June 2, 2022

Mr. Rodney Boden
VWP Escondido, LLC
2390 E Camelback Rd Ste. 305
Phoenix, AZ 85016

Subject: Meyers Avenue Industrial Warehouse Project – Blasting Noise and Vibration Evaluation

Dear Mr. Boden:

MD Acoustics, LLC (MD) completed a blasting and vibration evaluation for the proposed Meyers Avenue Industrial Warehouse project located at 2351 Meyers Avenue in the City of Escondido, CA. This report evaluates the potential noise and vibration impacts at locations where blasting may occur to remove rock and debris.

1.0 Assessment Overview

MD has evaluated the noise and vibration impact from the potential use of ammonium nitrate and fuel oil (ANFO) blasting agent at the said project site. The concern of damage from ground vibration, airblast, and flyrock from blasting are typical major concerns to adjacent land uses/owners. The purpose of this evaluation is to provide further information on blasting and the science behind the blasting noise and vibration calculations and to evaluate the potential impact to any adjacent sensitive uses. Exhibit A is a site map of the project site, and Exhibit B shows the boring plan with the presumed non-rippable rock location.

2.0 Noise and Vibration Requirements

2.1 City of Escondido

The City of Escondido outlines their blasting regulations in Ordinance no. 2013-13. The City outlines different procedures for whether the project qualifies as a major or minor blasting. To qualify as a minor blasting project, the following criteria must be met:

1. Quantity of rock to be blasted does not exceed one hundred (100) cubic yard per shot
2. Bore hole diameter does not exceed two inches (2”)
3. Hole depth does not exceed twelve feet (12’)
4. Maximum charge weight does not exceed eight (8) pounds of explosives per delay
5. The initiation of each charge will be separated by at least 10 milliseconds.

For blasting within 300 feet of an existing building, seismic monitoring is mandatory during blasting.

The blasting operation procedures for minor blasts are as follows:

1. Notification: Prior to issuance of a Blasting Permit, the general contractor or property owner/developer or blaster shall give a reasonable notice in writing, but not less than 12 hours

prior to the blasting occurrence, to all residences (including mobile homes), businesses or structures on contiguous properties or at the discretion of the Fire Department. The notice shall be in a form approved by the Fire Chief, and shall include, but not be limited to, the following:

   a. A statement indicating that the notice is given as part of the permitting/development process.
   b. The location, address, and type of development.
   c. The anticipated date and the estimated duration of blasting operations.
   d. The name, address and telephone number of the blaster and/or developer as well as the Fire Department's contact person's name, address and telephone number.

2. General Requirements: All blasting operations shall be monitored by an approved seismograph located at the nearest man-made structure. All daily seismograph reports shall be forwarded to the Fire Department by the end of the business week.

Major blasting projects have additional requirements such as notification within 600 feet of blasting and pre-/post-blasting building inspections for all buildings within 300 feet of blasting.

Blasting is only permitted between the hours of 9 AM and 4 PM, Monday through Thursday unless warranted with approval granted by the fire code official.

2.2 City of San Marcos

The project is adjacent to the City of San Marcos which outlines their blasting regulations in Chapter 17.60 of their municipal code. The City of San Marcos has blasting operations procedures similar to the City of Escondido which must be followed for all properties within the City of San Macros buildings, including notification of all buildings within 600 feet of blasting. Escondido also provides maximum charge weights allowed for different distances to the nearest man-made structure. These charge weight requirements will be met by the project.

In addition, MD will utilize the specifications outlined by the U.S. Bureau of Mines and Office of Surface Mining and Reclamation Enforcement (OSMRE).

2.3 U.S. Bureau of Mines

In 1974, USBM began a study to gather and update available blast vibration data. Work was included in the area of structural and human response to vibration. This resulted in the publishing in 1980 of USBM RI 8507, "Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting." Some of the conclusions contained in the report are as follows:

- The potential for damage to residential structures is greater with low-frequency blast vibration (below 40 Hz) than with high-frequency blast vibration (40 Hz and above).
- The type of residential construction is a factor in the vibration amplitude required to cause damage.
- For low-frequency blast vibration, a limit of **0.75 in/sec** for modern drywall construction and **0.50 in/sec** for older plaster-on-lath construction was proposed. For frequencies above 40 Hz, a limit of 2.0 in/sec for all types of construction was proposed. Alternative blasting-level criteria were also proposed that used the above limits over a wide range of frequencies and included some limits on displacement.

Exhibit A
Site Plan

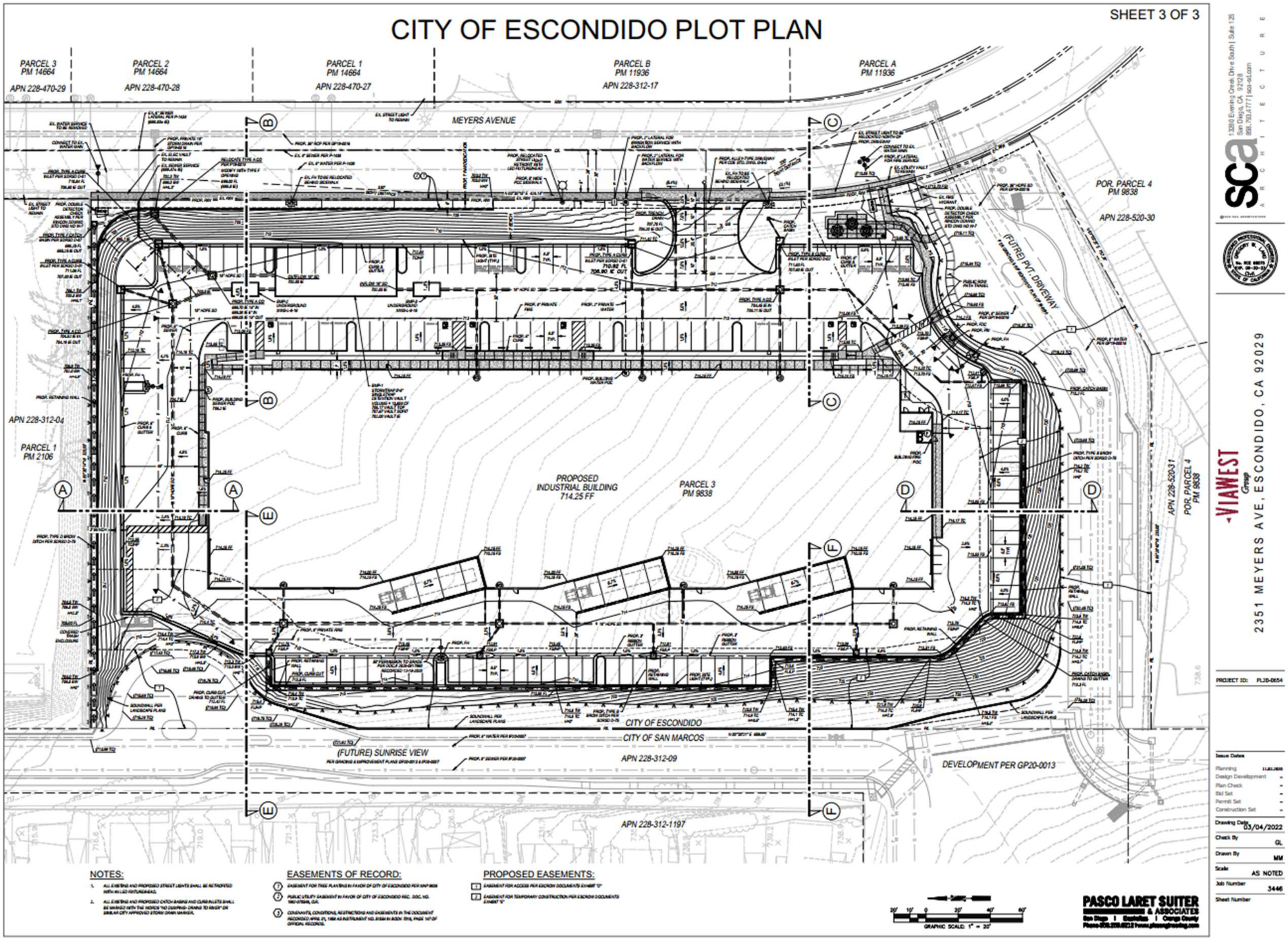
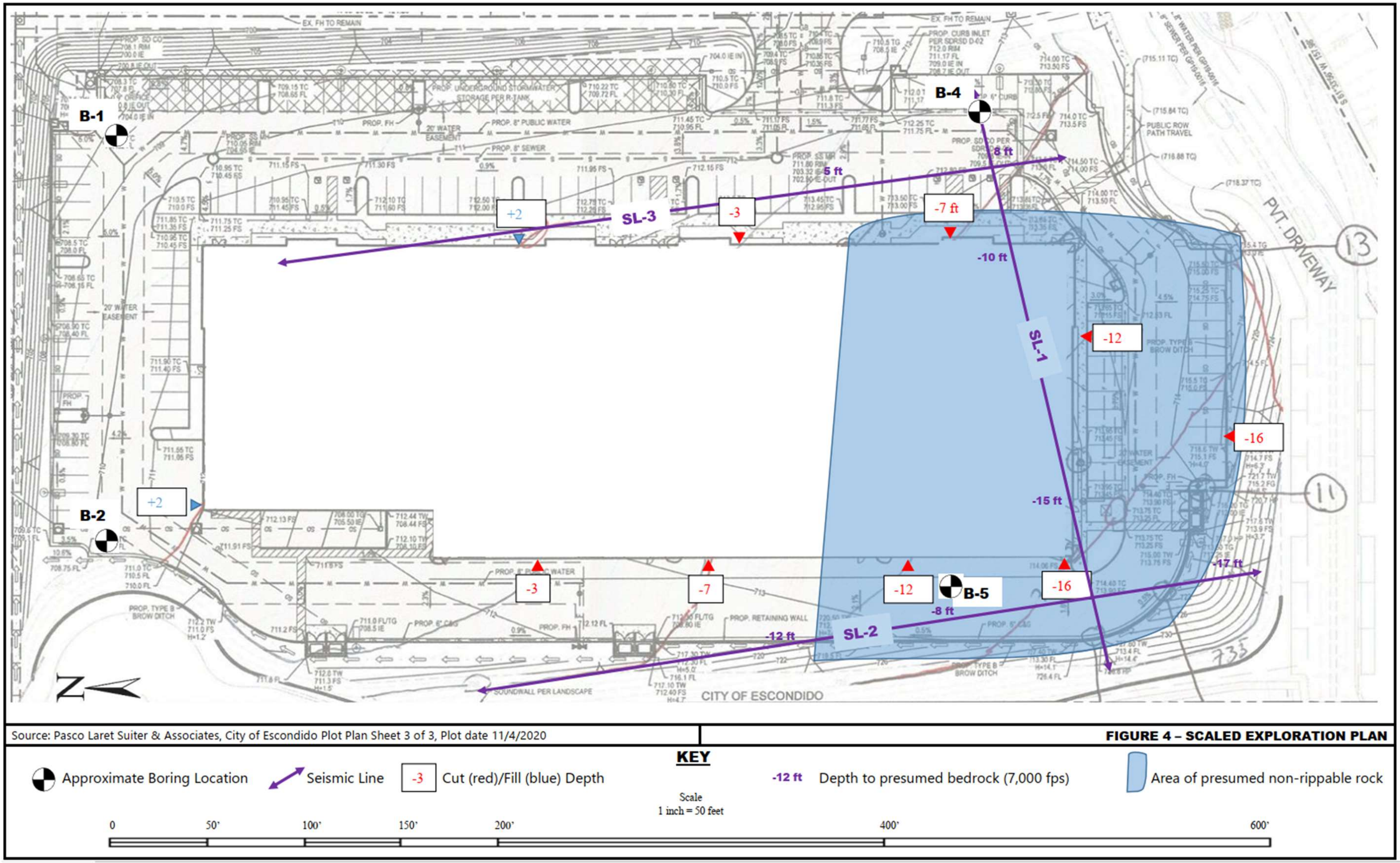


Exhibit B
Boring Map with Presumed Non-Rippable Rock Location



2.4 Office of Surface Mining and Reclamation Enforcement

In 1983, OSMRE established regulations controlling vibration at all surface coal mining operations. Three optional methods of limiting vibration are allowed:

1. The first option limits PPV based on the distance to the nearest protected structure. Each blast must be monitored by a seismograph. With this option, velocities must be kept at or below the following levels:

- Distances up to 300 ft.: 1.25 in/sec
- Distances of 301–5,000 ft.: 1.00 in/sec
- Distances beyond 5000 ft.: 0.75 in/sec

2. The second option does not require monitoring but requires the operator to design his blasts utilizing Square-Root Scaled Distances (D_s). The calculated Scaled Distances must not fall below the following values:

- Distances up to 300 ft.: 50
- Distances of 301–5000 ft.: 55
- Distances beyond 5000 ft.: 65

3. The third option requires an operator to monitor his blasts with a seismograph and use PPV limits that vary with frequency, similar to the alternative blasting level criteria proposed in the USBM Report of Investigations (RI) 8507. The OSMRE option differs from RI 8507 in two areas: (1) it does not differentiate between drywall and plaster on lath construction, allowing 0.75 in/sec in the medium frequencies for either case and (2) it allows a particle velocity of 2.0 in/sec down to a frequency of 30 Hz rather than 40 Hz.

Table 1 provides the OSMRE Overpressure Limits

Table 1: OSMRE Overpressure Limits

Recording Device Characteristics	Limit
Lower Limit of 0.1 Hz	134 dB
Lower Limit of 2.0 Hz	133 dB
Lower Limit of 6.0 Hz	129 dB
C-weighted slow response*	105 dBC

* To be used only with prior approval of OSMRE.

For several years, an air pressure limit of 140 dB was used primarily to prevent injury to workmen's hearing, it also successfully prevented damage to structures. In recent times, lower limits have been used, mostly in attempts to reduce annoyance.

3.0 Evaluation

MD utilized the calculation methodologies outlined in the *2013 Caltrans Transportation and Construction Vibration Manual, Chapter 11, Section 11.3 – Methods of Predicting Blast Vibration and Air Overpressures*. The distance between each potential blast location and the nearest sensitive receptor was measured. The noise and vibration levels were calculated to the nearest sensitive receptors located as close as 60 feet, 150 feet, and 180 feet from potential blast site locations (see Exhibit C).

As blasting activity will occur within 300 ft of existing buildings, seismic monitoring is mandatory for the project. Noise and vibration predictions are based upon distances of 60 feet, 150 feet, and 180 feet from the blast site and utilize charge weights ranging from 1 to 5 pounds. Input and output calculations are provided in Appendix B.

The project will require sound barriers which provide a 15 dB reduction for the air blast noise if blasting occurs closer than 150 feet to an existing building. The barriers must block the line of sight from the blasting area to the adjacent buildings. MD recommends that barriers are located as close to the blasting location as safely possible for maximum noise reduction.

4.0 Findings

As shown in the prediction calculations in Appendix B, the overpressure peak noise level at the nearest sensitive receptors when blasting occurs at the various locations will range between 111 to 130 dB using the maximum charge weights and mitigation specified in Table 1 below. The distances in the table are the distances between a blast and a sensitive receptor.

Table 2: Maximum Charge Weights per Distance

Distance (ft)	Max Charge Weight, lbs.
60-150 w/ wall	1
150-180	3
180+	5

The predicted vibration level at the nearest sensitive receptors when blasting occurs at the various locations will range between 0.02 to 0.35 PPV in/sec using the maximum charge weights specified. The predicted levels are below OSMRE's limit of 1.25 PPV in/sec limit, 50 D_s. The weights also meet the requirements given in the San Marcos' Blasting Operations code.

If blasting occurs within 150 ft of any building, sound barriers are required during blasting. A sound barrier needs to be constructed such that the line of sight to all existing windows are obstructed by the barrier, at least 8 feet tall. With the incorporation of sound barriers near the blasting location, the acoustic insertion loss is 15 dB and therefore the calculated mitigated noise level would range between 111 to 121 dB, which is approximately 12 dB below OSMRE's 133-dB limit.

Larger charge weights are permittable as long as they are designed such that the overpressue noise does not exceed 130 dB after mitigation and the vibration level does not exceed 0.5 PPV in/sec at the nearest sensitive receptor.

5.0 Recommendations

The following outlines the recommendations:

1. The Permittee/Owner shall have a noise and vibration monitoring plan (NVMP) prepared by a qualified noise and vibration expert prior to grading permit issuance. The NVMP shall provide locations where monitoring would occur over the duration of the blasting and/or removal of rock debris. The plan will outline noise and vibration monitoring methodology, equipment, duration, notification process, reporting process, vibration limits, exceedance protocol, and complaint resolution process.

2. The qualified noise and vibration expert shall monitor all blasting events. The blasting operator shall design the charge such that the overpressure noise level does not exceed 136 dB before mitigation or 130 dB when unmitigated, and the vibration level does not exceed 0.5 PPV in/sec at the nearest sensitive receptor. Blasts shall not occur closer than 50 feet from a sensitive receptor.

3. Sound barriers shall be used if the unmitigated max charge weights are exceeded. The sound barriers shall be at least 8-feet tall and shall block any line of sight between the blasting area and adjacent buildings. The qualified noise and vibration expert shall ensure the sound barriers are appropriately installed.

4. In locations where removal of rock is required when closer than 100 feet to an existing building, the project should use a nonexplosive option such as an excavator or nonexplosive agent for the removal of the large rock. The following links provide options for a nonexplosive agent. The blasting operator and the qualified noise and vibration expert shall determine the best option at the time of monitoring plan preparation (NVMP).

   http://www.ecobust.com/

   http://www.dexpan.com/dexpan-non-explosive-controlled-demolition-agent-silent-cracking-breaking.aspx

6.0 Conclusions

MD has provided the predicted overpressure noise levels and vibration levels associated with blasting at the Meyers Avenue Industrial Warehouse project. The prediction demonstrates that the levels would be within the OSMRE's guidelines and City of Escondido and San Marcos code (depending on the charge weight utilized). MD is pleased to provide this evaluation. If you have any questions regarding this analysis, please don't hesitate to call us at (805) 426-4477.

Sincerely,
MD Acoustics, LLC

Mike Dickerson, INCE-USA
Principal

Claire Pincock, INCE-USA
Acoustical Consultant

Exhibit C
Potential Blast Site Radii

Appendix A

Glossary of Vibration Terminology

Explosives: Any chemical mixture poured or placed in a borehole that reacts at a high speed to generate gas and heat, thus causing tremendous outward pressures. Some common types used are ANFO (ammonium nitrate and fuel oil), dynamite, TNT, and water gels and emulsions for boreholes filled with groundwater.

Two basic forms of energy are released when explosives react – gas energy and shock energy. Shock energy is the pressure that is transmitted outward from the borehole into the rock, causing microfractures to form and propagate outward for a short distance. Gas energy is the pressure that is exerted on the borehole walls by the expanding gases after a chemical reaction has been completed. These gases follow the 'path of least resistance' along existing and newly-formed fractures in the rock and this causes the majority of rock breakage in quarry blasting.

Energy from a blast which is not used for rock breakage is wasted in the form of ground vibration and airblast.

Ground Vibration: Seismic waves that spread out from the blasthole(s) along and through the ground, much like ripples in a pond. Ground vibration is comprised of many different waves with different frequencies and travel paths. The components (frequency, displacement, peak particle velocity, and acceleration) are measured with a seismometer, and it has been found that PPV is the most predictable and indicative of damage. Vibration levels, typically far below the levels required to produce damage, can be felt by humans.

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wavefront, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wavefront. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wavefront. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation

Peak Particle Velocity (PPV): A measurement of ground vibration. The maximum speed (measured in mm/sec or in/sec) at which a particle in the ground is moving relative to its inactive state.

RMS: Known as root mean squared (RMS) can be used to denote vibration amplitude.

VdB: A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

Airblast: An airborne wave emanating from the blast, which is observed by people and structures as sound and pressure. It is measured in decibels (dB), just like noise. The airblast from an improper blast is what can crack walls and break windows.

Flyrock: Rock or debris that is propelled into the air by the blast. Flyrock usually originates from material on the surface or the upper free face.

Appendix B

Overpressure Noise and Vibration Blasting
Input/Output Calculations

Blasting Noise and Vibration Calculations
Ref. Caltrans 2013

Airblast
Peak Air Overpressure (psi) = K(Ds)^-1.2
K = 0.78 to 2.5 for confined charge
K = 82 for unconfined charge
Ds = Distance (feet) / cube-root of charge weight (lbs)
dB = 20*log(psi / 2.9x10^-9)

Calculator

	lower bound	***upper bound***	
K	0.78	2.5	
Distance	180	180	ft
Charge Weight	5	5	lbs
Ds	105.3	105.3	
psi	0.00292	0.00936	
dB 120 130	**120**	**130**	(linear peak)

Results

Radius Color	**Distance ft**	**Ds**	**Air Overpressure, psi Lower Bound**	**Air Overpressure, psi Upper Bound**	**Sound Level, dB Lower Bound**	**Sound Level, dB Upper Bound**	**Max Charge Weight, lbs**
Red	60	60	0.00573	0.01837	126	136	1
Yellow	150	104.0	0.00296	0.00949	120	130	3
Blue	180	105.3	0.00292	0.00936	120	130	5

The charge weights were estimated assuming the charges are highly confined, per Caltrans' calculation procedures. That is, a K factor of 0.78 and 242 were used for the airblast This is a conservative assumption, as highly for airblast calculations only.

Blasting Noise and Vibration Calculations
Ref. Caltrans 2013

Ground Vibration
PPV (in/sec) = K(Ds)^-1.6
K = a variable subjtect to many factors
K = 24 to 242 for most conventional blasts
K = 605 for blast under extremely high confinement
Ds = square-root scaled disance (distance to receiver in ft. divided by square root of charge weights in lbs.)

Calculator

	lower bound	*upper bound*	
K	24	242	
Distance	180	180	ft
Charge Weight	5	5	lbs
Ds	80.5	80.5	
PPV	**0.02**	**0.22**	in/sec

Results

Radius Color	**Distance (ft)**	**Ds**	**PPV, in/sec** Lower Bound	**PPV, in/sec** Upper Bound	**Max Charge Weight, lbs**
Red	60	60	0.03	0.35	1
Yellow	150	86.6	0.02	0.19	3
Blue	180	80.5	0.02	0.22	5

The charge weights were estimated assuming the charges are highly confined, per Caltrans' calculation procedures. That is, a K factor of 0.78 and 242 were used for the airblast and groundborne vibration calculations, respectively. This is a conservative assumption, as highly confined charges would result in higher groundborne vibration levels.

Barrier insertion loss For Flat Ground

Receiver - North P/L

Enter variables here:

Source Height H_s(ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Receiver Height H_R(ft)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Barrier Height H_B(ft)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Distance Source to barrier (ft)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Distance Receiver to Barrier (ft)	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Soft Ground = 1; Hard Ground = 0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calculations																
A	11.661904	12.206556	12.80624847	13.453624	14.142136	14.866069	15.620499	16.401219	17.204651	18.027756	18.867962	19.723083	20.59126	21.470911	22.36068	23.259407
B	90.005555	90.022219	90.04998612	90.088845	90.138782	90.199778	90.271812	90.354856	90.448881	90.553851	90.66973	90.796476	90.934042	91.08238	91.241438	91.411159
C	100.12492	100.12492	100.124922	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492	100.12492
P	1.5425372	2.1038531	2.731312621	3.4175471	4.1559955	4.940925	5.7673891	6.6311535	7.5286092	8.4566858	9.4127706	10.394637	11.40038	12.428369	13.477196	14.545644
Ground type H_{eff} (with barrier)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Ground type H_{eff} (no barrier)	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
H_{eff} (with barrier)	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5
H_{eff} no barrier	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
G_B	0.5982143	0.5803571	0.5625	0.5446429	0.5267857	0.5089286	0.4910714	0.4732143	0.4553571	0.4375	0.4196429	0.4017857	0.3839286	0.3660714	0.3482143	0.3303571
G_{NB}	0.6207143	0.6207143	0.620714286	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143	0.6207143
$A_{barrier}$	14.876099	16.22367	17.35719542	18.330621	19.180225	19.931557	20.603267	21.209365	21.760622	22.265476	22.730649	23.161568	23.562668	23.937616	24.28947	24.620804
$IL_{barrier}$	**14.8**	**14.9**	**14.8**	**14.8**	**14.7**	**14.7**	**14.6**	**14.6**	**14.5**	**14.4**	**14.4**	**14.3**	**14.3**	**14.2**	**14.2**	**14.1**

Barrier Height (ft)	**IL (dBA)**
6	15
7	15
8	15
9	15
10	15
11	15
12	15
13	15
14	15
15	14
16	14
17	14
18	14
19	14
20	14
21	14