UPDATED NOISE IMPACT ANALYSIS

VAN BUREN AND ORANGETHORPE RESIDENTIAL

CITY OF PLACENTIA, 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 defined as unwanted sound. Sound is characterized by various parameters which 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 wave. In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. The unit of sound pressure expressed as a ratio to the faintest sound detectable by a young person with excellent auditory sensitivity is called a decibel (dB).

Because sound or noise can vary in intensity by over one million times within the range of human hearing, decibels are on a logarithmic loudness scale similar to the Richter scale used for earthquake magnitude. Because the human ear is not equally sensitive to all sound frequencies within the entire spectrum, noise levels at maximum human sensitivity are factored more heavily into sound descriptions in a process called "A-weighting," written as dBA. Any further reference to decibels written as "dB" in this report should be understood to be A-weighted values.

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 Community Noise Equivalent Level (CNEL).

CNEL-based standards apply to noise sources whose noise generation is preempted from local control (such as from on-road vehicles, trains, airplanes, etc.). Since local jurisdictions cannot regulate the noise generator, they exercise land use planning authority on the receiving property. Uses that are amenable to local control are generally considered "stationary sources." Local jurisdictions generally regulate the level of noise that one use may impose upon another though noise standards.

NOISE COMPATIBILITY GUIDELINES

General Plan noise standards are used by planners to evaluate the suitability of a given existing or proposed land use relative to its noise exposure. These guidelines are mainly advisory, except near airports, where state law prohibits construction of noise-sensitive uses in a high-noise area. They apply mainly to transportation activity noise impacts (vehicles, trains, planes, etc.) on adjacent land use. These guidelines are used in land use decisions because noise control from transportation is controlled by state or federal agencies and is not locally regulated.

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. A noise exposure of 65 dB CNEL is typically recommended as the exterior noise land use compatibility guideline for new residential dwellings in California. CNEL-based standards generally apply to

usable outdoor recreational space at backyards, patios or balconies. Interior exposures of noise-sensitive uses are controlled through adequate structural attenuation.
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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 any residential use, included single-family dwelling units. Since normal noise attenuation within residential structures with closed windows is 25-30 dB, an exterior noise exposure of 70-75 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.

Noise ordinance limits generally apply to "stationary" sources such as mechanical equipment or vehicles operating on private property. The City of Placentia noise standards are presented in Table 1. Applicable noise standards must be met at the nearest residential property line. For residential use, the noise standard is 55 dB Leq day time and 50 dB Leq night time.

In accordance with Section 23.81.170 of the Placentia Municipal Code, construction related activities are exempt from noise regulations provided the activities take place during the hours of 7 a.m. to 7 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. on Saturday. No construction activities are allowed on Sundays or Federal Holidays. Since the project will not create noise generating operational activities, the noise standards were not used for project evaluation and are presented for informational purposes only.

Table 1

City of Placentia Residential Noise Standards

Noise Zone	Noise Level	Time Period
Residential	55 dB(A)	7:00 a.m.--10:00 p.m.
	50 dB(A)	10:00 p.m.--7:00 a.m.
Commercial	65 dB(A)	Anytime
Industrial	70 dB(A)	Anytime

It is unlawful for any person at any location within the incorporated area of the city to create any noise, or to allow the creation of any noise on property owned, leased, occupied, or otherwise controlled by such person, when the foregoing causes the noise level, when measured on any other residential, commercial, or industrial property, either incorporated or unincorporated to exceed:

(1) The noise standards for a cumulative period of time more than thirty (30) minutes in any hour; or

(2) The noise standard plus five (5) dB(A) for a cumulative period of more than fifteen (15) minutes in any hour; or

(3) The noise standard plus ten (10) dB(A) for a cumulative period of more than five (5) minutes in any hour; or

(4) The noise standard plus fifteen (15) dB(A) for a cumulative period of more than one (1) minute in any hour; or

(5) The noise standard plus twenty (20) dB(A) for any period of time.

(c) In the event the ambient noise level exceeds any of the first four (4) noise limit categories above, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under said category shall be increased to reflect the maximum ambient noise level.

(d) In the event that the noise source and the affected property are within different noise zones, the noise standard applicable to the affected property shall apply. (Ord. 75-O-105 § 5, 1975)

BASELINE NOISE LEVELS

The project site is affected by train activity on the rail line along the northern boundary. There are 9 Metrolink trains that traverse the site during the week and 4 on Saturdays. The tracks are also used by BNSF for freight However BNSF does not provide any information regarding type or size of trains.

Noise measurements were made in order to document existing baseline levels in the area, particularly train noise along the adjacent rail line to serve as a basis to determine noise exposure from ambient noise activities upon the proposed project. Long term (24-hour) noise measurements were conducted on Thursday, August 17 to Friday August 18 2017, at two on-site locations. Long-term noise measurement locations were selected to document the daily trend in noise levels generated by the adjacent rail line. Measurement locations are shown in Figure 1. The monitoring results are shown in Table 2. Because of the passage of time since these readings were made, the same two sites were instrumented with recording digital sound level meters on February 13 – 14, 2020. The current noise levels were almost identical to the previous readings. The current measured CNEL at Meter 1 was 73.8 dB, while Meter 2 recorded a CNEL of 69.8 dB. Within the limits of accuracy of the meters, noise levels were unchanged since 2017.

Meter 1 was located on the northeastern site perimeter and captures both train noise as well as traffic noise from Orangethorpe Avenue. Along the northern site perimeter, to the east, the rail line is very close to the site; about 100 feet from the track centerline. Traveling west the distance separation becomes progressively larger so that readings at Meter 1 would presumably be much higher than at Meter 2. Meter 2 is approximately 250 feet from the main track centerline. A local freight service is adjacent to Meter 2, but this track is rarely used with one slow engine and only several cars.

Meter 1 was sited approximately 100 feet from the railway centerline and the observed noise level was 74 dB CNEL. Meter 2 has a greater separation and as a result, the observed noise level at this location were lower, about 70 dB CNEL.

Because CNEL is a weighted 24-hour noise metric, it is the average noise levels that are primarily evaluated. Given that noise levels may vary by location due to use of bells and distance to busy roadways, the above values are considered consistent and are considered to provide an accurate characterization of the existing acoustic baseline. From this data we may infer that baseline noise levels are high in proximity to the railroad tracks and that mitigation could be necessary to meet the City of Placentia recommended noise compatibility guidelines for usable outdoor space and possibly for habitable rooms close to the railroad track.

Figure 1

Noise Monitor Locations

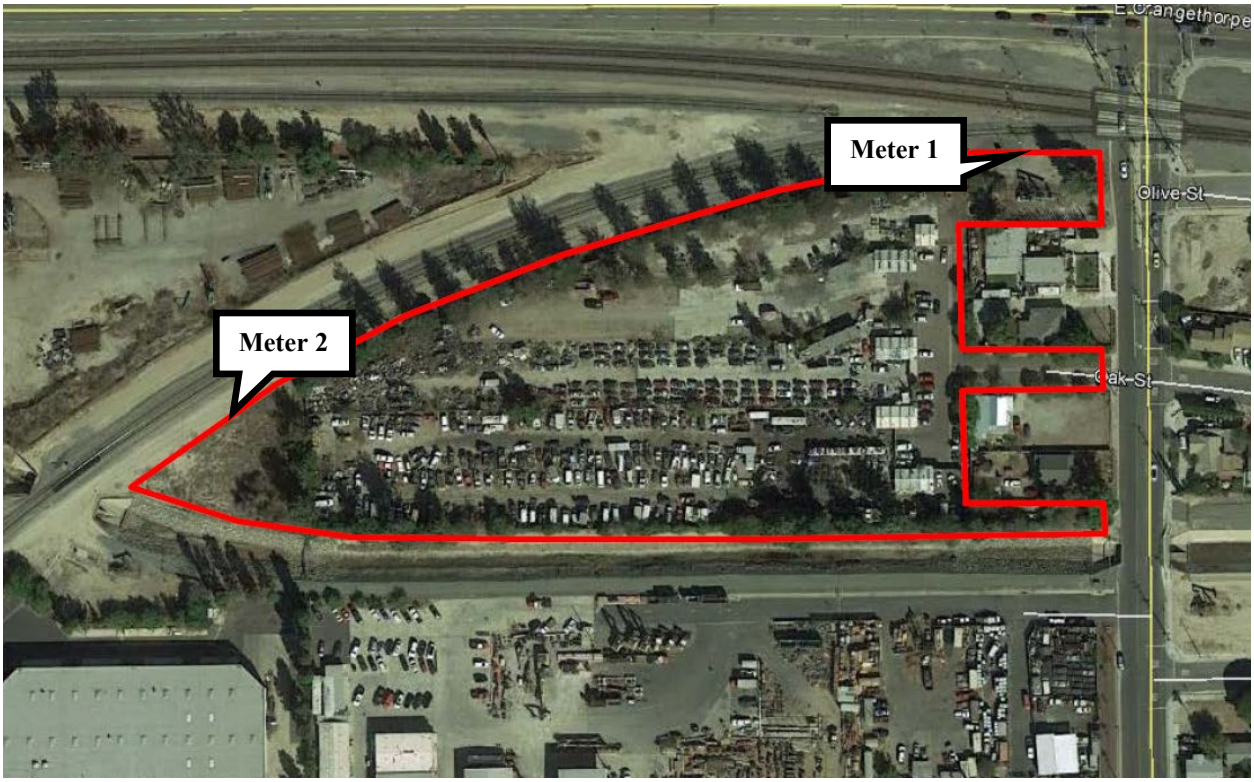


Table 2 Noise Measurements
Existing Hourly Leq's (dB)

Time Interval	Leqs Meter 1	Leqs Meter 2
13:00-14:00	66.4	64.5
14:00-15:00	66.0	54.5
15:00-16:00	67.4	61.2
16:00-17:00	66.8	62.2
17:00-18:00	68.1	62.1
18:00-19:00	65.9	54.8
19:00-20:00	71.0	73.9
20:00-21:00	68.6	66.4
21:00-22:00	65.5	52.8
22:00-23:00	66.6	55.3
23:00-24:00	70.5	58.9
0:00-1:00	64.3	53.5
1:00-2:00	67.7	64.3
2:00-3:00	68.7	67.1
3:00-4:00	64.3	53.0
4:00-5:00	68.3	58.6
5:00:6:00	66.8	55.8
6:00-7:00	62.2	52.3
7:00-8:00	63.1	52.2
8:00-9:00	67.4	64.9
9:00-10:00	54.0	48.3
10:00-11:00	64.0	63.3
11:00-12:00	64.0	53.9
12:00-13:00	66.8	53.2
CNEL	73.9	69.4

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.

For the proposed project, noise exposure would be considered excessive if it caused the residential standards to be exceeded. Vibration impacts would be considered potentially significant if the structural damage threshold level was potentially exceeded.

The following standards will be applied to the proposed development:

- Usable exterior space noise exposures less than 65 dB CNEL
- Habitable interior space noise exposure less than 45 dB CNEL
- Acceptable vibration levels in habitable rooms
- Construction activities limited to hours of lesser sensitivity

Recent CEQA case law decisions have concluded that the impact of the environment upon the project (such as train noise or vibration) is normally not a valid CEQA impact significance threshold. However, these criteria have been maintained in the following analysis as a point of information.

ON-SITE NOISE

RAILROAD NOISE FOR RECREATIONAL USES

The adjacent Burlington Northern/Metrolink rails line handles commuter rail and freight trains. Of the two, freight rail noise is the more dominant, though a less frequent, noise source. Based on recent train schedules 14 Metrolink trains traverse the line each day. No precise numbers of daily freight trains could be provided. Although the noise metric used to address train noise is a CNEL or a daily average, the single event noise intrusion potential is high.

There are two railway lines adjacent to the site. The nearest one is only minimally used, and is within 50 feet of the entire site. The more heavily utilized lines are farther north and range from 100 feet distance from the closest property line on the east side of the site to 250 feet on the west side of the site. On-site noise monitoring indicated maximum noise levels of 74 dB CNEL at the closest property line.

Figure 2
Rail Line Locations

It is assumed that the Common Open Space located in the areas eat of Building 19 and west of Building 23, will be shielded by the northern perimeter homes. A credit of 5 dB for structural attenuation and 2 dB for additional distance would reduce the maximum 74 dB of perimeter site loading to 67 dB. A small additional level of mitigation is needed to achieve the city standard. This additional protection will be provided by a solid perimeter wall along the northern site boundary.

CNEL is an imperfect metric for noise nuisance from train activity. CNEL is a weighted 24-hour average that correlates well to annoyance, speech interference, or sleep disturbance for semi-continuous sources such as on-road traffic. Trains and perhaps airplanes are characterized by extended periods of essentially no sound punctuated by a sudden short period noise spike. Train noise nuisance is exacerbated by the required use of train horns for safety near at-grade crossings. The Van Buren crossing is a "quiet zone" where horns are not used except in an emergency. Although CNEL has been used as the analysis metric for the noise impact study, it is an imperfect descriptor for single event noise and the single event noise intrusion potential is high such that suggested mitigation may be above and beyond that necessary to meet the CNEL threshold.

Recreational space may sli8ghtly exceed the city's noise standard for outdoor uses. However, a recommended 8--foot sound wall would provide an extra measure of safety in ensuring acceptable noise levels for recreational use. The wall is recommended as a precautionary measure to provide noise protection at individual units and common space to reduce the potential for single event noise intrusion.

Interior Noise for Railroad Adjacent Dwellings

A main noise concern from railroad noise is the interior noise level. The requirement for habitable interior space is a noise level less than 45 dB CNEL. Acoustical design of the building façade offers a noise mitigation option to reduce noise for any dwelling with a line of sight to the tracks. Therefore, acoustical upgrades capable of reducing interior noise to 45 dB CNEL in any noise sensitive space (bedrooms or living rooms) would be required.

The upper level exterior noise loading for the closest structure adjacent to the railroad tracks is 74 dB CNEL. Mitigation of noise levels can typically be achieved with the following upgraded structural features such that reductions up to 25-30 dB are typically attainable while still allowing for discretionary window opening.

- All facades must be constructed with substantial weight and insulation;

- Sound-rated windows providing noise reduction performance similar to that of the façade must be included for habitable rooms; a minimum sound reduction of 30 dB sound transmission class (STC) is required for all north-facing windows; a more upgraded set of windows on upstairs units directly abutting the northern site perimeter rated at STC = 33 or higher is recommended to reduce single event noise from late night train passages in upstairs bedrooms;

- Sound-rated doors or storm doors providing noise reduction performance similar to that of the façade must be included for all exterior entries;

• Acoustic baffling of vents is required for chimneys, fans and gable ends;

• Installation of a mechanical ventilation system affording comfort under closed window conditions is required.

Interior noise levels at the proposed residential units closest to the tracks will be reduced to the 45 dB CNEL interior standard for habitable rooms by standard construction practice with closed windows. If possible, locating non-habitable rooms (kitchens, baths, hallways, stairwells, etc.) along the building facades directly facing the tracks is suggested. The option to close windows to shut out noise requires the provision of supplemental ventilation. Although the interior CNEL-based standard can be met without any extra-ordinary acoustical measures, single event noise may be intrusive even if the interior standard is met. Window upgrades from "standard" to STC=30 or better are recommended for habitable rooms for the units closest to the tracks.

The following measures are recommended:

- All windows throughout the project will be dual-paned glass and all upstairs living and bedrooms of units abutting the tracks shall be equipped with supplemental ventilation supplying at least 30 CFM of fresh make-up air (Building Code requirement), and
- Upstairs windows of living or bedrooms in units with a line-of-site to the tracks shall be rated at STC=30 or better (single event noise nuisance reduction) with STC = 33 rated windows recommended for upstairs windows directly facing the train tracks.

Because window closure is a necessary condition to meet the noise standard, the code requires the provision of supplemental ventilation, including a fresh air intake that provides 30 CFM of fresh outside air. In order to not compromise acoustic protection integrity of the HVAC systems, the fresh air inlet should be located on the building facades away from the track.

ON SITE RAIL AND VIBRATION IMPACTS

Rail Vibration

Railroads generate ground-borne vibration that may be perceptible at on-site uses. Construction of residential units in close proximity to railroad tracks can cause rattling windows and throbbing floors. Ground-borne vibration is generally not a problem for buildings near railroad tracks at- or above-grade, because the airborne noise from trains typically overshadows effects of vibration. Vibration noise becomes an issue in cases where airborne noise is particularly blocked, such as for buildings near tunnels. Vibration is most commonly expressed in terms of the root mean square (RMS) velocity of a vibrating object.

Train vibration depends upon a variety of factors. The weight of the train, the travel speed, the condition of the track and the character of the subsoil all affect the observed vibration level. The USDOT (US Department of Transportation) Guideline called "Transit Noise and Vibration Impact Assessment" (May, 2006) suggests a significance threshold of 80 VdB for train vibrations if there

are fewer than 70 train movements per day. In addition to use by BNSF for freight transportation, there are currently approximately 14 daily Metrolink trains passing by the project site and this is not expected to increase substantially in the future. Therefore, the 80 VdB threshold has been adopted for use for this project.

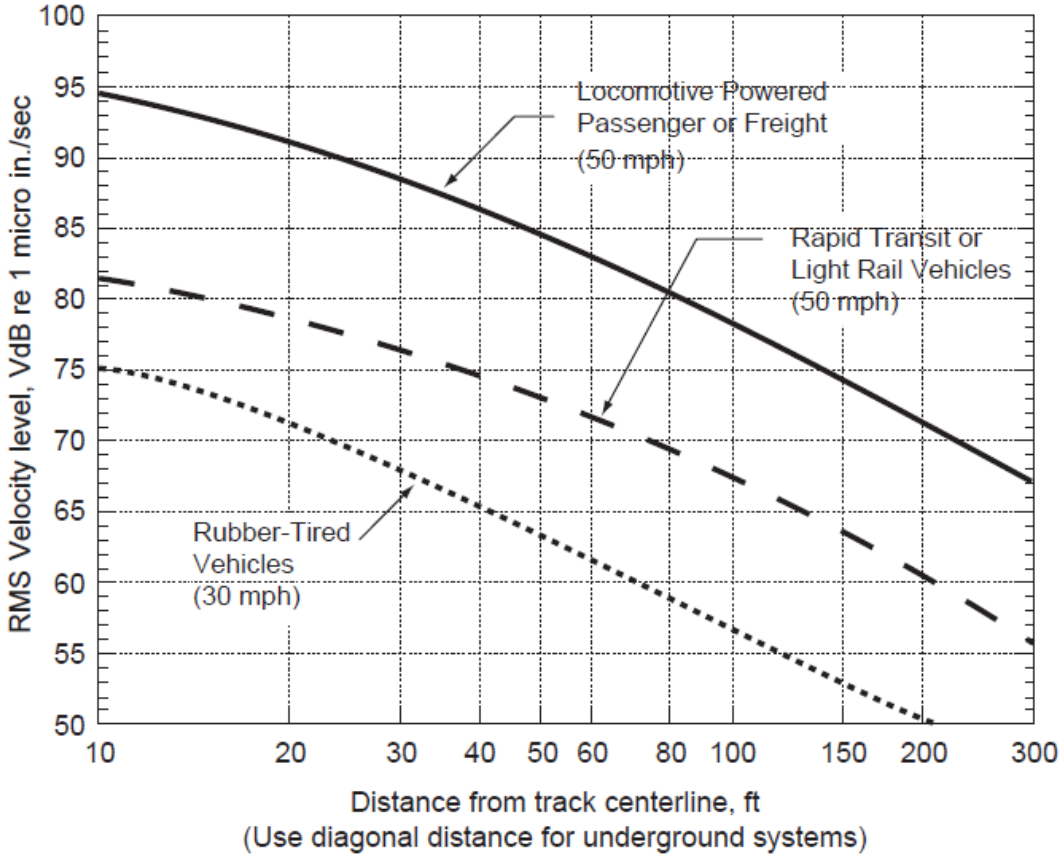
Vibration is most commonly expressed in terms of the root mean square (RMS) velocity of a vibrating object. RMS velocities are expressed in units of vibration decibels. Although the perceptibility threshold is about 65 VdB, human response to vibration is not usually significant unless the vibration exceeds 70 VdB. 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

As shown in Figure 3, use of Department of Transportation (DOT) data predicts vibration levels of 83 VdB at 60 feet from the track (the approximate setback for adjacent structures) for locomotive powered passenger and freight trains traveling at 50 mph. The Metrolink trains would produce a much lower vibration level of 72 VdB (rapid transit/light rail). The RMS vibration level at 30 mph is approximately 3 VdB less than at 50 mph. Since travel speed is unknown, the higher more conservative value is used for analysis for the buildings nearest the tracks.

FIGURE 3

GENERALIZE GROUND SURFACE VIBRATION CURVES



Vibration generally reduces as it propagates though a building. Coupling loss is the amount of vibration energy lost between the ground vibration and the vibration of the building; generally, the heavier the building foundation, the greater the coupling loss. In addition large masonry buildings with spread footings have a low response to ground vibration. The following coupling losses are generally observed in the indicated types of construction per US DOT Guidelines:

Wood Frame	-5 VdB
1-2 Story Masonry	-7 VdB
2-4 Story Masonry	-10 VdB
Large Masonry on Piles	-10 VdB
Large Masonry on Spread Footings	-13 VdB

For this project a -7 dB coupling loss "credit" was taken per building since the proposed buildings are two or three stories high. The residual vibration levels of 76 VdB at the closest building for a locomotive-powered train traveling at 50 mph would be much less than the damage threshold but

could reach the annoyance threshold due to frequent events even with the effects of coupling losses.

These vibration estimates are at slab level. The upstairs rooms will not experience the full vibration level that is observed at slab level. Floor/ceiling assemblies and floor coverings (especially carpet) will absorb a portion of the vibration energy. Vibration reduction "credit" for hard floor surfaces (tile, light weight concrete, etc.) is -2 VdB at ground levels and increases by an additional -2 dB upstairs. Measurements of impact isolation show that carpets and pads reduce vibration by more than 10 VdB.

Counteracting absorption effects, the USDOT guidelines suggest a +6 VdB factor be included to account for amplification due to resonance of floors, walls and ceilings. Table 3 summarizes the appropriate credits and losses, and shows that vibration levels experienced by a person standing indoors for living space on levels 1 and 2 of for adjacent units. First-floor space at units closest to the track are not proposed for continuous occupancy such that any floor-covering mitigation for vibration impacts would apply only to Level 2 users. Similarly, vibration dissipation with distance would limit the mitigation requirement to only the first tier of development within 150 feet of the track centerline. With the use of carpeted floors, the threshold for annoyance of 72 VdB will thus be met in any rooms closest to the tracks. Vibration levels for hard surfaces could be slightly above the recommended levels in the closest tier, but are well below the structural damage threshold for stucco or similar materials which requires vibration levels close to 100 VdB. It should be noted that the federal vibration guideline for infrequent events (<70 day) is 80 VdB. Neither carpeted or hard surface flooring will exceed the federal 80 VdB annoyance threshold.

Additionally all units facing the railroad tracks should be equipped with dual-paned windows with upgraded seals for noise control. These more robust windows will have little tendency to rattle. Vibration effects within residential units passing through floors or windows will be less-than-significant.

Table 3
Interior Vibration Levels (VdB)

	1st Story Hard Floor	1stStory Carpet & Pad	2nd Story Hard Floor	2nd Story Carpet & Pad
Max. Unmitigated Vibration	83	83	83	83
Coupling Losses	-7	-7	-7	-7
Building Resonance	+6	+6	+6	+6
Floor-to-Floor Absorption	0	0	-2	-2
Floor Covering	-2	-10	-2	-10
Net Vibration	80	72	78	70

CONSTRUCTION NOISE IMPACTS

Temporary construction noise impacts 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 by large, earth-moving equipment sources for demolition and grading. During construction and paving, equipment is generally less noisy.

Construction noise tends to occur in discrete phases dominated initially by demolition and/or earth-moving sources and later for finish construction and paving. Figure 4 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 6 dB in 100 feet of propagation. The impact radius 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.

The closest existing sensitive uses to the project site are the single family homes to the west. Only paving activities will be adjacent to this area and there is a minimum setback of 100 feet. The bulk of the project is to the west, with a

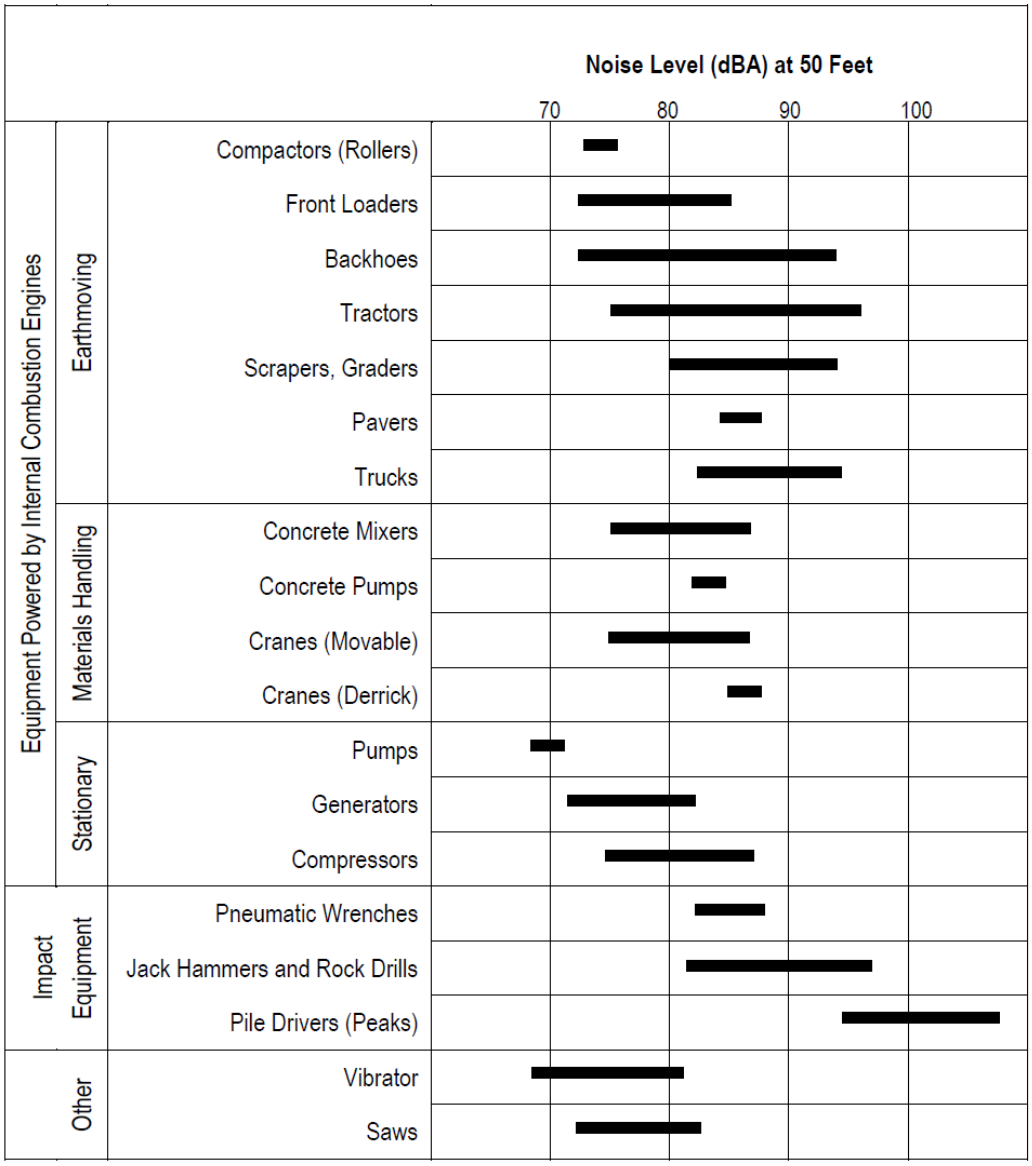
According to the City of Placentia Municipal Code, permissible hours of construction are 7 a.m. to 7 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. on Saturday. Construction is not allowed on Sundays or public holidays. Adherence to this schedule reduces impacts to less-than-significant.

Construction nuisance noise at the nearest sensitive use is minimized by the following suggested conditions:

- All equipment shall be equipped with properly operating and maintained mufflers.
- Equipment and materials shall be staged in areas that will create the greatest distance between construction-related noise sources and the noise-sensitive receptors nearest the project site during all project construction.
- All construction-related activities shall be restricted to the construction hours outlined in the City's Noise Ordinance.

Figure 4

Typical Construction Equipment Noise Generation Levels



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

SUMMARY

Construction impacts are not expected to be significant at the closest off-site residences. However, the following construction practices are recommended:

- All construction and general maintenance activities, except in an emergency, shall be limited to the hours of hours of 7 a.m. to 7 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. on Saturday.
- All on-site construction equipment shall have properly operating mufflers.
- All construction staging areas should be located as far away as practical from the nearest homes.

In the absence of mitigation, Metrolink and BNSF freight train noise could exceed the noise/land use compatibility standard of 65 dB CNEL in usable outdoor residential space at units closest to the track. However, the two planned open space areas are located within the site interior shielded by buildings and additional set-back distance. Proposed residences along the northern site perimeter would have no potentially impacted outdoor space and would have larger windows oriented toward the site interior. Preservation of the existing tree line at the northern property line would allow for desirable aesthetics without compromising any needed noise impact mitigation.

Interior noise levels at the proposed units closest to the tracks will be reduced to the 45 dB CNEL standard for habitable rooms by standard construction practice with closed windows. To the degree feasible, it is recommended that non-habitable rooms (kitchens, baths, hallways, stairwells, etc.) be located along the building facades directly facing the tracks. The option to close windows to shut out noise requires the provision of supplemental ventilation. Although the interior CNEL-based standard can be met without any extra-ordinary acoustical measures, single event noise may be intrusive even if the interior standard is met. Window upgrades from "standard" to "premium" are recommended for habitable rooms for the units closest to the tracks.

The following structural measures are recommended:

- All windows throughout the project will be dual-paned glass and all upstairs living and bedrooms of units abutting the tracks shall be equipped with supplemental ventilation supplying at least 30 CFM of fresh make-up air (Building Code requirement), and
- Upstairs side windows of living or bedrooms in units abutting the tracks shall be rated at STC=33 or better (single event noise nuisance reduction).

Vibration levels from track activities could exceed annoyance level at the ground floor if hard surfaces are used. Use of soft materials such as carpet would ensure vibration levels are below even annoyance thresholds. Regardless, the structural damage threshold would not be exceeded at any unit.