Environmental Noise Assessment

Balfour ampm Car Wash

City of Brentwood, California

August 15, 2023

Project #220205

Prepared for:

K12 Architects, Inc.
3090 Fite Circle, Suite 104
Sacramento, CA 95827

Prepared by:

Saxelby Acoustics LLC

Luke Saxelby, INCE Bd. Cert.
Principal Consultant
Board Certified, Institute of Noise Control Engineering (INCE)

(916) 760-8821
www.SaxNoise.com | Luke@SaxNoise.com
915 Highland Pointe Drive, Suite 250
Roseville, CA 95678

INTRODUCTION

The Balfour ampm Car Wash project is located near the southeast corner of the intersection of Balfour Road and John Muir Parkway in the City of Brentwood, California. The project includes the expansion of the existing car wash tunnel and the addition of a larger vacuum station on the eastern side of the convenience store.

The City of Brentwood has requested that an acoustical analysis be prepared to analyze potential noise impacts associated with the car wash operations. Therefore, this analysis will predict the noise generation associated with these uses and will seek to achieve compliance with the applicable City of Brentwood General Plan Noise Element goals and policies.

Figure 1 shows the project site plan.

ENVIRONMENTAL SETTING

BACKGROUND INFORMATION ON NOISE

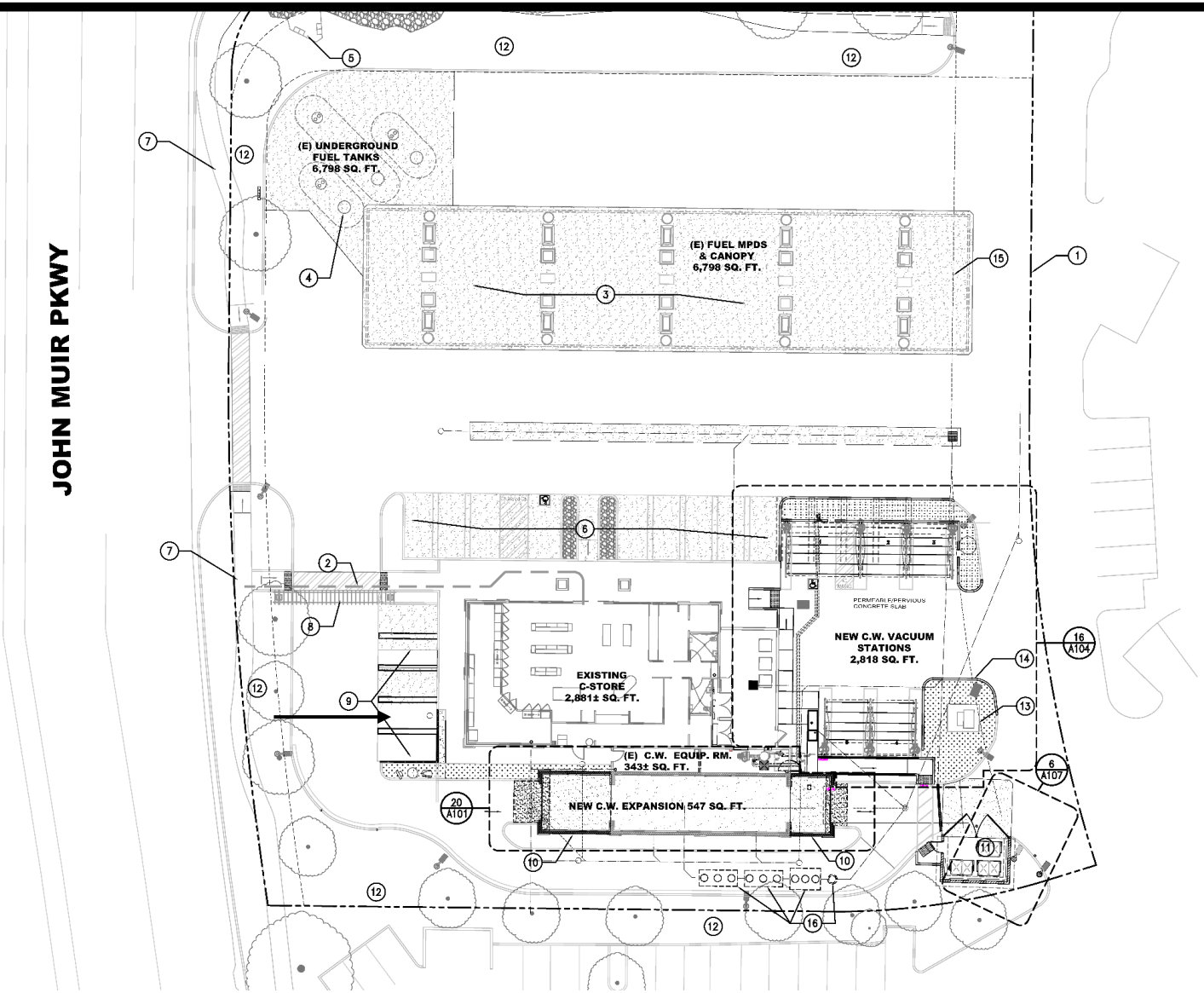
Fundamentals of Acoustics

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

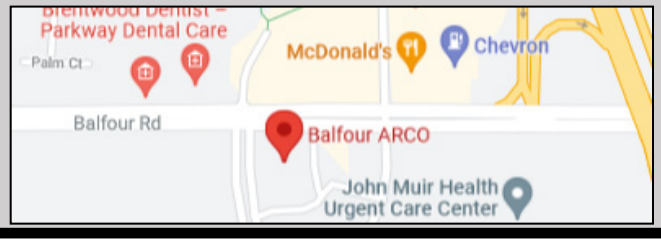
Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, but are expressed as dB, unless otherwise noted.



Balfour ampm Car Wash
City of Brentwood, California

Figure 1
Project Site Plan



SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

The decibel scale is logarithmic, not linear. In other words, two sound levels 10-dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10-dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound, and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The day/night average level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10-decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 1 lists several examples of the noise levels associated with common situations. **Appendix A** provides a summary of acoustical terms used in this report.

TABLE 1: TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	--110--	Rock Band
Jet Fly-over at 300 m (1,000 ft.)	--100--	
Gas Lawn Mower at 1 m (3 ft.)	--90--	
Diesel Truck at 15 m (50 ft.), at 80 km/hr. (50 mph)	--80--	Food Blender at 1 m (3 ft.) Garbage Disposal at 1 m (3 ft.)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft.)	--70--	Vacuum Cleaner at 3 m (10 ft.)
Commercial Area Heavy Traffic at 90 m (300 ft.)	--60--	Normal Speech at 1 m (3 ft.)
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
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing
Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. September, 2013.		

Effects of Noise on People

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6-dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

REGULATORY CONTEXT

FEDERAL

There are no federal regulations related to noise that apply to the Proposed Project.

STATE

There are no state regulations related to noise that apply to the Proposed Project.

LOCAL

City of Brentwood General Plan

The City of Brentwood Plan Noise Element establishes noise level criteria for both transportation and non-transportation noise sources. **Table 2** provides the noise level performance criteria for residential uses affected by non-transportation noise sources, such as car washes. These criteria are applied at the property lines of noise-sensitive land uses or a designated outdoor activity area at the discretion of the Community Development Director.

TABLE 2: STATIONARY NOISE SOURCE STANDARDS

Land Use Receiving the Noise	Hourly Noise Level Descriptor	Exterior Noise-Level Standard (dBA)	
		Daytime Maximum (7 am - 10 pm)	Nighttime Maximum (10 pm - 7 am)
Residential	L_{eq}	55	45
	L_{max}	70	65

Notes:
a) The residential standards apply to all properties that are zoned for residential use. The exterior noise level standard is to be applied at the property line of the receiving land use or at a designated outdoor activity area (at the discretion of the Community Development Director) of the new development. For mixed-use projects, the exterior noise level standard may be waived (at the discretion of the Community Development Director) if the project does not include a designated activity area and mitigation of property line noise is not practical. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings). The City can impose standards that are more restrictive than specified above based upon determination of existing low ambient noise levels.
b) Each of the noise levels specified above shall be lowered by 5 dBA for tonal noises characterized by a whine, screech, or hum, noises consisting primarily of speech or music, or recurring impulsive noises. In no case shall mitigation be required to a level that is less than existing ambient noise levels, as determined through measurements conducted during the same operational period as the subject noise source.
c) In situations where the existing noise level exceeds the noise levels indicated in the above table, any new noise source must include mitigation that reduces the noise level of the noise source to the existing level plus 3 dB.
d) Exterior noise exposure level not exceeding 65 dB Ldn is allowed along the State Route 4 corridor, the Union Pacific Railroad corridor, and arterial roadways.

Based upon the footnote in **Table 2**, project-related noise levels would be required to not exceed 55 dBA L_{eq} at the nearest existing residenitial uses in the project vicnity during daytime (7:00 a.m. to 10:00 p.m.) operations.

It should also be noted that for car wash uses, the average (L_{eq}) noise descriptor is the most applicable standard due to continuous operation of the car wash blowers and vacuum producers. The City's daytime maximum (L_{max}) standard of 70 dBA is 15 dBA higher than the average standard of 55 dBA L_{eq}. It is expected that maximum (L_{max}) noise levels from the car wash operation would typically be no more than 10 dBA higher than the average (L_{eq}) levels. Therefore, compliance with the City's average standard would also result in compliance with the maximum standard. For that reason and for the sake of simplicity, the L_{eq} is the primary noise descriptor used in this analysis.

EVALUATION OF CAR WASH NOISE AT RESIDENTIAL RECEPTORS

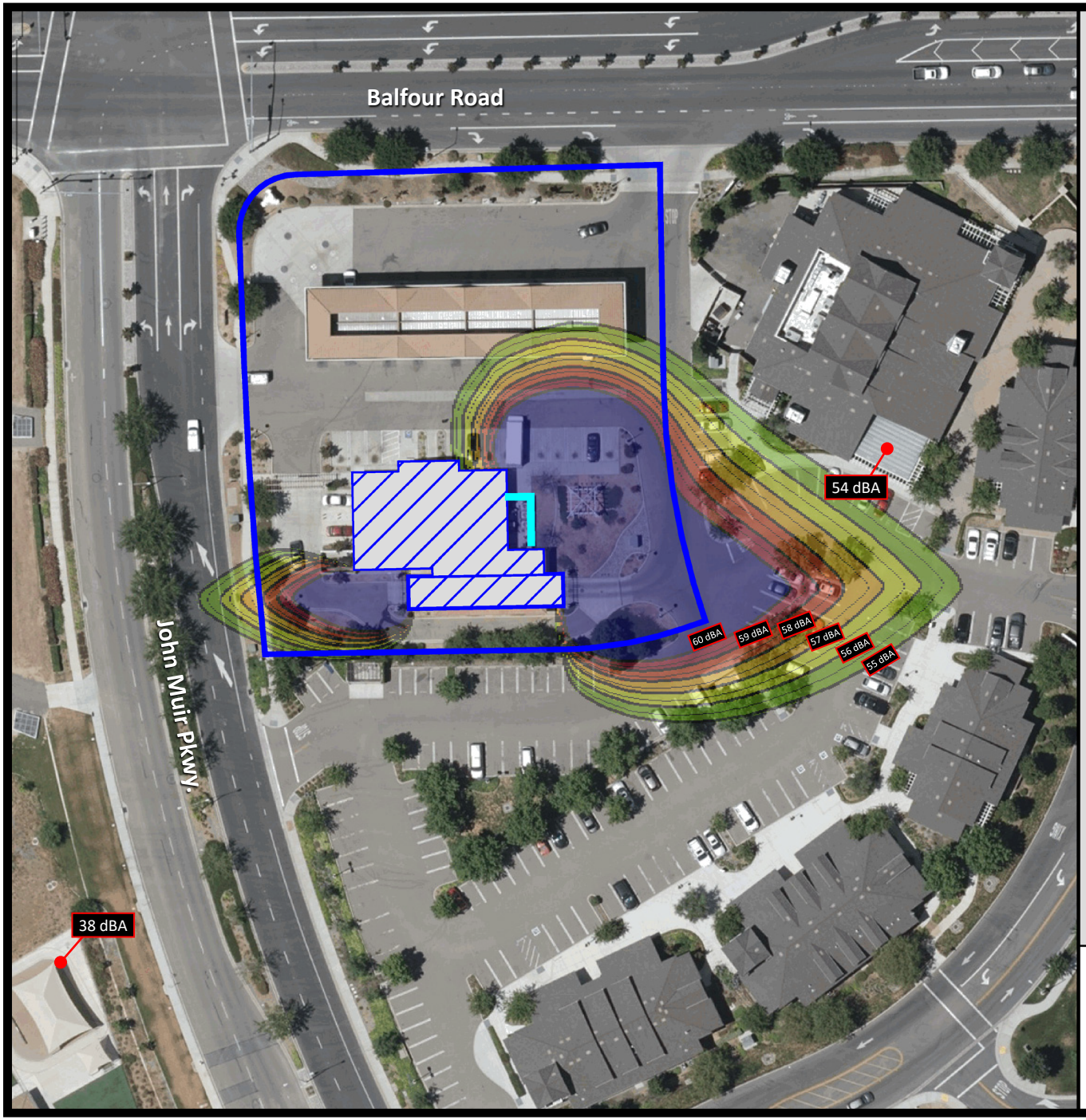
The air blower dryers are the dominate noise source for this type of a car wash. Additionally, the vacuum station area and associated central vacuum turbine are substantial noise-generating components. This analysis considers each of these primary noise sources along with vehicle circulation on the project site.

The following is a list of assumptions used for the noise modeling. The data used is based upon a combination of manufacturer's provided data and Saxelby Acoustics data from similar car wash operations.

Car Wash Blowers:	IDC 120 HP Predator Stealth Drying System. 65 dBA L_{eq} at 60 feet from car wash exit. MD Acoustics data (see Appendix B).
Vacuum Producer:	72 dBA Leq at 10 feet. Manufacturer's data.
Vacuum Station Area:	70 dBA Leq at edge of vacuum area. Saxelby Acoustics data.

Saxelby Acoustics used the SoundPLAN noise prediction model. Inputs to the model included sound power levels for the proposed car wash tunnel, existing and proposed buildings, terrain type, and locations of sensitive receptors. These predictions are made in accordance with International Organization for Standardization (ISO) standard 9613-2:1996 (Acoustics – Attenuation of sound during propagation outdoors). ISO 9613 is the most commonly used method for calculating exterior noise propagation.

Figure 2 shows the predicted car wash noise level contours in terms of the average (L_{eq}) noise descriptor.



Balfour ampm Car Wash

City of Brentwood, California

Figure 2

Project Noise Contours (dBA L_{eq})

Noise Level, dB(A)

55 <	<=	56	
56 <	<=	57	
57 <	<=	58	
58 <	<=	59	
59 <	<=	60	
60 <			

Legend

- Project Building
- Project Boundary
- Existing Sound Wall

Scale 1:75

0 15 30 60 90 120 feet

N

SAXELBY ACOUSTICS
Acoustics · Noise · Vibration

CONCLUSIONS

The proposed project is predicted to comply with the City of Brentwood daytime (7:00 a.m. to 10:00 p.m.) noise level standard of 55 dBA L_{eq} as planned. This analysis assumes that the car wash would only operate between the hours of 7:00 a.m. and 10:00 p.m.