SANTA ROSA MEMORIAL HOSPITAL NEW MEDICAL OFFICE BUILDING & PARKING STRUCTURE

ENVIRONMENTAL NOISE & VIBRATION ASSESSMENT

Santa Rosa, California

March 18, 2017

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INTRODUCTION

This report provides an assessment of noise resulting from Santa Rosa Memorial Hospital's proposal for a new four story medical office building and an associated new six level parking structure within the city of Santa Rosa at the Southeast corner of Montgomery Drive and Sotoyome Street across Montgomery Drive from the Hospital. This report includes a summary of applicable noise regulations, the results of a noise monitoring survey conducted for the project, and an assessment of noise impacts and mitigation measures necessary to meet the applicable City standards at adjacent noise sensitive land uses. Persons not familiar with environmental noise analysis are referred to Appendix A for additional discussion.

PROJECT DESCRIPTION

The project involves the construction and operation of a new four story medical office building (MOB) with a total of 69,000 square feet and an associated new 600 stall, 6 level parking structure. The new MOB will include a hospital licensed outpatient diagnostic imaging clinic on the first floor and the upper floor will have doctors' offices. The anchor tenants in the new MOB's will be Santa Rosa Memorial Hospital's (SRMH) outpatient diagnostic imaging clinic and their affiliated physician medical group. The affiliated physician medical group is multi-specialty group practice that is currently located in individual medical office buildings in the surrounding area. Development of the new MOB will allow for the consolidation of these physicians while co-locating the doctors' offices with the diagnostic imaging clinic will allow for reduced patient vehicle trips between office and testing locations. Additionally, the construction of a parking structure to serve the parking needs of the new medical office building will be situated on a corner to allow access to two streets. Figure 1, below, shows the location of the project site in relation to the Hospital and other area uses.

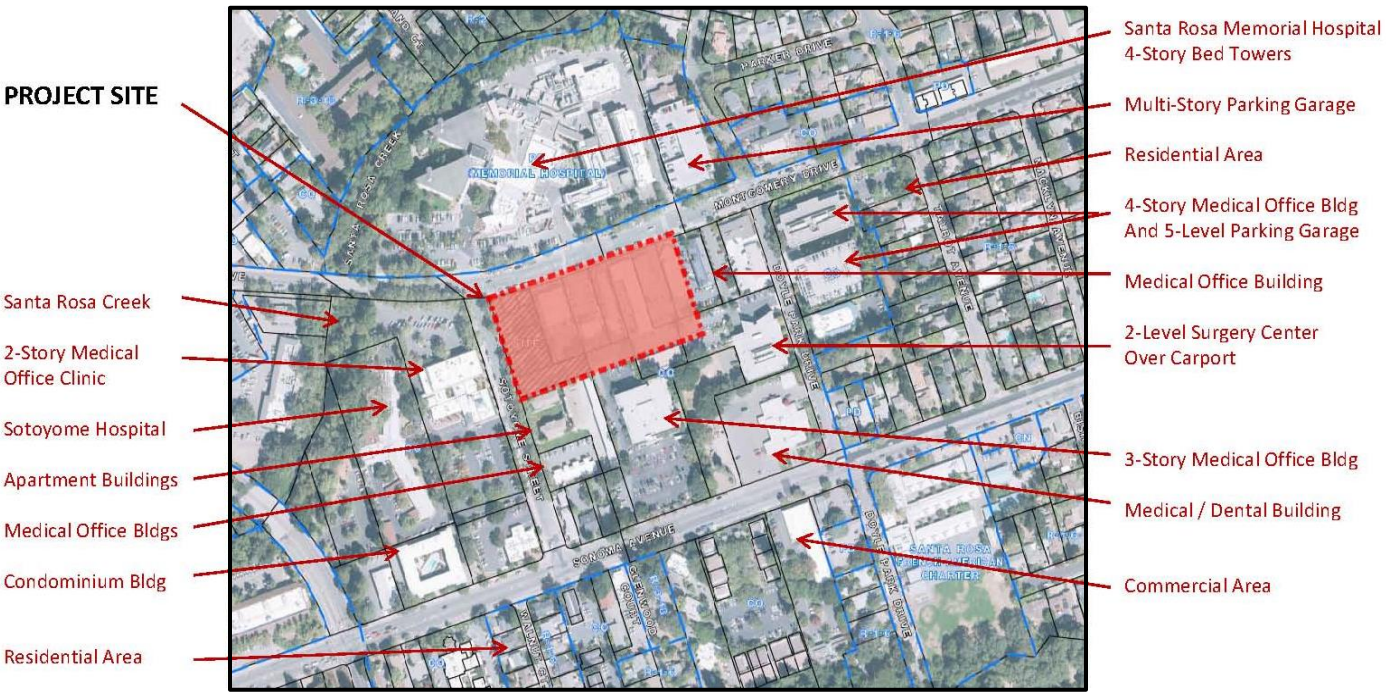


Figure 1: Site Location and Vicinity

REGULATORY BACKGROUND

The State of California and the City of Santa Rosa have established plans and policies that are designed to limit noise exposure at noise sensitive land uses. Plans and policies applicable to the proposed project include: (1) the State CEQA Guidelines, Appendix G; (2) 2013 California Building Cal Green Code, Title 24, Part 11; (3) the City of Santa Rosa General Plan Noise Element; (4) the City of Santa Rosa Noise Ordinance; and (5) Caltrans Construction Vibration Criteria.

State CEQA Guidelines

The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;
(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or
(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

Checklist items (a), (b), (c), and (d) are relevant to the proposed project. The project is not located in the vicinity of a public or private airstrip; therefore, checklist items (e) and (f) are not carried forward in this analysis.

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 3 dBA L_{dn} or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard. Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA L_{dn} or greater would be considered significant.

2013 California Building Cal Green Code, Title 24, Part 11[1], The Green Building Standards of the State of California Code of Regulations (Title 24, Part 11) establishes mandatory exterior sound transmission control standards for new <u>non-residential</u> buildings as set forth in the 2013 California Green Building Standards Code Sections 5.507.4.1 and 5.507.4.2 Exterior noise transmission as follows[2]:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a

[1] Including changes effective July 1, 2012.

[2] Exception: Buildings with few or no occupants and where occupants are not likely to be affected by exterior noise, as determined by the enforcement authority, such as factories, stadiums, storage, enclosed parking structures and utility buildings.

composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:

1. Within the 65 CNEL noise contour of an airport.

Exceptions:

1. L_{dn} or CNEL for military airports shall be determined by the facility Air Installation Compatible Land Use Zone (AICUZ) plan.
2. L_{dn} or CNEL for other airports and heliports for which a land use plan has not been developed shall be determined by the local general plan noise element.

2. Within the 65 CNEL or L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source as determined by the Noise Element of the General Plan.

5.507.4.1.1 Noise exposure where noise contours are not readily available. Buildings exposed to a noise level of 65 dB L_{eq}-1-hr during any hour of operation shall have exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).

5.507.4.2 Performance method. For buildings located as defined in Sections A5.507.4.1 or A5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq}-1Hr) of 50 dBA in occupied areas during any hour of operation.

5.507.4.2.1 Site features**.** Exterior features such as sound walls or earth berms may be utilized as appropriate to the project to mitigate sound migration to the interior.

5.507.4.2.2 Documentation of compliance. An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.

City of Santa Rosa General Plan

The Noise and Safety Element of the City of Santa Rosa's General Plan identifies policies that are intended to guide the development of new projects with regard to exposure to or generation of noise. The policies support the City's goal of maintaining an acceptable community noise level. The following policies are applicable to the proposed project:

NS-B Maintain an acceptable community noise level to protect the health and comfort of people living, working and/or visiting in Santa Rosa, while maintaining a visually appealing community.

- Multi-family residential uses are considered to be normally acceptable in areas with a noise environment of L_{dn} of less than 65 dBA and conditionally acceptable in areas exposed to an L_{dn} of 60 to 70 dBA.
- Office Buildings and professional uses are considered to be normally acceptable in areas with a noise environment of L_{dn} of less than 70 dBA and conditionally acceptable in areas exposed to an L_{dn} of 67 to 75 dBA.

NS-B-1 Do not locate noise-sensitive uses in proximity to major noise sources, except residential is allowed near rail to promote future ridership.

NS-B-2 Encourage residential developers to provide buffers other than sound walls, where practical. Allow sound walls only when projected noise levels at a site exceed land use compatibility standards in Figure 12-1.

NS-B-3 Prevent new stationary and transportation noise sources from creating a nuisance in existing developed areas. Use a comprehensive program of noise prevention through planning and mitigation, and consider noise impacts as a crucial factor in project approval.

NS-B-4 Require new projects in the following categories to submit an acoustical study, prepared by a qualified acoustical consultant:

- All new projects that could generate noise whose impacts on other existing uses would be greater than those normally acceptable.
- All new projects proposed for areas with existing noise above 60 dBA L_{dn}. Mitigation shall be sufficient to reduce noise levels below 45 dBA L_{dn} in habitable rooms and 60 dBA L_{dn} in private and shared recreational facilities. Additions to existing housing units are exempt.

NS-B-5 Pursue measures to reduce noise impacts primarily through site planning. Engineering solutions for noise mitigation, such as sound walls, are the least desirable alternatives.

NS-B-6 Do not permit existing uses to generate new noises exceeding normally acceptable levels unless those noises are mitigated to acceptable levels.

NS-B-7 Allow reasonable latitude for noise generated by uses that are essential to community health, safety, and welfare. These include emergency medical helicopter and vehicle operations, and emergency vehicle sirens.

NS-B-9 Encourage developers to incorporate acoustical site planning into their projects. Recommended measures include:

- Incorporating buffers and/or landscaped earth berms;
- Orienting windows and outdoor living areas away from unacceptable noise exposure;
- Using reduced-noise pavement (rubberized-asphalt);
- Incorporating traffic calming measures, alternative intersection designs, and lower speed limits; and
- Incorporating state-of-the-art structural sound attenuation and setbacks.

NS-B-10 Work with private enterprises to reduce or eliminate nuisance noise from industrial and commercial sources that impact nearby residential areas. If progress is not made within a reasonable time, the City shall issue abatement orders or take other legal measures.

NS-B-14 Discourage new projects that have potential to create ambient noise levels more than 5 dBA L_{dn} above existing background, within 250 feet of sensitive receptors.

City of Santa Rosa Noise Ordinance

The City of Santa Rosa has adopted a quantitative noise ordinance in Chapter 17-16 of the Municipal Code. Section 17-16.120 regulates noise from machinery and equipment: "It is unlawful for any person to operate any machinery, equipment, pump, fan, air conditioning apparatus, or similar mechanical device in any manner so as to create any noise which would

cause the noise level at the property line of any property to exceed the ambient base noise level by more than 5 decibels. Ambient base noise levels for residential areas are established in Section 17-16.030. The applicable ambient noise level criteria are shown in Table 1, following;

TABLE 1: City of Santa Rosa Municipal Code Ambient Base Noise Levels (dBA)

Land Use Zone	Daytime Level	Evening Level	Nighttime Level
Single-Family Residential	55	50	45
Multi-Family Residential	55	55	50
Office and Commercial	60	60	55
Intensive Commercial	65	65	55
Industrial	70	70	70

Source: City of Santa Rosa, City of Santa Rosa Municipal Code 17-16.030, 1989

The Noise Ordinance defines ambient noise as follows:
"Ambient noise is the all-encompassing noise associated with a given environment usually a composite of sounds from many sources near and far. For the purpose of this chapter, ambient noise level is the level obtained when the noise level is averaged over a period of 15 minutes without inclusion of noise from isolated identifiable sources at the location and time of day near that at which a comparison is to be made."
The noise descriptor, L_{eq}, is used in this report for the purposes of determining noise with respect to these limits.

California Department of Transportation - Construction Vibration.
Caltrans recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards. A conservative vibration limit of 0.20 in/sec PPV has been used for older residential buildings that are found to be structurally sound but where cosmetic damage to plaster ceilings or walls is a major concern. For historic buildings or buildings that are documented to be structurally weakened, a conservative limit of 0.08 in/sec PPV is often used to provide the highest level of protection. All of these limits have been used successfully and compliance to these limits has not been known to result in appreciable structural damage. All vibration limits referred to herein apply on the ground level and take into account the response of structural elements (i.e. walls and floors) to ground-borne excitation.

EXISTING NOISE ENVIRONMENT

As shown in Figure 1, the project site is bordered by SRMH to the north across Montgomery Drive, existing adjacent MOB uses to the east and south, an apartment building to the south, and existing MOB uses to the west across Sotoyome Street. The closest single-family residential uses in the area are located south of Sonoma Avenue and east of Doyle Park Drive, at about 500 feet from the development area. For the purpose of this evaluation the closest noise sensitive receiver to the project site is considered to the existing apartment building immediately south of the project site. The noise environment at the project site and the general vicinity is dominated by traffic on area roadways, and mechanical equipment at the existing area Hospital, MOB, and commercial uses. To evaluate the existing noise environment at the closest noise sensitive use to the project site, one long term and one short term measurements were in the vicinity of the apartment building immediately south of the project site and a short term noise measurements was conducted at the property line of the closest single family uses on Doyle Park Drive. The locations of these measurements relative to the site and vicinity are shown in Figure 2.

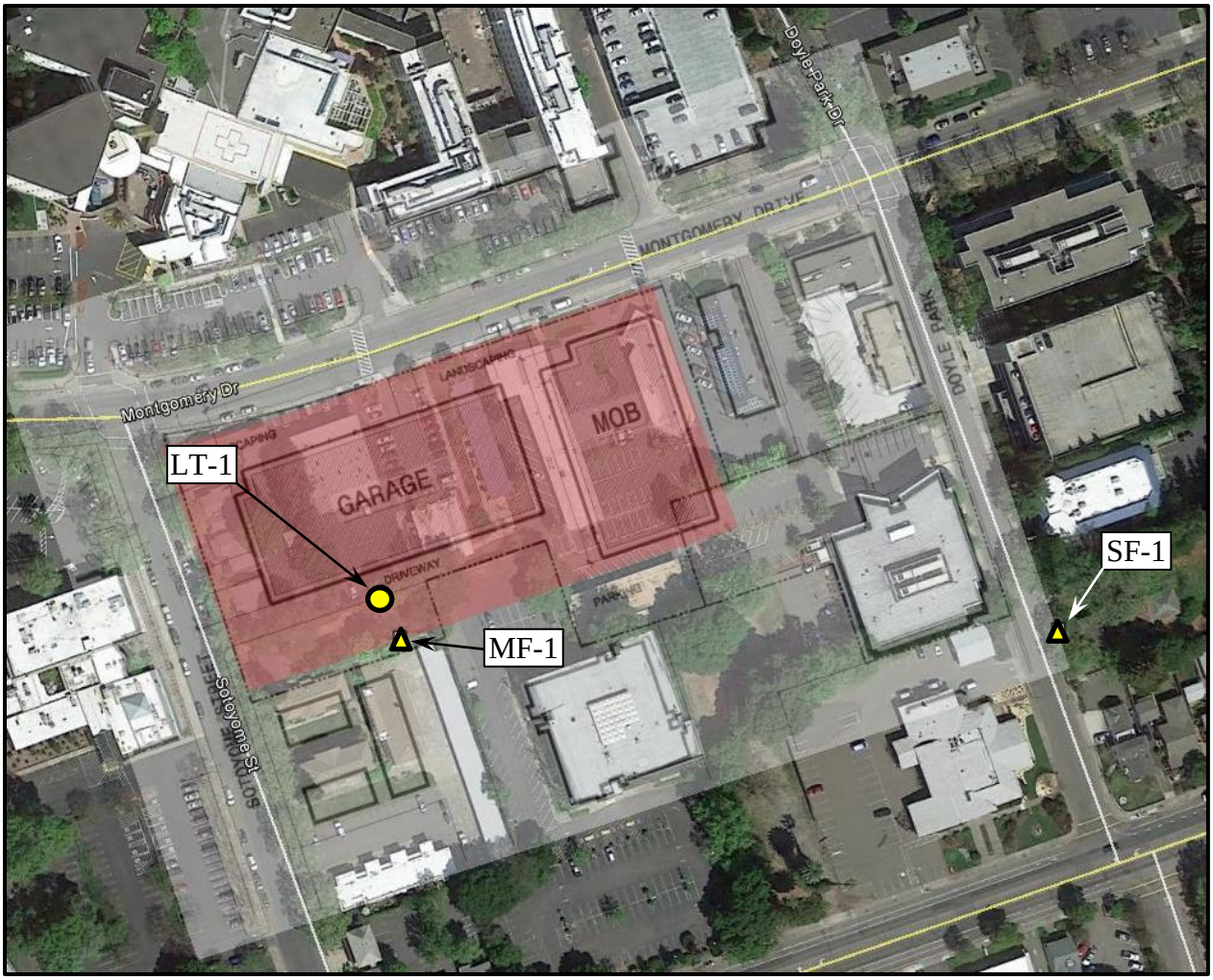
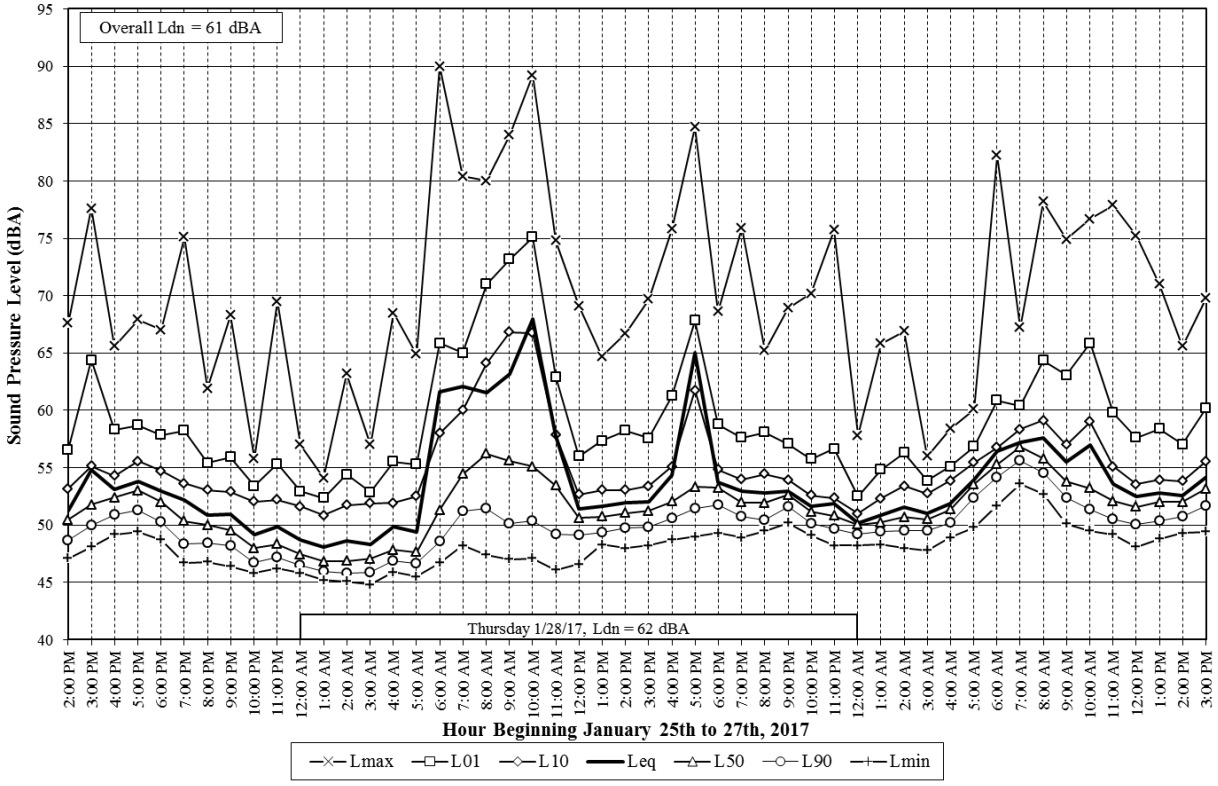


Figure 2: Aerial Photo with Site Plan and Measurement Locations

All noise measurements were made with Larson Davis Model 820 Integrating Sound Level Meters set at "slow" response. The sound level meters were equipped with a G.R.A.S. Type 40AQ ½ - inch random incidence microphones fitted with windscreens. All instrumentation used meets the requirements of the American National Standards Institute (ANSI) SI.4-1983 for Type 1 use. The sound level meters were calibrated prior to the noise measurements using a Larson Davis Model CAL200 acoustical calibrator. During the measurement period the weather was clear with no precipitation.

The long-term sound level measurement (LT-1) was conducted over a 51-hour weekday period between 1:00 p.m. on Wednesday, January 25th and 4:00 p.m. on Friday, January 27th, 2017 on a tree trunk at the southern edge of the parking lot behind the Sonoma Federal Credit Union building (1126 Montgomery Drive) at a distance of approximately 235 feet south of the centerline of Montgomery Drive, 195 east of the centerline of Sotoyome Street, and 50 feet north of the northernmost façade of the adjacent apartment building. Noise levels measured at this site were primarily produced by area traffic and building mechanical equipment, with intermittent high noise levels from parking lot usage. The hourly trend in noise levels at this location, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 1, 10, 50, and 90 percent of the time (indicated as L_{01}, L_{10}, L_{50}, and L_{90}) are shown on Chart 1.

Chart 1: Measured Noise Levels at LT-1



The average weekday noise levels at this location ranged from 53 to 60 dBA L_{eq} during the day, and 42 to 59 dBA L_{eq} at night, the average noise levels ranged from 49 to 68 dBA L_{eq} during the day and 48 to 62 dBA L_{eq} at night. The calculated average day/night noise level (L_{dn}) at this location ranged from 61 to 62 dBA.

Short-term noise measurements were made on a 10-minute basis at two locations to evaluate ambient conditions at the property lines of adjacent apartment building and the nearest single family home on Doyle Park Drive, identified as MF-1 and SF-2 in Figure 2 based on the change in noise levels from the long term to the short term position. The measurement locations are described as follows:

- Measurement location MF-1 made on the northern eastern property line of apartment uses closest to the project site (approximately 50 feet south of the long term (LT-1) measurement location.
- Measurement location SF-1 was made on the front property line of the single family home at 540 Doyle Park Drive.

The average day-night noise level (L_{dn}) at each short-term measurement location was estimated at this site by correlating the short-term measurement data to the data gathered during the corresponding time period at the long-term sites. Noise levels measured at these sites were produced primarily by roadway traffic. The measurement results and estimated L_{dn} levels at these locations are shown in Table 3.

Table 3: Summary of Short-Term Noise Measurement Data, dBA

Noise Measurement Location	Lmax	L01	L10	Leq	L50	L90	Lmin	Ldn
MF-1: Property line of adjacent Apartment Building	62	58	55	53	52	50	49	**61**
SF-1: Western property line of 540 Doyle Park Drive	71	63	58	53	51	49	47	**64**

Note: L_{dn} is approximated by correlation to the corresponding measurement period at the long-term sites.

NOISE IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would expose people to or generate excessive ground borne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis.

The following criteria were used to evaluate the significance of environmental noise and vibration resulting from the project (corresponding to the CEQA checklist items):

A. **Noise and Land Use Compatibility:** A significant noise impact would result if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the City of Santa Rosa General Plan or Noise Ordinance.

B. **Groundborne Vibration:** A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.25 in/sec PPV would have the potential to result in "architectural" damage to normal buildings.

C. **Substantial Permanent Increase in Ambient Noise Levels:** A significant impact would be identified if traffic or operational noise generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA L_{dn} or greater, with a project condition noise level of less than 60 dBA L_{dn}, or b) the noise level increase is 3 dBA L_{dn} or greater, with a project condition noise level of 60 dBA L_{dn} or greater.

D. **Substantial Temporary Increase in Ambient Noise Levels:** A significant noise impact would be identified if construction related noise would result in a substantial temporary increase in ambient noise levels. Construction noise is typically considered significant when noise from construction activities exceed 60 dBA L_{eq} and the ambient noise environment by at least 5 dBA L_{eq} for a period of greater than one year or more at exterior areas of noise sensitive residential uses in the project area, or if noise levels produced by construction activities would result in interior noise levels within adjacent residences which could result in significant speech interference. As discussed in Appendix A, the threshold for speech interference indoors is about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Thus, constant noise from construction related activities would begin to result in speech interference at a level of 45 dBA, while maximum noise from construction related activities would result in speech interference at a level of 55 dBA or above. Also per Appendix A, typical structural attenuation is as low as 12 dBA with open windows, around 20 dBA for an older structure with closed windows in good condition and around 25 dBA for a newer dwelling. Considering that the existing uses in the area are not new, but generally in good condition, a consideration that neighbors would generally choose to close their windows for other reasons in addition to noise control during periods of heavy, close construction, and that most construction noise levels are fluctuating in nature, residential speech interference is considered possible when noise levels at the exterior facades of residences in the project vicinity reach average (L_{eq}) levels of 65 dBA or maximum (L_{max}) noise levels of 75 dBA.

Impact A: Noise and Land Use Compatibility. Based on the results of existing noise measurements and a review of the year 2020 noise contours shown in Figure 12-2 of the City's 2035 General Plan Noise and Safety Element, the proposed office uses on the site would be exposed to exterior noise levels of less than 70 dBA L_{dn}. Therefore, the proposed MOB use would be considered 'Normally Acceptable' with the site noise environment under the City of Santa General Plan noise and land use guidelines.

Interior noise levels within the proposed MOB are also expected to comply with the State of California *Cal Green* Building Code standards for exterior sound transmission control using the performance (section 5.507.4.2) analysis methods. Under the performance method wall, window and roof-ceiling assemblies facing noise sources need to be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq}-1Hr) of 50 dBA in occupied areas during any hour of operation. Though building plans and are not available for review considering typical commercial building techniques with standard operable thermal insulating glazing systems and/or standard fixed storefront glazing systems at the exterior (which typically achieve a minimum exterior to interior sound loss of 25 to 30 dBA), and that the peak hour Leq is not expected to exceed 70 dBA at the building facades, this report finds that the interior hourly equivalent noise level ($L_{eq\text{-}1Hr}$) limit of 50 dBA during any hour of operation would be met with a standard, non-STC rated, operable thermal insulating glazing systems. *This is a less-than-significant impact.*

Mitigation A:
None Required.

Impact B: Exposure to Groundborne Noise or Vibration. Residences and businesses in the vicinity of the project site could be exposed to construction or operations related vibration. *This is a potential significant impact, which can be reduced an insignificant level with mitigation*

Project operation is not expected to result in perceivable ground borne vibration or noise levels as the proposed office and parking land uses would not do involve any source capable of generating significant ground borne vibration or noise. However, heavily loaded Delivery or Soil Dump Trucks, the possible use of jack hammers, hoe rams or other high powered tools for concrete or pavement removal during site clearing and construction work, the use of excavation equipment, driven or drilled piers, and ground compaction during building foundation work, could generate perceptible vibration in the immediate vicinity of the site. Structures of the adjacent apartments appear to be located as close as 100 feet from the proposed building footprints, while office buildings in the vicinity appear to be located as close 50 feet from the proposed building footprints. The adjacent office and commercial buildings appear to be adjacent buildings appear to be structurally sound and designed to modern engineering standards, and thus a vibration limit for these uses is established at 0.50 in/sec PPV (peak particle velocity). The adjacent apartment buildings appear to be of older normal (non-historic or weaken) type construction, and thus a vibration limit for these uses is established at 0.20 in/sec PPV to eliminate the potential of cosmetic damage to these buildings.

Table 4 presents typical vibration levels that could be expected from construction equipment at distances of 25, 50 and 100 feet. Project construction activities such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools may generate substantial vibration in the immediate vicinity. Construction activities are not expected to extend for more

than one construction season, and construction vibration would not be substantial for most of this time except during vibration generating activities. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

TABLE 4: Vibration Levels for Construction Equipment (PPV, in/sec)

Equipment		**PPV at 25 ft. (source level)[1]**	**PPV at 50 ft. (office buildings)[2]**	**PPV at 100 ft. (apart. building)[2]**
Impact Pile Driving	upper range	1.518	0.537	0.190
	typical	0.644	0.228	0.081
Vibratory Pile Diving	upper range	0.734	0.260	0.092
	typical	0.170	0.060	0.021
Vibratory Roller		0.210	0.074	0.026
Clam shovel drop		0.202	0.071	0.025
Hoe Ram		0.089	0.031	0.011
Large bulldozer		0.089	0.031	0.011
Caisson drilling (Drilled Piles)		0.089	0.031	0.011
Loaded trucks		0.076	0.027	0.009
Jackhammer		0.035	0.012	0.004
Small bulldozer		0.003	0.001	0.0004

Notes:
1. Source levels per Table 12.2 page 12-12 of FTA-VA-90-1003-06
2. Levels calculated using the equation $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$, page.12-11 of FTA-VA-90-1003-06

Source: FTA-VA-90-1003-06; Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

A review of Table 4 indicates that Pile driving could exceed the 0.5 in/sec PPV limit at the closest adjacent office buildings, but that all expected construction activities would be below the 0.20 in/sec PPV limit at the setback of the adjacent apartment building (100 feet). Additional analysis indicates that piles driven at 60 feet or farther from the office buildings would not exceed the 0.5 in/sec PPV limit, and that that piles driven at 95 feet or closer to the adjacent apartment building would exceed the 0.2 in/sec PPV limit.

In areas where vibration would not be expected to cause structural damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and it would not be considered significant given the intermittent and short duration of the phases that have the highest potential of producing vibration (foundation work, jackhammers and other high power tools).

Mitigation Measure B:
Foundation support piles within 60 feet of the adjacent office buildings or within 95 feet of the adjacent apartment building should either be installed using vibratory drivers or drilled and cast in place piers.

Impact C: Operational Noise. The operation of the proposed medical office building and parking garage would not generate noise levels exceeding the noise limits established in the City of Santa Rosa General Plan or Noise Ordinance, but may result in some speech disturbance within the adjacent apartment buildings. *This is a potential significant impact, which can be reduced an insignificant level with mitigation*

Potential noise producing activities resulting from the proposed medical office building and parking garage include (1) mechanical equipment noise from the building HVAC equipment, (2) operational noise from the parking structure, and (3) increased traffic noise on surrounding roadways due to project generated traffic. These noise producing activities are discussed below:

1. *Mechanical equipment noise:*

   Mechanical equipment associated with the proposed MOB will include exhaust fans and Heating, Ventilation, and Air Conditioning (HVAC) equipment installed on the building rooftop. The garage appears to be of an open air design and will not require ventilation equipment. Noise generated by mechanical equipment varies significantly depending upon the equipment type and size. The precise noise impacts of project equipment cannot be determined without detailed system design specifications regarding location, type, size, capacity, etc., details which are typically provided during later phases of the project design and development review along with other more detailed project engineering specifications. However, based on noise measurements made at hospitals and office buildings, HVAC exhaust equipment can produce noise levels between 70 to 75 dBA at 3 feet in the open environment. With the mechanical equipment located on the roof top the proposed MOB, and allowing for the accepted atmospheric attenuation rate of 6 dBA per doubling of distance from a fixed source, and without consideration of any attenuation provided by intervening structures or fences, the noise level at a position five feet above grade level at the closest adjacent residential property line[3], would be expected to range from 35 to 40 dBA. This sound level would comply with the nighttime noise ordinance limit of 45 dBA. *This is considered a less than significant noise impact.*

2. *Parking Structure Operational Noise*

   Based on noise measurements conducted of typical noise generating activities occurring on the various parking levels near a similarly designed open air four-story parking structure in downtown Petaluma[4] maximum (L_{max}) noise levels from door slams, engine starts, and vehicle circulation will typically range from 51-56 dBA and L_{max} noise levels from car horns will typically range from 60-68 dBA at the façade of the adjacent apartment building. Considering a typical minimum structural attenuation of 12 dBA with open windows and 20 dBA with closed windows, maximum noise levels resulting from infrequent events, such as car horns or the vehicle alarm systems would be between 48 to 56 dBA within apartment interiors with open windows and between 40 to 48 dBA with closed windows. More frequent maximum noise levels from door slams, engine starts, and vehicle circulation would be between 39 to 44 dBA within apartment interiors with open windows and 31 to 36 dBA with closed windows. Considering that, as discussed in Appendix A, the thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating, when the

[3] Based on review of the proposed site plan the distance from the closest MOB façade to closest residential property line is approximately 170 feet.

[4] Environmental Noise Assessment Vallco Fashion Park – North Parking Garage prepared for City of Cupertino by Illingworth & Rodkin, Inc., October 11, 2006.

noise from maximum noise levels from loud events within the parking garage, such as car horns or the vehicle alarm systems may cause speech interference within the adjacent apartment which have open windows. *This is a potential significant impact, which can be reduced an insignificant level with mitigation*

3. Increased Traffic Noise

A traffic noise report for the project was not available for review, however considering that the intent of the project is to consolidate existing physician offices and co-locate these offices with a diagnostic imaging clinic to allow for reduced patient vehicle trips between office and testing locations, we would expect the traffic on area roadways to remain the same or decrease. Based on this consideration we expect traffic noise levels along roadways serving the project site to remain the same or increase by less than 1 dBA L_{dn} as a result of the project. The project would not result in a measurable increase in noise at sensitive residential receivers in the vicinity. *This is considered a less than significant noise impact.*

Mitigation Measure C:

The project design team should consider constructing solid walls along the south facade of the parking garage facing the apartment in order to reduce maximum instantaneous noise levels attributable to garage use to 45 dBA within adjacent apartments with open windows.

It should be noted, however, that on a daily average basis, these loudest events within the parking garage, with or without mitigation, would be infrequent and would not be expected to cause a substantial increase in ambient noise levels (3 dBA L_{dn} or greater) at the adjacent apartments.

Impact D: Substantial Temporary Increase in Ambient Noise Levels. Noise levels generated by project construction activities would temporarily elevate ambient noise levels at sensitive land uses in the vicinity. Major noise generating construction activities would be limited to one construction season or less. *This is a less-than-significant impact.*

Construction activities generate considerable amounts of noise. Construction-related noise levels are normally highest during demolition and the construction of project infrastructure. These phases of construction require heavy equipment that normally generates the highest noise levels over extended periods of time. Typical hourly average construction generated noise levels are about 81 dBA to 88 dBA measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). Construction-related noise levels are normally less during building erection, finishing, and landscaping phases. There would be variations in construction noise levels on a day-to-day basis depending on the actual activities occurring at the site. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. The nearest existing residential receivers are about 80 feet from the project site. Hourly average noise levels would range from 77 dBA to 84 dBA during the busiest construction periods along the westernmost property line of the site. Shielding by barriers or buildings would provide an additional 5 to 10 decibels of attenuation at distant receptors.

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. Construction noise impacts primarily occur when construction activities occur during noise-sensitive times of the day (early

morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise sensitive land uses, or when construction durations last over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period greater than one year, the impact would be considered significant.

Demolition, grading, and the construction of project infrastructure would be completed first. The subgrade parking followed by the building structure units would then be constructed. As construction moves away from noise-sensitive receptors noise levels generated by heavy construction will be lower. Noise generated by demolition, grading, infrastructure improvements and the construction of units would not be expected to exceed ambient noise levels at receivers to the west, north, or south by more than 5 dBA L_{eq} for a period greater than one year.

Significant noise impacts do not normally occur when standard construction noise control measures are enforced at the project site and when the duration of the noise generating construction period at a particular receiver or group of receivers is limited to one construction season (typically one year) or less. Construction noises associated with projects of this type are disturbances that are necessary for the construction of buildings and structures in urban areas. Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction materials, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life.

The construction of the project would generate noise and would temporarily increase noise levels at adjacent residential receivers. Noise impacts resulting from construction depends on the noise generated by various pieces of construction equipment operating on site, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. During each stage of construction, there would be a different mix of equipment operating. Construction noise levels would vary by stage and vary within stages based on the amount of equipment in operation and location where the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Table 6, which gives the average noise level ranges by construction phase. To conduct a conservative assessment of construction noise impacts, this analysis was completed assuming that all pertinent equipment will be present at the site. Based on this consideration, most demolition and construction noise expected at the project is expected to range from 78 to 89 dBA at a distance of 50 feet from the source.

TABLE 6: Typical Ranges of L_{eq} Construction Noise Levels at 50 Feet, dBA

	Office Building, Hotel, Hospital, School, & Public Works		**Public Works; Roads & Highways, Sewers & Trenches**	
Construction Stage	**I**	**II**	**I**	**II**
Ground Clearing	84	84	84	84
Excavation	89	79	88	78
Foundations	78	78	88	88
Erection	87	75	79	78
Finishing	89	75	84	84
I - All pertinent equipment present at site, **II** - Minimum required equipment present at site.				

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973

Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. The closest existing residential receivers are in the apartment building about 100 feet from the perimeter of the proposed buildings. Hourly average noise levels at these residential uses would therefore range from 72 to 83 dBA dBA during busy construction periods near these uses. The closest commercial/office receivers are about 50 feet from the perimeter of the proposed buildings. Hourly average noise levels at these commercial/office uses would therefore range from 78 to 89 dBA dBA during busy construction periods near these uses. Though these levels would exceed 60 dBA L_{eq} and the average ambient daytime L_{eq} by 5 dBA, the period of time when maximum noise is produced at the closest point to these uses is expected to be of short duration. Additionally, the total construction period is expected to last for less than one year. As such the noise associated with construction activities would be less than significant. Nevertheless, the implementation of the following standard controls are recommended at the project:

a) Muffle and maintain all equipment used on site. All internal combustion engine-driven equipment shall be fitted with mufflers, which are in good condition. Good mufflers shall result in non-impact tools generating a maximum noise level of 80 dB when measured at a distance of 50 feet.
b) Utilize "quiet" models of air compressors and other stationary noise sources where technology exists.
c) Locate stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction project area.
d) Prohibit unnecessary idling of internal combustion engines.
e) Prohibit construction workers' radios which are audible on adjoining properties.
f) Restrict noise-generating activities at the construction site or in areas adjacent to the construction site to the hours between 7:00 a.m. and 7:00 p.m., Monday through Friday, and 8 a.m. to 6 p.m. Saturdays, with no construction is permitted on Sundays and holidays.
g) Do not allow machinery to be cleaned or serviced past 7:00 p.m. or prior to 7:00 a.m. Monday through Friday
h) Limit the allowable hours for the delivery of materials or equipment to the site and truck traffic coming to and from the site for any purpose to Monday through Friday between 7:00 a.m. and 7:00 p.m.
i) Allowable construction hours shall be posted clearly on a sign at the construction site.
j) The construction contractor shall designate a "noise disturbance coordinator" who will be responsible for responding to any local complaints about construction noise. A telephone number for the disturbance coordinator shall be conspicuously posted at the construction site. The Disturbance Coordinator shall:
    1. Receive and act on complaints about construction disturbances during site clearing, excavation, infrastructure installation, road building, residential construction, and site other construction activities.
    2. Determine the cause(s) and implement remedial measures as necessary to alleviate significant problems.
    3. Clearly post his/her name and phone number(s) on a sign at the construction site.
    4. Notify area residents of construction activities, schedules, and potential impacts.

While construction activities would be less-than-significant, implementation of the standard controls outlined above would reduce construction noise levels emanating from the site, thereby minimizing disruption and annoyance.

Mitigation Measure 3: No additional measures required

APPENDIX A:
FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL ACOUSTICS

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound may be caused by either its *pitch* or its loudness. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales that are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. For lesser increases of sound from the same or similar sources, a 6 dB change is perceived to be a "noticeable" change and a 3 dB change to be just perceptible. Technical terms are defined in Table 1. There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2.

Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Day/Night Average Sound Level, Ldn, is a measure of the cumulative noise exposure in a community, with a 10 dB penalty added to nighttime (10:00 pm - 7:00 am) noise levels. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels.

TERM	DEFINITIONS
Decibel, dB	A unit describing the amplitude of 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 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting 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 frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels in the night between 10:00 pm and 7:00 am.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Definitions Of Acoustical Terms **Table 1**

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Effects of Noise

Sleep and Speech Interference: The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. With intruding noise at 45 dBA conversations at normal vocal levels could be held between two persons at a distance about 10 feet (or across a typical room in a residential setting) and with intruding noise at 55 dBA conversations at normal vocal levels could be held between two persons at a distance of about 3 feet[5] (or the typical distance of persons sitting or standing near one another).

[5] Kryter Karl D., The effects of Noise on Man, Second Edition, Academic Press, Inc. London, 1985, Table 4.4, p.96

Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity; above 35 dBA, and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses.

Noise Source (Given Distance)	**A-Weighted Sound Level**	**Noise Environments**	**Subjective Impression**
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100')	100		Very Loud
	90	Boiler Room	
Freight Cars (50')		Printing Press Plant	
Pneumatic Drill (50')	80		
Freeway (100')		In Kitchen With Garbage	
Vacuum Cleaner (10')	70	Disposal Running	Moderately Loud
	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')			
	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

Typical Sound Levels in the Environment & Industry **Table 2**

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Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA with open windows and 65-70 dBA if the windows are closed.

Annoyance: Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The Ldn as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA Ldn. At an Ldn of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about 1 percent per dBA between an Ldn of 60-70 dBA. Between an Ldn of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed.