AMBIENT AND OPERATIONS NOISE STUDY FOR A PROPOSED EXPRESS CAR WASH IN THE CITY OF RIVERSIDE

Revision 3

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PREPARED FOR:

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1. Introduction

At the request of Mr. Tan Tingley (Tan & Eap Enterprises [TEE]), and in compliance with requirements of the city of Riverside (City), a noise study has been conducted by Advanced Engineering Acoustics (AEA). TEE has plans to build an express car wash on currently vacant land on the southeast corner of East Alessandro Blvd. and Vista Grande Drive in Riverside, CA (see Figure 1). In order to document the level of potential noise from the new car wash operations for this commercial business, AEA has obtained noise measurement data for the planned dryer system and vacuum equipment for the proposed car wash facility (see Appendix A) and has measured the ambient noise at the residential properties adjacent to the location of the proposed new car wash. This report gives the existing ambient noise and the predicted car wash operations noise at the nearby commercial and single-family residential properties.

2. Project Description

This express carwash development is situated on a 36,015 sq.ft. lot at the southwest corner of Alessandro Boulevard and Vista Grande Drive. The properties to the east, west and north are zoned commercial. The properties to the south are zoned single family residential. The carwash building is proposed to be 4,080 sq.ft. with a 120 long by 22 feet wide carwash tunnel. The remainder of the building is dedicated to carwash equipment, restrooms and an office. Fabric shade canopies are proposed over 19 vacuum parking spaces. There are two proposed automated pay stations with shade canopies and queuing for 12 cars. The hours of operation are proposed to be 7am to 9pm seven days a week. The estimated maximum number of cars washed is 700 with a daily average of 500.

3. Sound Fundamentals

Physically, sound pressure magnitude is measured and quantified in terms of the decibel (dB), which is associated with a logarithmic scale based on the ratio of a measured sound pressure to the reference sound pressure of 20 micropascal (20 μPa = 20 x 10^{-6} N/m^2). However, the decibel system can be very confusing. For example, doubling or halving the number of sources of equal noise output (a 2-fold change in acoustic *energy*) changes the noise level at the receptor by only 3 dB, which is a barely perceptible sound change for humans. While doubling or halving the sound *loudness* at the receptor results in a 10 dB change and also represents a 10-fold change in the acoustic *energy*.

The human hearing system is not equally sensitive to sound at all frequencies. Because of this variability, a frequency-dependent adjustment called “A-weighting” has been devised so that sound may be measured in a manner similar to the way the human hearing system responds. The A-weighted sound level is abbreviated "dBA". Figure 2 gives typical A-weighted sound levels for various noise sources and the typical responses of people to these levels.

Normally, ambient sounds change with the daily cycle of human activities. To account for these changes, the energy average sound level has been adopted and this sound descriptor is used by the City and in this report as the energy average equivalent sound level, L_{eq}. The L_{eq} is defined as the continuous A-weighted sound level that, in a specified period of time, contains the same sound energy as the actual time-varying sound during that period. It is a particularly stable and predictable descriptor for traffic and environmental noise and, at the same time, is well-correlated to people's reaction to noise. The City noise code calls for a noise measurement time period of 15 minutes.

Figure 1. Project Vicinity Aerial View

4. City Noise Standards

The city of Riverside has established stationary source noise limits to ensure that all segments of the community and spheres of influence will be protected from excessive noise exposure. The noise standards are contained within Title7 of the City of Riverside Municipal Code.

Section 7.25.010 Exterior sound level limits.

A. Unless a variance has been granted as provided in this chapter, it shall be unlawful for any person to cause or allow the creation of any noise which exceeds the following:

1. The exterior noise standard of the applicable land use category, up to five decibels, for a cumulative period of more than thirty minutes in any hour; or

2. The exterior noise standard of the applicable land use category, plus five decibels, for a cumulative period of more than fifteen minutes in any hour; or

3. The exterior noise standard of the applicable land use category, plus ten decibels, for a cumulative period of more than five minutes in any hour; or

4. The exterior noise standard of the applicable land use category, plus fifteen decibels, for the cumulative period of more than one minute in any hour; or

5. The exterior noise standard for the applicable land use category, plus twenty decibels or the maximum measured ambient noise level, for any period of time.

B. If the measured ambient noise level exceeds that permissible within any of the first four noise limit categories, the allowable noise exposure standard shall be increased in five decibel increments in each category as appropriate to encompass the 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…

Table 7.25.010A

Exterior Noise Standards		
Land Use Category	***Time Period***	***Noise Level***
Residential	*Night (10 p.m. to 7 a.m.)* *Day (7 a.m. to 10 p.m.)*	*45 dBA* *55 dBA*
Office/commercial	*Any time*	*65 dBA*

5. Sound Monitoring Equipment and Locations

In monitoring the proposed car wash location's area ambient noise, AEA used two NTi XL2 Type 1 Integrating and Audio Recording Sound Level Meter to monitor the various noise producing activities near the proposed project site. Each sound meter is in current laboratory calibration and was field calibrated according to the respective manufacturers' instructions just prior to and after making the sound measurements.

The two ambient noise monitoring positions (see Figure 3) were five feet above grade. The sound level meters (SLM) were approximately 235 feet south of the centerline of Aleassandro Blvd. SLM A was at the rear yard property line and approximately 80 feet east of the centerline of Vista Grande Drive. SLM B was at rear yard property line wall and approximately 225 feet east of the centerline of Vista Grande Drive

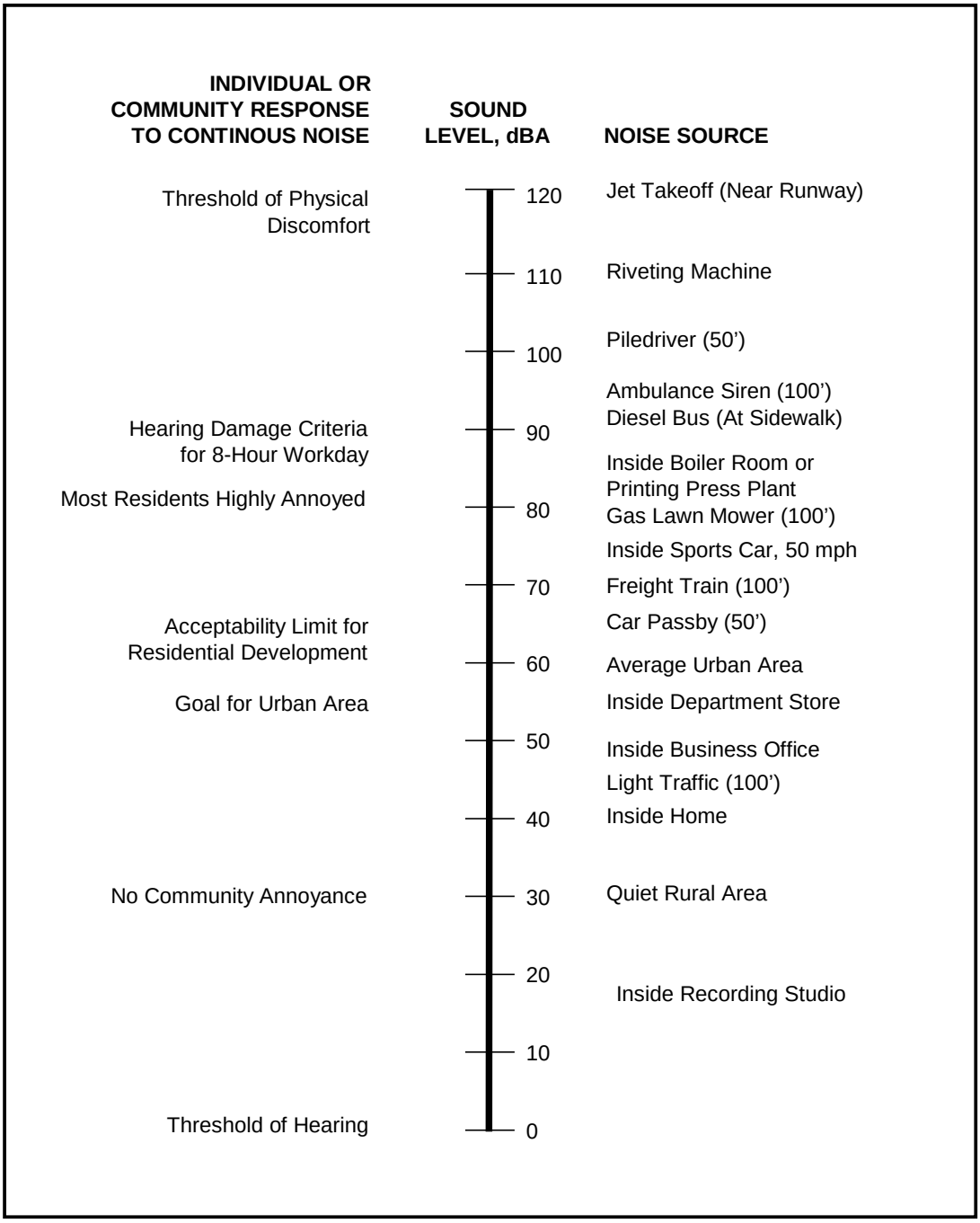

Figure 2 - Typical Sound Levels and their Effect on People

6. Sound Measurements and Results

Ambient noise was monitored in 1-hour intervals on November 4, 2019 at the adjacent residential-use property lines over the planned car wash operating from 7:00 a.m. to 9:00 p.m. The ambient noise measurement results for the project vicinity are given in Tables 1 and 2. Traffic studies show that the peak-noise traffic hour is very close to the 24-hour CNEL for the same location and roadway.

The ambient noise measurement results include the hourly equivalent energy average sound level (Leq[1-hr]), the minimum hourly sound level (Lmin) and the maximum hourly sound level (Lmax). In addition, the hourly noise measurements include the percentile or exceedance levels (L%). An L(2) exceedance level is the sound level that is exceeded for 2% of the measurement hour. The L(8) exceedance level is the sound level that is exceeded for 8% of the hour. L(25) and (L50) are the sound levels that are exceeded for 25% and 50% of their respective hourly periods. All noise level data herein are referenced to 20 micropascal (20 µPa) and are A-weighted sound levels (dBA) taken with the required "slow" response setting.

Figure 3. Aerial View of Project Site with Sound Meter Locations

Table 1. West Ambient Hourly Noise Monitoring Results (SLM A)

Date	Start Time	Leq(15m)	Lmax	L(2)	L(8)	L(25)	L(50)	L(90)	Lmin
City Code	*Daytime Limit >*	--	*80 Ld*	*75 Ld*	*70 Ld*	*65 Ld*	*60 Ld*	--	--
11/4/2019	7:00:00	60.6	75.2	65.7	63.7	61.8	59.5	51.8	44.1
11/4/2019	8:00:00	59.8	81.8	64.4	62.4	60.5	58.5	51.1	43.5
11/4/2019	9:00:00	58.9	75.5	63.7	62	60.1	58	48.4	33.2
11/4/2019	10:00:00	58.8	78.9	64.6	61.6	59.5	57.1	46.3	38.4
11/4/2019	11:00:00	59	70.5	64.7	62.5	60.5	57.5	47.6	38.1
11/4/2019	12:00:00	59.7	77.7	65.2	62.7	60.6	58.1	48.5	38.1
11/4/2019	13:00:00	59.3	71.8	64.4	62.7	60.9	58.3	48.5	38.4
11/4/2019	14:00:00	60.6	74.4	65.2	63.7	61.9	59.8	50.7	39.7

11/4/2019	15:00:00	61.3	79	66.2	64.2	62.6	60.5	50.6	39.4
11/4/2019	16:00:00	62.4	81.8	66.9	65	63.7	61.4	50.6	39.9
11/4/2019	17:00:00	63.5	79.3	68.3	66.1	64.7	62.8	54.2	44
11/4/2019	18:00:00	63	74.3	67.9	66.3	64.8	62	52.6	42.3
11/4/2019	19:00:00	60.3	71.1	65.8	64.1	61.9	58.7	49.8	42.9
11/4/2019	20:00:00	61.2	79.6	67.6	65	62.3	58.7	49.1	42.6
11/4/2019	21:00:00	59.8	66.7	66.2	64.9	61.1	56	46.7	43.2
Ambient-Based Code Noise Limit			***81.8***	***75.0***	***70.0***	***65.9***	***62.8***	**--**	**--**

*** CNEL =**

Table 2. East Ambient Hourly Noise Monitoring Results (SLM B)

Date	Start Time	Leq(15m)	Lmax	L(2)	L(8)	L(25)	L(50)	L(90)	Lmin
City Code	***Daytime Limit >***	--	***80 Ld***	***75 Ld***	***70 Ld***	***65 Ld***	***60 Ld***	**--**	**--**
11/4/2019	7:00:00	61.8	70.8	66.6	65.1	63.2	61	53.1	45.2
11/4/2019	8:00:00	61.7	81.1	66.5	64.6	62.6	60.5	53.2	44.8
11/4/2019	9:00:00	60.7	73.2	65.6	63.9	62.1	59.9	50.1	34.4
11/4/2019	10:00:00	60.5	83	65.8	63.2	60.8	58.4	48.4	37
11/4/2019	11:00:00	59.6	70.3	65	63.2	61.1	58.2	48.6	37.2
11/4/2019	12:00:00	60.4	78.7	66	63.2	61.1	58.6	49.4	37.2
11/4/2019	13:00:00	59.7	73.3	64.7	63	61.2	58.8	49.6	37.2
11/4/2019	14:00:00	60.8	79.6	65.6	63.8	61.9	59.9	52.2	37.7
11/4/2019	15:00:00	61.8	77.3	67	64.5	62.9	60.6	51.8	37.9
11/4/2019	16:00:00	63.1	84.5	67.6	65.3	63.8	61.6	51.5	38.7
11/4/2019	17:00:00	63.5	81.5	68.3	65.5	64.2	62.4	54.6	44.2
11/4/2019	18:00:00	62.3	79	67.2	65.4	63.8	61.3	53.1	40.9
11/4/2019	19:00:00	60	70.7	65.2	63.5	61.6	58.5	51	41.9
11/4/2019	20:00:00	60.2	76	66.4	63.7	61.2	58.2	49.7	42.6
Ambient-Based Code Noise Limit			***84.5***	***75.0***	***70.0***	***65.0***	***62.4***	**--**	**--**

CNEL =

7. Unabated Projected Car Wash Noise Modeling Results

The planned hours of operation of the proposed car wash are with the daytime hours seven (7) days a week. Using the project layout in Figure 6, a worst-case condition with a maximum number of patron vehicles queued up for a car wash at a time could be up to twenty-six (26) vehicles. In addition, there are nineteen (19) vacuum stations. AEA modeling assumes a worst-case scenario of 19 queued idling vehicles and 7 low speed vehicle movements. AEA also assumes 19 vehicles being vacuumed at once. An equipment room contains small pumps and the central vacuum tank. Computer modeling of the measured ambient noise, modeled receptor ambient noise along with the car wash equipment noise, transmitted through the car wash tunnel exit opening, entrance opening, the tunnel walls (north grating replaced with thick glass windows) and tunnel roof, was conducted using the SoundPLAN™, Version 8.1, community noise modeling software. Figure 7 shows the predicted unabated project noise in the local project vicinity, due to the car wash dryers, 19 idling vehicles waiting for a car wash, 7 low speed vehicles and 19 vacuums operating simultaneously. It is very unlikely that the worst-case conditions would actually occur, but the results of such an occurrence, given in Figure 7, shows that the worst-case scenario noise contours for an unabated car wash operation would not exceed either the standard noise code nor the ambient-based noise code.

8. Project Noise Conclusions and Recommendation

The project noise study finds that the proposed unabated project's operational car wash noise would not exceed the residential and commercial standard noise limits nor the ambient-based noise limits. Thus, the project would be in full compliance with the city noise code with the planned equipment operating at maximum capacity. As a courtesy, it is suggested that patron car radios be turned off while at the car wash unless patrons are using blue-tooth enabled ear pieces. Signage should request patron cooperation as a consideration for the neighbors.

Figure 6. Proposed Express Car Wash Layout with Receptor Locations

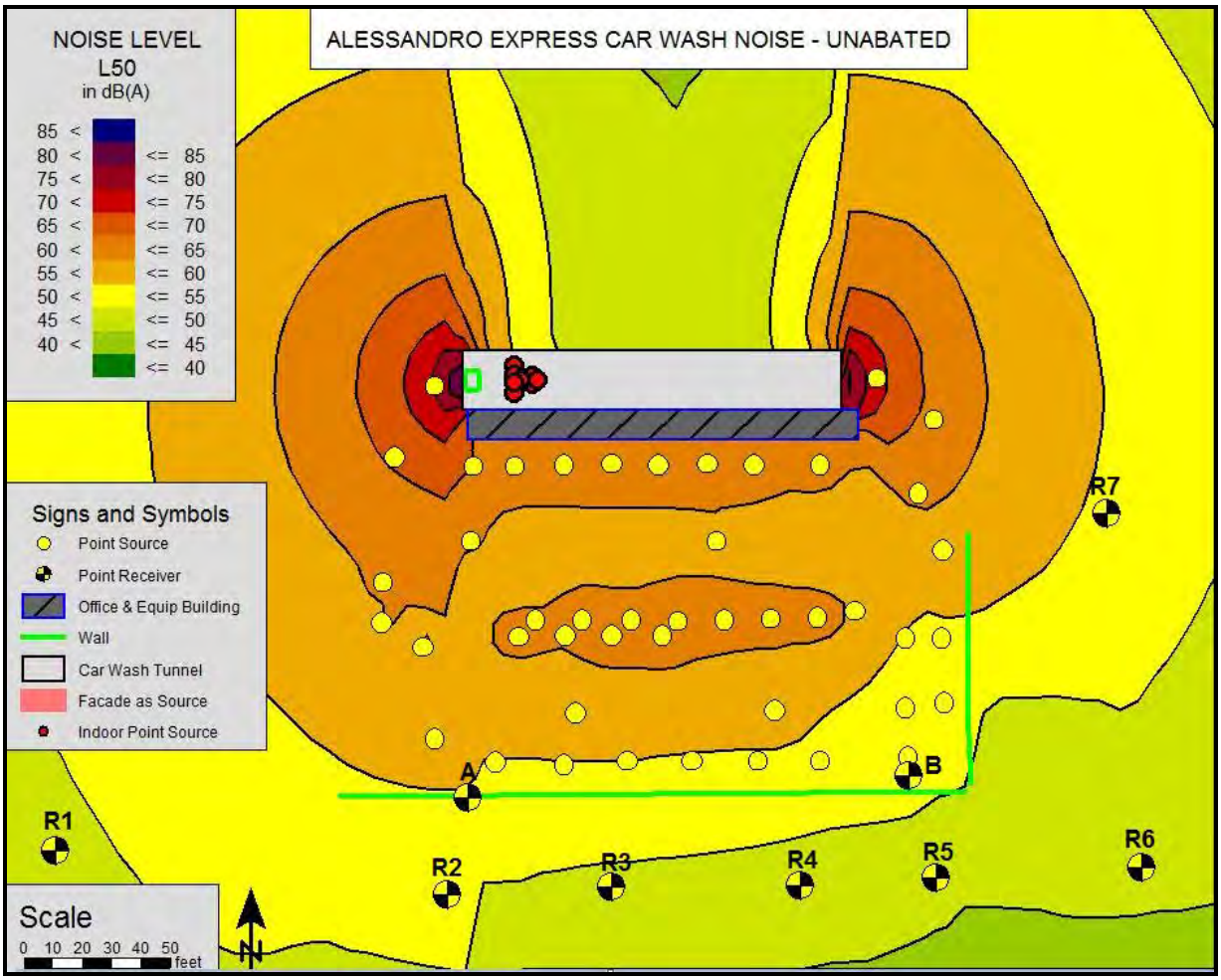

Figure 7. Proposed Car Wash Unabated Noise Contours with Meters & Receptors

A P P E N D I X A

Car Wash Equipment Noise Data Sheets

MacNeil Dryer Fan Noise Measurements

MacNeil Dryer Powerlock Valve Fan Noise Reduction

15 HP Data (1m):

	SPL (dBA)	SPL (Pa)
Data at Measurement Location 1 (Directly in Front of Fan)		
No valve (loc 1)	95.8	1.23
Max Air (valve + foam)	92.2	0.81
Min Air (valve + foam)	87.1	0.45
Averaged Data (in Front of Fan)		
No valve (front fan)	94.4	1.04
Max Air (valve + foam)	92.0	0.80
Min Air (valve + foam)	88.0	0.50

10 HP Data (1m):

	SPL (dBA)	SPL (Pa)
Data at Measurement Location 1 (Directly in Front of Fan)		
No valve (loc 1)	92.2	0.81
Max Air (valve + foam)	87.9	0.50
Min Air (valve + foam)	84.9	0.35
Averaged Data (in Front of Fan)		
No valve (front fan)	89.4	0.59
Max Air (valve + foam)	88.0	0.50
Min Air (valve + foam)	85.2	0.36

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POWERLOCK SOUND PRESSURE LEVELS
Individual Fan Study

10HP Tech 21 Dryer

10HP at 1 meter **without** PowerLock	=	92DB
10HP at 1 meter with PowerLock **open**	=	88DB
10HP at 1 meter with PowerLock **closed**	=	85DB

15HP Tech 21 Dryer

15HP at 1 meter **without** PowerLock	=	96DB
15HP at 1 meter with PowerLock **open**	=	92DB
15HP at 1 meter with PowerLock **closed**	=	87DB

On average, a site will appreciate a 30-50% sound reduction, depending on its dryer package, valve cycling, and wash area.

Bob MacNeil
R&D

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