ENVIRONMENTAL NOISE ASSESSMENT

THE CROSSINGS RETAIL DEVELOPMENT
BAKERSFIELD, CALIFORNIA

WJVA Report No. 21-40

PREPARED FOR

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1. INTRODUCTION

Project Description

As proposed, the project would consist of four (4) components: 1) A General Plan Amendment from Low Density Residential (LR) to General Commercial on approximately 12.4 acres; 2) a Zone Change from R-1 (Single-Family Residential) to C-2/P.C.D. (General Commercial/Planned Commercial Development); 3) A site plan consisting of general commercial uses for the entire 21.4-acre project area zoned C-2/P.C.D.; and 4) a Parcel Map dividing the project site in to various parcels.

The proposed Project is the construction of multi-use commercial development. The maximum gross leasable area for the commercial uses is based on typical floor area ratio (FAR) of 1.0 for GC (General Commercial) designation and estimates 184,196 sq ft of gross square footage of floor area. The project site plan, provided as Figure 1, provides the proposed layout, density, size, and estimated number of commercial uses of the proposed project area.

Environmental Noise Assessment

This environmental noise assessment has been prepared to determine if significant noise impacts would be produced by the project and to describe mitigation measures for noise if significant impacts are determined. The environmental noise assessment, prepared by WJV Acoustics, Inc. (WJVA), is based upon the project site plan dated 5-20-21, project-related traffic data provided by Ruettgers & Schuler Civil Engineers, and a project site visit on August 17 and 18, 2021. Revisions to the site plan, project-related traffic data or other project-related information available to WJVA at the time the analysis was prepared may require a reevaluation of the findings and/or recommendations of the report.

Appendix A provides definitions of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported in this analysis are A-weighted sound pressure levels in 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-weighted sound levels, as they correlate well with public reaction to noise. Appendix B provides typical A-weighted sound levels for common noise sources.

In terms of human perception, a 5 dB increase or decrease is considered to be a noticeable change in noise levels. Additionally, a 10 dB increase or decrease is perceived by the human ear as half as loud or twice as loud. In terms of perception, generally speaking the human ear cannot perceive an increase (or decrease) in noise levels less than 3 dB.

2. THRESHOLDS OF SIGNIFICANCE

The CEQA Guidelines apply the following questions for the assessment of significant noise impacts for a project:

a. Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b. Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

a. Noise Level Standards

City of Bakersfield

The project site lies within the City of Bakersfield. The applicable standards for noise levels that apply to this project are contained within Chapter VII of the Metropolitan Bakersfield General Plan[1], adopted in 2002.

For transportation noise sources (e.g., traffic and railway noise), the Metropolitan Bakersfield General Plan establishes noise level criteria in terms of the Community Noise Equivalent Level (CNEL) metric. The CNEL is the time-weighted energy average noise level for a 24-hour day, with a 4.77 dB penalty added to noise levels occurring during the evening hours (7:00 p.m.-10:00 p.m.) and a 10 dB penalty added to noise levels occurring during the nighttime hours (10:00 p.m.-7:00 a.m.). The CNEL represents cumulative exposure to noise over an extended period of time and is therefore calculated based upon *annual average* conditions.

The Noise Element establishes a land use compatibility criterion of 65 dB CNEL for exterior noise levels in outdoor activity areas of new residential developments. 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.

The Noise Element also requires that interior noise levels attributable to exterior noise sources not exceed 45 dB CNEL. The intent of the interior noise level standard is to provide an acceptable noise environment for indoor communication and sleep.

For non-transportation noise sources, the noise element applies hourly noise level performance standards at residential and other noise-sensitive uses. Table I summarizes the applicable hourly noise level standards. According the General Plan, the noise level standards apply to the following noise-sensitive land uses:

- Residential Areas
- Schools
- Convalescent and Acute Care Hospitals
- Parks and Recreational Areas

TABLE I

HOURLY NOISE LEVEL PERFORMANCE STANDARDS
STATIONARY NOISE SOURCES
METROPOLITAN BAKERSFIELD GENERAL PLAN

Maximum Acceptable Noise Level, dB		
Min./Hr. (L_n)	**Day (7a-10p)**	**Night (10p-7a)**
30 (L_{50})	55	50
15 (L_{25})	60	55
5 ($L_{8.3}$)	65	60
1 ($L_{1.7}$)	70	65
0 (L_{max})	75	70

Note: L_n means the percentage of time the noise level is exceeded during an hour. L_{50} means the level exceed 50% of the hour, L_{25} is the level exceed 25% of the hour, etc.

Source: Metropolitan Bakersfield General Plan

Additionally, The City of Bakersfield General Plan Noise Element sets standards for project-related noise impacts and cumulative noise impacts from mobile (transportation-related) noise sources affecting existing noise-sensitive land uses. The City utilizes the standards listed below in impact determination in regards to increases in ambient noise levels at existing noise-sensitive land uses resulting from project-related transportation noise sources.

Standards For Project-Related Noise Impacts From Mobile Sources

A significant increase of existing ambient noise levels affecting existing noise-sensitive land uses (receptors), and requiring the adoption of practical and feasible mitigation measures, is deemed to occur where a project will cause:

- *An increase of the existing ambient noise level by 5 dB or more, where the existing ambient level is less than 60 dB CNEL;*

- *An increase of the existing ambient noise level by 3 dB or more, where the existing ambient level is 60 to 65 dB CNEL;*

- *An increase of the existing ambient noise level by 1.5 dB or more, where the existing ambient level is greater than 65 dB CNEL*

Standards For Cumulative Noise Impacts From Mobile Sources

The project's contribution to noise increases would normally be considered cumulatively considerable and significant when ambient noise levels affect noise sensitive land uses (receptors) and when the following occurs.

- *A project increases the ambient (cumulative without project) noise level by 1 dB or more;*

and

- *The cumulative with project noise level cause the following:*
    - *An increase of the existing ambient noise level by 5 dB or more, where the existing ambient level is less than 60 dB CNEL;*
    - *An increase of the existing ambient noise level by 3 dB or more, where the existing ambient level is 60 to 65 dB CNEL;*
    - An increase on the existing ambient noise level by 1.5 dB or more, where the existing ambient level is greater than 65 dB CNEL

State of California

There are no state noise standards that are applicable to the project.

Federal Noise Standards

There are no federal noise standards that are applicable to the project.

b. Construction Noise and Vibration

Section 9.22.050 of the Bakersfield Municipal Code[2] limits construction to the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends, when construction is within 1,000 feet of a residence. Certain exceptions to these hours are specified in the code.

The City of Bakersfield does not have regulations that define acceptable levels of vibration. One of the most recent references suggesting vibration guidelines is the California Department of Transportation (Caltrans) Transportation and Construction Vibration Guidance Manual[3]. The

Manual provides guidance for determining annoyance potential criteria and damage potential threshold criteria. These criteria are provided below in Table II and Table III, and are presented in terms of peak particle velocity (PPV) in inches per second (in/sec).

TABLE II

GUIDELINE VIBRATION ANNOYANCE POTENTIAL CRITERIA

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely Perceptible	0.04	0.01
Distinctly Perceptible	0.25	0.04
Strongly Perceptible	0.9	0.1
Severe	2.0	0.4

Source: Caltrans

TABLE III

GUIDELINE VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile, historic buildings, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans

3. SETTING

The Crossings Project is located on a 28.8-acre parcel (APN: 514-030-25) in southeast Bakersfield, California, in Kern County. The project site is located on the southeast corner of Hosking Avenue and South H Street. The Project is within Section 36, Township 30S, Range 27E, Mount Diablo Base and Meridian.

The proposed Project site is currently vacant and is bounded by vacant commercial land to the north and east, vacant residential land to the south, and State Route-99 to the west. The Metropolitan Bakersfield General Plan designates Project site as GC (General Commercial) and LR (Low Density Residential). The Project site has a zone classification of C-2/PCD (Regional Commercial / Planned Commercial Development) and R-1 (One-Family Dwelling). Sensitive receptors located in the project vicinity include the residential land uses to the east and northeast of the project site.

a. Background Noise Level Measurements

Existing ambient noise levels in the project vicinity are dominated by traffic noise along California State Route 99 (SR 99), Hosking Avenue and South H Street. Additional sources of noise observed during site inspection included aircraft overflights, birds, barking dogs, and noise associated with landscaping and construction activities.

Measurements of existing ambient noise levels in the project vicinity were conducted on August 17 and 18, 2021. Long-term (24-hour) ambient noise level measurements were conducted at two (2) locations (sites LT-1 and LT-2). One long-term ambient noise measurement site was located along the norther portion of the project site, near Hosking Avenue (LT-1) and a second long-term ambient noise monitoring site was located near the western portion of the project site, near SR 99 (LT-2).

Additionally, short-term (15-minute) ambient noise level measurements were conducted at five (5) locations (Sites ST-1 through ST-5). Two (2) individual measurements were taken at each of the five short-term sites to quantify ambient noise levels in the morning and afternoon hours. The project vicinity and locations of the noise monitoring sites are shown on Figure 2.

Noise monitoring equipment consisted of Larson-Davis Laboratories Model LDL-820 sound level analyzers equipped with B&K Type 4176 1/2" microphones. The equipment complies with the specifications of the American National Standards Institute (ANSI) for Type I (Precision) sound level meters. The meters were calibrated with a B&K Type 4230 acoustic calibrator to ensure the accuracy of the measurements.

Measured hourly energy average noise levels (L_{eq}) at site LT-1 ranged from a low of 49.6 dB between 2:00 a.m. and 3:00 a.m. to a high of 56.4 dB between 7:00 a.m. and 8:00 a.m. Hourly maximum (L_{max}) noise levels at site LT-1 ranged from 58.6 to 75.9 dB. Residual noise levels at the monitoring site, as defined by the L_{90} statistical descriptor ranged from 35.2 to 49.8 dB. The L_{90} is a statistical descriptor that defines the noise level exceeded 90% of the time during each hour of the sample period. The L_{90} is generally considered to represent the residual (or background) noise

level in the absence of identifiable single noise events from traffic, aircraft and other local noise sources. The measured CNEL value at site LT-1 during the 24-hour noise measurement period was 59.6 dB CNEL. Figure 3 graphically depicts hourly variations in ambient noise levels at the LT-1 long-term monitoring site as well as a site photograph.

Measured hourly energy average noise levels (L_{eq}) at site LT-2 ranged from a low of 59.5 dB between 2:00 a.m. and 3:00 a.m. to a high of 67.8 dBA between 7:00 a.m. and 8:00 a.m. Hourly maximum (L_{max}) noise levels at site LT-2 ranged from 70.7 to 83.4 dB. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 49.1 to 63.6 dB. The measured CNEL value at site LT-2 during the 24-hour noise measurement period was 69.5 dB CNEL. Figure 4 graphically depicts hourly variations in ambient noise levels at the LT-2 long-term monitoring site as well as a site photograph.

The short-term site noise measurement data included energy average (L_{eq}) maximum (L_{max}) as well as five (5) individual statistical parameters. Observations were made of the dominant noise sources affecting the measurements. The statistical parameters describe the percent of time a noise level was exceeded during the measurement period. Table IV summarizes short-term noise measurement results.

TABLE IV

SUMMARY OF SHORT-TERM NOISE MEASUREMENT DATA
THE CROSSINGS RETAIL DEVELOPMENT
BAKERSFIELD, CALIFORNIA
AUGUST 17 & 18, 2021

Site	Time	A-Weighted Decibels, dBA							Sources
		L_{eq}	L_{max}	L_2	L_8	L_{25}	L_{50}	L_{90}	
ST-1	8:15 a.m.	60.3	72.4	68.7	64.1	60.8	58.0	52.9	TR
ST-1	2:45 p.m.	59.2	69.4	67.0	62.9	59.5	57.4	52.8	TR
ST-2	8:35 a.m.	70.1	82.4	77.1	73.2	66.9	58.1	50.3	TR, AC, C
ST-2	3:05 p.m.	68.9	89.4	76.4	73.0	67.2	57.6	49.6	TR
ST-3	9:00 a.m.	55.5	81.4	57.6	55.8	53.1	52.0	49.6	TR, D, L
ST-3	3:30 p.m.	52.7	71.7	56.0	54.2	52.6	51.3	49.1	TR, D
ST-4	9:20 a.m.	63.8	77.7	71.0	68.7	63.5	58.1	51.4	TR, D
ST-4	3:50 p.m.	65.2	78.6	73.4	70.2	65.8	60.2	52.5	TR, D
ST-5	9:00 a.m.	54.7	64.8	56.0	55.7	54.3	52.0	49.9	TR, C
ST-5	3:30 p.m.	53.4	65.5	56.6	55.5	54.1	53.1	50.7	TR, AC

TR: Traffic AC: Aircraft V: Voices D: Dogs Barking B: Birds C: Construction Activities L: Landscaping Activities
Source: WJV Acoustics, Inc.

Short-term noise measurements were conducted for 15-minute periods. Sites ST-1 and ST-2 were located adjacent to S. H Street, and we exposed to traffic noise from the roadway. Site ST-3 was located within nearby residential neighborhood, at the western terminus of Astor Avenue, and was exposed to traffic noise from S. H Street as well as noise typical of residential areas (landscaping activities, vehicle movements, etc.). Site ST-4 was located in the vicinity of residential land uses adjacent to Hosking Avenue, and was exposed to traffic noise associated

with vehicles on Hosking Avenue and S. H Street. Site ST-5 was located centrally within the project site, and was exposed to traffic noise associated with vehicles along SR 99, Hosking Avenue, S. H Street as well as construction activities occurring south of the project site.

4. PROJECT IMPACTS AND MITIGATION MEASURES

a. Project Traffic Noise Impacts on Existing Noise-Sensitive Land Uses Outside Project Site (Less Than Significant)

WJVA utilized the FHWA Traffic Noise Model[4] to quantify expected project-related increases in traffic noise exposure at representative noise-sensitive receptor locations in the project vicinity. Traffic noise exposure levels for Existing, Existing Plus Project, 2042 Cumulative and 2042 Cumulative Plus Project traffic conditions were calculated based upon the FHWA Model and traffic volumes provided by Ruettgers & Schuler Civil Engineers. The day/evening/night distribution of traffic and the percentages of trucks on the roadways used for modeling were obtained from previous studies WJVA has conducted along similar roadways. The Noise modeling assumptions used to calculate project traffic noise are provided as Appendix C.

Project-related significant impacts would occur if an increase in traffic noise associated with the project would result in noise levels exceeding the City's applicable noise level standards at the location(s) of sensitive receptors. The City of Bakersfield also considers a significant impact to occur if the project were to cause the CNEL at noise sensitive receptors to increase by five (5) dBA CNEL or more where existing noise levels is less than 60 dB CNEL, increase by three (3) dB CNEL or more, where existing ambient levels is 60 to 65 dB CNEL or an increase by 1.5 dB CNEL or more where the existing ambient level is greater than 65 dB CNEL.

The City of Bakersfield also considers a cumulative noise impact to occur when a project increases ambient (cumulative without project) noise levels by 1 dB or more AND the cumulative with project noise level cause the CNEL at noise sensitive receptors to increase by five (5) dBA CNEL or more where existing noise levels is less than 60 dB CNEL, increase by three (3) dB CNEL or more, where existing ambient levels is 60 to 65 dB CNEL or an increase by 1.5 dB CNEL or more where the existing ambient level is greater than 65 dB CNEL.

This analysis of project traffic noise focuses on potential impacts to residential land uses, as they represent the most restrictive noise level criteria by land use type provided in the General Plan. The City's exterior noise level standard for residential land uses is 65 dB CNEL. Traffic noise was modeled at ten (10) receptor locations (R-1 through R-10). The ten modeled receptors are located at roadway setback distances representative of the sensitive receptors (residences) along each analyzed roadway segment. The receptor locations are described below and provided graphically on Figure 5.

- R-1: Approximately 70 feet from the centerline of S. H St., south of Panama Ln.
- R-2: Approximately 185 feet from the centerline of S. H St., south of Berkshire Rd.
- R-3: Approximately 80 feet from the centerline of Hosking Ave., west of Akers Rd.
- R-4: Approximately 85 feet from the centerline of Hosking Ave., east of Akers Rd.
- R-5: Approximately 90 feet from the centerline of Hosking Ave., east of Wible Rd.
- R-6: Approximately 140 feet from the centerline of Hosking Ave., east of Hughes Ln.
- R-7: Approximately 90 feet from the centerline of Hosking Ave., east of S. H St.
- R-8: Approximately 90 feet from the centerline of Hosking Ave., east of Monitor St.

- R-9: Approximately 180 feet from the centerline of S. H St., south of Hosking Ave.
- R-10: Approximately 190 feet from the centerline of S. H St., south of McKee Rd.

Table V provides a comparison of traffic noise levels at the ten (10) modeled receptor locations for Existing, Existing Plus Project, 2042 Cumulative and 2042 Cumulative Plus Project traffic conditions. As described in Table V, project-related traffic is not expected to result in noise levels at any sensitive receptors to exceed the City's noise level standard, nor result in any noise exposure levels to increase by more than 1 dB. Therefore, project-related increases in traffic noise exposure are considered to be less than significant.

TABLE V

PROJECT-RELATED INCREASES IN TRAFFIC NOISE, dB, CNEL
THE CROSSING RETAIL DEVELOPMENT, BAKERSFIELD

Modeled Receptor	Existing	Existing Plus Project	2042 Cumulative	2042 Cumulative Plus Project	Change (Maximum)	Significant Impact?
R-1	65	66	68	68	+1	No
R-2	59	60	62	63	+1	No
R-3	65	65	68	68	0	No
R-4	65	66	68	68	+1	No
R-5	66	67	69	69	+1	No
R-6	63	64	66	67	+1	No
R-7	66	67	69	69	+1	No
R-8	63	63	67	67	0	No
R-9	58	58	60	60	0	No
R-10	57	58	58	58	+1	No

Source: WJV Acoustics, Inc.
Ruettgers & Schuler Civil Engineers

b. Noise Impacts from On-Site Noise Sources (Less Than Significant With Mitigation)

The project would include a variety of commercial retail land uses, including major retail chains, restaurants (including drive-thru quick service), convenience store, fuel service retail and car wash. The exact tenants of the multi-use retail development were not known at the time this analysis was prepared. A wide variety of noise sources can be associated with commercial retail land uses. The noise levels produced by such sources can also be highly variable and could potentially impact existing off-site and proposed on-site sensitive receptors. Typical examples of stationary noise sources associated with such land uses include:

- HVAC/Mechanical equipment
- Truck deliveries
- Parking lot activities (closing of car doors and trunks, stereos, alarms etc.)

- Drive Thru operations
- Loading Dock Activities
- Car Wash Operations

Mechanical Equipment

It is assumed that the project would include roof-mounted HVAC units on the proposed buildings. The heating, ventilating, and air conditioning (HVAC) requirements for the buildings would likely require the use of multiple packaged roof-top units. For the purpose of noise and aesthetics, roof-mounted HVAC units are typically shielded by means of a roof parapet. WJVA has conducted reference noise level measurements at numerous commercial and retail buildings with roof-mounted HVAC units, and associated noise levels typically range between approximately 45-50 dB at a distance of 50 feet from the building façade.

For this project, the closest residential property lines to any potential roof-mounted HVAC equipment would be located at a minimum setback distance of 500 feet. Taking into account the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance), noise levels associated with the operation of roof-mounted HVAC units would be approximately 25-30 dB at the closest sensitive receptor property line. Such levels do not exceed any City of Bakersfield noise level standard or exceed existing (without project) ambient noise levels.

Truck Movements

At the time of this analysis, a specific truck access route (or routes) had not been designated. However, trucks would access the project site by one of three (3) access points, one access point off of Hosking Avenue and two access points off of S. H Street. It is assumed that truck deliveries would occur at various times and locations throughout the overall project area. Precise details on truck deliveries were not known at the time of this analysis.

WJVA has conducted measurements of the noise levels produced by slowly moving trucks for a number of studies. Such truck movements would be expected to produce noise levels in the range of 65 to 71 dBA at a distance of 100 feet. The range in measured truck noise levels is due to differences in the size of trucks, their speed of movement and whether they have refrigeration units in operation during the pass-by.

Truck movements within the project site would be located at distances of 400 feet or greater from existing noise-sensitive land uses (residences to the east and northeast). At such distances, noise levels associated with truck movements would produce maximum noise levels in the range of approximately 53 to 59 dB or less. Such noise levels do not exceed the City's daytime (7:00 a.m. to 10:00 p.m.) noise level standard of 75 dB L_{max}, or the City's nighttime (10:00 p.m. to 7:00 a.m.) noise level standard of 70 dB L_{max}. Additionally, such levels would not be expected to exceed existing (without project) ambient noise levels in the project vicinity.

Parking Lot Activities

Noise due to traffic in parking lots is typically limited by low speeds and is not usually considered to be significant. Human activity in parking lots that can produce noise includes voices, stereo systems and the opening and closing of car doors and trunk lids. Such activities can occur at any

time. The noise levels associated with these activities cannot be precisely defined due to variables such as the number of parking movements, time of day and other factors. It is typical for a passing car in a parking lot to produce a maximum noise level of 60 to 65 dBA at a distance of 50 feet, which is comparable to the level of a raised voice.

For this project, parking would be dispersed throughout the overall project area. The closest proposed parking areas would be located at least 475 feet from the closest existing residential property lines to the northeast. At this distance, maximum (L_{max}) parking lot vehicle movements would be expected to be approximately 40 to 45 dB. Such levels would not exceed any of the City's applicable noise levels standards or exceed existing ambient noise levels at the closest residential land uses. Due to existing elevated ambient noise levels at the closest sensitive receptor locations (residential land uses north of the project site), noise levels associated with parking lot activities would generally not be audible over existing (without project) noise levels.

Drive Thru Retail

The proposed project could include multiple retail areas that would likely include drive-thru operations (the existing site plan indicates as many as three drive-thru operations). While the exact tenants and type of retail stores were not known at this time, it is assumed that amplified speech would be incorporated into drive-thru operations.

In order to assess potential project noise levels associated with drive-thru operations, WJVA utilized reference noise levels measured at a Wendy's drive-thru restaurant located on South Mooney Boulevard in Visalia. Measurements were conducted during the early afternoon of July 11, 2011 between 12:45 p.m. and 1:45 p.m. using the previously-described noise monitoring equipment.

The microphone used by customers to order food and the loudspeaker used by employees to confirm orders are both integrated into a menu board that is located a few feet from the drive-thru lane at the approximate height of a typical car window. Vehicles would enter the drive-thru lane from the west and then turn to the north along the east side of the restaurant.

Reference noise measurements were obtained at a distance of approximately 40 feet from the menu board containing the microphone/loudspeaker system at an angle of about 45° toward the rear of the vehicle being served. This provided a worst-case exposure to sound from the loudspeaker system since the vehicle was not located directly between the loudspeaker and measurement location. Cars were lined up in the access lane during the noise measurement period indicating that the drive-through lane was operating at or near a peak level of activity.

Each ordering cycle was observed to take approximately 60 seconds including vehicle movements. A typical ordering cycle included 5-10 seconds of loudspeaker use with typical maximum noise levels in the range of 60-62 dBA at the 40 foot-reference location. Vehicles moving through the drive-thru lane produced noise levels in the range of 55-60 dBA at the same distance. Vehicles parked at the ordering position (between the menu board and measurement site) were observed to provide significant acoustic shielding during the ordering sequence. The effects of such shielding are reflected by the noise measurement data. Noise levels were measured to approximately 60 dB L_{50} at the measurement site, and included noise from all

sources, including the loudspeaker, vehicle movements and HVAC equipment.

The closest noise-sensitive receptors (residential land uses) to the proposed retail drive thru operations are located approximately 600 feet to the east. Potential project-related noise exposure at the locations of the closest residential land uses was calculated based upon the above-described reference noise measurement data and the normal rate of sound attenuation over distance for a "point" noise source (6 dB/doubling of distance). At the setback distance of the closest residential land uses to any proposed drive-thru operations, noise levels associated with drive thru retail operations would be expected to produce noise levels of approximately 37-39 dB L_{max} and approximately 36 dB L_{50}. Such levels would not exceed any daytime or nighttime City of Bakersfield noise level standards.

Loading Dock Activities

According to the project site plan, the retail buildings located along the southern portion of the project site would include loading docks at the rear of the retail stores. The tenants of the retail stores were not known at the time this analysis was prepared. The frequency and times of any potential loading dock deliveries were also not known at the time this analysis was prepared. The closest proposed docks (as indicated on the site plan) to residential land uses are located at a distance of approximately 600 feet.

Noise sources typically associated with loading dock activities include truck engines, the operation of truck-mounted refrigeration units, fork lifts, the banging of hand carts and roll-up doors, noise from P.A. systems, and the voices of truck drivers and store employees. Truck engines and/or refrigeration units are typically turned off while trucks are in loading dock areas to reduce noise and save energy.

Based upon noise level measurements conducted by WJVA for other studies, loading dock noise levels would be expected to be in the range of approximately 43 to 61 dBA at a distance of 600 feet (closest residential land uses to the north). Such levels do not exceed the applicable City of Bakersfield daytime (75 dB L_{max}) or nighttime (70 dB L_{max}) noise level standards. Additionally, such noise levels would be below existing (without project) ambient noise levels in the project vicinity.

Car Wash

According to the project site plan, the project would include a drive-through car wash tunnel, located within the northeast portion of the project site, at the convenience store/fuel service retail location. The distance between the proposed car wash operations and the closest sensitive receptors (residential land uses) are as follows:

- 500 to northeast (residential)
- 650 feet to east (residential)

It should be noted, the residential land uses located to the northeast of the car wash location (at the northeast corner of Hosking Avenue and S. H Street) have an existing 6-foot CMU wall that would provide approximately 5 dB of noise attenuation within the outdoor activity areas (backyards) of the residences. The residential land uses located to the east of the car wash do

not have existing sound walls, and no additional noise attenuation would be expected within these backyards.

The exact tenant of the convenience store/fuel service retail operations was not known at the time this analysis was prepared. Subsequently, the type (manufacturer/model) of car wash equipment that would be used was not known at the time this analysis was prepared. However, WJVA has conducted noise studies of numerous car wash operations. Car wash operations can typically be divided into two main categories, 1). Conveyor belt operations and 2). Drive-in operations. With conveyor belt operations, multiple cars can proceed through the tunnel simultaneously, and are pulled along through the wash tunnel by the conveyor belt, and during peak hours of operation, the dryer blowers (dominant noise producing component) may be in constant operation. With Drive-in styles one vehicle drives into the car wash tunnel and remains in place while the car wash operates around the vehicle. With this type of system one car is processed through the car wash tunnel at a time, and typical wash cycle times are approximately six (6) minutes, with the dryer blower in operation for approximately 90 seconds out of the 6-minute wash cycle time. The drive-in type of car wash operations is the most common at convenience store/fuel service retail operations while the conveyor belt type of car wash is more common with "stand-alone" car wash retail locations. Both types of car wash operations are discussed below.

Conveyor Belt Car Wash-
During peak hours of operation, conveyor belt car wash operations may be in constant operation, with the dryer blowers continuously operating. Therefore, the applicable noise standard would be the L_{50} noise level standards provided above in Table I (55 dB daytime and 50 dB nighttime). WJVA has conducted noise level measurements at numerous such car wash operations and has reviewed manufacturer-supplied noise level data. Noise levels associated with such operations typically range between approximately 83-87 dB a distance of twenty (20) feet from the tunnel entrance and exit.

The noise levels described above represent the noise levels that occur directly in front the tunnel entrance and exit. The blowers are located within the tunnel, and the tunnel provides acoustical shielding of blower noise to the sides of the car wash tunnel. Generally speaking, at a 45-degree angle from a car wash tunnel entrance/exit, noise levels are approximately 6-8 dB below noise levels measured directly in line with the tunnel, at the same distance. Additionally, at a 90-degree angle, WJVA has observed noise levels to be approximately 10-15 dB below noise levels measured directly in line with the tunnel, at the same distance.

Taking into account the above-described noise levels, applying the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance) and accounting for the acoustic shielding provided by the tunnel walls and existing residential sound walls, WJVA calculated expected car wash noise levels at the closest noise-sensitive receiver locations (residences) to the proposed car wash facility. Car wash noise levels would be approximately 51-55 dB at the residences located northeast of the car wash location and approximately 49-55 dB at the residences located west of the car wash location. Such noise levels could exceed the City's nighttime noise level standard at nearby residential land uses.

The noise levels described above apply noise levels measured and reviewed for Tommy Car Wash Systems, Peco Wash and Dryer System and MacNeil Wash Systems washers with Motor City drying systems. The noise data for Tommy Car Wash Systems and Peco Wash Systems are provided at the end of this report as Appendix D. Noise levels of the MacNeil Wash System with Motor City drying system were measured directly by WJVA.

Drive-Thru Car Wash-

As described above, with drive-thru type car wash operations (most common at convenience store/fuel service retail locations), one car is processed through the car wash tunnel at a time. Typical wash cycles take approximately 6 minutes in length, of which the dryer blowers are in operation for approximately 90 seconds per cycle. Taking these cycle times into account, the maximum number of car washes that could occur per hour would be ten (10). As described above, the blowers are in operation for approximately 90 seconds during each 6-minute cycle, with the resulting maximum blower operation time of fifteen (15) minutes during any one hour, and the resulting applicable noise standard would be the L_{25} noise level standards provided above in Table I (60 dB daytime and 55 dB nighttime).

The most common type of equipment associated with drive-thru style of car wash operations is the Mark VII ChoiceWash XT Wash System utilizing a Mark VII Dryer System. WJVA has measured noise levels at numerous locations utilizing this equipment and has also reviewed manufacturer-supplied noise level data. Noise levels measured by WJVA indicate that car wash noise levels for the drive-thru (Mark VII equipment) would be approximately 69 dB L_{50} during any one hour, at a distance of 50 feet directly in front of the entrance and exit of the tunnel. This noise level assumes the car wash is in constant peak operation during any given hour, and should therefore be considered a worst-case assessment of car wash operational noise levels.

Taking into account the above-described noise levels, applying the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance) and accounting for the acoustic shielding provided by the tunnel walls and existing residential sound walls, WJVA calculated expected car wash noise levels at the closest noise-sensitive receiver locations (residences) to the proposed car wash facility. Car wash noise levels would be approximately 47 dB at the residences located northeast of the car wash location and approximately 44 dB at the residences located west of the car wash location. Such noise levels would not exceed the applicable City of Bakersfield daytime or nighttime noise level standards.

Potential Impact

If the proposed car wash utilized the conveyor belt style of car wash tunnel operations, associated noise levels could exceed the City's nighttime noise level standard, if nighttime car wash operations were proposed.

Mitigation Measures

If the proposed car wash was to utilize the conveyor belt style of car wash tunnel operations, car wash noise levels could be mitigated by incorporating one of the following two measures:

- Restrict car wash operations to the daytime hours of 7:00 a.m. to 10:00 p.m.

- Tunnel/Bay Door: Incorporate a tunnel (bay) door at the entrance side of the tunnel. The bay door would only be required during nighttime (10:00 p.m. to 7:00 a.m.) operations. WJVA staff analyzed noise level test data provided by Bay Watch Car Wash Tunnel Door Solutions. Bay Watch provides custom car wash doors constructed to provide acoustic attenuation in noise-sensitive environments. The door would be installed at the northern tunnel opening, and would close once the vehicle has entered the car wash tunnel. The door would remain closed until the dry cycle has completed and the vehicle is ready to exit the tunnel.

  According to test data provided by Bay Watch, the inclusion of a polycarbonate door would reduce noise levels by approximately 11-14 dB at the nearby residential land uses. The noise level reduction provided by the door would reduce project-related noise levels at the nearby residential land uses to below the applicable City of Bakersfield nighttime noise level standards. As stated above, the usage of the bay door would not be required during daytime hours (7:00 a.m. to 10:00 p.m.) for compliance with the City's daytime noise level standard. Appendix D provides the noise test data for the Bay Watch tunnel door.

- Construction of a sound wall in the vicinity of the tunnel exit/entrance.

Once the exact type of car wash equipment and proposed hours of car wash operations are known, an acoustical analysis (specially addressing car wash noise levels) should be prepared by a qualified acoustic consultant to determine if car wash noise levels would result in a noise impact at nearby sensitive receptor locations, and to determine if mitigation measures are required to comply with the City's applicable noise level standards.

c. Noise From Construction (Less Than Significant)

Construction noise would occur at various locations within and near the project site through the build-out period. The distance from the closest residences to the project site is approximately 300 feet. Table VI provides typical construction-related noise levels at distances of 100 feet, 200 feet, and 300 feet.

TABLE VI

TYPICAL CONSTRUCTION EQUIPMENT MAXIMUM NOISE LEVELS, dBA

Type of Equipment	100 Ft.	200 Ft.	300 Ft.
Concrete Saw	84	78	74
Crane	75	69	65
Excavator	75	69	65
Front End Loader	73	67	63
Jackhammer	83	77	73
Paver	71	65	61
Pneumatic Tools	79	73	69
Dozer	76	70	66
Rollers	74	68	64
Trucks	80	72	70
Pumps	74	68	64
Scrapers	81	75	71
Portable Generators	74	68	64
Backhoe	80	74	70
Grader	80	74	70

Source: FHWA
Noise Control for Buildings and Manufacturing Plants, Bolt, Beranek & Newman, 1987

Construction noise is not considered to be a significant impact if construction is limited to the daytime hours and construction equipment is adequately maintained and muffled. Extraordinary noise-producing activities (e.g., pile driving) are not anticipated. The City of Bakersfield states that construction activities must be limited to the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends, when construction is within 1,000 feet of a residence. Construction noise impacts could result in annoyance or sleep disruption for nearby residents if nighttime operations were to occur or if equipment is not properly muffled or maintained.

d. Vibration Impacts (Less Than Significant)

The dominant sources of man-made vibration are sonic booms, blasting, pile driving, pavement breaking, demolition, diesel locomotives, and rail-car coupling. None of these activities are

anticipated to occur with construction or operation of the proposed project. Typical vibration levels at distances of 100 feet and 300 feet are summarized by Table VII. These levels would not be expected to exceed any significant threshold levels for annoyance or damage, as provided above in Table II and Table III.

TABLE VII

TYPICAL VIBRATION LEVELS DURING CONSTRUCTION

	PPV (in/sec)	
Equipment	**@ 100´**	**@ 300´**
Bulldozer (Large)	0.011	0.006
Bulldozer (Small)	0.0004	0.00019
Loaded Truck	0.01	0.005
Jackhammer	0.005	0.002
Vibratory Roller	.03	0.013
Caisson Drilling	.01	0.006

Source: *Caltrans*

After full project build out, it is not expected that ongoing operational activities will result in any vibration impacts at nearby sensitive uses. Activities involved in trash bin collection could result in minor on-site vibrations as the bin is placed back onto the ground. Such vibrations would not be expected to be felt at the closest off-site sensitive uses. Additional mitigation is not required.

e. Noise Impacts from Nearby Airports or Airstrips (No Impact)

The Project site is not located within two miles of a public airport or private airstrip. The Bakersfield Municipal Airport is located approximately 2.5 miles northeast of the project site.

5. IMPACT SUMMARY

This impact summary addresses only the noise impacts determined to be "potentially significant" and summarizes the mitigation measures that would be required to reduce noise levels to a "less than significant" level. Project-related noise levels resulting from the proposed project are not expected to exceed any applicable City of Bakersfield noise level standards if proper mitigation measures are incorporated into project construction operations. Potential impacts and correlating mitigation measures are described in detail above, and summarized below.

Potential Impact
The project would include an automated car wash, located within the convenience store/fuel service retail area located at the northeast corner of the project site. If the proposed car wash utilized the conveyor belt style of car wash tunnel operations (described in detail above), associated noise levels could exceed the City's nighttime noise level standard, if nighttime car wash operations were proposed.

Mitigation Measures
If the proposed car wash was to utilize the conveyor belt style of car wash tunnel operations, car wash noise levels could be mitigated by incorporating one of the following two measures:

- Restrict car wash operations to the daytime hours of 7:00 a.m. to 10:00 p.m.

- Tunnel/Bay Door: Incorporate a tunnel (bay) door at the entrance side of the tunnel. The bay door would only be required during nighttime (10:00 p.m. to 7:00 a.m.) operations. WJVA staff analyzed noise level test data provided by Bay Watch Car Wash Tunnel Door Solutions. Bay Watch provides custom car wash doors constructed to provide acoustic attenuation in noise-sensitive environments. The door would be installed at the northern tunnel opening, and would close once the vehicle has entered the car wash tunnel. The door would remain closed until the dry cycle has completed and the vehicle is ready to exit the tunnel.

  According to test data provided by Bay Watch, the inclusion of a polycarbonate door would reduce noise levels by approximately 11-14 dB at the nearby residential land uses. The noise level reduction provided by the door would reduce project-related noise levels at the nearby residential land uses to below the applicable City of Bakersfield nighttime noise level standards. As stated above, the usage of the bay door would not be required during daytime hours (7:00 a.m. to 10:00 p.m.) for compliance with the City's daytime noise level standard. Appendix D provides the noise test data for the Bay Watch tunnel door.

- Construction of a sound wall in the vicinity of the tunnel exit/entrance.

Once the exact type of car wash equipment and proposed hours of car wash operations are known, an acoustical analysis (specially addressing car wash noise levels) should be prepared by a qualified acoustic consultant to determine if car wash noise levels would result in a noise impact at nearby sensitive receptor locations, and to determine if mitigation measures are required to comply with the City's applicable noise level standards.

6. SOURCES CONSULTED

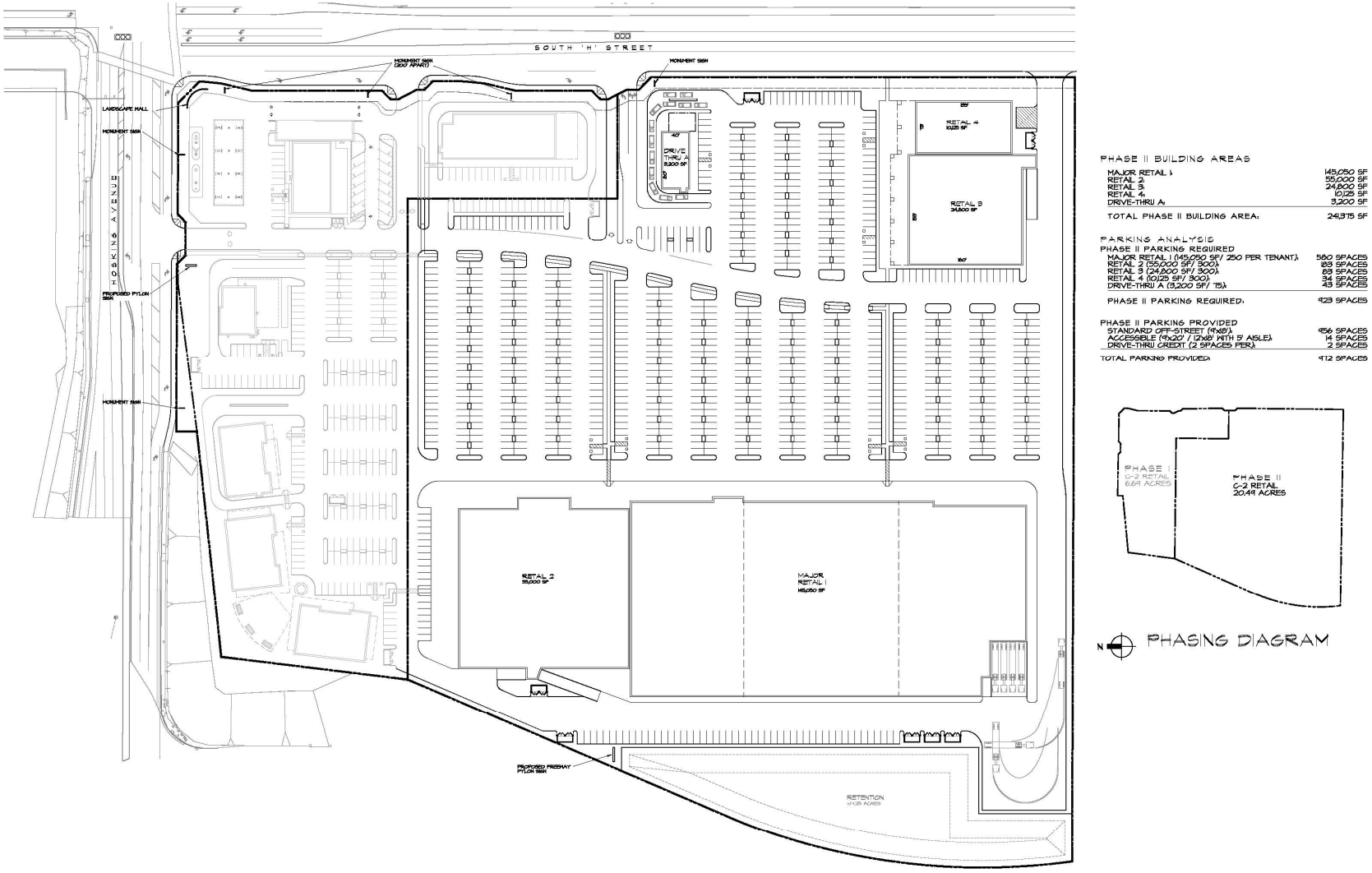
1. *City of Bakersfield, Metropolitan Bakersfield General Plan, December 2002.*

2. City of Bakersfield, Municipal Code Section 9.22.050, *Noise During Construction*, 1999.

3. California Department of Transportation, *Transportation and Construction Vibration Guidance Manual,* September 2013.

4. Federal Highway Administration, *Traffic Noise Model, Version 2.5,* April 14, 2004

FIGURE 1: PROJECT SITE PLAN



PHASE II BUILDING AREAS

MAJOR RETAIL 1:	145,050 SF
RETAIL 2:	55,000 SF
RETAIL 3:	24,800 SF
RETAIL 4:	10,125 SF
DRIVE-THRU A:	3,200 SF
TOTAL PHASE II BUILDING AREA:	241,375 SF

PARKING ANALYSIS

PHASE II PARKING REQUIRED

MAJOR RETAIL 1 (145,050 SF/ 250 PER TENANT):	580 SPACES
RETAIL 2 (55,000 SF/ 300):	183 SPACES
RETAIL 3 (24,800 SF/ 300):	83 SPACES
RETAIL 4 (10,125 SF/ 300):	34 SPACES
DRIVE-THRU A (3,200 SF/ 75):	43 SPACES
PHASE II PARKING REQUIRED:	923 SPACES

PHASE II PARKING PROVIDED

STANDARD OFF-STREET (9'x18'):	456 SPACES
ACCESSIBLE (9'x20' / 12'x18' WITH 5' AISLE):	14 SPACES
DRIVE-THRU CREDIT (2 SPACES PER):	2 SPACES
TOTAL PARKING PROVIDED:	472 SPACES

N PHASING DIAGRAM

FIGURE 2: PROJECT VICINITY AND AMBIENT NOISE MONITORING SITES

FIGURE 3: HOURLY NOISE LEVELS AT LONG-TERM MONITORING SITE LT-1

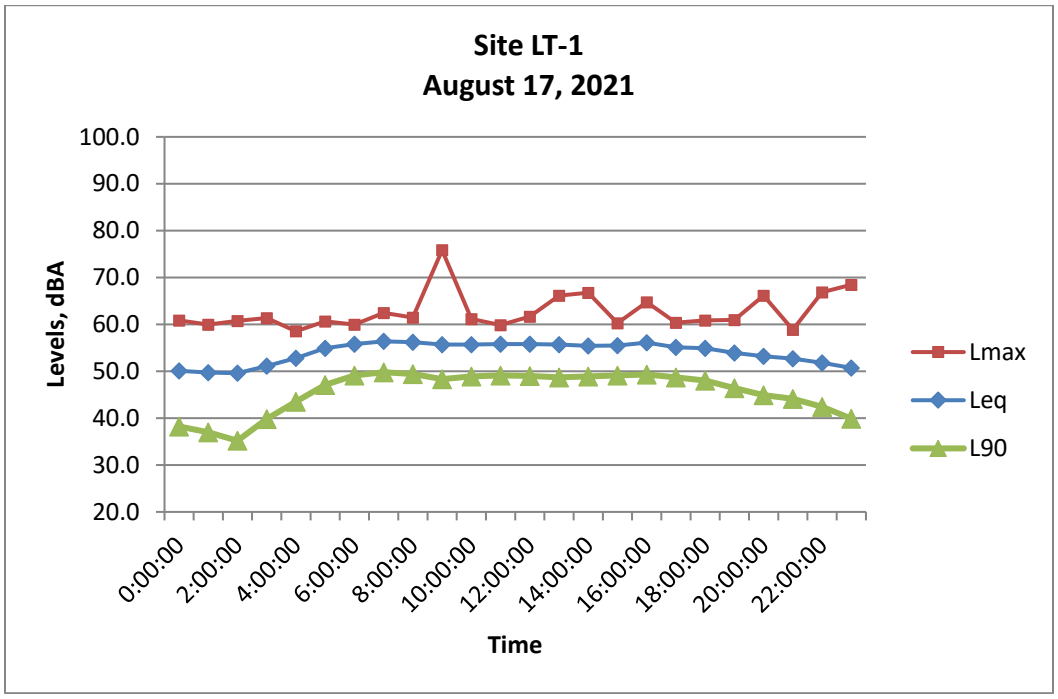


FIGURE 4: HOURLY NOISE LEVELS AT LONG-TERM MONITORING SITE LT-2

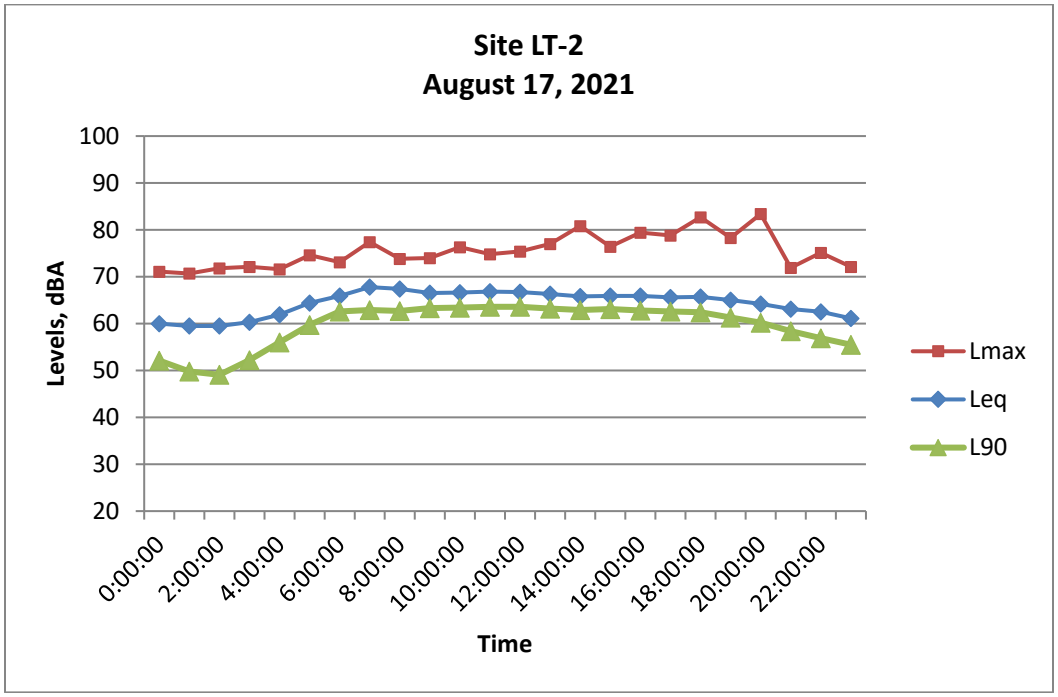
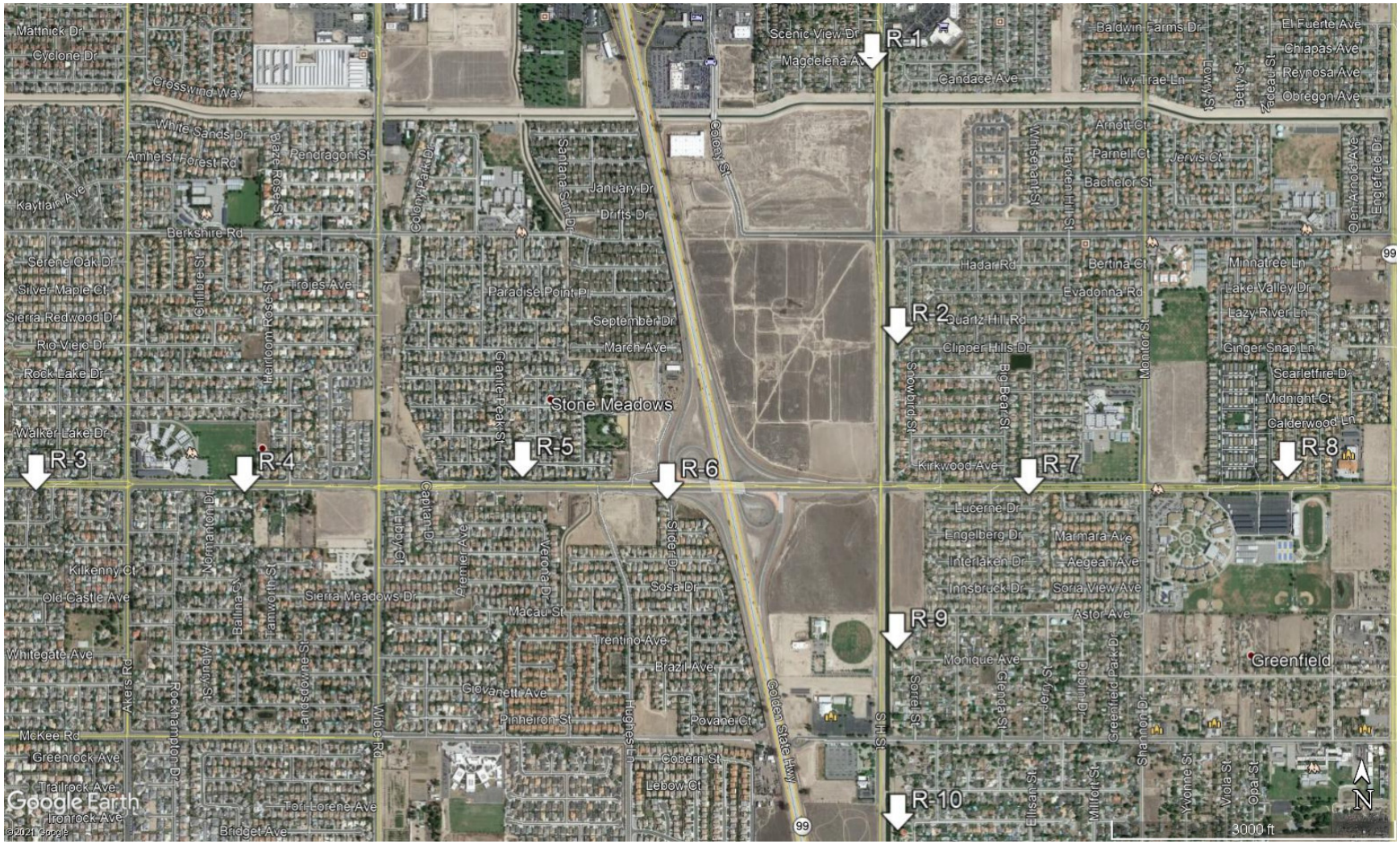


FIGURE 5: LOCATIONS OF MODELED TRAFFIC NOISE RECEPTORS



APPENDIX A-1

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.

A-2

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.

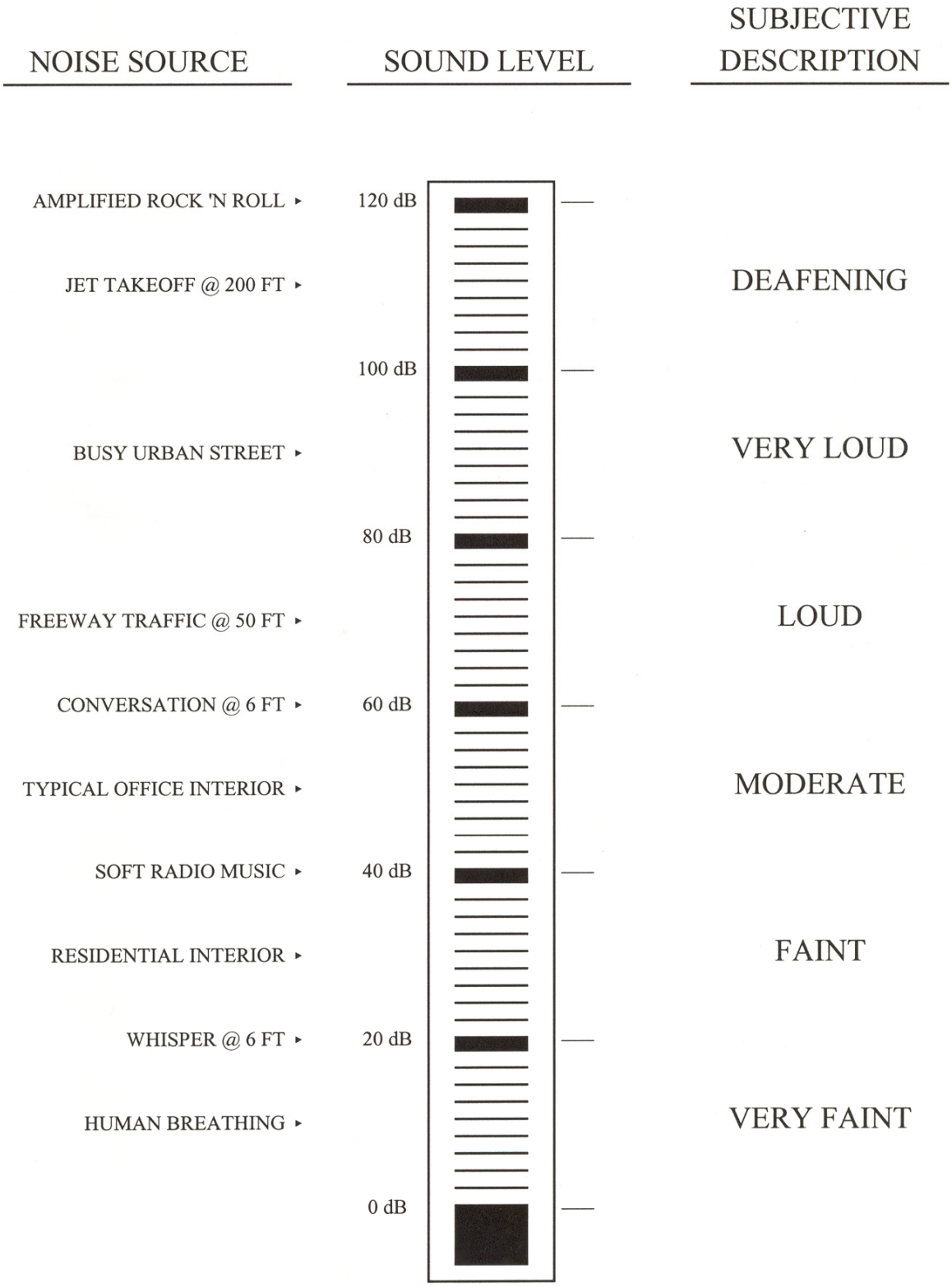
NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of Anoise level reduction" combines the effect of the transmission loss 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.

APPENDIX B
EXAMPLES OF SOUND LEVELS



APPENDIX C

TRAFFIC NOISE MODELING CALCULATIONS

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
March 24, 2022

Project #:	21-40
Description:	Existing
Ldn/Cnel:	CNEL
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	S. H Street	Panama Ln to Berkshire Rd R-1	8958	77	14	9	2	1	50	70	
2	S. H Street	Berkshire Rd to Hosking Ave R-2	9020	77	14	9	2	1	50	185	
3	Hosking Ave	Stine Rd to Akers Rd R-3	9458	77	14	9	2	1	50	80	
4	Hosking Ave	Akers Rd to Wible Rd R-4	11286	77	14	9	2	1	50	85	
5	Hosking Ave	Wible Rd to Hughes Ln R-5	15267	77	14	9	2	1	50	90	
6	Hosking Ave	Hughes Ln to SR 99 On Ramp R-6	15627	77	14	9	2	1	50	140	
7	Hosking Ave	S. H St to Monitor St R-7	14857	77	14	9	2	1	50	90	
8	Hosking Ave	Monitor St to Union Ave R-8	7713	77	14	9	2	1	50	90	
9	S. H Street	Hosking Ave to McKee Rd R-9	6251	77	14	9	2	1	50	180	
10	S. H Street	McKee Rd to Tafty Hwy R-10	6263	77	14	9	2	1	50	190	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
March 24, 2022

Project #:	21-40
Description:	Existing + project
Ldn/Cnel:	CNEL
Site Type:	Soft

Contour Levels (dB) 60 65 70 75

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	S. H Street	Panama Ln to Berkshire Rd R-1	10937	77	14	9	2	1	50	70	
2	S. H Street	Berkshire Rd to Hosking Ave R-2	11868	77	14	9	2	1	50	185	
3	Hosking Ave	Stine Rd to Akers Rd R-3	10819	77	14	9	2	1	50	80	
4	Hosking Ave	Akers Rd to Wible Rd R-4	13162	77	14	9	2	1	50	85	
5	Hosking Ave	Wible Rd to Hughes Ln R-5	18006	77	14	9	2	1	50	90	
6	Hosking Ave	Hughes Ln to SR 99 On Ramp R-6	18018	77	14	9	2	1	50	140	
7	Hosking Ave	S. H St to Monitor St R-7	20073	77	14	9	2	1	50	90	
8	Hosking Ave	Monitor St to Union Ave R-8	8571	77	14	9	2	1	50	90	
9	S. H Street	Hosking Ave to McKee Rd R-9	7441	77	14	9	2	1	50	180	
10	S. H Street	McKee Rd to Tafty Hwy R-10	7029	77	14	9	2	1	50	190	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
March 24, 2022

Project #:	21-40
Description:	2041
Ldn/Cnel:	CNEL
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	S. H Street	Panama Ln to Berkshire Rd R-1	16061	77	14	9	2	1	50	70	
2	S. H Street	Berkshire Rd to Hosking Ave R-2	17837	77	14	9	2	1	50	185	
3	Hosking Ave	Stine Rd to Akers Rd R-3	18959	77	14	9	2	1	50	80	
4	Hosking Ave	Akers Rd to Wible Rd R-4	23051	77	14	9	2	1	50	85	
5	Hosking Ave	Wible Rd to Hughes Ln R-5	31241	77	14	9	2	1	50	90	
6	Hosking Ave	Hughes Ln to SR 99 On Ramp R-6	31678	77	14	9	2	1	50	140	
7	Hosking Ave	S. H St to Monitor St R-7	28497	77	14	9	2	1	50	90	
8	Hosking Ave	Monitor St to Union Ave R-8	20737	77	14	9	2	1	50	90	
9	S. H Street	Hosking Ave to McKee Rd R-9	11129	77	14	9	2	1	50	180	
10	S. H Street	McKee Rd to Tafty Hwy R-10	7204	77	14	9	2	1	50	190	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
March 24, 2022

Project #:	21-40
Description:	2041 + project
Ldn/Cnel:	CNEL
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	S. H Street	Panama Ln to Berkshire Rd R-1	18040	77	14	9	2	1	50	70	
2	S. H Street	Berkshire Rd to Hosking Ave R-2	20685	77	14	9	2	1	50	185	
3	Hosking Ave	Stine Rd to Akers Rd R-3	20320	77	14	9	2	1	50	80	
4	Hosking Ave	Akers Rd to Wible Rd R-4	24927	77	14	9	2	1	50	85	
5	Hosking Ave	Wible Rd to Hughes Ln R-5	33620	77	14	9	2	1	50	90	
6	Hosking Ave	Hughes Ln to SR 99 On Ramp R-6	34069	77	14	9	2	1	50	140	
7	Hosking Ave	S. H St to Monitor St R-7	33713	77	14	9	2	1	50	90	
8	Hosking Ave	Monitor St to Union Ave R-8	21595	77	14	9	2	1	50	90	
9	S. H Street	Hosking Ave to McKee Rd R-9	12319	77	14	9	2	1	50	180	
10	S. H Street	McKee Rd to Tafty Hwy R-10	7970	77	14	9	2	1	50	190	

APPENDIX D

CAR WASH EQUIPMENT NOISE LEVEL DATA

Sound Level Measurements for BayWatch Triple Wall (16mm) Polycarbonate Doors

Car Wash w/ Free Standing Dryer (30hp)

Feet From Door	Door Open	Door Closed
5’	95 db	81 db
10’	92 db	79 db
15’	90 db	78 db
20’	85 db	76 db
30’	83 db	72 db

Car Wash w/ On-Board Dryer (30hp)

Feet From Door	Door Open	Door Closed
5’	94 db	81 db
10’	92 db	78 db
15’	85 db	74 db
20’	83 db	71 db
30’	81 db	68 db

ABD Engineering & Design
Architectural Acoustics • AV Design • Noise & Vibration

June 30, 2020

Introduction

ABD Engineering & Design, Inc., (ABD) was retained by Tommy Car Wash to complete a noise study of the new facility at 4665 32nd Ave, Hudsonville, MI 49426. Both long term and short term sound level measurements were collected at the site to capture noise levels generated by the Car Wash. Long term measurements were initiated on June 17, 2020 at 7:00 AM and were concluded on June 18, 2020 at 11:00 AM. Short term measurements were conducted on the morning of June 17. The following report details relevant acoustical concepts, and the results of our acoustical measurements.

Acoustical Terminology and Concepts

When dealing with sound, there is the physical quantity which is expressed as sound level and the perceived level which is expressed as loudness. Sound level is measured in units called decibels (abbreviated dB). Decibels are power ratios and are logarithmic quantities. Audible sound occurs over a wide frequency range, from approximately 20 Hertz (Hz) to 20,000 Hz. Human hearing does not respond equally to sounds at different frequencies (or pitch). Lower frequency sounds that are equally as "loud" have a much higher decibel level than high frequency sounds. To accommodate this variation in frequency sensitivity of human hearing, a frequency weighting can be applied to sound level measurements. When the weighting is applied, the resulting sound level measurements are said to be "A-weighted" and the decibel level is abbreviated dBA.

While the decibel or A-weighted decibel are the basic units used for noise measurement, other indices are also used. One common index, the equivalent sound level, abbreviated as Leq, is commonly used to indicate the average sound level over a period of time. Leq represents the steady level of sound which would contain the same amount of sound energy as does the actual time varying sound level. Although it is an average, it is strongly influenced by the loudest events occurring during the time period because these loudest events contain most of the sound energy.

Listed in Table 1 are some commonly encountered noises, their A-weighted level, and associated subjective evaluations:

Table 1: Noise Source Comparison

Subjective Evaluation	A-weighted Decibels		Examples
Deafening	140 dBA		Near Jet Engine
	130 dBA		Threshold of Pain
	120 dBA		Threshold of Feeling – Hard Rock Band
Very Loud	100 dBA		Loud Auto Horn (at 10 ft)
	90 dBA		OSHA 8 Hour Noise Exposure Limit
Loud	80 dBA		Shouting at 1m (3 ft)
	70 dBA		Busy Office
Moderate	60 dBA		Conversational Speech at 1m (3 ft)
	50 dBA		Average Office
Faint	40 dBA		Soft Radio Music in Apartment
	30 dBA		Average Residence without Stereo Playing
Very Faint	20 dBA		Average Whisper
	10 dBA		Human Breathing
Threshold of Hearing	0 dBA		Threshold of Audibility

Adapted from *Concepts in Architectural Acoustics* by M. David Egan (1972) and *Architectural Acoustics: Principles and Design* by M. Mehta, J. Johnson, and J. Rocafort (1999)

Instrumentation

One (1) Larson-Davis Laboratories Model 831 sound level meter was used for all short term measurements reported here. The Model 831 sound level meter was equipped with a Larson-Davis Laboratories model 377B20 microphone and Larson-Davis Laboratories Model PRM831 preamplifier. This meter conforms to the ANSI Standard Specifications for Sound Level Meters S1.4-1983 (R2006), Type 1 (Precision), and the IEC Standard 61672-1 Ed. 1.0 (2002-05), Sound-Level Meters, Class 1. The instrument was calibrated and is traceable to The National

Institute of Standards. Evidence of traceability is on file at the Larson Davis Corporate Headquarters. The meter calibration was field verified before and after the measurement session.

Four Soft-dB, Piccolo Model sound level meters were used for A-weighted measurements for the 24-hour noise study. These meters conform to ANSI Standard Specifications for Sound Level Meters S1.4-1983 (R2006), Type 2, and the IEC Standard 61672-1 Ed. 1.0 (2002-05), Sound Level Meters Class 2. The instruments were calibrated and are traceable to the National Institute of Standards. Evidence of traceability is on file at the Soft-dB Corporate Headquarters. The meters were field verified before and after the measurement session.

Atmospheric Conditions

ABD completes noise measurements within atmospheric limits specified in ANSI S12.9 *Quantities and Procedures for Description and Measurement of Environmental Sound* and S12.18 *Outdoor Measurement of Sound Pressure Level* for environmental noise measurements. Data measured during higher wind speeds risk reliability contamination due to wind noise on the microphone, and repeatability limitations due to the directionality of the receiver relative to the noise source.

The environmental conditions, as measured at the Gerald R. Ford International Airport, in Grand Rapids MI on June 17-18, 2020 were within the range of the specified limits and are summarized in Table 2.

Table 2: Environmental conditions during testing over June 17 & 18, 2020

Time	Average Temperature (F)	Average Relative Humidity	Nominal Wind Direction	Average Wind Speed (MPH)	Precipitation (in.)
June 17-18, 2020	72°	58 %	E	3.8 mph	0.0 in

Environmental data provided by www.wunderground.com, from the Gerald R. Ford International Airport Weather Station

Noise Measurements

Noise measurements were completed at a variety of interior and exterior positions, as shown in Figure 1. The measurement locations indicated by the red squares are where the long-term measurements were taken. The locations indicated by the blue circles (and the blue gradations) are the suggested measurement locations by Tommy Car Wash and represent the short-term measurements taken while on site.

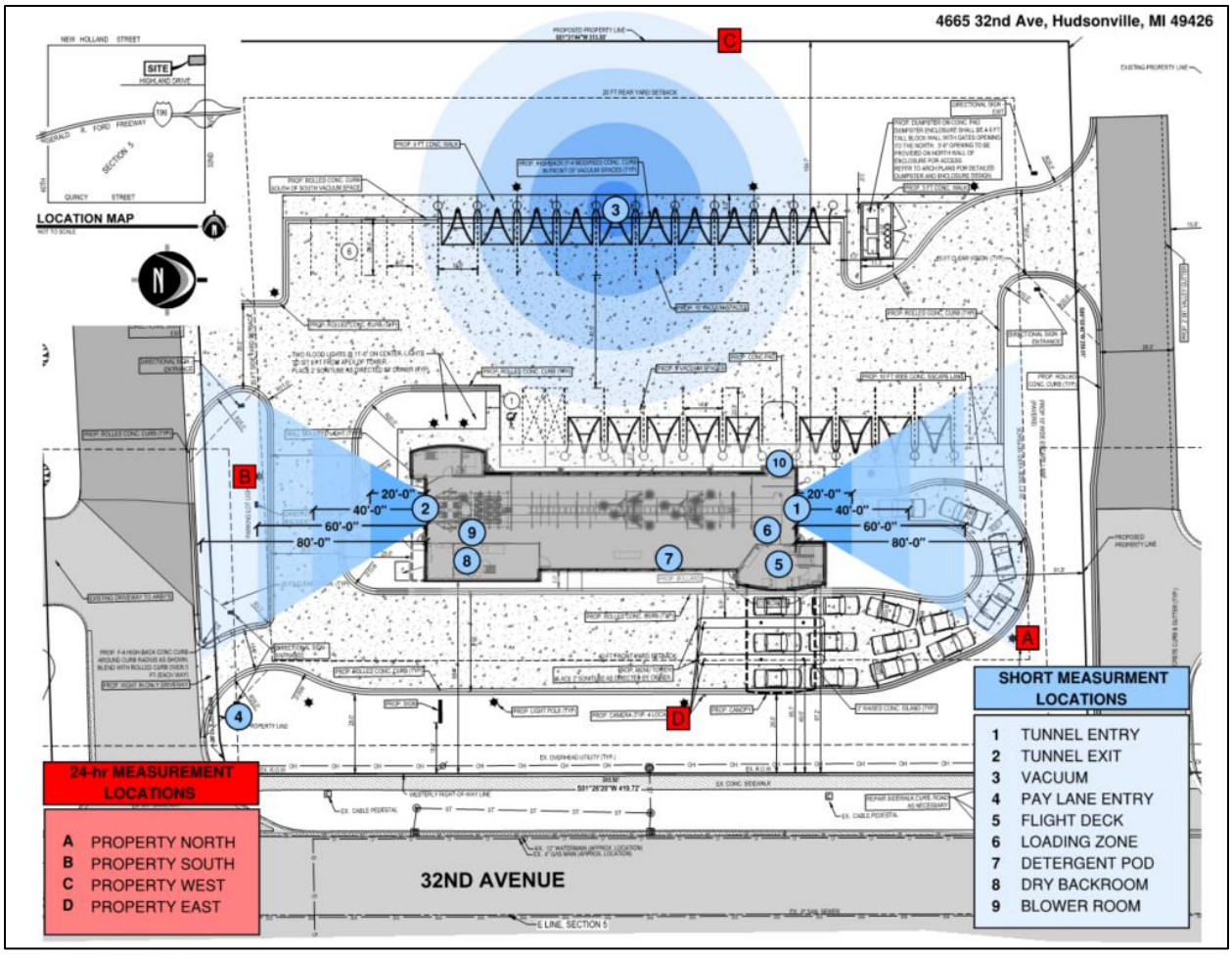


Figure 1: Site Plan with Measurement Locations

Short-Term Measurements

A description of each measurement location is provided for clarity. The short-term measurements (1-10) were taken with the Larson Davis Model 831 hand-held meter.

1) Tunnel Entry: This position is the vehicular entry location to the car-wash structure. Measurements were also taken at the vehicle entry to the building and at 20', 40' and 60' from the entrance towards the north of the building. All measurements were in-line with the vehicle path as it moves through the car-wash process.

2) Tunnel Exit: This position is the vehicular exit location to the car-wash structure. Measurements were also taken at the vehicle's exit location at distances of 20', 40', 60', and 80' from the exit towards the south of the building. All measurements were in-line with the vehicle path as it exits the car-wash process.

3) Vacuum: This position is intended to capture the operational noise of a single vacuum unit for which Vacuum #12 was selected. It was observed that on this unit with both hose nozzles stowed, there was a significant whistling noise being generated by the air-flow

leakage at the storage pocket. Since typical use would involve using at least one of the hoses, one hose was removed from its pocket and placed on the ground during measurements.

Measurements were also taken relative to this vacuum station at distances of 20', 40', 60', and 80' to the west of the vacuum bay. These measurements of vacuum operational noise at these distances to the west were completed with all vacuum units within this bay operating simultaneously. This was in order to capture the loudest operating condition.

4) Pay Lane Entry: This location is the vehicle entry point to the property, for users who proceed through the car wash process.
5) Flight Deck: This location was to capture the noise within the enclosed office area where employees interact with customers through the drive-through window.
6) Loading Zone: This is the position where vehicles are transitioned onto the conveyer system for shuttling the car through the car-wash mechanism.
7) Detergent Pod: This position is located behind the bank of car-wash detergent chemical storage and delivery tanks.
8) Dry Backroom: This position is located within a separate closed room behind the blower bay of the car-wash facility. Chemical pumping equipment was observed within this room.
9) Blower Room: This space is the area where the air-blowers are used to dry the vehicles after being washed and rinsed, it is near the vehicular exit of the car-wash structure.
10) Mat Washer: This position is the location of two separate, self-service car mat-washer machines. Three measurements were taken at this position with one (1) of the mat washers on and operating, but no floor mat was being conveyed into the machine. The specific measurement locations are as follows: 3 ft. in front of door with the door closed, 6' in front of the door with the door closed, and 3' in front of the door with the door open.

It should be noted that noise measurements on the interior of the car wash were collected at these various locations, and during multiple operating conditions for the car wash. This was done to provide a general understanding of the noise generated within the car wash, as requested by Tommy Car Wash. It should be understood that the noise measurements that were collected are strictly informational. To understand regulations for OSHA's allowable noise exposure, please refer to the OSHA standard. For compliance to this standard, noise dosimetry testing should be performed on individual employees that spend significant amounts of time in high noise areas that are identified in the following results. Listed in Table 3 are the results of these short-term measurements. Reported here are the loudest measured levels at each measurement location over the various operating conditions evaluated.

Table 3: Short-term Measurement Results

Short-term Measurement Locations	Measured Sound Pressure Level dB(A)[1]
(1) Tunnel Entry	86
(2) Tunnel Exit	95
(3) Vacuum	90
(4) Pay Lane Entry	67
(5) Flight Deck	66
(6) Loading Zone	91
(7) Detergent Pod	93
(8) Dry Backroom	92
(9) Blower Room	104
(10) Mat Washer	86

Utilizing the short-term measurement results, we have projected how noise generated by Tommy Car Wash will propagate over the property; these results are shown in Figure 2. Please note that our measurements at distances away from the vacuum include the noise levels with all vacuums in operation (worst case scenario). This "all-vacuums on" condition was projected onto the entire property for the sound map. It should be noted that noise contribution from the vacuums dominated the noise levels at the entrance, so the results shown at the entrance on the sound map exceed the short term measurements taken in these locations with no vacuum in operation.

[1] Reported values are for the loudest operating condition captured during the measurement session.

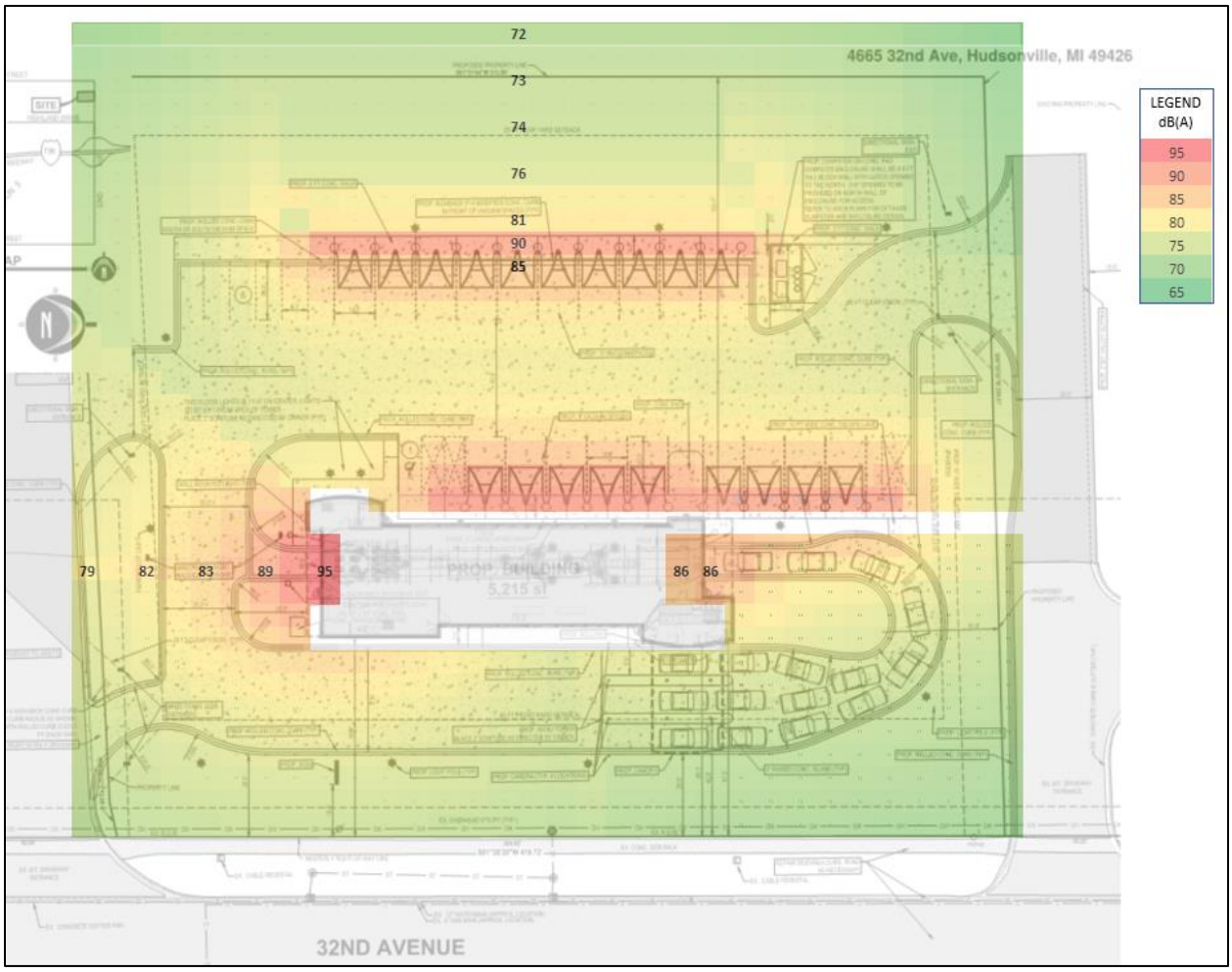


Figure 2: Sound Map of Tommy's Car Wash Property

Long-Term Measurements

The long-term measurements (A-D) were taken with the Soft-dB Piccolo meters and located at the perimeter of the property as shown in Figure 1. Locations A, B, and D were approximately 9' above the ground. Location C was 5' above the ground.

All meters were set to run with a 1-second sampling interval and using exponential (slow) detector integration methods. The time-history results of these long-term measurements over the time interval are shown in Figure 3.

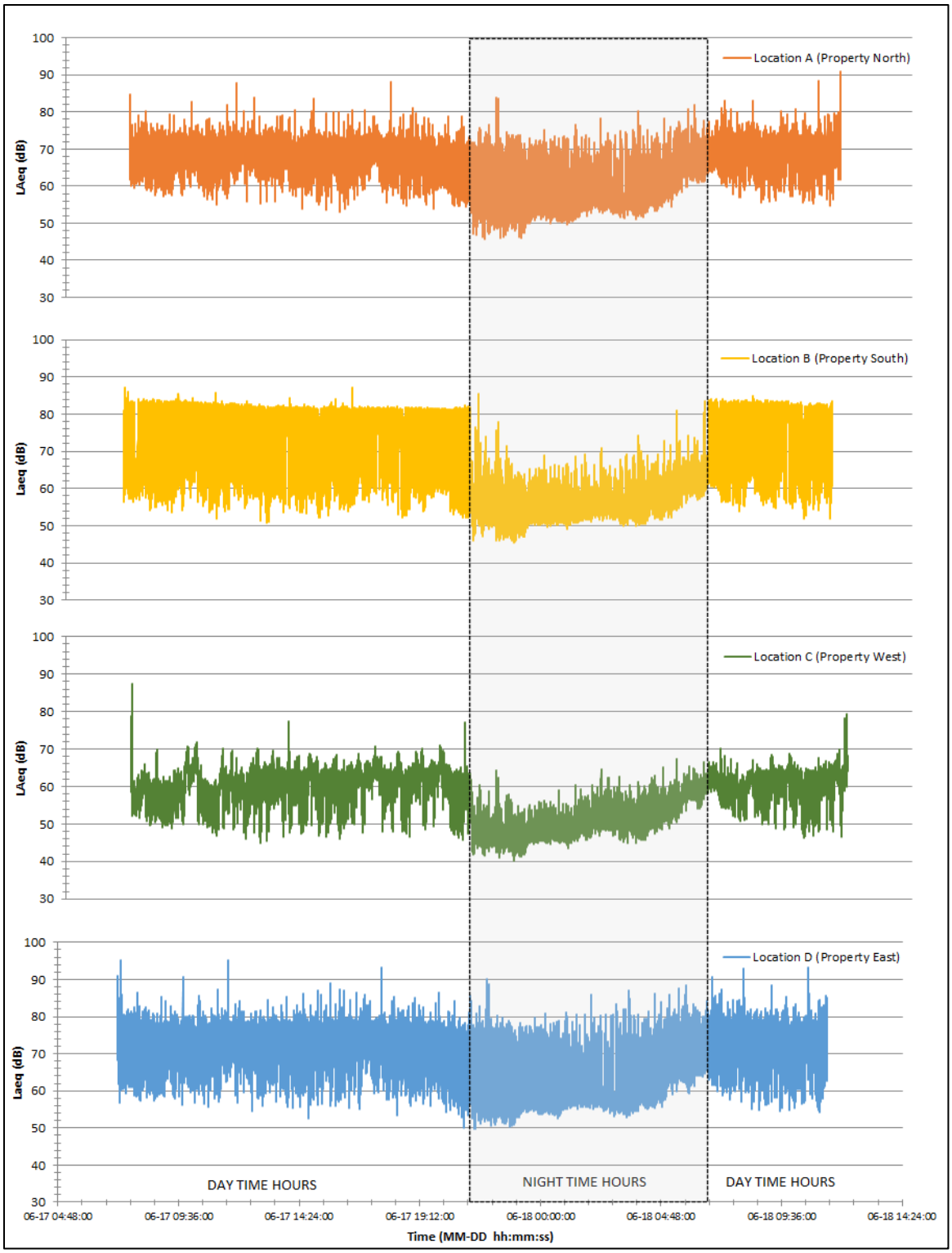


Figure 3: Time-History Results of Long-Term Measurements

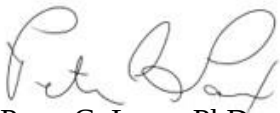
Measurement Location A and D, on the street side of the property, show no clear transition between the car wash operational noise and the nighttime noise collected at this position. Consistent with observations made at site, the noise at these locations is dominated by general traffic noise. Also note that at both Location A and D, there are a significant number of short-term peaks in these time histories. Again, based on observations made on site, these peaks are likely due to motorcycles passing by, and trucks traversing pot-holes producing a series of "bangs & clanks" as the vehicle navigated the uneven road surface.

Noise data at Location B and C clearly show a distinction between the day-time (operational hours) and night-time noise levels. Location B in particular, has the loudest consistent noise levels due to the dryers at the exit..

If you have any questions, please call.

Sincerely,

ABD ENGINEERING & DESIGN, INC.
Per:



Peter C. Laux, PhD
Chief Scientist and Senior Consultant

Quincey Smail
Acoustical Consultant

cc: Marci Boks – ABD Engineering & Design

BACKGROUND NOISE
62.0dB WITH TRAFFIC
51.6dB MIN. WITHOUT TRAFFIC
125'-0" FROM EXIT
DOOR OPENING
66.0dB

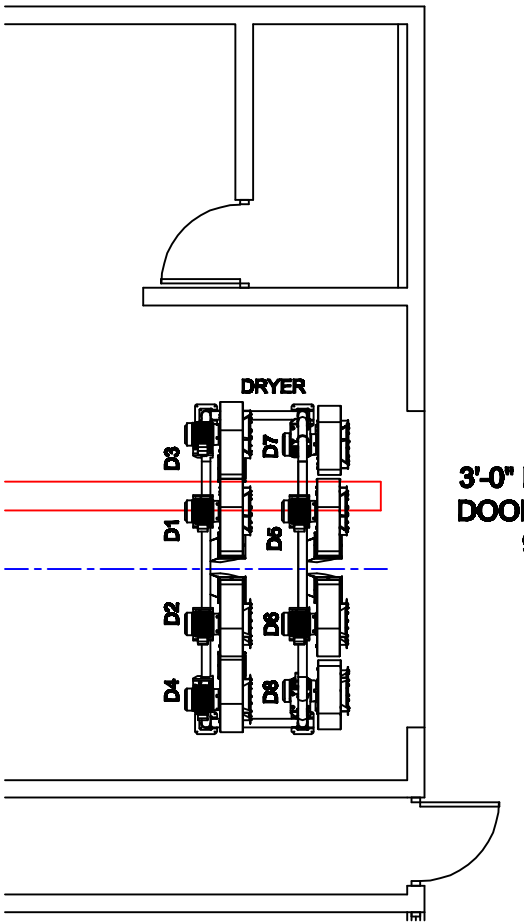
120'-0" FROM EXIT
DOOR OPENING
66.0dB

100'-0" FROM EXIT
DOOR OPENING
67.3dB

Peco Car Wash Equipment
Peco #990682 15 Horse Power Blower

80'-0" FROM EXIT
DOOR OPENING
71.5dB

40'-0" FROM EXIT
DOOR OPENING
78.4dB



3'-0" FROM EXIT
DOOR OPENING
96.2dB

20'-0" FROM EXIT
DOOR OPENING
87.3dB

40'-0" FROM EXIT
DOOR OPENING
83.9dB

60'-0" FROM EXIT
DOOR OPENING
77.4dB

SOUND LEVEL MEASUREMENTS