ever-increasing area such that the energy level is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced

with distance as a result of material damping in the form of internal friction, soil layering, and special voids. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

Table 2-1: Human Reaction to Typical Vibration Levels

Vibration Level Peak Particle Velocity (in/sec)	Human Reaction	Effect on Buildings
0.006–0.019	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibration begins to annoy people	Virtually no risk of "architectural" (i.e., not structural) damage to normal buildings
0.20	Vibrations annoying to people in buildings	Threshold at which there is a risk to "architectural" damage to normal dwelling – houses with plastered walls and ceilings
0.4–0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage

Source: Caltrans, Division of Environmental Analysis, *Transportation Related Earthborne Vibration, Caltrans Experiences*, Technical Advisory, Vibration, TAV-02-01-R9601, 2002.

3.0 SIGNIFICANCE THRESHOLDS AND STANDARDS

3.1 Construction Noise

The City of San Marcos Municipal Code addresses the limits grading, extraction and construction activities between 7:00 a.m. and 4:30 p.m. Monday through Friday and no grading, extraction or construction is allowed on the weekends or holidays. The Municipal code does not set noise limits on construction activities. Commonly, the City has utilized the County of San Diego's Noise Ordinance noise limit of 75 dBA for projects.

3.2 Vibration Standards

The City of San Marcos has not yet adopted vibration criteria. The United States Department of Transportation Federal Transit Administration (FTA) provides criteria for acceptable levels of groundborne vibration for various types of special buildings that are sensitive to vibration. For purposes of identifying potential project-related vibration impacts, the FTA criteria will be used. The human reaction to various levels of vibration is highly subjective. The upper end of the range shown for the threshold of perception, or roughly 65 VdB, may be considered annoying by some people. Vibration below 65 VdB may also cause secondary audible effects, such as a slight rattling of doors, suspended ceilings/fixtures, windows, and dishes, any of which may result in additional annoyance. Table 3-1 shows the FTA groundborne vibration and noise impact criteria for human annoyance.

Table 3-1: Groundborne Vibration and Noise Impact Criteria (Human Annoyance)

	Groundborne Vibration Impact Levels (VdB re 1 microinch/second)			Groundborne Noise Impact Levels (dB re 20 micropascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[4]	N/A[4]	N/A[4]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: US Department of Transportation Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment,* June 2006.

[1] "Frequent Events" are defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.

[2] "Occasional Events" are defined as between 30 and 70 vibration events of the same source per day. Most commuter truck lines have this many operations.

[3] "Infrequent Events" are defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines

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

[5] Vibration-sensitive equipment is not sensitive to groundborne noise.

In addition to the vibration annoyance standards presented above, the FTA also applies the following standards for construction vibration damage. As shown in Table 3-2, structural damage is possible for typical residential construction when the peak particle velocity (PPV) exceeds 0.2 inch per second (in/sec). This criterion is the threshold at which there is a risk of damage to normal dwellings.

In the context of this analysis, the noise and vibration impacts associated with the construction operations and blasting operations will be conditioned to comply with the thresholds stated above. The potential noise and vibration impacts are analyzed separately below.

Table 3-2: Groundborne Vibration Impact Criteria (Structural Damage)

Building Category	PPV (in/sec)	VdB
I. Reinforced-concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: US Department of Transportation Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment,* June 2006.
Notes: RMS velocity calculated from vibration level (VdB) using the reference of one microinch/second.

3.3 Transportation Noise Standards

The City's General Plan Chapter 7 Noise Element uses the Noise Compatibility Guidelines listed in Table 7-3 of the General Plan Noise Element (provided below as Table 3-3) to determine the compatibility of land use when evaluating proposed development projects. The Noise Compatibility Guidelines indicate ranges of compatibility and are intended to be flexible enough to apply to a range of projects and environments.

A land use located in an area identified as "acceptable" indicates that standard construction methods would attenuate exterior noise to an acceptable indoor noise level and that people can carry out outdoor activities with minimal noise interference. Land uses that fall into the "conditionally acceptable" noise environment should have an acoustical study that considers the type of noise source, the sensitivity of the noise receptor, and the degree to which the noise source may interfere with sleep, speech, or other activities characteristic of the land use. For land uses indicated as "conditionally acceptable," structures must be able to attenuate the exterior noise to the indoor noise level as indicated in the Noise Standards listed in Table 7-4 of the General Plan Noise Element (provided below as Table 3-4).

Table 3-3: Noise Compatibility Guidelines

Table 7-3
Noise and Land Use Compatibility Guidelines for Transportation-related Noise

	Land Use Category	Exterior Noise Level (CNEL) 55	60	65	70	75	80
A	Residential—single family residences, mobile homes, senior/age-restricted housing						
B	Residential—multifamily residences, mixed use (residential/commercial)						
C	Lodging—hotels, motels						
D[2]	Schools, churches, hospitals, residential care facility, child care facilities						
E[2]	Passive recreational parks, nature preserves, contemplative spaces, cemeteries						
F[2]	Active parks, golf courses, athletic fields, outdoor spectator sports, water recreation						
G[2]	Office/professional, government, medical/dental, commercial, retail, laboratories						
H[2]	Industrial, manufacturing, utilities, agriculture, mining, stables, ranching, warehouse, maintenance/repair						

Acceptable - Specified land use is satisfactory, based upon the assumption that any buildings involved

Conditionally Acceptable - New construction or development should be undertaken only after a detailed noise analysis is conducted to determine if noise reduction measures are necessary to achieve acceptable levels for land use. Criteria for determining exterior and interior noise levels are listed in Table 7-4, Noise Standards. If a project cannot mitigate noise to a level deemed Acceptable, the appropriate County decision-maker must determine that mitigation has been provided to the greatest extent practicable or that extraordinary circumstances exist.

Unacceptable - New construction or development shall not be undertaken.

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Table 3-4: Noise Standards

Table 7-4
Noise Standards[1]

1. The exterior noise level (as defined in Item 3) standard for Category A shall be 60 CNEL, and the interior noise level standard for indoor habitable rooms shall be 45 CNEL.

2. The exterior noise level standard for Categories B and C shall be 65 CNEL, and the interior noise level standard for indoor habitable rooms shall be 45 CNEL.

3. The exterior noise level standard for Categories D and G shall be 65 CNEL and the interior noise level standard shall be 50 dBA Leq (one hour average).

4. For single-family detached dwelling units, "exterior noise level" is defined as the noise level measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum net lot area: (i) for lots less than 4,000 square feet in area, the exterior area shall include 400 square feet, (ii) for lots between 4,000 square feet to 10 acres in area, the exterior area shall include 10 percent of the lot area; (iii) for lots over 10 acres in area, the exterior area shall include 1 acre.

5. For all other residential land uses, "exterior noise level" is defined as noise measured at exterior areas which are provided for private or group usable open space purposes. "Private Usable Open Space" is defined as usable open space intended for use of occupants of one dwelling unit, normally including yards, decks, and balconies. When the noise limit for Private Usable Open Space cannot be met, then a Group Usable Open Space that meets the exterior noise level standard shall be provided. "Group Usable Open Space" is defined as usable open space intended for common use by occupants of a development, either privately owned and maintained or dedicated to a public agency, normally including swimming pools, recreation courts, patios, open landscaped areas, and greenbelts with pedestrian walkways and equestrian and bicycle trails, but not including off-street parking and loading areas or driveways

6. For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use.

7. For noise sensitive land uses where people normally do not sleep at night, the exterior and interior noise standard may be measured using either CNEL or the one-hour average noise level determined at the loudest hour during the period when the facility is normally occupied.

8. The exterior noise standard does not apply for land uses where no exterior use area is proposed or necessary, such as a library.

9. For Categories E and F the exterior noise level standard shall not exceed the limit defined as "Acceptable" in by the City, or an equivalent one-hour noise standard.

(1) Exterior Noise Level compatibility guidelines for Land Use Categories A-H are identified in Table 3.11-6, Noise Compatibility Guidelines.
Note: "Category(ies)" discussed in this table refer to lettered Land Use Category(ies) in Table 7-3 of this Element.

3.4 Operational Noise Standards

The City noise regulations and guidelines that apply to the Project are found in Chapter 20.300 Site Planning and General Development Standards of the City Municipal Code. These regulations aim to prohibit unnecessary, excessive, and annoying noises from all sources, as certain noise levels are detrimental to the health and welfare of individuals. The standards of this section and of Chapter 10.24 Noise of the Municipal Code apply to all land uses in all Zones unless otherwise specified. No person shall create or allow the creation of exterior noise that causes the noise level to exceed the noise standards established by Table 20.300-4 (provided below in Table 3-5).

Table 3-5: Sound Level Limits

Zone	Allowable Noise Level (dBA Leq) Measured from the Property Line
Single-Family Residential (A, R-1, R-2) [1, 2]	
7 a.m. to 10 p.m. (daytime)	60
10 p.m. to 7 a.m. (overnight)	50
Multifamily Residential (R-3) [1, 2]	
7 a.m. to 10 p.m. (daytime)	65
10 p.m. to 7 a.m. (overnight)	55
Commercial (C, O-P, SR)[3]	
7 a.m. to 10 p.m. (daytime)	**65**
10 p.m. to 7 a.m. (overnight)	**55**
Industrial	
7 a.m. to 10 p.m. (daytime)	65
10 p.m. to 7 a.m. (overnight)	60

Notes:

1. For single-family detached dwelling units, the "exterior noise level" is defined as the noise level measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum net lot area: (i) for lots less than 4,000 square feet in area, the exterior area shall include 400 square feet, (ii) for lots between 4,000 square feet to 10 acres in area, the exterior area shall include 10 percent of the lot area; (iii) for lots over 10 acres in area, the exterior area shall include 1 acre.
2. For all other residential land uses, "exterior noise level" is defined as noise measured at exterior areas which are provided for private or group usable open space purposes. "Private Usable Open Space" is defined as usable open space intended for use of occupants of one dwelling unit, normally including yards, decks, and balconies. When the noise limit for Private Usable Open Space cannot be met, then a Group Usable Open Space that meets the exterior noise level standard shall be provided. "Group Usable Open Space" is defined as usable open space intended for common use by occupants of a development, either privately owned and maintained or dedicated to a public agency, normally including swimming pools, recreation courts, patios, open landscaped areas, and greenbelts with pedestrian walkways and equestrian and bicycle trails, but not including off-street parking and loading areas or driveways.
3. For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use.

4.0 CONSTRUCTION NOISE AND VIBRATION

4.1 Construction Noise Prediction Methodology

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders and scrapers can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by heavy construction equipment can range from 60 dBA to in excess of 100 dBA when measured at 50 feet. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 75 dBA measured at 50 feet from the noise source to the receptor would be reduced to 69 dBA at 100 feet from the source to the receptor and reduced to 63 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers.

The equipment needed for the development will consist of a D4 bulldozer, a skip loader, a water truck, and a roller/compactor and haul trucks. Based on the EPA noise emissions, empirical data and the amount of equipment needed, worst case noise levels from the construction equipment for site preparation would occur during the grading operations.

4.2 Grading Activities Noise Findings and Mitigation

The grading activities will consist of the preparation of internal driveways, parking and the finished pad. The grading equipment will be spread out over the project site from distances near the occupied property lines to distances of 75 feet or more away. For example: while the dozer is working in the northwest portion of the site the skip loader maybe working in the center of the site and the roller compactor and water truck will be moving around the site. This will create separation between the individual equipment resulting in an average distance of 75 feet from the same property line. This means that the average distance from all the equipment to the same property line is 75 feet. As can be seen in Table 4-1, at an average distance of 75 feet from the construction activities to the nearest property line would result in a noise attenuation of -6.0 dBA without shielding.

Table 4-1: Construction Noise Levels

Equipment Type	Quantity Used	Source @ 50 Feet (dBA)	Cumulative Noise Level @ 50 Feet (dBA)
Dozer D4 Cat	1	74	74.0
Loader/Grader	1	73	73.0
Water Truck	1	70	70.0
Roller/Compactor	1	74	74.0
Haul Truck	1	75	75.0
Cumulative Level if equipment was located in the same location			80.5
Average distance from all equipment to adjacent use (Feet)			100
Noise Reduction due to average distance			-6.0
Average Property Line Noise Level			**74.5**

In addition to on-site construction, off-site construction would also be required for sewer and water line improvements and connection along Bent Avenue. Unlike construction associated with on-site development, utility pipeline construction is linear along a pipeline/roadway alignment. The project will require extension of a sewer line approximately 300 feet. Excavation and pipeline equipment used for sewer and water pipeline projects would generate similar noise levels as roadway improvements and the amount of equipment utilized would be limited due to alignment and work area constraints. Based on a construction area of approximately 50 feet by 300 feet, the average hourly off site construction noise levels would be approximately 75 dBA at the edge of the roadway right-a-way.

Given this, the noise levels will comply with the 75 dBA Leq standard at the property lines. Therefore, no impacts are anticipated and no mitigation is required during construction of the proposed Project. Additionally, all equipment should be properly fitted with mufflers.

4.3 Construction Vibration Findings and Mitigation

The nearest vibration-sensitive uses are the commercial uses adjacent to the project site. Table 4-2 lists the average vibration levels that would be experienced at the nearest vibration sensitive land uses from the temporary construction activities.

The FTA has determined vibration levels that would cause annoyance to a substantial number of people and potential damage to building structures. The FTA criterion for vibration induced structural damage is 0.20 in/sec for the peak particle velocity (PPV) for non-engineered timber structures and 0.30-0.50 for engineered structures. Project construction activities would result in PPV levels below the FTA's criteria for vibration induced structural damage. Therefore, project

construction activities would not result in vibration induced structural damage to buildings near the construction areas. The FTA criterion for infrequent vibration induced annoyance is 83 Vibration Velocity (VdB) for normal commercial uses. Construction activities would generate levels of vibration that would not exceed the FTA criteria for nuisance for nearby commercial uses. Therefore, vibration impacts would be less than significant.

Table 4-2: Vibration Levels from Construction Activities

Equipment	Approximate Velocity Level at 25 Feet (VdB)	Approximate RMS Velocity at 25 Feet (in/sec)	Approximate Velocity Level at 50 Feet (VdB)[1]	Approximate RMS Velocity at 50 Feet (in/sec)[2]
Small bulldozer	58	0.003	49	0.0011
Jackhammer	79	0.035	70	0.0124
Large bulldozer	87	0.089	78	0.0315
		FTA Criteria	83	0.2
		Significant Impact?	**No**	**No**

[1] VdB = VdBref – 30log(D/25)
[2] PPV at Distance D = PPVref x $(25/D)^{1.5}$

5.0 TRANSPORTATION NOISE

5.1 Future Onsite Noise Prediction

The projected roadway noise levels from vehicular traffic were calculated using the methods in the Highway Noise Model published by the Federal Highway Administration (FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108, December, 1978). The FHWA Model uses the traffic volume, vehicle mix, speed, and roadway geometry to compute the equivalent noise level. A spreadsheet calculation was used which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these equivalent noise levels and summing them gives the CNEL for the traffic projections. The Buildout conditions include the future traffic volume forecasts provided in the Project's Traffic Study (Source: Linscott, Law, and Greenspan Engineers, 2021).

Table 5-1: Future Traffic Parameters

Roadway	Average Daily Traffic (ADT)[1]	Modeled Speeds (MPH)	Vehicle Mix %[2]		
			Auto	Medium Trucks	Heavy Trucks
San Marcos Boulevard	48,970	45	96.0	2.0	2.0
Bent Avenue	8,920	35	96.0	2.0	2.0

[1] Source: Linscott, Law, and Greenspan Engineers, 2021
[2] Typical City vehicle mix

The restaurant outdoor seating area was modeled to determine if shielding/mitigation is required to reduce the noise levels below the City's 65 dBA CNEL threshold. The Project is proposing a 4-foot-high planter surrounding the outdoor seating area that will also act as a sound wall.

5.2 Onsite Noise Findings and Mitigation

The outdoor seating area was modeled to determine if shielding/mitigation is required to reduce the noise levels below the City's 65 dBA CNEL threshold. The proposed building will provide partial shielding from San Marcos Boulevard and a 3 decibel reduction is anticipated from traffic along the roadway. No reductions were accounted for from traffic along Bent Avenue. The modeling results are quantitatively shown in Figure 5-A. Based upon these findings, the outdoor seating areas at the restaurant will comply with the City of San Marcos Noise standards of 65 dBA CNEL.

Figure 5-A: Future Noise Levels

Traffic Volumes, Mix and Speeds				
	Autos	Med. Trucks	Heavy Trucks	
Mix Ratio by Percent	96.0	2.0	2.0	
Roadway	**ADT**	**Speed MPH**	**CNEL @ 50 Feet**	**65 CNEL (Feet)**
San Marcos Boulevard	48,970	45	74	207
Bent Avenue	8,920	35	65	46

Noise Reductions				
	Distance from Center Line	**Reduction from Distance**	**Reduction from Barriers**	**Resultant Level**
San Marcos Boulevard	135	-6	-3	63
Bent Avenue	192	-9	0	56
Cumulative Noise Level			**64**	**dBA CNEL**

The City also requires interior noise levels in retail buildings be reduced to 50 dBA CNEL. Basic calculations show that a windows open condition will only reduce the interior noise levels roughly 15 dBA CNEL and not provide adequate interior noise mitigation. A windows closed condition will typically reduce the interior noise levels 25 dBA CNEL if the windows are dual pane. To meet the 50 dBA CNEL interior noise standard at the retail space, an interior noise level reduction of 20-25 dBA CNEL is needed for the proposed project. Therefore, with the incorporation of standard dual pane windows and mechanical ventilation as a project design feature the project will achieve the necessary interior noise reductions to meet the City's 50 dBA CNEL standard.

5.3 Project Related Offsite Transportation Noise

The off-site Project related roadway segment noise levels projected in this report were calculated using the methods in the Highway Noise Model published by the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model, FHWA-RD-77-108, December, 1978). The FHWA Model uses the traffic volume, vehicle mix, speed, and roadway geometry to compute the equivalent noise level. A spreadsheet calculation was used which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these equivalent noise levels and summing them gives the CNEL for the traffic projections. The noise contours are then established by iterating the equivalent noise level over many distances until the distance to the desired noise contour(s) are found.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore, the doubling of

the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiate in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation.

Community noise level changes greater than 3 dBA are often identified as audible and considered potentially significant, while changes less than 1 dBA will not be discernible to local residents. In the range of 1 to 3 dBA, residents who are very sensitive to noise may perceive a slight change. There is no scientific evidence available to support the use of 3 dBA as the significance threshold. Community noise exposures are typically over a long time period rather than the immediate comparison made in a laboratory situation. Therefore, the level at which changes in community noise levels become discernible is likely greater than 1 dBA and 3 dBA appears to be appropriate for most people. For the purposes for this analysis a direct and cumulative roadway noise impacts would be considered significant if the project increases noise levels for a noise sensitive land use by 3 dBA CNEL and if the project increases noise levels above an unacceptable noise level per the City's General Plan in the area adjacent to the roadway segment.

Direct Traffic Related Noise

To determine if direct off-site noise level increases associated with the development of the Project will create noise impacts. The noise levels for the existing conditions were compared with the noise level increase from the Project. Utilizing the Project's traffic assessment, noise contours were developed for the following traffic scenarios:

Existing: Current day noise conditions without construction of the project.

Existing Plus Project: Current day noise conditions plus the completion of the project.

Existing vs. Existing Plus Project: Comparison of the direct project related noise level increases in the vicinity of the project site.

The noise levels at 50 feet for the roadways in the vicinity of the Project site are given in Table 5-2 for the Existing Scenario and in Table 5-3 for the Existing Plus Project Scenario. Note that the values given do not take into account the effect of any noise barriers or topography that may affect ambient noise levels. Table 5-4 presents the comparison of the Existing Year with and without Project related noise levels. The overall roadway segment noise levels will increase from 0.0 dBA CNEL to 0.1 dBA CNEL with the development of the Project. The Project does not create a direct noise increase of more than 3 dBA CNEL on any roadway segment. Therefore, the Project's direct contributions to off-site roadway noise increases will not cause any significant impacts to any existing or future noise sensitive land uses.

Table 5-2: Existing Noise Levels

Roadway	Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 50-Feet (dBA CNEL)
San Marcos Boulevard	Via Vera Cruz to Bent Avenue	36,900	45	74.9
	Bent Avenue to Grand Avenue	40,600	45	75.3
	Grand Avenue to SR-78 EB Ramps	54,500	45	76.6
Bent Avenue	Grand Avenue to San Marcos Boulevard	5,100	35	64.0
[1] Source: Project Traffic study prepared by Linscott, Law, & Greenspan Engineers				

Table 5-3: Existing + Project Noise Levels

Roadway	Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 50-Feet (dBA CNEL)
San Marcos Boulevard	Via Vera Cruz to Bent Avenue	37,160	45	74.9
	Bent Avenue to Grand Avenue	41,280	45	75.4
	Grand Avenue to SR-78 EB Ramps	54,810	45	76.6
Bent Avenue	Grand Avenue to San Marcos Boulevard	5,190	35	64.0
[1] Source: Project Traffic study prepared by Linscott, Law, & Greenspan Engineers				

Table 5-4: Existing vs. Existing + Project Noise Levels

Roadway	Roadway Segment	Existing Noise Level (dBA CNEL)	Existing Plus Project Noise Level (dBA CNEL)	Project Related Noise Increase (dBA CNEL)
San Marcos Boulevard	Via Vera Cruz to Bent Avenue	74.9	74.9	0.0
	Bent Avenue to Grand Avenue	75.3	75.4	0.1
	Grand Avenue to SR-78 EB Ramps	76.6	76.6	0.0
Bent Avenue	Grand Avenue to San Marcos Boulevard	64.0	64.0	0.0
[1] Source: Project Traffic study prepared by Linscott, Law, & Greenspan Engineers				

Cumulative Traffic Related Noise

To determine if cumulative off-site noise level increases associated with the development of the Project and other planned or permitted projects in the vicinity will create noise impacts. The noise levels for the future Project Buildout and other planned and permitted projects were compared with the existing conditions. Utilizing the Project's traffic assessment, noise contours were developed for the following traffic scenarios:

Existing: Current day noise conditions without construction of the project.

Existing Plus Cumulative Projects Plus Project: Current day noise conditions plus the completion of the project and the completion of other permitted, planned projects or approved ambient growth factors.

Existing vs. Existing Plus Cumulative Plus Project: Comparison of the existing noise levels and the related noise level increases from the combination of the project and all other planned or permitted projects in the vicinity of the site.

The existing noise levels at 50 feet for the roadways in the vicinity of the Project site are given in Table 5-2 above for the Existing Scenario. The future cumulative noise conditions are provided in Table 5-5. No noise barriers or topography that may affect noise levels were incorporated in the calculations.

Table 5-5: Existing + Project + 2035 Cumulative Noise Levels

Roadway	Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 50-Feet (dBA CNEL)
San Marcos Boulevard	Via Vera Cruz to Bent Avenue	48,320	45	76.1
	Bent Avenue to Grand Avenue	48,290	45	76.1
	Grand Avenue to SR-78 EB Ramps	63,910	45	77.3
Bent Avenue	Grand Avenue to San Marcos Boulevard	8,830	35	66.3
[1] Source: Project Traffic study prepared by Linscott, Law, & Greenspan Engineers				

Table 5-6 presents the comparison of the Existing Year and the future Cumulative noise levels. The overall roadway segment noise levels will increase 0.7 dBA CNEL to 2.3 dBA CNEL with the development of the Project and proposed cumulative projects. The cumulative noise increase is less than 3 dBA CNEL and the Project is not the main reason for the overall increase. Therefore, the Project's contributions to off-site roadway noise increases will not cause any significant impacts to any existing or future noise sensitive land uses.

Table 5-6: Existing vs. Existing + Project + 2035 Cumulative Noise Levels

Roadway	Roadway Segment	Existing Noise Level (dBA CNEL)	Existing Plus Project Noise Level (dBA CNEL)	Project Related Noise Increase (dBA CNEL)
San Marcos Boulevard	Via Vera Cruz to Bent Avenue	74.9	76.1	1.2
	Bent Avenue to Grand Avenue	75.3	76.1	0.8
	Grand Avenue to SR-78 EB Ramps	76.6	77.3	0.7
Bent Avenue	Grand Avenue to San Marcos Boulevard	64.0	66.3	2.3

[1] Source: Project Traffic study prepared by Linscott, Law, & Greenspan Engineers

6.0 OPERATIONAL NOISE

This section examines the potential operational noise source levels associated with the development and operation of the proposed project. Noise from a fixed or point source drops off at a rate of 6 dBA for each doubling of distance. Which means a noise level of 70 dBA at 5 feet would be 64 dBA at 10 feet and 58 dBA at 20 feet. A review of the proposed project indicates that noise sources such as the roof mounted HVAC and the drive-thru speaker are the primary sources of stationary noise. Minimal noise will also occur from vehicle idling in the drive thru.

The City noise regulations and guidelines that apply to the Project are found in Chapter 20.300 Site Planning and General Development Standards of the City Municipal Code. These regulations aim to prohibit unnecessary, excessive, and annoying noises from all sources, as certain noise levels are detrimental to the health and welfare of individuals. The City Ordinance limits noise generation in commercial zones to 65 dB Leq (one-hour average) between the hours of 7 am and 10 pm and 55 dB Leq between the hours of 10 pm and 7 am as measured at the project property line as shown above in Table 3-5 "For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use".

Property lines surrounding the project site are all commercial as can be seen in Figure 6-A and none of the adjacent properties have outdoor use areas. Therefore, a 65 dBA hourly noise standard during the daytime hours between 7 a.m. and 7 p.m., a 55 dBA standard during the evening hours of 7 p.m. and 10 p.m.

To examine the potential stationary noise source impacts associated with the operation of the proposed drive-thru, reference noise levels were used for the menu board and speaker post (Source: HME Electronics, Inc., HME SPP2 Speaker Post). The reference noise level of the speaker board is 54 dBA at 32 feet. The drive-thru speaker is located 140 feet from the commercial property line to the east and would result in a noise level below 55 dBA at a distance of 32 feet. Additionally, noise from vehicle idling in the drive-thru may increase the overall noise level to 58 dBA at 32 feet and would be reduced to less than 55 dBA at a distance of 64 feet. The commercial structure located adjacent to the drive-thru to the south, as shown in Figure 6-A, is a storage facility with a perimeter wall and the structures would provide 20-25 decibels of reduction to any indoor uses, resulting in exterior and interior noise levels below 40 dBA. This is well below the City's commercial exterior nighttime hourly noise threshold of 55 dBA and the interior noise threshold of 50 dBA hourly.

Typically, mechanical equipment (HVAC) noise is 50-55 dBA at 50 feet from the source. HVAC units would be included on the roof of the proposed building and would be shielded by a mechanical screen and/or the roof parapet, which would reduce the noise. The HVAC units would be located approximately 35-60 feet from the property lines, resulting in noise levels of 56-62 dBA. The noise level would be reduced to less than 55 dBA at a distance of 50 feet or less with the parapets. No unshielded sensitive outdoor uses are located within 50 feet of the site and therefore no impacts are anticipated.

As stated in Chapter 20.300 Site Planning and General Development Standards of the City Municipal Code "For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use". As stated above, there are no exterior outdoor sensitive areas near the project site. Therefore, the proposed development related operational noise levels comply with the noise standards and no impacts are anticipated and no mitigation is required.

Figure 6-A: Surrounding Land Uses