

NOISE IMPACT ANALYSIS
GARDENA TOWNHOMES
GARDENA, CALIFORNIA

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NOISE SETTING

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally considered to be unwanted sound. Sound is characterized by various parameters that describe the rate of oscillation of sound waves, the distance between successive troughs or crests, the speed of propagation, and the pressure level or energy content of a given sound. In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level.

The decibel (dB) scale is used to quantify sound pressure levels. Although decibels are most commonly associated with sound, "dB" is a generic descriptor that is equal to ten times the logarithmic ratio of any physical parameter versus some reference quantity. For sound, the reference level is the faintest sound detectable by a young person with good auditory acuity.

Since the human ear is not equally sensitive to all sound frequencies within the entire auditory spectrum, human response is factored into sound descriptions by weighting sounds within the range of maximum human sensitivity more heavily in a process called "A-weighting," written as dB(A). Any further reference in this discussion to decibels written as "dB" should be understood to be A-weighted.

Time variations in noise exposure are typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called LEQ), or alternately, as a statistical description of the sound pressure level that is exceeded over some fraction of a given observation period. Finally, because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law requires that, for planning purposes, an artificial dB increment be added to quiet time noise levels in a 24-hour noise descriptor called the Ldn (day-night) or the Community Noise Equivalent Level (CNEL). The CNEL metric has gradually replaced the Ldn factor, but the two descriptors are essentially identical.

CNEL-based standards are generally applied to transportation-related sources because local jurisdictions are pre-empted from exercising direct noise control over vehicles on public streets, aircraft, trains, etc. The City of Gardena therefore regulates the traffic noise exposure of the receiving property through land use controls.

NOISE COMPATIBILITY GUIDELINES

The City of Gardena General Plan contains recommended compatibility noise guidelines for a variety of land uses as shown in Figure 1. These guidelines would apply in usable outdoor space such as patios, yards, spas, etc. The guidelines indicate that an exterior noise level of 60 dB CNEL is considered to be a “normally acceptable” noise level for single family, duplex and multi-family uses involving normal conventional construction, without any special noise insulation requirements. Exterior noise levels up to 65 dB CNEL are typically considered “conditionally acceptable”, and residential construction should only occur after a detailed analysis of the noise reduction requirements is made and needed noise attenuation features are included in the project design. Exterior noise attenuation features include, but are not limited to, setbacks to place structures outside the conditionally acceptable noise contour, orienting structures so no windows open to the noise source, and /or installing noise barriers such as berms or solid walls.

An interior CNEL of 45 dB is mandated by the State of California Noise Insulation Standards (CCR, Title 24, Part 6, Section T25-28) for multiple family dwellings and hotel and motel rooms. In 1988, the State Building Standards Commission expanded that standard to include all habitable rooms in residential use, included single-family dwelling units. Since normal noise attenuation within residential structures with closed windows is 20-30 dB, an exterior noise exposure of 65-75 dB CNEL allows the interior standard to be met without any specialized structural attenuation (dual paned windows, etc.), but with closed windows and fresh air supply systems or air conditioning in order to maintain a comfortable living environment.

For “stationary” noise sources such as mechanical equipment (pool pumps, air conditioners, etc.) the City does have legal authority to establish noise performance standards designed to not adversely impact adjoining residential uses. These standards are typically articulated in the jurisdictional Municipal Code. These standards recognize the varying noise sensitivity of both transmitting and receiving land uses. The property line noise performance standards are normally structured according to land use and time-of-day.

CITY OF GARDENA NOISE STANDARDS

The City Noise Ordinance is designed to protect people from non-transportation (stationary) noise. The Noise Ordinance for the City of Gardena sets limits on the level and the duration of time a stationary noise source may impact an adjoining residential use.

Ordinance limits generally apply to “stationary” sources such as mechanical equipment, or vehicles operating on private property. The City’s noise ordinance limits are stated in terms of a 15-minute limit threshold.

The standards in Table 2 apply at any residential property line. Previous commercial use of the project site itself did not impose any noise constraints upon adjacent commercial uses (e.g. trailer and RV storage). Residential development of the project parcel places potential noise limits upon remaining commercial uses. As subsequently discussed, this “new” constraint is not anticipated to be a significant source of impact.

The Noise Ordinance identifies specific activities that would be exempt from the provisions of the noise restrictions. Exempted activities include, but are not limited to, construction, repair, remodeling and grading, provided such activities do not take place between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, and between the hours of 6:00 p.m. and 9:00 a.m. on Saturday, or at any time on Sunday or a federal holiday.

**Figure 1
Gardena Land Use Compatibility Matrix**

Land Use Category	CNEL, dB							Legend
	55	60	65	70	75	80		
Residential - Single family, multifamily, duplex	A	A	B	C	C			<p>A NORMALLY ACCEPTABLE Specified land use is satisfactory based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.</p> <p>B CONDITIONALLY ACCEPTABLE New construction or development should be undertaken only after a detailed analysis of the noise requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.</p> <p>C NORMALLY UNACCEPTABLE New construction or development should generally be discouraged. If it does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.</p> <p>Clearly Unacceptable New construction or development should generally not be undertaken.</p>
Residential - Mobile homes	A	A	B	C	C			
Transient Lodging - Motels, hotels	A	A	B	B	C	C		
Schools, Libraries, Churches, Hospitals, Nursing Homes	A	A	B	C	C			
Auditoriums, Concert Halls, Amphitheaters, Meeting Halls	B	B	C	C				
Sports Arenas, Outdoor Spectator Sports, Amusement Parks	A	A	A	B	B			
Playgrounds, Neighborhood Parks	A	A	A	B	C			
Golf Courses, Riding Stables, Cemeteries	A	A	A	A	B	C	C	
Office and Professional Buildings	A	A	A	B	B	C		
Commercial Retail, Banks, Restaurants, Theaters	A	A	A	A	B	B	C	
Industrial, Manufacturing, Utilities, Wholesale, Service Stations	A	A	A	A	B	B	B	
Agriculture	A	A	A	A	A	A	A	

Source: Taken in part from "Aircraft Noise Impact Planning Guidelines for Local Agencies," U.S. Dept. of Housing and Urban Development, TE/NA-472, November 1972.

Table 2
City of Gardena Exterior and Interior Noise Limits
Land Use Noise Level (dBA) at Property Line Time Period

Type of Land Use	Allowable Exterior Noise Level			
	15-Minute Average Level (Leq)		Maximum Level (Lmax)	
	7 a.m. to 10 p.m.	10 p.m. to 7 am	7 a.m. to 10 p.m.	10 p.m. to 7 am
Residential	55 dB(A)	50 dB(A)	75 dB(A)	70 dB(A)
Residential portions of mixed-use	60 dB(A)	50 dB(A)	80 dB(A)	70 dB(A)
Commercial	65 dB(A)	60 dB(A)	85 dB(A)	80 dB(A)
Industrial or manufacturing	70 dB(A)	70 dB(A)	90 dB(A)	90 dB(A)

Source: Gardena Municipal Code Section 8.36.040

In the event the ambient noise level exceeds the noise standard, the ambient noise level shall become the noise standard.
 (Ord. 1683, 2006; Urg. Ord. 1682, 2006)

BASELINE NOISE LEVELS

An on-site noise measurement was made in order to document existing baseline levels in the area. These help to serve as a basis for projecting future noise exposure from ambient noise activity upon the proposed project. A short-term measurement was conducted by Giroux & Associates on Thursday, November 17, 2016. The results of the measurement are shown below and a graphic description of the meter location is provided in Figure 2.

Short-Term Noise Measurements (dB[A])

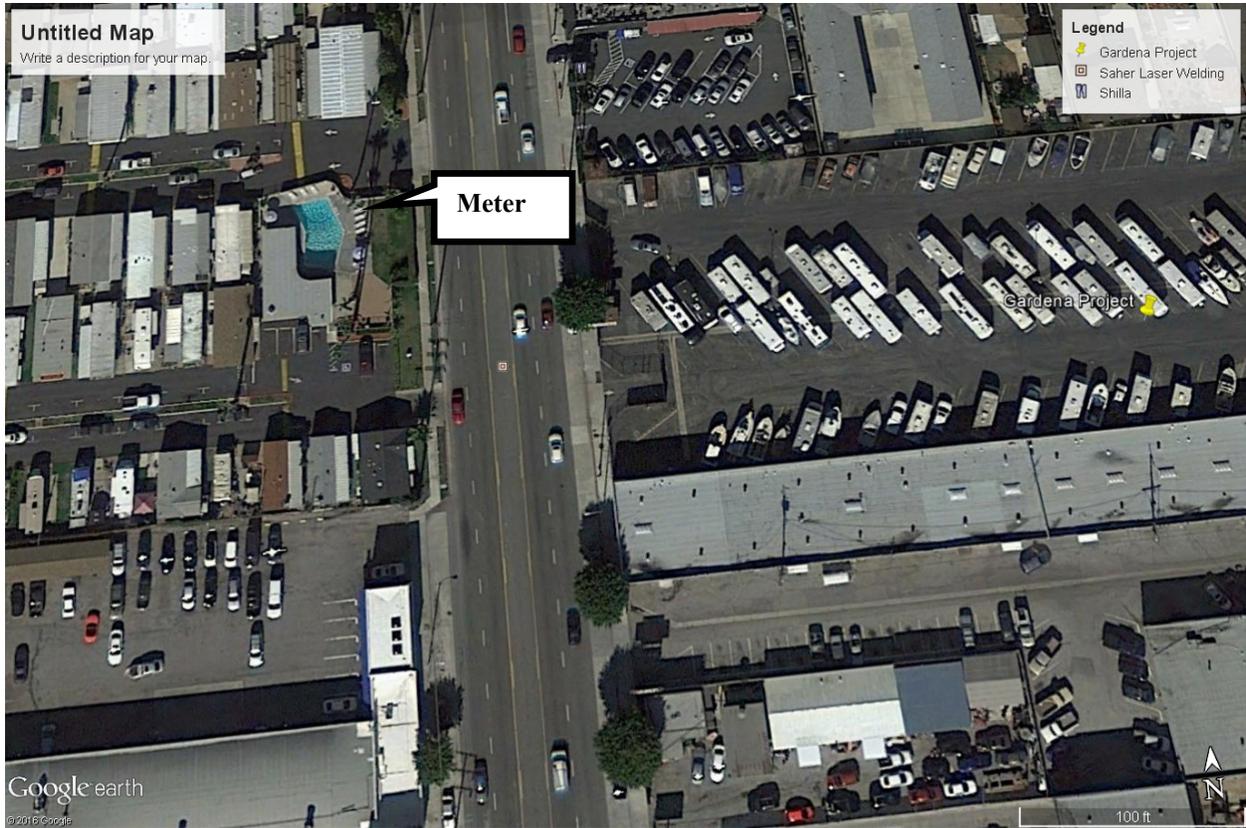
Time	Leq	Lmax	Lmin	L₁₀	L₃₃	L₅₀	L₉₀
13:30-13:45	73	84	50	77	73	71	57

Because site access was limited, the noise measurement was limited; monitoring took place on the western side of Western Avenue, directly across the street from the proposed project site, at approximately 50 feet from the centerline. Monitoring experience has shown that 24-hour weighted CNELs are typically the same as early-afternoon Leq readings shown above. This would translate into an existing on-site CNEL of 73 dB at 50 feet from the centerline.

At the project site, traffic noise levels could be above the 65 dB CNEL recommended compatibility standards for a residential use. Noise mitigation in the form of increased setback or shielding is likely necessary for usable outdoor space at residential units adjacent to Western Avenue. Accordingly, this report provides an evaluation of noise reduction measures to ensure the proposed project residential noise exposure is within recommended compatibility guidelines.

Figure 1

Noise Monitor Location



NOISE IMPACTS

NOISE SIGNIFICANCE CRITERIA

Noise impacts are considered significant if they 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.

STANDARDS OF SIGNIFICANCE

Noise impacts are considered significant if they expose persons to levels in excess of standards established in local general plans or noise ordinances. The exterior noise standard for the City of Gardena multi-family residential uses is 65 dBA CNEL in usable outdoor space such as backyards, decks, patios, etc. If required, attenuation through setback and noise barriers is anticipated to be used to reduce traffic noise to the 65 dBA CNEL goal. However, an inability to achieve this goal through the application of reasonably available mitigation measures would be considered a significant impact.

Impacts may also be significant if they create either a substantial permanent or temporary increase. The term "substantial" is not quantified in CEQA guidelines. In most environmental analyses, "substantial" is taken to mean a level that is clearly perceptible to humans. In practice, this is at least a +3 dB increase. Some agencies, such as Caltrans, require substantial increases to be +10 dB or more if noise standards are not exceeded by the increase. For purposes of this analysis, a +3 dB increase is considered a substantial increase. The following noise impacts due to project-related traffic would be considered significant:

1. If project traffic noise were to cause an increase by a perceptible amount (+3 dB CNEL) or expose receivers to levels exceeding city compatibility noise standards.
2. If future build-out noise levels were to expose on site sensitive receivers to levels exceeding compatibility standards of 65 dB CNEL exterior at any outdoor uses or 45 dB CNEL interior noise levels in any habitable space.

CONSTRUCTION NOISE SIGNIFICANCE

Noise levels from an activity crossing the property line of an adjacent property are regulated by the Gardena Municipal Code. Construction activities such as the proposed project are normally exempt from any numerical thresholds if they are conducted during hours of lesser noise sensitivity. The City of Gardena limits construction activities to the following hours:

Monday through Friday	7:00 a.m. to 6 p.m.
Saturdays	9:00 a.m. to 6 p.m.
Sundays and Federal Holidays	Construction is prohibited

Construction Noise Impacts

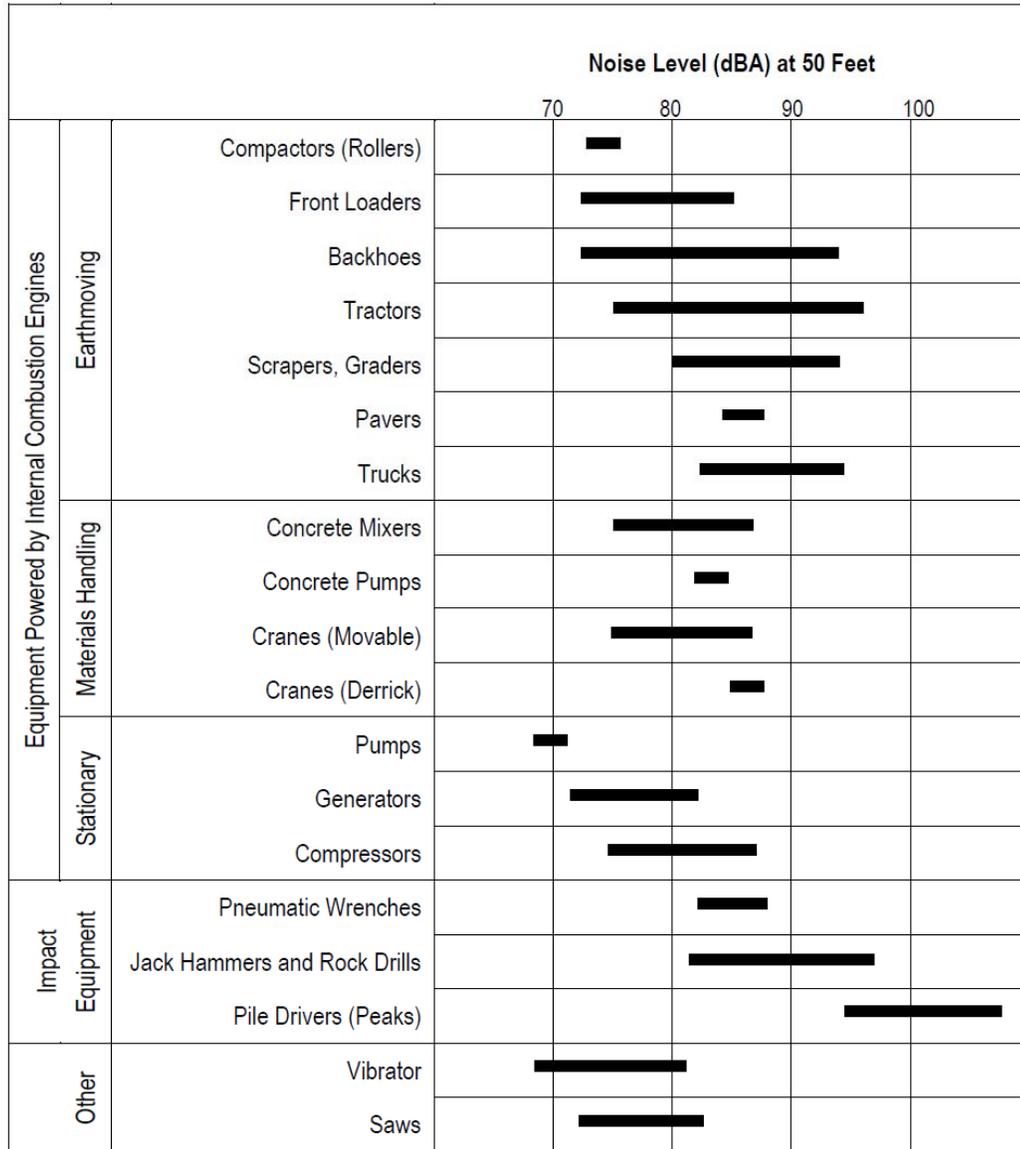
Temporary construction noise impacts will vary markedly because the noise strength of construction equipment ranges widely as a function of the equipment used and its activity level. Short-term construction noise impacts tend to occur in discrete phases dominated initially by demolition activities, then foundation work followed by construction and paving activities.

Demolition or construction noise impacts vary markedly because the noise strength of construction equipment ranges widely as a function of the equipment used which changes during the course of the project. Construction noise tends to occur in discrete phases dominated initially by demolition and/or earth-moving sources and later for finish construction. Figure 2 shows the typical range of construction activity noise generation as a function of equipment used in various building phases. The earth-moving sources are seen to be the noisiest with equipment noise ranging up to about 90 dB(A) at 50 feet from the source. Spherically radiating point sources of noise emissions are atmospherically attenuated by a factor of 6 dB per doubling of distance, or about 20 dB in 500 feet of propagation. The loudest earth-moving noise sources may therefore sometimes be detectable above the local background beyond 1,000 feet from the construction area. An impact radius of 1,000 feet or more pre-supposes a clear line-of-sight and no other machinery or equipment noise that would mask project construction noise. With buildings and other barriers to interrupt line-of-sight conditions, the potential “noise envelope” around individual construction sites is reduced. Construction noise impacts are, therefore, somewhat less than that predicted under idealized input conditions.

Construction noise exposure can be further worsened when several pieces of equipment operate in close proximity. Because of the logarithmic nature of decibel addition, two equally loud pieces of equipment will be +3 dB louder than either one individually. Three simultaneous sources are +5 dB louder than any single source. Thus, while average operational equipment noise levels are perhaps 5 dB less than at peak power, simultaneous equipment operation can still yield an apparent noise strength equal to any individual source at peak noise output. Whereas the average heavy equipment reference noise level is 85 dB(A), short-term levels from either peak power or from several pieces operating in close proximity can be as high as 90 dB(A).

Figure 2

Typical Construction Equipment Noise Generation Levels



Source: EPA PB 206717, Environmental Protection Agency, December 31, 1971, "Noise from Construction Equipment and Operations."

During most intensive heavy equipment operations, the peak hourly average noise level from several pieces of equipment in simultaneous hourly operation is 85 dB Leq at 50 feet from the activity. However, there are no existing residences or sensitive uses within proximity of the project site which could experience a temporary construction noise nuisance except the mobile home park across Western Avenue from the site. Distance separation and an elevated traffic noise baseline will likely minimize potential construction activity impacts.

CONSTRUCTION ACTIVITY VIBRATION

Typical background vibration levels in residential areas are usually 50 VdB or lower, below the threshold of human perception. Perceptible vibration levels inside residences are typically attributed to the operation of heating and air conditioning systems, door slams or street traffic. Construction activities and street traffic are some of the most common external sources of vibration that can be perceptible inside residences.

Construction activities generate ground-borne vibration when heavy equipment travels over unpaved surfaces or when it is engaged in soil movement. The effects of ground-borne vibration include discernable movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Vibration related problems generally occur due to resonances in the structural components of a building because structures amplify groundborne vibration. Within the “soft” sedimentary surfaces of much of Southern California, ground vibration is quickly damped out. Groundborne vibration is almost never annoying to people who are outdoors (FTA 2006).

Groundborne vibrations from construction activities rarely reach levels that can damage structures. Because vibration is typically not an issue, very few jurisdictions have adopted vibration significance thresholds. Vibration thresholds have been adopted for major public works construction projects, but these relate mostly to structural protection (cracking foundations or stucco) rather than to human annoyance.

Vibration is most commonly expressed in terms of the root mean square (RMS) velocity of a vibrating object. RMS velocities are expressed in units of vibration decibels. The range of vibration decibels (VdB) is as follows:

65 VdB	-	threshold of human perception
72 VdB	-	annoyance due to frequent events
80 VdB	-	annoyance due to infrequent events
94-98 VdB	-	minor cosmetic damage

To determine potential impacts of the project’s construction activities, estimates of vibration levels induced by the construction equipment at various distances are presented in Table 4. The closest residential use to the north of the project is approximately 50 feet from the nearest proposed project structure. The closest off-site residential use to the east is approximately 25 feet from the nearest on-site structure.

**Table 3
Approximate Vibration Levels Induced by Construction Equipment**

Equipment	Approximate Vibration Levels (VdB)*			
	25 feet	50 feet	100 feet	1000 feet
Pile Driver	93	87	81	61
Large Bulldozer	87	81	75	55
Loaded Truck	86	80	74	54
Jackhammer	79	73	67	47
Small Bulldozer	58	52	46	26

* (FTA Transit Noise & Vibration Assessment, Chapter 12, Construction, 2006)

The on-site construction equipment that will create the maximum potential vibration is a large bulldozer. The stated vibration source level in the FTA Handbook for such equipment is 81 VdBA at 50 feet from the source. With typical vibrational energy spreading loss, the vibration annoyance standard is met at 56 feet. There are no existing residences within 56 feet of the project property except possible for multi-family uses east of the project site. Effects of vibration perception such as rattling windows could only occur at the nearest residential structures, though vibration resulting from project construction would not exceed cosmetic damage thresholds.

Regardless, large bulldozers will not likely operate directly at the shared property line with the perimeter homes. Any fine grading at the property line should be performed with small bulldozers which are seen above to have 30 VdB less vibration potential. Therefore, to ensure adequate vibration annoyance protection the following mitigation measure is recommended:

- Only small bulldozers shall be permitted to operate within 56 feet of the nearest residential structures along the eastern property line.

Construction activity vibration impacts are judged as less-than-significant.

PROJECT-RELATED VEHICULAR NOISE IMPACTS

Long-term noise concerns from the development of residential uses at the project site center primarily on mobile source emissions on project area roadways. These concerns were addressed using the California specific vehicle noise curves (CALVENO) in the federal roadway noise model (the FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108). The model calculates the Leq noise level for a particular reference set of input conditions, and then makes a series of adjustments for site-specific traffic volumes, distances, roadway speeds, or noise barriers. The typical day-night travel percentages and auto-truck vehicle mixes is then applied to convert one-hour Leq levels to a weighted 24-hour CNEL.

Table 4 summarizes the calculated 24-hour CNEL level at 50 feet from the roadway centerline along eight project adjacent roadway segments. Two time frames were evaluated; existing conditions with and without project, and future year with and without project. The noise analysis utilized data from the project traffic analysis prepared by Linscott, Law & Greenspan for this project. Travel speeds were also obtained from the traffic report. Western Avenue was modeled at 40 mph, Artesia Blvd was modeled with a traffic speed of 45 mph and 169th Place was modeled with a 25 mph travel speed.

As shown in Table 4, the project itself will not cause any roadway segment to have even a +0.1 dB impact. Because traffic volumes are already high and because the project does not result in many trips relative to existing traffic volumes, there is no discernible impact along any analyzed roadway segment.

Cumulative impacts compare the “future with project” noise levels with the “existing no project” scenario. The largest cumulative impact is +0.3 dB CNEL. There are no cumulative traffic noise increases that exceed the +3 dB CNEL threshold. Therefore, both project only traffic noise impacts and cumulative traffic noise impacts are considered to be less-than-significant.

**Table 4
Near-Term Traffic Noise Impact Analysis
(CNEL in dBA at 50 feet from Centerline)**

<i>Roadway Segment</i>		<i>Existing</i>	<i>Existing + Project</i>	<i>Future</i>	<i>Future + Project</i>
Western/	N of 169th	70.9	70.9	71.0	71.0
	S of 169th	70.9	70.9	71.1	71.1
	N of Artesia	70.8	70.8	71.0	71.0
	S of Artesia	70.8	70.8	71.0	71.0
169th Pl/	W of Western	40.8	40.8	40.8	40.8
	E of Western	55.4	55.4	55.5	55.5
Artesia/	W of Western	72.8	72.8	73.0	73.1
	E of Western	73.6	73.6	73.7	73.7

**Project-Related Noise Impact
(CNEL in dBA at 50 feet from Centerline)**

<i>Roadway Segment</i>		<i>Project Only Existing</i>	<i>Project Only Future</i>	<i>Cumulative Impacts</i>
Western/	N of 169th	0.0	0.0	0.1
	S of 169th	0.0	0.0	0.2
	N of Artesia	0.0	0.0	0.2
	S of Artesia	0.0	0.0	0.2
169th Pl/	W of Western	0.0	0.0	0.0
	E of Western	0.0	0.0	0.1
Artesia/	W of Western	0.0	0.0	0.3
	E of Western	0.0	0.0	0.1

ON-SITE NOISE EXPOSURE

Residential uses are exposed to vehicular noise sources. Traffic noise from Western Avenue and, will impact proposed sensitive uses. The closest residential on-site use to Western Avenue is approximately 60 feet from roadway centerline. Expected noise exposures are as follows:

	Build Out Traffic Noise Level at 50 feet from Roadway Centerline	Distance to Nearest Residential Use	Distance Attenuated Noise Level
Western Avenue	71.1 dB CNEL	60 feet	70.3 dB CNEL

A noise level of 65 dB is the level at which ambient noise begins to interfere with one's ability to carry on a normal conversation at reasonable separation without raising one's voice. This standard applies to exterior recreational space. Residential units adjacent to Western Avenue are 5 dB in excess of recommended 65 dB CNEL.

Therefore, if there are patios or balconies on units adjacent to Western Avenue noise protection would be required. A shield would break the line-of-sight between the receiver and noise source. A transparent noise shield (e.g., plexi-glass) along the residential patios facing the roadway would reduce noise by at least 5 dBA and while still permitting view and reduce noise to within the recommended guideline.

The interior residential noise standard is 45 dB CNEL. For typical wood-framed construction with stucco and gypsum board wall assemblies, the exterior to interior noise level reduction is as follows:

- Partly open windows – 12 dB
- Closed single-paned windows – 20 dB
- Closed dual-paned windows – 30 dB

Use of dual-paned windows is required by the California Building Code (CBC) for energy conservation in new residential construction.

Interior standards will be met as long as residents have the option to close their windows. Where window closure is needed to shut out noise, supplemental ventilation is required by the CBC with some specified gradation of fresh air. Central air conditioning or a fresh air inlet on a whole house fan would meet this requirement.

SUMMARY AND MITIGATION

Short-term construction noise intrusion will be limited by conditions on construction permits requiring compliance with the City of Gardena Ordinance. The allowed hours of construction are 7 a.m. to 6 p.m. on weekdays, and 9 a.m. to 6 p.m. on Saturdays. Construction is not permitted on any national holiday or on any Sunday. In addition the following construction practices are recommended:

- All mobile equipment shall have properly operating and maintained mufflers.

Vibration levels from heavy equipment may be noticeable at times at the nearest single family homes to the north and east of the project site, but will not cause any structural damage and will likely be masked by truck traffic on Western Avenue. Nevertheless, to ensure adequate vibration protection the following mitigation measure is recommended:

- Only small bulldozers shall be permitted to operate within 56 feet of the nearest residences along the eastern property line.

The project noise impact study indicates a less-than-significant noise impact from project-related traffic on project vicinity receptors. Project-related traffic will not cause noise standards to be exceeded, nor make substantially worse any existing violations.

For all residential perimeter units along the Western Avenue frontage, traffic noise may exceed City of Gardena standards for possible outdoor recreational space adjacent to the roadway. In order to create outdoor space that achieves 65 dB CNEL at these units patios or balconies facing Western Avenue will be equipped with solid or transparent (glass or plastic) shields that reduce noise. Shields would need to be 5 feet tall and fill the entire roadway frontage. If patios and balconies were on the side of the buildings facing interior to the project site, no mitigation is required.

Residential habitable rooms facing Western Avenue will meet the City of Gardena 45 dB CNEL interior noise standard with no acoustical mitigation except the option to close windows. Window closure requires that supplemental ventilation be provided to rooms facing Western Avenue.