APPENDIX D

ENVIRONMENTAL NOISE ASSESSMENT

Environmental Noise Assessment

Rocketship Antioch School

Antioch, California

BAC Job # 2017-083

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Introduction

The Rocketship Antioch School (project) is located north of East 18th Street in between Noia Avenue and Cavallo Road in Antioch, California. The project proposes the demolition of a vacant 24,900 square foot building and the construction of a new building for a K-5 charter elementary school with associated play structures, field area, parking areas, and drive-thru lane for student drop-offs and pick-ups. Land uses in the project vicinity include residential uses directly to the east and west, and commercial uses to the north and south. The project area and site plan are shown in Figures 1 and 2, respectively.

This analysis focuses on off-site traffic noise generation, noise generated by on-site school-related activities, and construction activity noise and vibration generation. On-site school-related activities that were considered in this analysis consisted of play area activities, drive-thru lane circulation, and parking area movements. Specific noise mitigation recommendations are provided in this analysis to mitigate project noise impacts.

Noise & Vibration Fundamentals

Noise

Noise is simply described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. Discussing sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel (dB) scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are compared to the reference pressure and the logarithm is taken to keep the numbers in a practical range. The dB scale allows a million-fold increase in pressure to be expressed as 120 dB.

To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed. There is a strong correlation between the way humans perceive sound and A-weighted sound levels. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment for community exposures. All sound levels expressed as dB in this section are A-weighted sound levels, unless noted otherwise. Definitions of acoustical terminology are provided in Appendix A.

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 noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors, day-night average level (L_{dn}) and the community noise equivalent level (CNEL), and shows very good correlation with community response to noise for the average person. The median noise level descriptor, denoted L_{50}, represents the noise level which is exceeded 50% of the hour. In other words, half of the hour ambient conditions are higher than the L_{50} and the other half are lower than the L_{50}.

The L_{dn} is based upon the average noise level over a 24-hour day, with a +10 dB weighting 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. Where short-term noise sources are an issue, noise impacts may be assessed in terms of maximum noise levels, hourly averages, or other statistical descriptors.

The perceived loudness of sounds and corresponding reactions to noise are dependent upon many factors, including sound pressure level, duration of intrusive sound, frequency of occurrence, time of occurrence, and frequency content. As mentioned above; however, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. Figure 3 shows examples of noise levels for several common noise sources and environments.

It is generally recognized that an increase of at least 3 dB of similar sources is usually required before most people will perceive a change in noise levels in the community, and an increase of 5 dB is required before the change will be clearly noticeable. A common practice is to assume that a minimally perceptible increase of 3 dB represents a significant increase in ambient noise levels. This approach is very conservative, however, when applied to noise conditions substantially below levels deemed acceptable in general plan noise elements or in noise ordinances.

Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through the ground or structures. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. The maximum rate, or velocity of particle movement, is the commonly accepted descriptor of the vibration "strength".

Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases.

Legend

Project Parcel Boundary

Long-Term Noise Measurement Sites

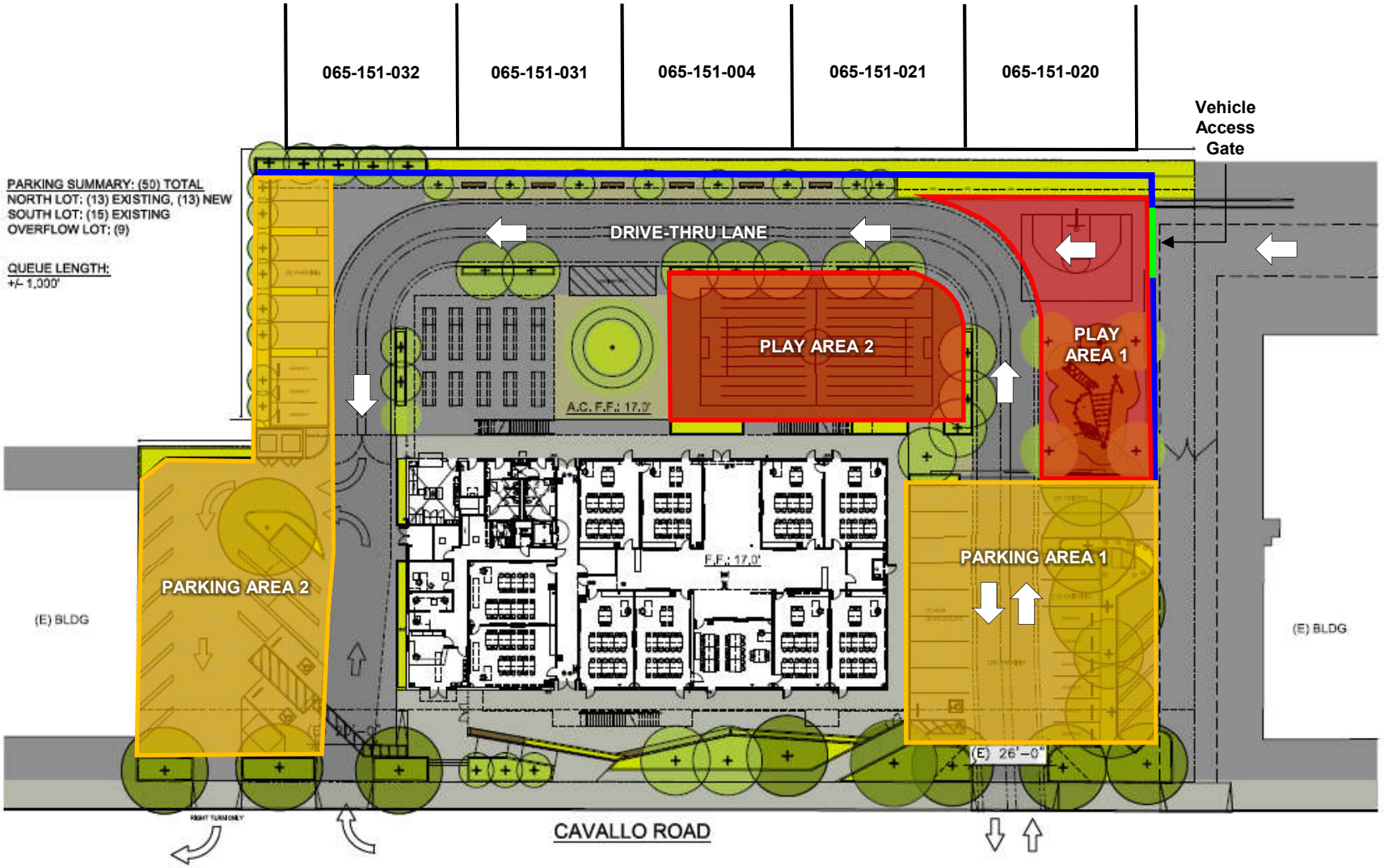
N

Scale (Feet)

0 75 150

Figure 1

Project Area and Ambient Noise Level Measurement Locations
Rocketship Antioch School
Antioch, California



Legend

Recommended 6-Foot Tall Solid Sound Wall

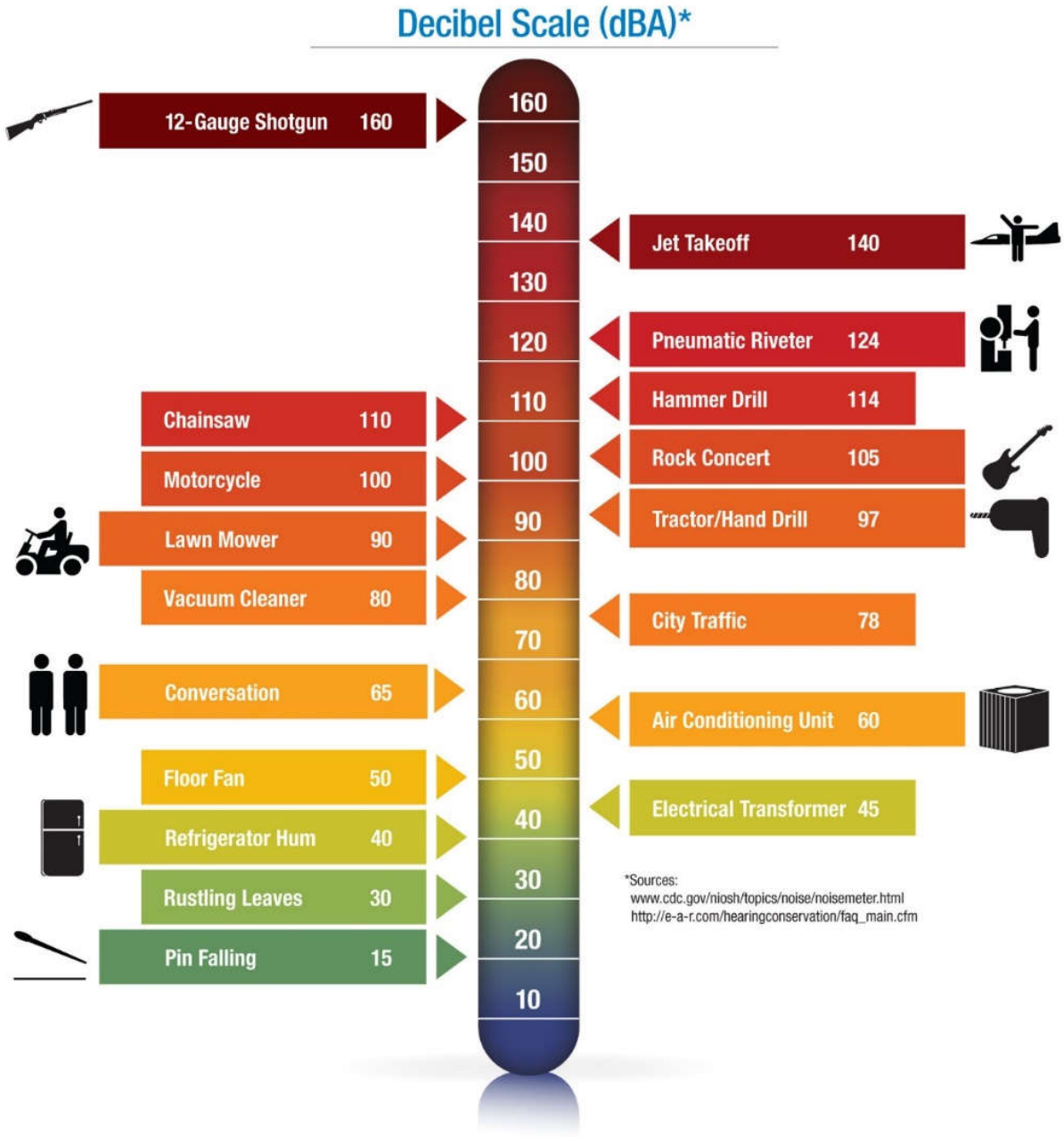
N

Scale (Feet)

0 40 80

Figure 2
Project Area and Site Plan
Rocketship Antioch School
Antioch, California

Figure 3
Typical A-Weighted Sound Levels of Common Noise Sources



According to the Transportation and Construction-Induced Vibration Guidance Manual (Caltrans, June 2004), operation of construction equipment and construction techniques generate ground vibration. Traffic traveling on roadways can also be a source of such vibration. At high enough amplitudes, ground vibration has the potential to damage structures and/or cause cosmetic damage. Ground vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities. However, traffic, rarely generates vibration amplitudes high enough to cause structural or cosmetic damage.

Existing Ambient Noise Environment at the Project Site

The existing ambient noise environment in the immediate project vicinity is primarily defined by local traffic on East 18th Street and Cavallo Road. To generally quantify the existing ambient noise environment in the project area, long-term (72 hour) ambient noise level measurements were conducted at two (2) locations on the project site from June 3-5, 2017. The locations of the long-term noise monitoring sites are shown on Figure 1.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the noise level measurement survey. The meters were calibrated before use with an LDL Model CA200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all specifications of the American National Standards Institute requirements for Type 1 sound level meters (ANSI S1.4). The results of the measurements are shown numerically and graphically in Appendices B and C (respectively), and are summarized in Table 1.

Table 1
Summary of Long-Term Ambient Noise Monitoring Results[1]
Rocketship Antioch School – Antioch, California

Site	Date	L_{dn}, dB	Average Measured Hourly Noise Levels (dB)					
			Daytime (7 a.m. to 10 p.m.)			Nighttime (10 p.m. to 7 a.m.)		
			L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}
Site 1 – Eastern edge of the project site, approximately 35' from the center of Cavallo Road.	6/3/17	68	66	59	87	61	49	83
	6/4/17	66	65	57	87	58	48	77
	6/5/17	68	66	59	88	60	49	83
Site 2 – Southwestern corner of the project site, against the 5' retaining wall dividing nearby residences from the site.	6/3/17	58	53	49	74	51	44	70
	6/4/17	58	51	48	71	51	45	72
	6/5/17	55	51	48	72	48	44	69

Notes:
[1] Long-term ambient noise monitoring locations are identified on Figure 1 as sites 1 & 2.
Source: Bollard Acoustical Consultants, Inc. (2017)

The Table 1 results indicate that average measured hourly daytime and nighttime noise levels at site 2 were generally comparable. The Table 1 results also indicate that average measured hourly noise levels were highest at site 1. This was most likely due to the location of site 1 relative to Cavallo Road.

Regulatory Setting

State of California

The State of California has established regulatory criteria that are applicable to this assessment. Specifically, Appendix G of the State of California Environmental Quality Act (CEQA) Guidelines are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. According to Appendix G of the CEQA guidelines, the project would result in a significant noise or vibration impact if the following occur:

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. a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

C. a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

D. exposure of persons to or generation of excessive groundborne vibration or noise levels;

E. for a project located within an ALUP or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels;

F. or a project within the vicinity of a private airstrip, the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. However, it is generally recognized that a 3 dB L_{dn}/CNEL or greater increase in noise levels due to a project would be considered significant where exterior noise levels would exceed 60 dB L_{dn} (for residential uses). Where pre-project ambient conditions are at or below 60 dB L_{dn}/CNEL, a 5 dB increase is applied as the standard of significance.

It should be noted that audibility is not a test of significance according to CEQA. If this were the case, any project which added any audible amount of noise to the environment would be considered unacceptable according to CEQA. Because every physical process creates noise, whether by the addition of a single vehicle on a roadway, or a tractor in an agricultural field, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change.

City of Antioch Municipal Code

The Antioch Municipal Code sets forth noise attenuation requirements for stationary and mobile noise sources, such as those proposed by the project. The provisions applicable to the project include the following:

Section 5-17.04 Heavy Construction Equipment Noise

A. For the purpose of this chapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

Heavy construction Equipment. Equipment used in grading and earth moving, including diesel engine equipped machines used for that purpose, except pickup trucks of one ton or less.

Operate. Includes the starting, warming-up, and idling of heavy construction equipment engines or motors.

B. It shall be unlawful of any person to operate heavy construction equipment during the hours specified below:

    1. On weekdays prior to 7:00 a.m. and after 6:00 p.m.
    2. On weekdays within 300 feet of occupied dwelling space, prior to 8:00 a.m. and after 5:00 p.m.
    3. On weekends and holidays, prior to 9:00 a.m. and after 5:00 p.m., irrespective of the distance from the occupied dwelling.

Section 5-17.05 Construction Activity Noise

A. As used in this section, "construction activity" means the process or manner of constructing, building, refurbishing, remodeling or demolishing a structure, delivering supplies thereto and includes, but is not limited to, hammering, sawing, drilling, and other construction activities when the noise or sound there from can be heard beyond the perimeter of the parcel where such work is being performed. The term "construction activity" also includes the testing of any audible device such as a burglar or fire alarm or loudspeaker. "Construction activity" does not include floor covering installation or painting when done with non-powered equipment.

B. It shall be unlawful of any person to operate heavy construction equipment during the hours specified below:

    1. On weekdays prior to 7:00 a.m. and after 6:00 p.m.
    2. On weekdays within 300 feet of occupied dwelling space, prior to 8:00 a.m. and after 5:00 p.m.
    3. On weekends and holidays, prior to 9:00 a.m. and after 5:00 p.m., irrespective of the distance from the occupied dwelling.

Section 9-5.1901 Noise Attenuation Requirements

A. *Stationary noise sources.* Uses adjacent to outdoor living areas (e.g., backyards for single-family homes and patios for multi-family units) and parks shall not cause an increase in background ambient noise which will exceed 60 CNEL.

B. *Mobile noise sources*.

    1. Arterial and street traffic shall not cause an increase in background ambient noise which will exceed 60 CNEL.

C. *Noise attenuation.* The city may require noise attenuation measures be incorporated into a project to obtain compliance with this section. Measures outlined in the noise policies of the General Plan should be utilized to mitigate noise to the maximum feasible extent.

City of Antioch General Plan

The Noise Element of the City of Antioch General Plan establishes standards for acceptable non-transportation (stationary) noise exposure at residential uses. Because the City's General Plan Noise Element standards are consistent with the City's Noise Ordinance non-transportation noise level standards, compliance with the applicable City Municipal Code standards would ensure that both the Noise Ordinance and Noise Element standards of the City of Antioch have been satisfied.

Vibration Criteria

The City of Antioch does not have adopted vibration standards. As a result, Caltrans-recommended criteria are applied for this project, as described below. Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. The Caltrans publication, *Transportation-and Construction-Induced Vibration Guidance Manual*, written for Caltrans by Jones & Stokes in June 2004, provides guidelines for acceptable vibration limits for transportation and construction projects in terms of the induced peak particle velocity (PPV). Those standards are reproduced below in Table 2.

Table 2
Vibration Criteria for Structures

	Maximum PPV (in/sec)	
Structure and Condition	**Transient Sources[1]**	**Continuous or Frequent Intermittent Sources[2]**
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old building	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial building	2.00	0.50

Notes:
1 Transient sources create a single isolated vibration event.
2 Continuous/frequent intermittent sources include repetitive single events.

Current Caltrans research illustrates that there are different thresholds of perception for different types of vibration sources. Section XI(b) of Appendix G of the CEQA guidelines requires that a project result in exposure of persons to, or generation of, *excessive* groundborne vibration levels or groundborne noise levels, for the finding of a significant impact. The CEQA guidelines specifically mention "excessive" vibration, rather than just perceptible vibration. Because the general range at which vibration becomes distinctly to strongly perceptible ranges from 0.1 – 0.50 in/sec ppv (Caltrans 2004), project-generated vibration levels exceeding 0.1 inches/second PPV at the nearest residences are considered significant for this study.

Evaluation of Future On-Site Generated Noise Levels

Outdoor Play Area Noise

For the assessment of outdoor play area noise impacts at the nearest noise-sensitive uses (single-family residences to the west), noise level data collected by BAC staff at various outdoor play areas in recent years was utilized. The primary noise source associated with outdoor play area use is shouting children. For the purposes of this analysis, the proposed outdoor play areas have been identified as play areas 1 and 2 on Figure 2.

BAC file data indicate that average noise levels of similar sized outdoor play areas is approximately 55 dB L_{eq} at a distance of 50 feet from the focal point of the play area during recess hours. According to information obtained from the client (Rocketship Education Bell Schedule), the students will have access to the outdoor play areas from 8:10 a.m. to 4:00 p.m. In addition, the project also proposes afterschool programs that would commence at 6:00 p.m. Table 3 provides proposed time periods with associated number of students in outdoor areas during those times.

Table 3
Proposed Outdoor Play Area Schedule
Rocketship Antioch School

Times	Number of Students in Outdoor Play Areas
7:55 a.m. – 8:10 a.m.	--
8:10 a.m. to 8:50 a.m.	120
9:40 a.m. – 10:20 a.m.	116
10:30 a.m. – 11:10 a.m.	84
11:10 a.m. – 11:30 a.m.	120
11:30 a.m. – 11:50 a.m.	120
12:00 p.m. – 12:20 p.m.	116
12:20 p.m. – 12:40 p.m.	120
12:50 p.m. – 1:10 p.m.	90
1:10 p.m. – 1:30 p.m.	84
1:00 p.m. – 1:50 p.m.	120
2:00 p.m. – 2:50 p.m.	90
3:00 p.m. – 3:50 p.m.	120
4:00 p.m. – 6:00 p.m.[1]	100

Notes:

[1] According to information from the client, the project proposes to have afterschool programs. Because information was not available for estimated number of students utilizing the outdoor play areas during these programs, it was conservatively assumed that 100 students could occupy these areas during the 4:00 p.m. to 6:00 p.m. time period.

Based on the information above, outdoor play area noise exposure was computed to be 52 CNEL at a reference distance of 50 feet. Assuming standard spherical spreading loss (-6 dB per doubling of distance), outdoor play area noise exposure was projected from the assumed focal point of the proposed areas to the outdoor activity areas (backyards) of the nearest single-family residential parcels to the west. The results of those projections are presented in Table 4.

For a conservative assessment of outdoor play area noise generation, it was assumed that all of the students could be in one outdoor play area at one time during the indicated time periods (worst-case scenario). However, it is likely that student activity would be distributed between the outdoor play areas.

Table 4
Predicted Outdoor Play Area Noise Levels at Nearest Outdoor Activity Areas
Rocketship Antioch School – Antioch, California

Description[1]	Distance from Nearest Play Area Focal Point (feet)[2]	Predicted Play Area Noise Levels, CNEL (dBA)[3]
Play Area 1 to APN: 065-151-020	75	48
Play Area 2 to APN: 065-151-021	80	48
Play Area 2 to APN: 065-151-004	100	46
City of Antioch Stationary Noise Standard:		**60**

Notes:
1 Nearest single-family residential parcels are shown on Figure 1.
2 Distances measured from assumed play area focal points to the center of the single-family residential backyards.
3 Predicted levels based on reference noise level of 55 dB Leq (52 CNEL) at a distance of 50 feet and a sound attenuation rate of 6 dB per doubling of distance.

The Table 4 data indicate that predicted noise exposure from the proposed outdoor play areas would satisfy the City of Antioch 60 CNEL stationary noise level standard at the outdoor activity areas (backyards) of the nearest single-family residences to the west. As a result, no further consideration of outdoor play area noise mitigation measures would be warranted for this project. Nonetheless, due to the content of the noise source (children shouting), a 6-foot tall masonry noise barrier should be constructed at the location illustrated on Figure 2 in order to limit the potential for annoyance of residents. The recommended noise barrier would provide approximately 5 dB of additional sound attenuation.

Parking Area Noise

The Rocketship Antioch School project site has two proposed parking areas, one located at the north end of the property and one at the south end. Based on the project site plans, the proposed parking areas could accommodate up to approximately 50 vehicles (approximately 25 parking stalls in each area). For the purposes of this analysis, the proposed parking areas have been identified as parking areas 1 and 2 on Figure 2.

As a means of determining potential noise exposure due to project parking lot activities, Bollard Acoustical Consultants, Inc. (BAC) utilized specific parking lot noise level measurements conducted by BAC. Specifically, a series of individual noise measurements were conducted of multiple vehicle types arriving and departing a parking area, including engines starting and stopping, car doors opening and closing, and persons conversing as they entered and exited the vehicles. The results of those measurements revealed that individual parking lot movements generated mean noise levels of 70 dB SEL at a reference distance of 50 feet.

For a conservative assessment of parking area noise generation, it was assumed that the parking area could fill or empty during a peak hour of school operations. During school hours, it is likely that parking area activity would be more spread out. Parking area noise exposure was determined using the following equation.

$$\text{Peak Hour } L_{eq} = 70+10*\log (N) - 35.6$$

Where 70 is the SEL for a single automobile parking operation, N is the number of parking area operations in a peak hour, and 35.6 is 10 times the logarithm of the number of seconds in an hour.

Using BAC parking lot noise measurement data, the equation provided above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), data were projected from the effective noise center of the proposed parking areas to the outdoor activity areas (backyards) of nearest single-family residences to the west. The results of the parking lot noise assessment at those nearest residential parcels are shown in Table 5.

Table 5
Predicted Parking Area Noise Levels at Nearest Outdoor Activity Areas
Rocketship Antioch School – Antioch, California

Description[1]	Distance from Nearest Parking Area Focal Point (feet)[2]	Predicted Parking Area Noise Levels, CNEL (dBA)[3]
Parking Area 1 to APN: 065-151-020	165	36
Parking Area 2 to APN: 065-151-032	115	38
City of Antioch Stationary Noise Standard:		**60**

Notes:
1 Nearest single-family residential parcels are shown on Figure 1.
2 Distances measured from parking area focal points to the center of nearest residences backyards.
3 Predicted levels based on a reference levels of 70 dB SEL and 65 dB Lmax per parking lot movement at a distance of 50 feet and a sound attenuation rate of 6 dB per doubling of distance.

The Table 5 data indicate that predicted noise exposure from the proposed parking areas would satisfy the City of Antioch 60 CNEL stationary noise level standard at the outdoor activity areas of the nearest single-family residences to the west by a wide margin. As a result, no further consideration of parking area noise mitigation measures would be warranted for this project.

Drive-Thru Lane Noise

The project proposes a one-way drive-thru lane designated for student pick-up and drop-offs. Based on the project site plans, the entry and exit to the one-way drive-thru lane is proposed to off Cavallo Road, and wrap around the school facilities on the western end of the project. The location of the proposed drive-thru lane is shown on Figure 2.

To quantify the noise generation of the proposed drive-thru vehicle passages, Bollard Acoustical Consultants, Inc. utilized vehicle trip rate data from the project traffic study prepared by Hexagon Transportation Consultants, Inc., and BAC file data for vehicle passbys. According to Hexagon Transportation Consultants, Inc., the proposed project would generate an estimated 578 trips during the AM peak hour (314 inbound and 264 outbound), and 314 trips during the PM peak hour (128 inbound and 186 outbound). However, not all of the estimated vehicle trips would be utilizing the drive-thru lane (staff would use the parking areas). After subtraction of parking area generated vehicle trips from the total, the remaining vehicle trips attributed to the drive-thru lane for student drop-off and pick-ups is 392 (264 AM peak hour outbound + 128 inbound PM peak hour).

BAC file data indicate that typical noise levels of vehicle passbys are approximately 65 SEL dB at a distance of 50 feet. Based on the vehicle trip information above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), drive-thru lane nose exposure at the outdoor activity area (backyard) of nearest single-family residence to the west (APN: 065-151-031) was calculated to be 45 CNEL. The predicted drive-thru noise level of 45 CNEL would satisfy the applicable City of Antioch 60 CNEL stationary noise level standard. As a result, no additional consideration of drive-thru lane noise mitigation measures would be warranted for this project.

Evaluation of Future Off-Site Traffic Noise Level Increases

Construction of this project would result in increased traffic on the local roadway network. BAC utilized the FHWA Model with the traffic study prepared by Hexagon Transportation Consultants, Inc. to determine whether traffic noise impacts (by the impact significance criteria listed previously) would occur as a result of this project. The FHWA Model inputs are provided in Appendix D, and the results are shown in Tables 6 and 7.

Table 6
Existing vs. Existing Plus Project Traffic Noise Levels, L_{dn} (dBA)
Rocketship Antioch School – Antioch, California

Roadway	Segment	Existing	Existing + Project	Change	Substantial Increase?
A Street	North of Wilbur Ave	55.7	56.3	0.6	No
A Street	Wilbur Ave to 10th Ave	56.6	57.0	0.4	No
A Street	W 10th St to E 13th St	57.9	58.3	0.4	No
A Street	E 13th St to W 18th St	61.6	61.6	--	No
A Street	South of W 18th St	62.2	62.3	0.1	No
Cavallo Road	North of Wilbur Ave	48.7	48.7	--	No
Cavallo Road	Wilbur Ave to E 13th St	60.6	60.9	0.3	No
Cavallo Road	E 13th St to 18th St	58.5	60.7	2.2	No
Cavallo Road	South of E 18th St	54.8	55.0	0.2	No
East 13th Street	A St to Cavallo Rd	51.6	53.4	1.8	No
East 18th Street	A St to Evergreen Ave	60.3	61.0	0.7	No
East 18th Street	Evergreen Ave to Cavallo Rd	60.4	61.2	0.8	No
East 18th Street	Cavallo Rd to Hillcrest Ave	60.9	61.5	0.6	No
East 18th Street	East of Hillcrest Ave	64.1	64.2	0.1	No
Evergreen Avenue	South of E 18th St	48.4	50.1	1.7	No
G Street	North of W 10th St	54.0	54.5	0.5	No
G Street	W 10th St to W 18th St	55.9	56.2	0.3	No
G Street	South of W 18th St	56.6	56.8	0.2	No
Hillcrest Avenue	South of E 18th St	63.3	63.4	0.1	No
Hillcrest Avenue	North of E 18th St	53.6	54.0	0.4	No
West 10th Street	West of W 10th St	58.0	58.1	0.1	No
West 10th Street	G St to A St	58.1	58.6	0.5	No
West 18th Street	West of W 18 St	58.1	58.1	--	No
West 18th Street	G St to A St	56.7	57.2	0.5	No
Wilbur Avenue	A St to Cavallo Rd	61.2	61.8	0.6	No
Wilbur Avenue	East of Cavallo Rd	60.8	60.9	0.1	No

Sources: FHWA-RD-77-108, project traffic study, and Bollard Acoustical Consultants, Inc. (BAC),

Table 7
Cumulative vs. Cumulative Plus Project Traffic Noise Levels, L_{dn} (dBA)
Rocketship Antioch School – Antioch, California

Roadway	Segment	Cumulative	Cumulative + Project	Change	Substantial Increase?
A Street	North of Wilbur Ave	55.8	56.4	0.6	No
A Street	Wilbur Ave to 10th Ave	57.5	57.8	0.3	No
A Street	W 10th St to E 13th St	58.4	58.7	0.3	No
A Street	E 13th St to W 18th St	62.0	62.0	--	No
A Street	South of W 18th St	62.5	62.6	0.1	No
Cavallo Road	North of Wilbur Ave	48.7	48.7	--	No
Cavallo Road	Wilbur Ave to E 13th St	57.1	58.3	0.2	No
Cavallo Road	E 13th St to 18th St	58.5	60.7	2.2	No
Cavallo Road	South of E 18th St	54.9	55.0	0.6	No
East 13th Street	A St to Cavallo Rd	52.4	53.5	1.1	No
East 18th Street	A St to Evergreen Ave	60.4	61.1	0.7	No
East 18th Street	Evergreen Ave to Cavallo Rd	60.5	61.2	0.7	No
East 18th Street	Cavallo Rd to Hillcrest Ave	61.0	61.5	0.5	No
East 18th Street	East of Hillcrest Ave	64.3	64.4	0.1	No
Evergreen Avenue	South of E 18th St	48.9	50.2	1.3	No
G Street	North of W 10th St	55.1	55.5	0.4	No
G Street	W 10th St to W 18th St	56.2	56.5	0.3	No
G Street	South of W 18th St	57.1	57.3	0.2	No
Hillcrest Avenue	South of E 18th St	63.7	63.8	0.1	No
Hillcrest Avenue	North of E 18th St	53.8	54.2	0.4	No
West 10th Street	West of W 10th St	58.1	58.1	--	No
West 10th Street	G St to A St	58.3	58.8	0.5	No
West 18th Street	West of W 18 St	58.3	58.3	--	No
West 18th Street	G St to A St	56.8	57.3	0.5	No
Wilbur Avenue	A St to Cavallo Rd	61.2	61.8	0.6	No
Wilbur Avenue	East of Cavallo Rd	60.8	60.9	0.1	No

Sources: FHWA-RD-77-108, project traffic study, and Bollard Acoustical Consultants, Inc. (BAC),

As mentioned previously, it is generally recognized that a 3 dB L_{dn}/CNEL or greater increase in noise levels due to a project would be considered significant where exterior noise levels would exceed 60 dB L_{dn} (for residential uses). The data shown in Tables 6 and 7 indicate that the project-related increase in traffic noise levels on the local roadway network would not be substantial. As a result, no off-site traffic noise impacts are predicted to occur as a result of this project.

Evaluation of Construction Noise at Nearest Existing Residences

During project construction, heavy equipment would be used for grading excavation, paving, and building construction, which would increase ambient noise levels when in use. Noise levels would vary depending on the type of equipment used, how it is operated, and how well it is maintained. Noise exposure at any single point outside the project site would also vary depending on the proximity of construction activities to that point. Standard construction equipment, such as graders, backhoes, loaders, and trucks, would likely be used for this work.

The range of maximum noise levels for various types of construction equipment at a distance of 50 feet is depicted in Table 8. The noise values represent maximum noise generation, or full-power operation of the equipment. As one increases the distance between equipment, or increases separation of areas with simultaneous construction activity, dispersion and distance attenuation reduce the effects of combining separate noise sources.

Table 8
Construction Equipment Noise Emission Levels

Equipment	Typical Sound Level (dBA) 50 Feet from Source
Air compressor	81
Backhoe	80
Compactor	82
Concrete mixer	85
Concrete pump	82
Concrete vibrator	76
Crane, mobile	83
Dozer	85
Generator	81
Grader	85
Impact wrench	85
Jackhammer	88
Loader	85
Paver	89
Pneumatic tool	85
Pump	76
Roller	74
Saw	76

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, Table 12-1. (May 2006)

The nearest sensitive receptors to the project site are the single-family residences located to the west. The nearest residence is located approximately 30 feet from construction activities which would occur on the project site. As shown in Table 8, construction activities typically generate noise levels ranging from approximately 75 to 90 dB L_{max} at a reference distance of 50 feet from the construction activities. The noise levels from construction operations decrease at a rate of approximately 6 dB per doubling of distance from the source. As a result, maximum

construction noise levels would range from 79 to 94 dB L_{max} at the outdoor activity areas (backyards) of the nearest residences.

Given the proximity of the nearest residences to the project area, construction-related noise levels are predicted to be elevated throughout the course of the project. As a result, the measures identified in Sections 5-17.04 and 5-17.05 of the City of Antioch Municipal Code pertaining to construction activity noise should be implemented to the extent practical to minimize the potential for adverse public reaction to project construction noise. In addition to the City's measures, the following construction noise mitigation measures should also be implemented:

- All noise-producing project equipment and vehicles using internal-combustion engines shall be equipped with manufacturers-recommended mufflers and be maintained in good working condition.
- All mobile or fixed noise-producing equipment used on the project site that are regulated for noise output by a federal, state, or local agency shall comply with such regulations while in the course of project activity.
- Electrically powered equipment shall be used instead of pneumatic or internal-combustion-powered equipment, where feasible.
- Material stockpiles and mobile equipment staging, parking, and maintenance areas shall be located as far as practicable from noise-sensitive receptors.
- Construction site and access road speed limits shall be established and enforced during the construction period.

Evaluation of Off-Site Construction Vibration Levels

During project construction heavy equipment would be used for grading excavation, paving, and building construction, which would generate localized vibration in the immediate vicinity of the construction. As mentioned previously, the nearest residence is located approximately 30 feet from construction activities which would occur on the project site.

The range of vibration source levels for construction equipment commonly used in similar projects are shown in Table 9. The vibration levels depicted in Table 9 are representative of measurements at a distance of 25 feet from the equipment source.

Table 9
Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 feet (in/sec)	Approximate RMS L_v[1] at 25 feet
Hoe ram	0.089	87
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Notes:

[1] RMS velocity in decibels (VdB) re 1 micro-inch/second

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, Table 12-2. (May 2006)

Because vibration levels generated by the type of construction equipment which will be required for this project dissipates very rapidly with distance, and because the nearest residential structure to the project construction area is approximately 30 feet away, vibration levels at the nearest residences are expected to be well below 0.1 inches/second peak particle velocity at those residences over the course of project construction activities. As a result, construction vibration levels would be well below levels which would cause damage to structures or annoyance. As a result, no construction-generated vibration mitigation measures would be warranted for this project.

Combined Noise from On-Site Sources

Combined noise levels for each on-site noise source occurring concurrently are shown in Table 10. The results in Table 9 reflect the combined on-site noise exposure when calculated from the nearest on-site noise sources to the nearest outdoor activity areas (backyards). It should be noted that project construction noise would not occur simultaneously with operational noise.

Table 10
Predicted Noise Levels at Nearest Residences from All On-Site Noise Sources Combined
Rocketship Antioch School – Antioch, California

	Predicted Noise Levels at Outdoor Activity Areas, L_{dn} (dBA)[1]			
Nearest Residential Parcels	Outdoor Play Areas	Parking Areas	Drive-Thru Lane	Combined
APN: 065-151-004	46	35	40	47
APN: 065-151-020	48	36	42	49
APN: 065-151-021	48	38	43	50
APN: 065-151-031	43	37	45	48
APN: 065-151-032	41	38	42	45

Notes:
[1] Predicted levels are based on the decibel addition of data contained in previous sections of this report.
Source: Bollard Acoustical Consultants, Inc. (2017)

Because the cumulative noise generation of all on-site sources would satisfy the City of Antioch 60 CNEL stationary noise standard at the outdoor activity areas (backyards) of the nearest single-family residences, no additional consideration of mitigation measures for on-site noise sources would be warranted for this project.

Conclusions & Recommendations

Noise generation resulting from proposed on-site related activities (drive-thru lane circulation, parking movements, and outdoor play areas) are predicted to be in compliance with all applicable City of Antioch and California Environmental Quality Act (CEQA) noise level criteria at the nearest noise-sensitive uses. Nonetheless, to reduce the potential for annoyance at those nearest residences to noise generated by children playing outside, BAC recommends that the noise mitigation measures cited below are incorporated into the project design.

Increases in off-site traffic noise exposure as a result of the project are predicted to be less than significant at existing noise-sensitive uses in the project vicinity.

Project construction noise and vibration as a result of the improvements and expansion of the camp are predicted to be less than significant at the nearest noise-sensitive uses to the project area provided the mitigation measures cited under the construction noise section previously in this report are implemented.

Outdoor Play Areas:

1. In order to limit the potential for annoyance of residents, a 6-foot tall masonry noise barrier should be constructed at the location indicated on Figure 2.

2. If concerns are expressed by the nearest residences regarding play area noise generation, BAC recommends that Rocketship Antioch School officials work closely with the residences to identify the cause of the most excessive noise levels and implement administrative measures to reduce the noise generation of those activities to the extent practical.

Project Construction:

3. All construction activities must adhere to the construction related noise requirements identified in Sections 5-17.04 and 5-17.05 of the City of Antioch Municipal Code.

4. All construction activities must adhere to the BAC-recommended construction noise related mitigation measures identified in this report.

5. The construction contractor shall locate on-site equipment staging areas so as to maximize the distance between construction-related noise sources and noise-sensitive receptors nearest the project construction areas.

This concludes BAC's noise assessment for the proposed Rocketship Antioch School in Antioch, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B-1
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Saturday, June 3, 2017

Hour	Leq	Lmax	L50	L90
0:00	61	88	48	45
1:00	59	83	47	43
2:00	57	80	44	41
3:00	57	86	42	39
4:00	55	77	43	41
5:00	64	78	57	43
6:00	64	91	53	46
7:00	62	79	55	48
8:00	63	80	57	48
9:00	65	81	60	51
10:00	65	87	59	50
11:00	70	97	63	54
12:00	68	90	62	52
13:00	66	89	61	51
14:00	66	90	60	52
15:00	69	97	59	51
16:00	65	88	62	52
17:00	65	88	60	52
18:00	64	88	58	51
19:00	64	83	58	50
20:00	64	87	56	49
21:00	63	85	56	50
22:00	62	86	56	49
23:00	58	79	50	46

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	70	62	66	64	55	61
Lmax (Maximum)	97	79	87	91	77	83
L50 (Median)	63	55	59	57	42	49
L90 (Background)	54	48	51	49	39	44

Computed Ldn, dB	68
% Daytime Energy	84%
% Nighttime Energy	16%

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Appendix B-2
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Sunday, June 4, 2017

Hour	Leq	Lmax	L50	L90
0:00	58	75	49	45
1:00	60	83	48	43
2:00	54	73	43	41
3:00	53	74	44	41
4:00	52	72	43	40
5:00	62	75	55	43
6:00	60	78	53	45
7:00	62	76	55	47
8:00	63	86	54	47
9:00	61	79	55	49
10:00	66	97	57	51
11:00	64	85	59	53
12:00	65	83	60	52
13:00	65	87	59	52
14:00	64	87	59	51
15:00	70	102	59	52
16:00	64	86	58	52
17:00	64	90	58	52
18:00	62	77	56	50
19:00	63	84	56	49
20:00	65	95	57	50
21:00	63	85	54	47
22:00	59	82	49	45
23:00	57	79	48	44

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	70	61	65	62	52	58
Lmax (Maximum)	102	76	87	83	72	77
L50 (Median)	60	54	57	55	43	48
L90 (Background)	53	47	50	45	40	43

Computed Ldn, dB	66
% Daytime Energy	88%
% Nighttime Energy	12%

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Appendix B-3
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Monday, June 5, 2017

Hour	Leq	Lmax	L50	L90
0:00	60	84	45	42
1:00	56	81	44	41
2:00	58	83	44	41
3:00	55	82	44	41
4:00	58	78	49	43
5:00	65	95	56	49
6:00	63	78	57	48
7:00	64	83	60	51
8:00	65	86	61	52
9:00	71	101	59	49
10:00	64	84	59	50
11:00	65	87	60	52
12:00	65	85	60	52
13:00	64	81	60	52
14:00	66	89	61	53
15:00	64	78	60	52
16:00	69	98	60	52
17:00	67	94	61	52
18:00	64	83	59	51
19:00	70	98	58	50
20:00	65	87	57	50
21:00	62	82	54	48
22:00	60	82	51	45
23:00	58	80	48	44

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	71	62	66	65	55	60
Lmax (Maximum)	101	78	88	95	78	83
L50 (Median)	61	54	59	57	44	49
L90 (Background)	53	48	51	49	41	44

Computed Ldn, dB	68
% Daytime Energy	87%
% Nighttime Energy	13%

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Appendix B-4
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Saturday, June 3, 2017

Hour	Leq	Lmax	L50	L90
0:00	50	75	44	43
1:00	58	79	44	42
2:00	50	74	43	42
3:00	46	68	43	41
4:00	45	66	42	40
5:00	45	61	43	41
6:00	51	74	46	43
7:00	52	66	48	44
8:00	49	69	46	43
9:00	52	67	47	43
10:00	56	80	50	46
11:00	54	77	49	47
12:00	52	79	48	46
13:00	52	75	48	46
14:00	52	72	48	46
15:00	55	83	49	47
16:00	51	77	48	46
17:00	52	68	49	47
18:00	51	74	49	47
19:00	53	77	49	47
20:00	51	66	49	47
21:00	53	75	50	48
22:00	51	68	49	46
23:00	48	69	46	44

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	56	49	53	58	45	51
Lmax (Maximum)	83	66	74	79	61	70
L50 (Median)	50	46	49	49	42	44
L90 (Background)	48	43	46	46	40	42

Computed Ldn, dB	58
% Daytime Energy	71%
% Nighttime Energy	29%

Appendix B-5
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Sunday, June 4, 2017

Hour	Leq	Lmax	L50	L90
0:00	50	73	47	45
1:00	52	78	46	45
2:00	54	79	46	44
3:00	57	82	46	45
4:00	48	69	45	43
5:00	45	62	42	39
6:00	46	62	44	41
7:00	46	63	44	41
8:00	49	72	45	42
9:00	50	73	47	44
10:00	52	78	48	46
11:00	51	72	49	47
12:00	51	69	49	47
13:00	50	66	49	46
14:00	50	70	48	46
15:00	52	74	49	47
16:00	51	68	49	47
17:00	51	70	49	47
18:00	51	68	49	47
19:00	51	76	48	46
20:00	53	76	48	46
21:00	52	81	47	46
22:00	48	76	44	42
23:00	47	69	43	41

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	53	46	51	57	45	51
Lmax (Maximum)	81	63	72	82	62	72
L50 (Median)	49	44	48	47	42	45
L90 (Background)	47	41	46	45	39	43

Computed Ldn, dB	58
% Daytime Energy	59%
% Nighttime Energy	41%

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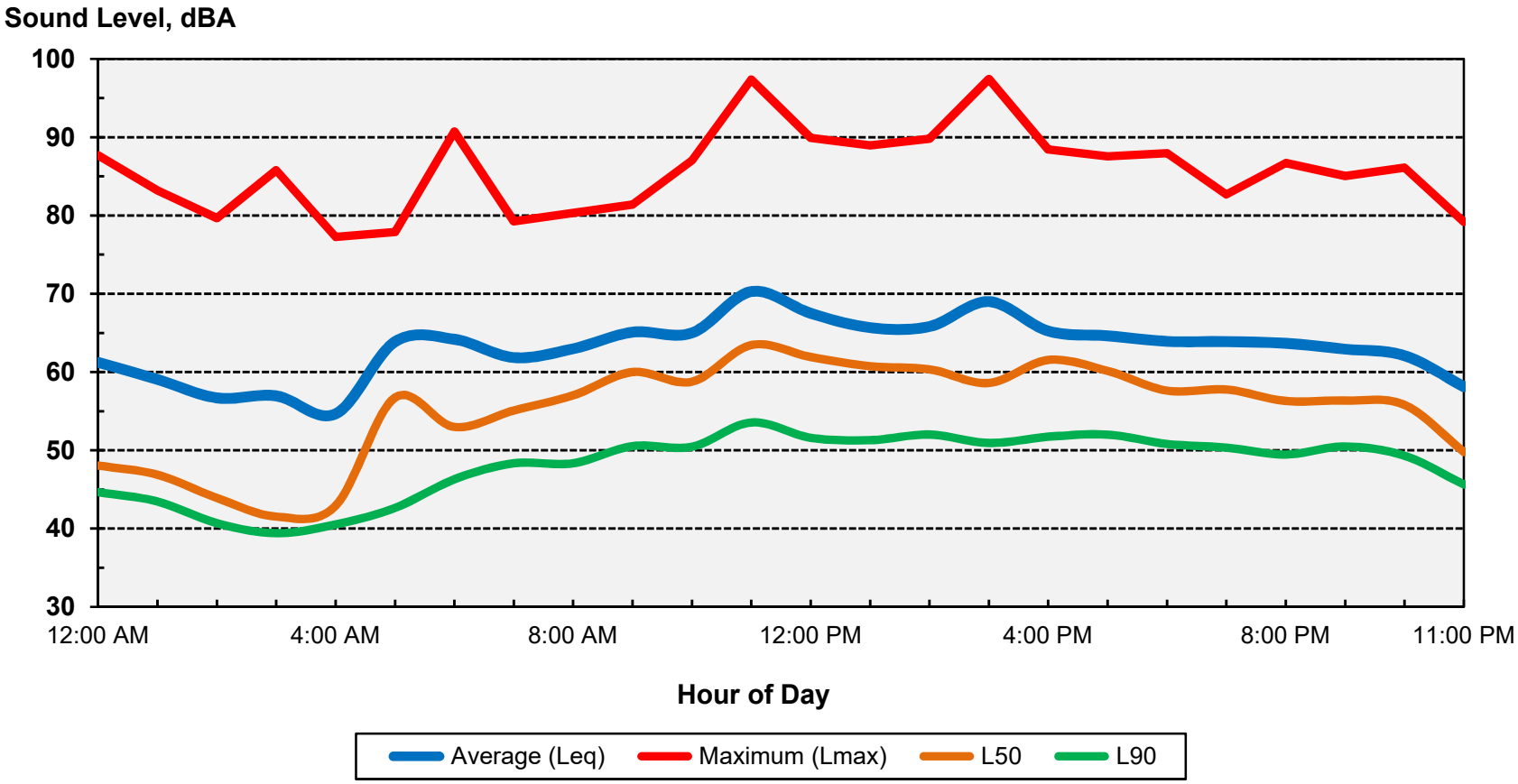
Appendix B-6
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Monday, June 5, 2017

Hour	Leq	Lmax	L50	L90
0:00	48	71	43	41
1:00	49	71	43	42
2:00	48	72	43	41
3:00	46	73	43	41
4:00	46	67	44	41
5:00	50	72	46	42
6:00	48	62	45	43
7:00	51	65	48	45
8:00	50	68	47	44
9:00	52	79	46	43
10:00	50	64	48	44
11:00	51	74	48	45
12:00	50	73	47	45
13:00	50	66	47	45
14:00	51	72	48	45
15:00	52	71	48	46
16:00	54	78	49	46
17:00	52	76	48	46
18:00	50	68	48	46
19:00	53	75	48	46
20:00	51	70	48	46
21:00	50	73	47	46
22:00	47	68	45	43
23:00	47	67	45	43

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	54	50	51	50	46	48
Lmax (Maximum)	79	64	72	73	62	69
L50 (Median)	49	46	48	46	43	44
L90 (Background)	46	43	45	43	41	42

Computed Ldn, dB	55
% Daytime Energy	79%
% Nighttime Energy	21%

Appendix C-1
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Saturday, June 3, 2017



Ldn: 68 dB

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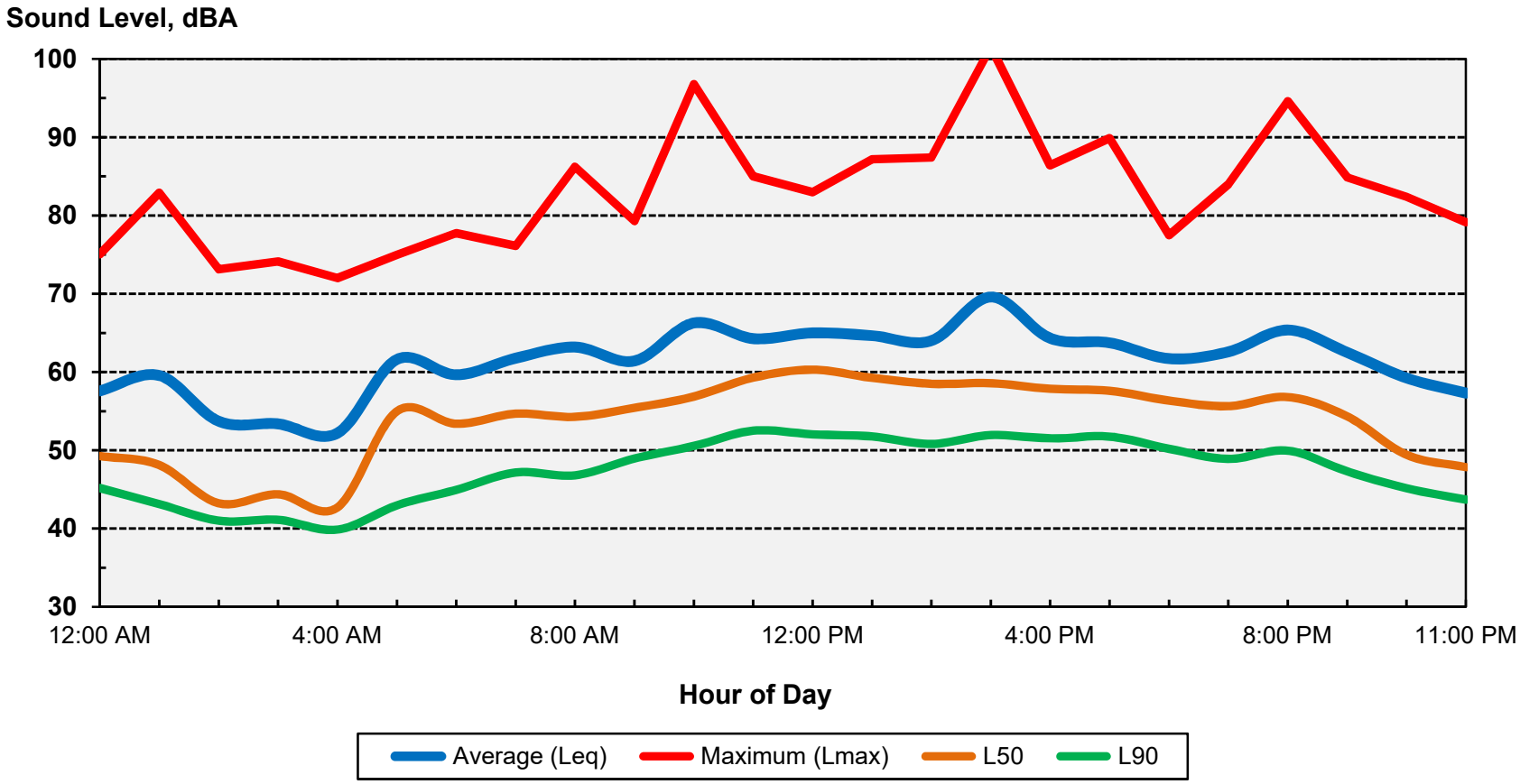
Appendix C-2
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Sunday, June 4, 2017



Ldn: 66 dB

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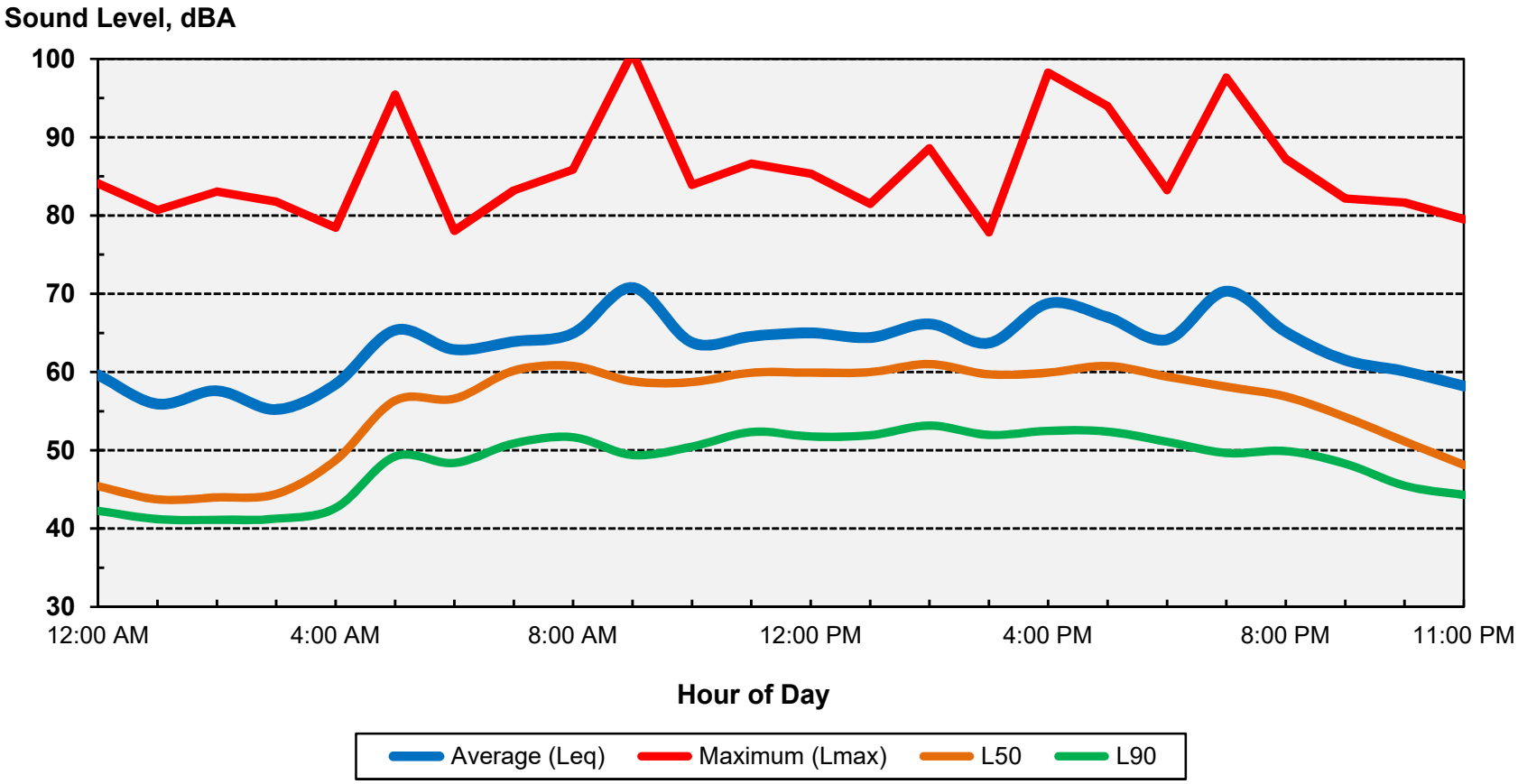
Appendix C-3
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site A
Monday, June 5, 2017



Ldn: 68 dB

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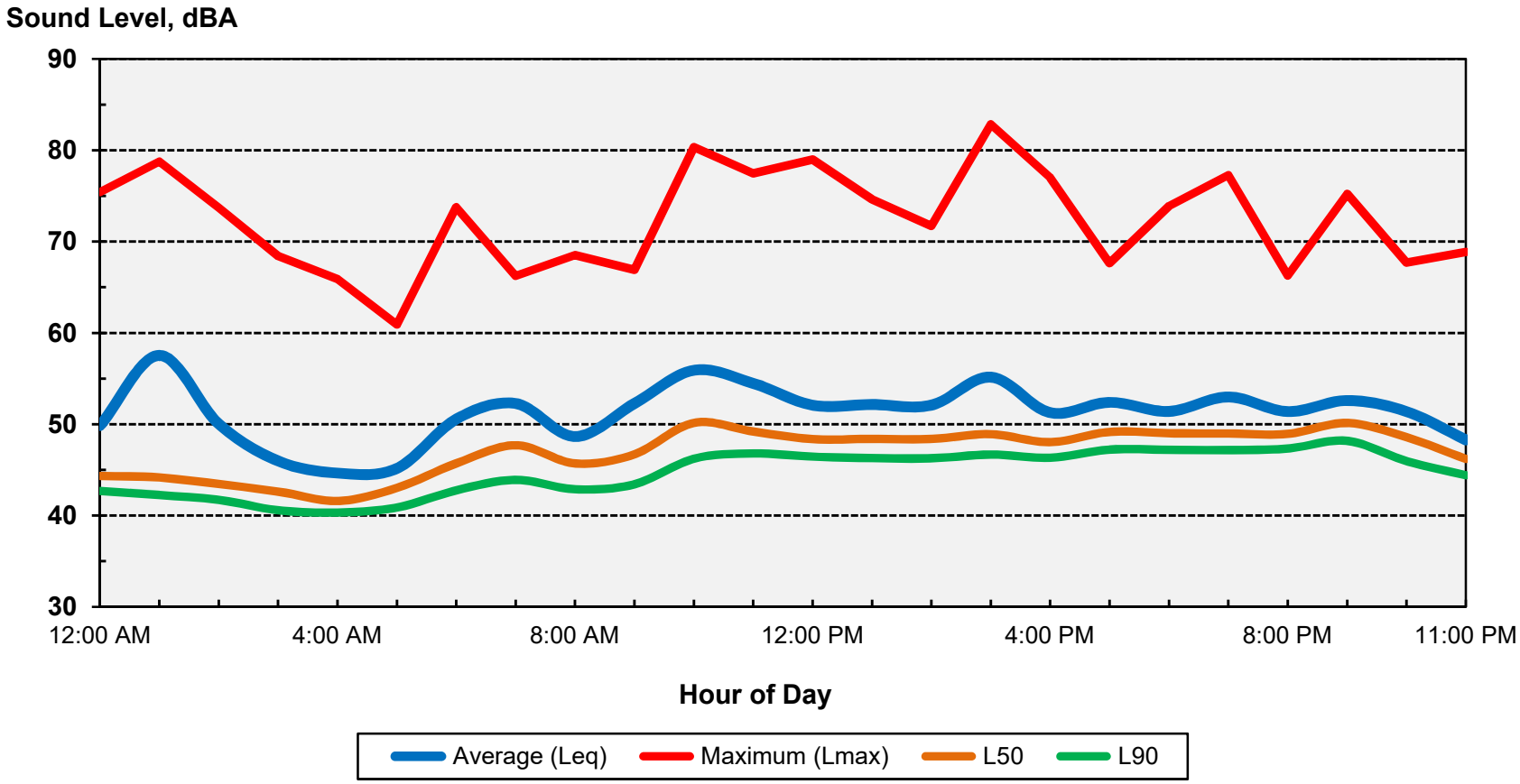
Appendix C-4
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Saturday, June 3, 2017



Ldn: 58 dB

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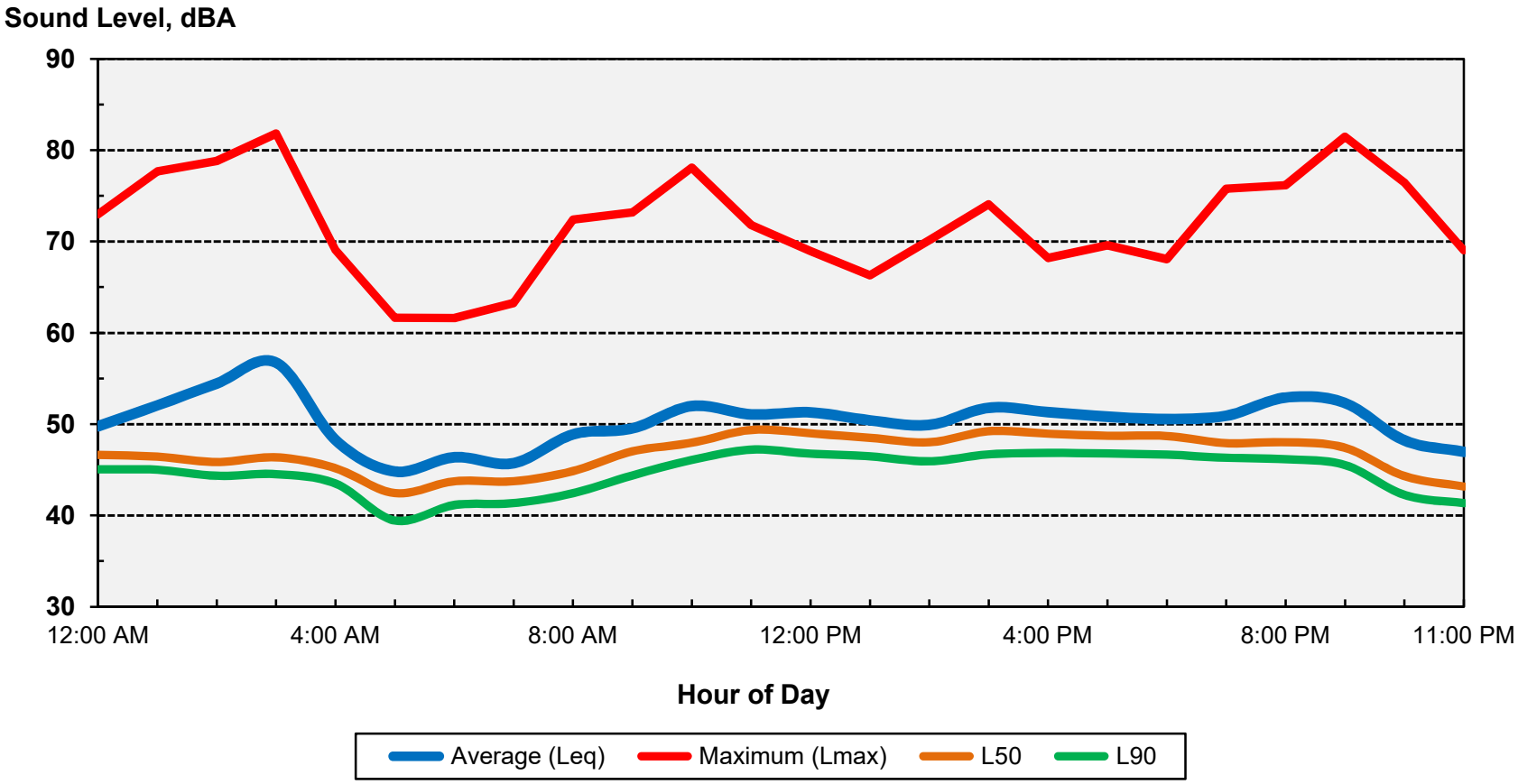
Appendix C-5
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Sunday, June 4, 2017



Ldn: 58 dB

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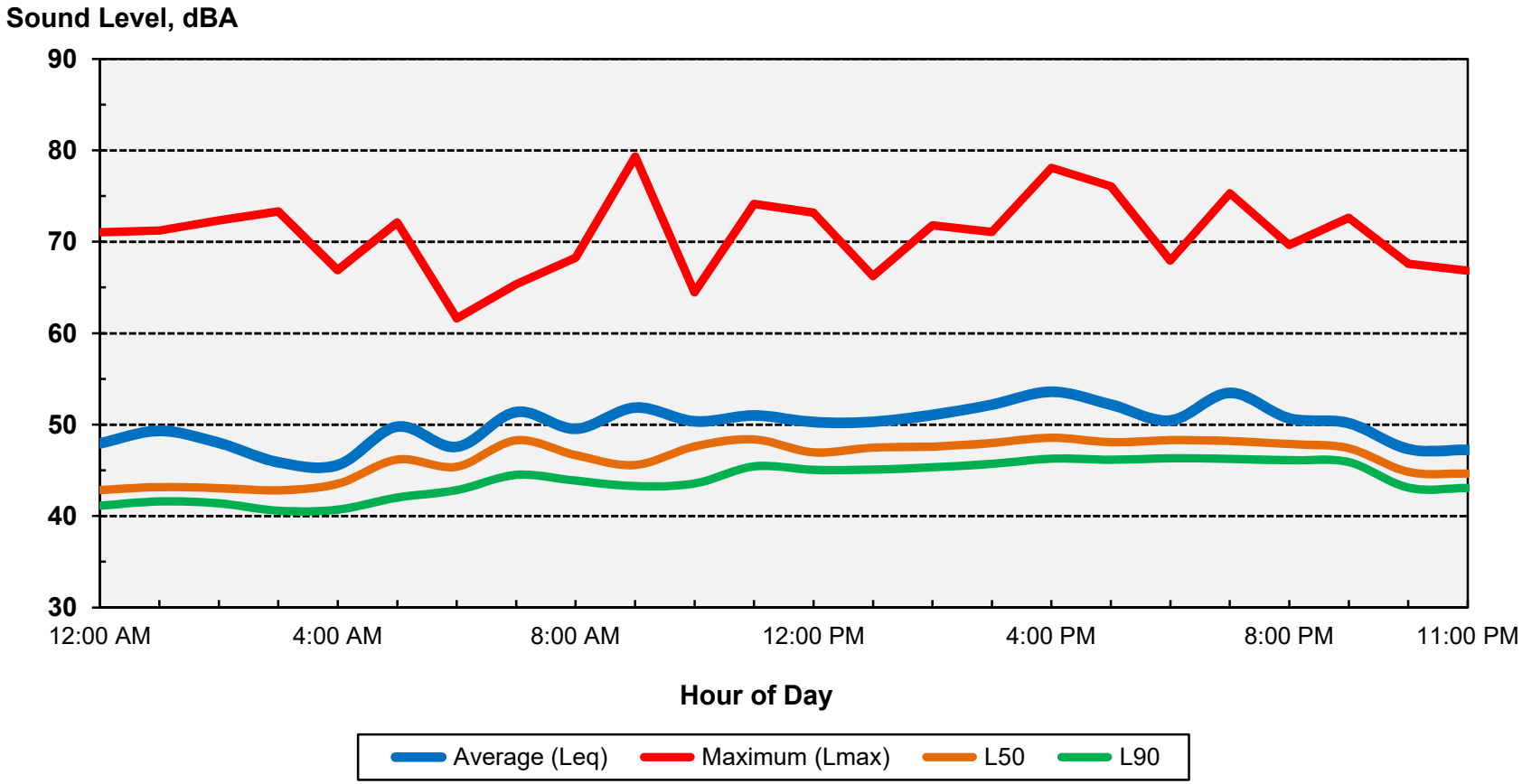
Appendix C-6
Rocket Ship K-5 Charter School
Ambient Noise Monitoring Results - Site B
Monday, June 5, 2017



Ldn: 55 dB

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Appendix D-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2017-083 Rocketship Antioch Public School
Description: Existing
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	A Street	North of Wilbur Ave	5,080	99		1	2	1	25	50	
2	A Street	Wilbur Ave to 10th Ave	6,190	99		1	2	1	25	50	
3	A Street	W10th St to E 13th St	8,470	99		1	2	1	25	50	
4	A Street	E 13th St to W 18th St	13,830	99		1	2	1	30	50	
5	A Street	South of W 18th St	15,620	99		1	2	1	30	50	
6	Cavallo Road	North of Wilbur Ave	700	99		1	2	1	30	50	
7	Cavallo Road	Wilbur Ave to E13th St	8,470	99		1	2	1	35	50	
8	Cavallo Road	E 13th St to E 18th St	5,240	99		1	2	1	35	50	
9	Cavallo Road	South of E 18th St	4,150	99		1	2	1	25	50	
10	East 13th Street	A Street to Cavallo Road	1,950	99		1	2	1	25	50	
11	East 18th Street	A St to Evergreen Ave	10,240	99		1	2	1	30	50	
12	East 18th Street	Evergreen Ave to Cavallo Rd	10,390	99		1	2	1	30	50	
13	East 18th Street	Cavallo Rd to Hillcrest Ave	9,110	99		1	2	1	35	50	
14	East 18th Street	East of Hillcrest Ave	10,450	99		1	2	1	45	50	
15	Evergreen Avenue	South of E 18th St	930	99		1	2	1	25	50	
16	G Street	North of W 10th St	3,400	99		1	2	1	25	50	
17	G Street	W 10th St to W 18th St	5,310	99		1	2	1	25	50	
18	G Street	South of W 18th St	6,150	99		1	2	1	25	50	
19	Hillcrest Avenue	South of E 18th St	11,520	99		1	2	1	40	50	
20	Hillcrest Avenue	North of E 18th St	3,080	99		1	2	1	25	50	
21	West 10th Street	West of W 10th St	8,630	99		1	2	1	25	50	
22	West 10th Street	G St to A St	8,860	99		1	2	1	25	50	
23	West 18th Street	West of W 18th St	8,770	99		1	2	1	25	50	
24	West 18th Street	G St to A St	6,350	99		1	2	1	25	50	
25	Wilbur Ave	A St to Cavallo Rd	7,130	99		1	2	1	40	50	
26	Wilbur Ave	East of Cavallo Rd	6,490	99		1	2	1	40	50	

Appendix D-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2017-083 Rocketship Antioch Public School
Description: Existing + Plus Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	A Street	North of Wilbur Ave	5,770	99		1	2	1	25	50	
2	A Street	Wilbur Ave to 10th Ave	6,820	99		1	2	1	25	50	
3	A Street	W10th St to E 13th St	9,120	99		1	2	1	25	50	
4	A Street	E 13th St to W 18th St	13,830	99		1	2	1	30	50	
5	A Street	South of W 18th St	16,190	99		1	2	1	30	50	
6	Cavallo Road	North of Wilbur Ave	700	99		1	2	1	30	50	
7	Cavallo Road	Wilbur Ave to E13th St	9,120	99		1	2	1	35	50	
8	Cavallo Road	E 13th St to E 18th St	8,700	99		1	2	1	35	50	
9	Cavallo Road	South of E 18th St	4,260	99		1	2	1	25	50	
10	East 13th Street	A Street to Cavallo Road	2,960	99		1	2	1	25	50	
11	East 18th Street	A St to Evergreen Ave	11,860	99		1	2	1	30	50	
12	East 18th Street	Evergreen Ave to Cavallo Rd	12,470	99		1	2	1	30	50	
13	East 18th Street	Cavallo Rd to Hillcrest Ave	10,380	99		1	2	1	35	50	
14	East 18th Street	East of Hillcrest Ave	10,740	99		1	2	1	45	50	
15	Evergreen Avenue	South of E 18th St	1,390	99		1	2	1	25	50	
16	G Street	North of W 10th St	3,870	99		1	2	1	25	50	
17	G Street	W 10th St to W 18th St	5,670	99		1	2	1	25	50	
18	G Street	South of W 18th St	6,460	99		1	2	1	25	50	
19	Hillcrest Avenue	South of E 18th St	11,810	99		1	2	1	40	50	
20	Hillcrest Avenue	North of E 18th St	3,430	99		1	2	1	25	50	
21	West 10th Street	West of W 10th St	8,690	99		1	2	1	25	50	
22	West 10th Street	G St to A St	9,910	99		1	2	1	25	50	
23	West 18th Street	West of W 18th St	8,830	99		1	2	1	25	50	
24	West 18th Street	G St to A St	7,080	99		1	2	1	25	50	
25	Wilbur Ave	A St to Cavallo Rd	8,230	99		1	2	1	40	50	
26	Wilbur Ave	East of Cavallo Rd	6,600	99		1	2	1	40	50	

Appendix D-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2017-083 Rocketship Antioch Public School
Description: Cumulative
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	A Street	North of Wilbur Ave	5,190	99		1	2	1	25	50	
2	A Street	Wilbur Ave to 10th Ave	7,570	99		1	2	1	25	50	
3	A Street	W10th St to E 13th St	9,480	99		1	2	1	25	50	
4	A Street	E 13th St to W 18th St	15,130	99		1	2	1	30	50	
5	A Street	South of W 18th St	16,670	99		1	2	1	30	50	
6	Cavallo Road	North of Wilbur Ave	700	99		1	2	1	30	50	
7	Cavallo Road	Wilbur Ave to E13th St	3,780	99		1	2	1	35	50	
8	Cavallo Road	E 13th St to E 18th St	5,300	99		1	2	1	35	50	
9	Cavallo Road	South of E 18th St	4,220	99		1	2	1	25	50	
10	East 13th Street	A Street to Cavallo Road	2,360	99		1	2	1	25	50	
11	East 18th Street	A St to Evergreen Ave	10,450	99		1	2	1	30	50	
12	East 18th Street	Evergreen Ave to Cavallo Rd	10,500	99		1	2	1	30	50	
13	East 18th Street	Cavallo Rd to Hillcrest Ave	9,240	99		1	2	1	35	50	
14	East 18th Street	East of Hillcrest Ave	10,970	99		1	2	1	45	50	
15	Evergreen Avenue	South of E 18th St	1,060	99		1	2	1	25	50	
16	G Street	North of W 10th St	4,350	99		1	2	1	25	50	
17	G Street	W 10th St to W 18th St	5,680	99		1	2	1	25	50	
18	G Street	South of W 18th St	6,990	99		1	2	1	25	50	
19	Hillcrest Avenue	South of E 18th St	12,670	99		1	2	1	40	50	
20	Hillcrest Avenue	North of E 18th St	3,260	99		1	2	1	25	50	
21	West 10th Street	West of W 10th St	8,740	99		1	2	1	25	50	
22	West 10th Street	G St to A St	9,150	99		1	2	1	25	50	
23	West 18th Street	West of W 18th St	9,230	99		1	2	1	25	50	
24	West 18th Street	G St to A St	6,500	99		1	2	1	25	50	
25	Wilbur Ave	A St to Cavallo Rd	7,180	99		1	2	1	40	50	
26	Wilbur Ave	East of Cavallo Rd	6,490	99		1	2	1	40	50	

Appendix D-4

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2017-083 Rocketship Antioch Public School
Description: Cumulative + Plus Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	A Street	North of Wilbur Ave	5,880	99		1	2	1	25	50	
2	A Street	Wilbur Ave to 10th Ave	8,200	99		1	2	1	25	50	
3	A Street	W10th St to E 13th St	10,130	99		1	2	1	25	50	
4	A Street	E 13th St to W 18th St	15,130	99		1	2	1	30	50	
5	A Street	South of W 18th St	17,240	99		1	2	1	30	50	
6	Cavallo Road	North of Wilbur Ave	700	99		1	2	1	30	50	
7	Cavallo Road	Wilbur Ave to E13th St	4,990	99		1	2	1	35	50	
8	Cavallo Road	E 13th St to E 18th St	8,760	99		1	2	1	35	50	
9	Cavallo Road	South of E 18th St	4,330	99		1	2	1	25	50	
10	East 13th Street	A Street to Cavallo Road	3,010	99		1	2	1	25	50	
11	East 18th Street	A St to Evergreen Ave	12,070	99		1	2	1	30	50	
12	East 18th Street	Evergreen Ave to Cavallo Rd	12,470	99		1	2	1	30	50	
13	East 18th Street	Cavallo Rd to Hillcrest Ave	10,400	99		1	2	1	35	50	
14	East 18th Street	East of Hillcrest Ave	11,260	99		1	2	1	45	50	
15	Evergreen Avenue	South of E 18th St	1,410	99		1	2	1	25	50	
16	G Street	North of W 10th St	4,820	99		1	2	1	25	50	
17	G Street	W 10th St to W 18th St	6,040	99		1	2	1	25	50	
18	G Street	South of W 18th St	7,300	99		1	2	1	25	50	
19	Hillcrest Avenue	South of E 18th St	12,960	99		1	2	1	40	50	
20	Hillcrest Avenue	North of E 18th St	3,610	99		1	2	1	25	50	
21	West 10th Street	West of W 10th St	8,800	99		1	2	1	25	50	
22	West 10th Street	G St to A St	10,200	99		1	2	1	25	50	
23	West 18th Street	West of W 18th St	9,290	99		1	2	1	25	50	
24	West 18th Street	G St to A St	7,230	99		1	2	1	25	50	
25	Wilbur Ave	A St to Cavallo Rd	8,280	99		1	2	1	40	50	
26	Wilbur Ave	East of Cavallo Rd	6,600	99		1	2	1	40	50	