

ACOUSTICAL ANALYSIS
BLYTHE CROSSING RESIDENTIAL DEVELOPMENT
FRESNO, CALIFORNIA

WJVA Project No. 17-036

PREPARED FOR

GINDER DEVELOPMENT
759 WEST ALLUVIAL AVENUE, SUITE 102
FRESNO, CA 93711

PREPARED BY

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OCTOBER 10, 2017

INTRODUCTION

The project is a proposed 80-unit multi-family residential development to be located northwest of the intersection of North Blythe Avenue and West Herndon Avenue, within the City of Fresno. Since the project site is located adjacent to West Herndon Avenue, the applicant has requested this acoustical analysis to quantify project site noise exposure and determine the extent of noise mitigation that may be required for compliance with applicable noise level standards. This analysis, prepared by WJV Acoustics, Inc. (WJVA), is based upon a site plan provided by the project architect (Jeff Cazaly Architect) and the findings of on-site noise level measurements. Revisions to the site plan may affect the findings and recommendations of this report. The project site plan is provided as Figure 1.

Appendix A provides a description of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported are in A-weighted decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

NOISE EXPOSURE CRITERIA

The City of Fresno Noise Element of the General Plan (adopted 12/18/14) sets noise compatibility standards for transportation noise sources in terms of the Day-Night Average Level (L_{dn}). Implementing Policy NS-1-a of the noise element establishes a land use compatibility criteria as 65 dB L_{dn} for exterior noise exposure within outdoor activity areas of residential land uses. Outdoor activity areas generally include backyards of single-family residences, individual patios or decks of multi-family developments and common outdoor recreation areas of multi-family developments. The intent of the exterior noise level requirement is to provide an acceptable noise environment for outdoor activities and recreation.

Additionally, Implementing Policy NS-1-h of the noise element requires that interior noise levels attributable to exterior transportation noise sources not exceed 45 dB L_{dn} . The intent of the interior noise level standard is to provide an acceptable noise environment for indoor communication and sleep.

PROJECT SITE NOISE EXPOSURE

The project site is located northwest of the intersection of North Blythe Avenue and West Herndon Avenue, within the City of Fresno. The predominant source of noise within the project site is vehicular traffic along West Herndon Avenue.

Traffic Noise Exposure:

Noise exposure from traffic on West Herndon Avenue was calculated for existing and future (2035) conditions using the FHWA Traffic Noise Model and traffic data obtained from the Fresno Council of Governments (Fresno COG).

WJVA utilized the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108). The FHWA Model is a standard analytical method used for roadway traffic noise calculations. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles) and heavy trucks (3 or more axles), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within ± 1.5 dB. To predict L_{dn} values, it is necessary to determine the hourly distribution of traffic for a typical day and adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Noise level measurements and concurrent traffic counts were conducted by WJVA staff within the project site on October 6, 2017 at one location along West Herndon Avenue. The purpose of the measurement was to evaluate the accuracy of the FHWA Model in describing traffic noise exposure within the project site. The measurement site was located within the project site at a distance of approximately 110 feet from the centerline of W. Herndon Avenue. The posted speed limit along W. Herndon Avenue is 50 mph (miles per hour). The project vicinity and noise monitoring site location are provided as Figure 2.

Noise monitoring equipment consisted of a Larson-Davis Laboratories Model LDL-820 sound level analyzer equipped with a B&K Type 4176 1/2" microphone. The equipment complies with the specifications of the American National Standards Institute (ANSI) for Type I (Precision) sound level meters. The meter was calibrated in the field prior to use with a B&K Type 4230 acoustic calibrator to ensure the accuracy of the measurements. The microphone was located on a tripod at 5 feet above the ground. The project site presently consists of a tilled and partially graded undeveloped soil.

Noise measurements were conducted in terms of the equivalent energy sound level (L_{eq}). Measured L_{eq} values were compared to L_{eq} values calculated (predicted) by the TNM Model using as inputs the traffic volumes, truck mix and vehicle speed observed during the noise measurements. The results of that comparison are shown in Table I.

From Table I it may be determined that the traffic noise levels predicted by the FHWA Model were 2.2 dB lower than those measured for the traffic conditions observed at the time of the noise measurements. This slight over-prediction by the model is expected, and is due to the fact that vehicles heading westbound on W. Herndon Avenue are often accelerating after departing the traffic light located at the intersection of N. Blythe Avenue and W. Herndon Avenue. The FHWA model was therefore adjusted for by 2 dB.

<p style="text-align: center;">TABLE I</p> <p style="text-align: center;">COMPARISON OF MEASURED AND PREDICTED (FHWA MODEL) NOISE LEVELS BLYTHE CROSSING, FRESNO</p>	
	@ 110' W. Herndon Avenue
Measurement Date	October 6, 2017
Measurement Start Time	2:15 p.m.
Observed # Autos/Hr.	2,160
Observed # Medium Trucks/Hr.	24
Observed # Heavy Trucks/Hr.	24
Posted Speed (MPH)	50
Distance, ft. (from center of roadway)	110
L _{eq} , dBA (Measured)	68.9
L _{eq} , dBA (Predicted)	66.7
Difference between Measured and Predicted L_{eq}, dBA	+2.2
Note: FHWA "soft" site assumed for calculations. Source: WJV Acoustics, Inc.	

Annual Average Daily Traffic (AADT) data for the above-described roadways were obtained from Fresno COG. Truck percentages and the day/night distribution of traffic were estimated by WJVA, based upon previous studies conducted in the project vicinity. Table II summarizes annual average traffic data used to model noise exposure within the project site.

<p style="text-align: center;">TABLE II</p> <p style="text-align: center;">TRAFFIC NOISE MODELING ASSUMPTIONS EXISTING and 2035 TRAFFIC CONDITIONS BLYTHE CROSSING, FRESNO</p>		
	W. Herndon Avenue	
	Existing	2035
Annual Avenue Daily Traffic (AADT)	35,119	68,647
Day/Night Split (%)	90/10	90/10
Assumed Vehicle Speed (mph)	50	50
% Medium Trucks (% AADT)	2	2
% Heavy Trucks (% AADT)	1	1
Sources: Fresno COG WJV Acoustics, Inc.		

Using data from Table II, the FHWA Model and the above-described +2 dB offset (due to vehicle acceleration), annual average traffic noise exposure was calculated for the closest proposed residential building setbacks from W. Herndon Avenue. The calculated noise exposures for existing and future (2035) traffic conditions for the closest proposed setbacks to W. Herndon Avenue were 66.2 dB L_{dn} and 69.1 dB L_{dn} , respectively.

Future (2035) traffic conditions represent a worst-case assessment of traffic noise exposure, and was therefore used to demonstrate compliance with applicable City of Fresno noise level standards.

NOISE MITIGATION

Exterior Noise Mitigation:

Traffic noise level exposure along West Herndon Avenue is expected to be approximately 69 dB L_{dn} for future (2035) traffic conditions at the distance of the closest proposed multi-family residential setbacks. Such levels exceed the City's applicable exterior noise level standard of 65 dB L_{dn} . However, the project also proposes the construction of a 6-foot CMU sound wall along the W. Herndon Avenue project frontage. Additionally, the project will include continuous, finished garage structures, constructed to approximately 12 feet above project site elevation. The garage structures will provide significant acoustical shielding at the closest proposed residential units along W. Herndon Avenue.

In order to determine the amount of noise attenuation provided by the sound wall and garage units, WJVA utilized a sound wall insertion loss program based on the FHWA Model to calculate the expected noise attenuation. The model calculates the insertion loss (noise reduction) of a wall (or berm/wall/structure) of a given height based on the effective height of the noise source, height of the receiver, distance from the receiver to the wall, and distance from the noise source to the wall. For roadway vehicle traffic, the standard assumptions used in the sound wall calculations are effective source heights of 8, 2 and 0 feet above the roadway for heavy trucks, medium trucks and automobiles, respectively. The standard height of a residential receiver is 5 feet above the finished floor elevation.

Based upon the above-described assumptions and method of analysis, the noise level insertion loss values for the proposed sound wall and garage structures were calculated. The calculations indicated that the expected noise attenuation would be approximately 9 dB at first floor elevations and approximately 5 dB at second floor elevations. The resulting exterior noise levels would be approximately 60 dB L_{dn} at first floor receiver locations and approximately 64 dB L_{dn} at second floor receiver locations. Such levels are below the City's applicable exterior noise level standard for residential land uses. Additionally, traffic noise exposure along the closest proposed units to N. Blythe Avenue would not exceed the City's applicable exterior noise level standard. Additional mitigation is therefore not required.

Interior Noise Mitigation:

The City of Fresno interior noise level standard is 45 dB L_{dn} . With the proposed sound walls and garage structures in place, the exterior first-floor facades facing W. Herndon would be approximately 60 dB L_{dn} and the second-floor facades would be approximately 64 dB L_{dn} (worst case assessment of project-site noise exposure). This means that the proposed multi-family buildings would need to be capable of providing a minimum outdoor-to-indoor noise level reduction (NLR) of 19 dB ($64-45=19$).

A specific analysis of interior noise levels was not performed. However, it may be assumed that residential construction methods complying with current building code requirements will reduce exterior noise levels by approximately 25 dB if windows and doors are closed. This will be sufficient for compliance with the City's 45 dB L_{dn} interior standard. Requiring that it be possible for windows and doors to remain closed for sound insulation means that air conditioning or mechanical ventilation will be required.

CONCLUSIONS AND RECOMMENDATIONS

The proposed 80-unit multi-family residential development will comply with applicable City of Fresno exterior and interior noise level requirements provided that the following noise mitigation measures are included in the proposed project design.

1. The proposed 6-foot CMU sound wall and garage structures are built as proposed.
2. Air conditioning or mechanical ventilation should be installed in the homes so that it will be possible for windows and doors to remain closed for sound insulation purposes.

The conclusions and recommendations of this acoustical analysis are based upon the best information known to WJV Acoustics Inc. (WJVA) at the time the analysis was prepared concerning the proposed site plan, project site elevation, railway operations, traffic volumes and roadway configurations. Any significant changes in these factors will require a reevaluation of the findings of this report. Additionally, any significant future changes in motor vehicle technology, railway technology, noise regulations or other factors beyond WJVA's control may result in long-term noise results different from those described by this analysis.

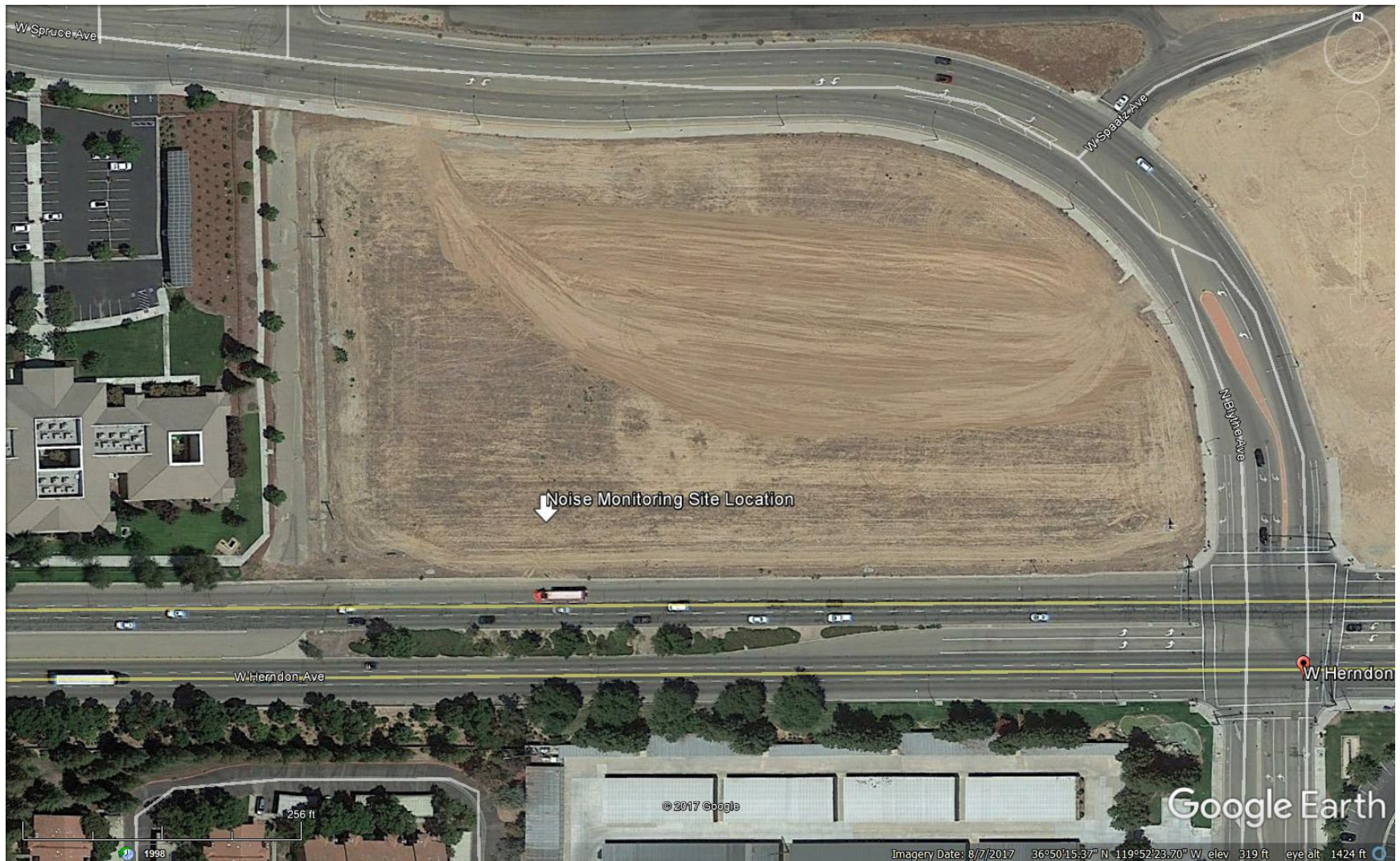
Respectfully submitted,



Walter J. Van Groningen
President

WJV:wjv

FIGURE 2: PROJECT VICINITY AND NOISE MONITORING SITE LOCATION



APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL:	The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.
CNEL:	Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.
DECIBEL, dB:	A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
DNL/L_{dn}:	Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.
L_{eq}:	Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.
NOTE:	The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.
L_{max}:	The maximum noise level recorded during a noise event.
L_n:	The sound level exceeded "n" percent of the time during a sample interval (L_{90} , L_{50} , L_{10} , etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

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ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE

CONTOURS:

Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL

REDUCTION (NLR):

The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of “noise level reduction” combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION

CLASS (STC):

The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.