Noise and Vibration

Existing Conditions Report

May 2020

CITY OF RANCHO CUCAMONGA GENERAL PLAN UPDATE

Summary

The Noise and Vibration Background Report (Report) assesses and summarizes the existing environmental conditions of the City of Rancho Cucamonga (City) as they relate to noise and vibration. The Report also provides a summary of acoustic and vibration fundamentals and relevant federal, state, and local regulations pertaining to noise and land use planning. The following key findings, based on the results of the analysis, have been identified to help inform the development of goals and policies related to noise and vibration in the City's General Plan Update.

Key Findings

- Dominant sources of noise and vibration in the city of Rancho Cucamonga include traffic noise on major roadways throughout the city, freeways running through the city, as well as the more localized noise from passenger and freight trains that particularly affects nearby communities.
- Health effects of excessive noise and vibration range from minor psychological stress, irritability, and fatigue due to lack of sleep, to more serious stress-induced effects resulting from long-term exposure including cardiovascular disease, cognitive impairment, anxiety, and depression. Sensitive receptors and communities of the city in close proximity to noise sources may be more affected.
- Roadway traffic is the predominant source of noise affecting sensitive land uses in the city. Freeways and major arterial roadways are the primary sources of this traffic noise. Roadways in the city with the greatest traffic noise levels are Interstate 15 (I-15), State Route 210 (SR-210), Foothill Boulevard, and Base Line Road. To a lesser extent, Interstate 10 (I-10), which is located approximately 0.7 miles south of the city, may also contribute to some of the city's background noise, but it was not included as a source in noise modeling.
- Noise generated by industrial and stationary sources contribute to the ambient noise environment in their immediate vicinities.
- Metrolink and BNSF (Burlington Northern Santa Fe Railway Company) trains operating along the same corridor through the southern portion of the city, adjacent to East 8th Street, are existing noise and vibration sources. Sensitive receptors and other residents in the southern portion of the city near the Metrolink/BNSF railway experience a disproportionate amount of noise and vibration from these sources compared to the rest of the city.

Noise and Vibration

Noise and vibration in Rancho Cucamonga are regulated through the efforts of various federal, state, and local government agencies. These agencies work jointly and independently to standardize noise and vibration levels throughout their jurisdictions through the passage of legislation, regulation, land use planning, education, and policy making. These agencies and regulations, as well as a comprehensive evaluation of the existing sources of noise and vibration in Rancho Cucamonga are discussed, following a summary of acoustic fundamentals.

Introduction

This Noise and Vibration Background Report has been developed to assess and summarize the existing environmental conditions of Rancho Cucamonga as it relates to noise and vibration. The report also provides a summary of acoustic and vibration fundamentals and relevant federal, state, and local regulations pertaining to noise, vibration, and land use planning. This report is being developed as part of a larger process to set potential new goals, policies, and implementing actions related to noise to be incorporated into the Noise Element of the City's General Plan. The information provided in this report was derived from existing documentation, including the Noise section and Appendix G (Noise Assessment) of the City's Environmental Impact Report (EIR) prepared for the 2010 General Plan Update (City of Rancho Cucamonga 2010).

The analysis conducted for this report was informed by and is consistent with the current *General Plan Guidelines* issued by the Governor's Office of Planning and Research (OPR), guidance from the Federal Transit Administration (FTA) and the California Department of Transportation (Caltrans), and current academic literature regarding noise and vibration. Key findings, based on the results of the analysis, have been identified to help inform the development of goals and policies in the City's General Plan Update.

Acoustics Fundamentals

Before discussing the regulatory setting, background information about sound, noise, vibration, and common descriptors is needed to provide context to help understand the technical terms referenced throughout.

Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a human ear. Noise is defined as loud, unexpected, or annoying sound.

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilo Hz, or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (µPa). One mPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 µPa. Because of this large range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB).

A-Weighted Decibels

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an "A-weighted" sound level (expressed in units of A-weighted decibels) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgment correlates well with the A-scale sound levels of those sounds. Thus, noise levels are typically reported in terms of A-weighted decibels or dBA. All sound levels discussed in this section are A-weighted decibels. For the remainder of this report, it is assumed that the shorthand "dB" refers to A-weighted decibels. Table 1 describes typical A-weighted noise levels for various noise sources.

Table 1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Gas leaf blower at 3 feet	— 110 —	Rock band
Jet fly-over at 1,000 feet	— 100 —	Baby crying
Gas lawn mower at 3 feet	— 90 —	Hair dryer
Diesel truck at 50 feet at 50 miles per hour	— 80 —	Food blender at 3 feet, Garbage disposal at 3 feet
Noisy urban area, daytime, Gas lawn mower at 100 feet	— 70 —	Vacuum cleaner at 10 feet, Normal speech at 3 feet
Commercial area, Heavy traffic at 300 feet	— 60 —	Quiet conversation
Quiet urban daytime	— 50 —	Large business office, Dishwasher in next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime	— 30 —	Library, Bedroom at night
Quiet rural nighttime	— 20 —	Concert hall (background)
Breathing	— 10 —	Broadcast/recording studio
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing
Source: Caltrans 2013		

Addition of Decibels

Because decibels are logarithmic units, SPL values cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness at the same time, the resulting sound level at a given distance would be 3 dB higher than if only one of the sound sources was producing sound under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

Human Response to Noise

Excessive and chronic exposure to elevated noise levels can result in auditory and non-auditory impacts to humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavioral and physiological effects. The non-auditory behavioral effects of noise on humans are associated primarily with the subjective effects of annoyance, nuisance, and dissatisfaction, which lead to interference with activities such as communication, sleep, and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research indicates that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induce response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise environments is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment an individual has become accustomed to, the less tolerable the new noise source will be perceived.

As mentioned previously, the doubling of sound energy results in a 3-dB increase in the sound level. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different from what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear can discern 1-dB changes in sound levels when exposed to steady, single-frequency (“pure-tone”) signals in the mid-frequency (1,000–8,000 Hz) range. In typical noisy environments, changes in noise of 1–2 dB are generally not perceptible. However, it is widely accepted that people can begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

Common Noise Descriptors

Noise in our daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors used throughout this Report.

Equivalent Continuous Sound Level (L_{eq}): L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that occurs during the same period. The 1-hour A-weighted equivalent sound level ($L_{eq[h]}$) is the energy average of A-weighted sound levels occurring during a 1-hour period and is the basis for noise abatement criteria used by Caltrans and Federal Highway Administration (FHWA).

Maximum Sound Level (L_{max}): L_{max} is the largest instantaneous sound level measured during a specified period.

Minimum Sound Level (L_{min}): L_{min} is the smallest instantaneous sound level measured during a specified period.

Day-Night Level (L_{dn}): L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10-dB “penalty” applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

$L_{8.3}$: The noise level that is equaled or exceeded 8.3 percent of the specified time period (typically one hour).

L_{50}: The noise level that is equaled or exceeded 50 percent of the specified time period (typically one hour). The L_{50} represents the median sound level.

L_{90}: The noise level that is equaled or exceeded 90 percent of the specified time period (typically one hour). The L_{90} typically represents the background or ambient level of a noise environment.

Community Noise Equivalent Level (CNEL): Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10-dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m. and a 5-dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The amount of noise is reduced with increasing distance from the source depends on the following factors.

Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Roads and highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources, thus propagating at a slower rate in comparison to a point source. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source.

Ground Absorption

The propagation path of noise from a source to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance. This would hold true for point sources, resulting in an overall drop-off rate of up to 7.5 dB per doubling of distance.

Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels, as wind can carry sound. Sound levels can be increased at large distances (e.g., more than 500 feet) from the source because of atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction (Caltrans 2013, FTA 2018). Taller barriers provide increased noise reduction. Vegetation between the source and receiver is rarely effective in reducing noise because it does not create a solid barrier.

Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV and RMS vibration velocity are normally described in inches per second (in/sec) or in millimeters per second. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (Caltrans 2013, FTA 2018).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2018). This is based on a reference value of 1 micro inch per second.

The typical background vibration-velocity level in residential areas is approximately 50 VdB. Ground vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2018).

Typical outdoor sources of perceptible ground vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities can generate enough ground vibrations to pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2018).

Vibrations generated by construction activity can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 2 describes the general human response to different ground vibration-velocity levels.

Table 2. Human Response to Different Levels of Ground Noise and Vibration

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Notes: VdB = vibration decibels referenced to 1 micro inch per second and based on the root-mean-square (RMS) velocity amplitude.

Source: FTA 2018

Regulatory Setting

This section provides a summary of federal, state, and local regulations, ordinances, plans, and policies that are related to noise and vibration in Rancho Cucamonga. Also provided is a summary of noise guidance from the state's General Plan Guidelines.

Federal

U.S. Environmental Protection Agency Office of Noise Abatement and Control

The U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at more local levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to state and local governments. However, documents and research completed by the EPA Office of Noise Abatement and Control continue to provide value in the analysis of noise effects.

Federal Transit Administration

To address the human response to ground vibration, FTA has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These guidelines are presented below in Table 3.

Table 3. Ground-Borne Vibration Impact Criteria for General Assessment

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch/second)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 [4]	65 [4]	65 [4]
Category 2: Residences and buildings where people normally sleep.	72	75	80

Category 3: Institutional land uses with primarily daytime uses.	75	78	83

Notes: VdB = vibration decibels referenced to 1 μ inch/second and based on the root mean square (RMS) velocity amplitude. GBV = Ground-Borne Vibration

[1] "Frequent Events" is defined as more than 70 vibration events of the same source per day.

[2] "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.

[3] "Infrequent Events" is defined as fewer than 30 vibration events of the same source per day.

[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels.

Source: FTA 2018

State

California Department of Transportation

In 2013, Caltrans published the Transportation and Construction Vibration Manual (Caltrans 2013). The manual provides general guidance on vibration issues associated with construction and operation of projects in relation to human perception and structural damage. Caltrans recommendations for vibration levels that could result in damage to structures exposed to continuous vibration are presented in Table 4.

Table 4. Caltrans Recommendations Regarding Levels of Vibration Exposure

PPV (in/sec)	Effect on Buildings
0.4–0.6	Architectural damage and possible minor structural damage
0.2	Risk of architectural damage to normal dwelling houses
0.1	Virtually no risk of architectural damage to normal buildings
0.08	Recommended upper limit of vibration to which ruins and ancient monuments should be subjected
0.006–0.019	Vibration unlikely to cause damage of any type

Notes: PPV= Peak Particle Velocity; in/sec = inches per second

Source: Caltrans 2013

Local

City of Rancho Cucamonga Exterior Noise Standards

Section 17.66.050(C) of the City of Rancho Cucamonga's municipal code regulates exterior noise levels. The noise ordinance provides Noise Standards relative to community noise level exposure, guidelines, and regulations. It is deemed unlawful to exceed the following exterior noise levels at any location within the city as adjusted below:

- Basic noise level for a cumulative period of not more than 15 minutes in any one hour; or
- Basic noise level plus five dBA for a cumulative period of not more than ten minutes in any one hour; or
- Basic noise level plus 14 dBA for a cumulative period of not more than five minutes in any one hour; or
- Basic noise level plus 15 dBA at any time.

City of Rancho Cucamonga Residential Noise Standards

Pursuant to Municipal Code Section 17.66.050(F), exterior noise levels should not exceed 65 dBA between the hours of 7:00 AM and 10:00 PM at residential uses (Table 5). These are the noise limits when measured at the adjacent residential property line (exterior) or within a neighboring home (interior).

Table 5. Residential Noise Limits

Location of Measurement	Maximum Allowable	
	10:00 p.m. to 7:00 a.m.	7:00 a.m. to 10:00 p.m.
Exterior	60 dBA	65 dBA
Interior	45 dBA	50 dBA

Notes:

(A) It shall be unlawful for any person at any location within the city to create any noise or to allow the creation of any noise which causes the noise level when measured within any other fully enclosed (windows and doors shut) residential dwelling unit to exceed the interior noise standard in the manner described herein.

(B) If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be determined, each of the noise limits above shall be reduced five dBA for noise consisting of impulse or simple tone noise.

Source: Rancho Cucamonga Municipal Code §17.66.050(F)

City of Rancho Cucamonga Commercial Noise Standards

The City of Rancho Cucamonga has adopted noise standards for commercial and office uses, pursuant to Municipal Code Section 17.66.050(G). All commercial operations and businesses shall be conducted to comply with the following standards:

- General: Commercial and office activities shall not create any noise that would exceed an exterior noise level of 65 dBA during the hours of 10:00 p.m. to 7:00 a.m. and 70 dBA during the hours of 7:00 a.m. to 10:00 p.m. when measured at the adjacent property line.
- Loading and unloading: No person shall cause the loading, unloading, opening, closing, or other handling of boxes, crates, containers, building materials, garbage cans, or similar objects between the hours of 10:00 p.m. and 7:00 a.m., in a manner which would cause a noise disturbance to a residential area.
- Vehicle repairs and testing: No person shall cause or permit the repairing, rebuilding, modifying, or testing of any motor vehicle, motorcycle, or motorboat in such a manner as to increase a noise disturbance between the hours of 10:00 p.m. and 8:00 a.m. adjacent to a residential area.

Environmental Setting

Discussed in this section are local sources of concern and existing community conditions, including disproportionately affected neighborhoods in Rancho Cucamonga.

Existing Noise- and Vibration-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, schools, historic sites, cemeteries, and recreation areas are also generally considered sensitive to increases in exterior noise levels. Places of worship and transit lodging, and other places where low interior noise levels are essential are also considered noise sensitive. Those noted above are also considered vibration-sensitive land uses in addition to commercial and industrial buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance.

Community Noise Survey

Existing community noise in the city was documented during a noise monitoring survey completed for the City's 2010 General Plan Update EIR. Sampling was done at twenty-one individual noise monitoring locations in July of 2009. The monitoring locations are listed in Table 6 and depicted on an area map in Figure 1. Average noise measurements at these twenty-one sites are presented below as L_{eq} levels (Table 7). While these measurements were made in 2009, a recent Rancho Cucamonga profile report published by the Southern California Association of Governments (SCAG) indicated that only a small amount of growth occurred between 2010 and 2018, the most recent year for which data are available. From 2010 to 2018, the population of Rancho Cucamonga increased by 6.9

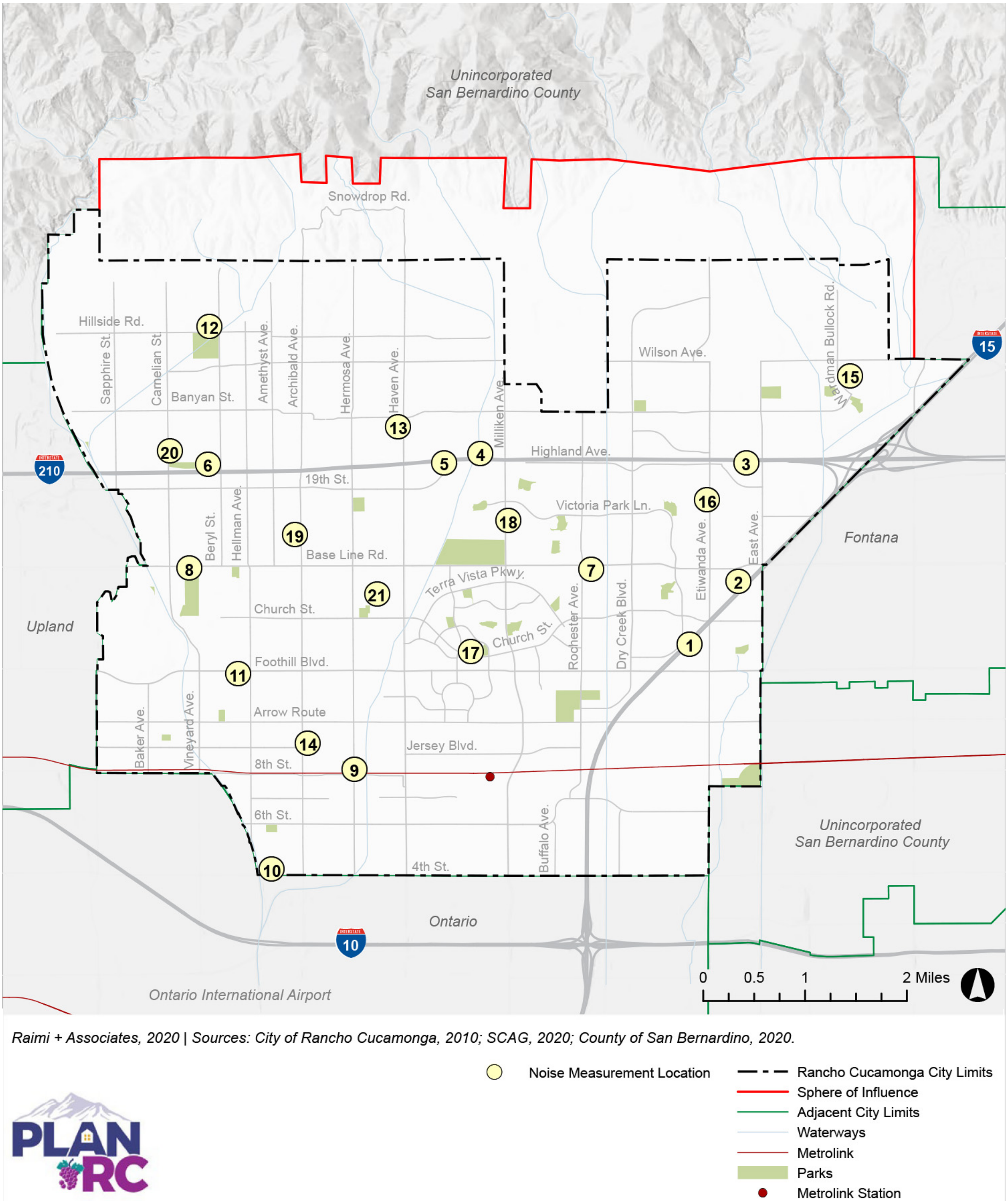
percent and the number of households within the city increased by 5.5 percent (SCAG 2019). While some growth has occurred since 2010, the primary result of these growth increases would be changes in traffic volume, rather than changes in the number or size of stationary noise sources. Noise due to increases in traffic volumes will be captured by the traffic noise modeling to be conducted, but community background noise measurements would not be significantly affected. The 2009 noise measurements presented below are therefore considered representative of existing community noise levels in 2020.

Table 6. Existing Noise Measurement Locations (dBA)

Site Number	Location
1	Inside apartment complex, central location, adjacent to the I-15 Freeway
2	Colonial Drive and Bungalow Way, on sidewalk, adjacent to I-15 Freeway
3	Mueller Court and Dicarlo Place, on sidewalk, adjacent to SR-210 Freeway
4	Near end of walking path, off of Silver Sun, adjacent to SR-210 Freeway
5	Ring Avenue, north tip of cul-de-sac, on sidewalk, next to SR-210 Freeway
6	Beryl Park, west of tennis courts, at edge of soccer field, next to SR-210 Freeway
7	Fennel Road, end of cul-de-sac, near Base Line Road
8	Redhill Community Park, (Base Line and Vineyard), north of shuffleboard area
9	North side of Humbolt Avenue, near cul-de-sac, on dirt
10	Glenaire Ct, end of cul-de-sac, near complex entrance on Golden Oak
11	On sidewalk inside complex, between Lion and Hellman, on Foothill
12	Intersection of Hillside and Buckthorn Ave, on grass at north-east side
13	Between sidewalks in complex, near Haven Ave, about 390 feet north of Lemon
14	On school ground, next to Archibald, near playground
15	In park, near intersection of Santa Ynez Pl and Hickcox Lane, on playground pad
16	On walking trail, west side of Etiwanda Ave, between Victoria and Carnesi
17	Walking path, Church St, between Ralph M Lewis Park and Jamboree complex
18	Genova Rd, end of cul-de-sac, between cul-de-sac and Milliken Avenue
19	On sidewalk, in complex near entrance from Archibald, south of Monte Vista
20	Intersection of Carnelian St and Somerset Dr, northeast corner, on sidewalk
21	On school ground, next to Palo Alto, at bus entrance, near Center and Palo Alto

Source: City of Rancho Cucamonga 2010

Figure 1. Noise Measurement Site Locations



Raimi + Associates, 2020 | Sources: City of Rancho Cucamonga, 2010; SCAG, 2020; County of San Bernardino, 2020.

Table 7. Existing Noise Measurements (dBA)

Site Number	Date	Time	L_{eq}	L_{max}	L_{min}	$L_{8.3}$	L_{50}	L_{90}
1	7/7/2009	11:48 AM	67.9	73.7	59.1	70.5	67	63.5
2	7/7/2009	11:04 AM	66.2	73.7	61.7	67.5	65.5	63.5
3	7/7/2009	9:44 AM	62.2	77	57	63	61	59.5
4	7/7/2009	2:51 PM	72.3	78.4	66.4	73.5	72	70
5	7/8/2009	8:22 AM	56.6	72.6	51.2	58	55.5	53.5
6	7/8/2009	11:24 AM	60	64.2	56.4	61.5	59.5	58
7	7/7/2009	12:32 PM	53	68.8	40	56.5	49.5	44.5
8	7/8/2009	2:09 PM	57.5	72.7	45.8	60.5	55	49.5
9	7/9/2009	12:15 PM	67.8	93.2	46.1	62	58.5	54
10	7/9/2009	1:01 PM	52.9	71	42.7	56	50	46
11	7/9/2009	10:47 AM	60.8	73.8	46.4	64.5	58.5	52.5
12	7/8/2009	1:16 PM	64.3	89	39	65.5	48	41
13	7/8/2009	9:02 AM	56.9	76.5	44.3	60.5	54	48
14	7/9/2009	11:33 AM	69.7	84.3	52.2	72.5	68	60
15	7/7/2009	8:52 AM	48.9	64	43.2	51.5	46	44
16	7/7/2009	10:24 AM	53.1	68.8	38.6	58	43	40
17	7/7/2009	1:20 PM	60.7	69.8	45.6	65	58.5	51
18	7/7/2009	2:13 PM	65.9	79.4	43.4	70.5	61.5	51
19	7/8/2009	9:48 AM	59.1	70.6	41.8	62.5	57	48.5
20	7/8/2009	12:38 PM	68.7	84.1	47.2	72.5	66	55.5
21	7/8/2009	10:34 AM	47.9	64.5	38.2	50.5	41.5	40
Source: City of Rancho Cucamonga 2010								

Existing Aircraft Noise Levels

The closest airport to Rancho Cucamonga is the Ontario International Airport (ONT), located approximately one mile south of the city's southern border. According to the latest noise contour (4th Quarter 2009 by Los Angeles World Airports), Rancho Cucamonga's southern border is approximately 1 mile north of the Ontario International Airport's 65 dBA CNEL noise contour. Therefore, aircraft noise does not significantly impact the city.

Existing Traffic Noise Levels

Several major roadways run through the city that contribute a notable amount of noise to the ambient environment. These roadways include the I-15 and SR-210 freeways, as well as Foothill Boulevard and Base Line Road, which are major local roadways. Additionally, the I-10 freeway lies approximately 0.7 miles south of the city and vehicles travelling along this route may also noticeably contribute to the city's ambient noise during quieter periods, such as evenings.

At a later stage of the process in updating the City's General Plan, a formal traffic analysis, including a determination of peak average daily traffic (ADT) volumes, will be completed. Peak ADT volume data from the traffic analysis will allow for quantitative traffic noise modeling to be performed. Results of the traffic noise modeling will be considered in developing comprehensive noise and vibration goals and policies to be included in the City's General Plan Update.

Existing Railroad Noise and Vibration Levels

Two east/west rail lines lie in the vicinity of Rancho Cucamonga. The Alameda Corridor East rail line does pass through San Bernardino county; however, it is located nearly one mile to the south of the city's southern boundary and does not pass through Rancho Cucamonga proper. The modeled train noise impact to the city from the Alameda Corridor has been estimated to be less than 65 CNEL (City of Rancho Cucamonga 2010). Thus, noise and vibration from this line does not have a significant noise impact on the city.

There is an additional pair of east/west rail lines that run through the southern portion of the city. Metrolink passenger trains and BNSF freight trains run along the double-tracked corridor (eastbound and westbound) located just north of East 8th Street. As verified by Metrolink's train schedule for the Rancho Cucamonga station in April 2020, during normal service conditions a total of 38 Metrolink trains pass through the City of Rancho Cucamonga each weekday, with an additional late-night train on Fridays. Of the total Metrolink trains, 30 are scheduled to operate between 7 a.m. and 10 p.m. While this rail line is primarily used as a secondary route for freight trains, it was conservatively assumed that an average of two BNSF freight trains pass through the city each day, between 7 a.m. and 10 p.m.

Noise levels along these railways are dependent on several factors, including the location of railroad crossings, where noise levels are greater due to horns blowing. Railway noise modeling performed by Ascent in 2020 determined that CNEL noise levels for both Metrolink and BNSF trains at railroad crossings, where horn use is more frequent, are as high as 81.7 dBA at a distance of 50 feet from the center of the two tracks. CNEL noise levels along other portions of the track, segments at least 1,000 feet from any crossings, are as low as 64.5 dBA at a distance of 50 feet from the tracks.

Existing Stationary Sources of Noise

Industrial operations comprise the primary stationary noise sources that contribute to local community noise levels. These stationary sources (e.g., loading areas, large mechanical equipment, fabrication) are often located in commercially- and industrially zoned areas and are isolated from noise-sensitive land uses. However, when noise-sensitive land uses such as residential housing are located in close proximity to industrial noise sources, they may be affected to a greater extent than non-adjacent areas. Other noise sources that affect sensitive receptors in the city include commercial land uses or those often associated with and/or secondary to residential development including, but not limited to, nightclubs, outdoor dining areas, gas stations, car washes, drive throughs, fire stations, air conditioning units, swimming pool pumps, school playgrounds, athletic and music events, and public parks.

Temporary Construction Noise

Construction is a temporary source of noise for residences and business located near construction sites. Construction noise can be significant for short periods of time at any location as a result of public improvement projects, private development projects, and remodeling. The greatest level of noise occurs during the grading and site excavation phases. Large earth-moving equipment, such as grader, scrapers, and bulldozers generated maximum noise levels of 80 to 85 dB when measured at 50 feet from a construction site. Other construction equipment, such as pile drivers, can generate levels of noise up to 101 dB at 50 feet (FTA 2018). Construction activities can elevate noise levels at adjacent land uses by 15 to 20 dB or more, depending on the project.

Findings

- Based on ambient noise level measurements throughout the city, the dominant sources of noise include traffic noise on major roadways and freeways, as well as transit and freight train noise, which is primarily localized to the southern portion of the city where the shared railway is located.
- Health effects of excessive noise and vibration range from minor psychological stress, irritability, and fatigue due to lack of sleep, to more serious stress-induced chronic effects, including cardiovascular disease, cognitive impairment, anxiety, and depression. Sensitive receptors and communities of the city in close proximity to noise sources may experience these effects more intensely.
- Roadway traffic is the predominant source of noise affecting sensitive land uses in the city. Freeways and major arterial roadways are the primary sources of traffic noise. Roadways in the city with the greatest traffic noise levels are Interstate 15, SR-210, Foothill Boulevard, and Base Line Road. I-10, which lies approximately 0.7 miles south of the city, may contribute to ambient background noise to a lesser extent, but it was not included as a source in noise modeling.
- Noise generated by industrial and stationary sources contribute to the ambient noise environment in their immediate vicinities.
- The Metrolink and BNSF trains operating along the same corridor, through the southern portion of the city, are existing noise and vibration sources. Sensitive receptors and other residents in close proximity to this railway experience a disproportionate amount of noise and vibration from these sources compared to the rest of the city.

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Acronyms

ADT	average daily traffic (volumes)
BNSF	Burlington Northern Santa Fe Railway Company
Caltrans	California Department of Transportation
CNEL	community noise equivalent level
dB	decibels
dBA	A-weighted decibels
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
FTA	Federal Transit Administration
L_{eq}	Equivalent Continuous Sound Level
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
ONT	Ontario International Airport
OPR	Office of Planning and Research
PPV	peak particle velocity
RMS	root-mean-square (velocity)
SCAG	Southern California Association of Governments
SPL	sound pressure level
VdB	vibration decibels