5. AZUSA VIBRATION IMPACT

The most current vibration analysis for the Metro Gold Line Foothill Extension Phase 2A shows that predicted vibration levels with mitigation would exceed the FTA impact criteria at one location in Azusa (Azusa westbound group 1). The vibration analysis and prediction for the group is presented in the technical memorandum: "*Updated Vibration Predictions for Metro Gold Line Phase 2A, Pasadena to Azusa*" dated November 17, 2010. The updated vibration analysis takes into account a design modification that shifted the proposed light-rail tracks closer to the affected group. The affected group consists of one single-family residence located at engineering station 1368+00, near the intersection of the right-of-way with Angeleno Avenue. The location of the residence relative to the proposed track alignment is shown in Figure 7 below. The proposed inbound tracks are 15 feet from the residence, which would result in high vibration levels.

The predicted vibration levels with and without mitigation are shown in Table 8. Without mitigation, vibration levels are predicted to reach 88 VdB in the 63 Hz 1/3 octave band. The proposed mitigation measure for the majority of Phase 2A is a 12 inch layer of tire-derived aggregate (TDA) under the ballast. With TDA, vibration levels at Azusa westbound group 1 are predicted to reach 79 VdB in the 63 Hz 1/3 octave band, exceeding the FTA impact threshold by 7 dB.

Because the residence is located so close to the proposed track alignment, it may not be feasible to eliminate this impact with track mitigation measures without resorting to approaches such as a floating slab track to protect the residence. Floating slabs are very expensive to implement and more difficult to maintain than standard ballast and tie track. The cost of a floating slab to protect a single residence makes floating slab track an unreasonable mitigation option.

Considering the residual impact is only at a single residence, more reasonable approaches for addressing the impact at this location would be to acquire the property or negotiate an easement with the property owner. This would create a "buffer zone" between the near track and any vibration sensitive receivers.

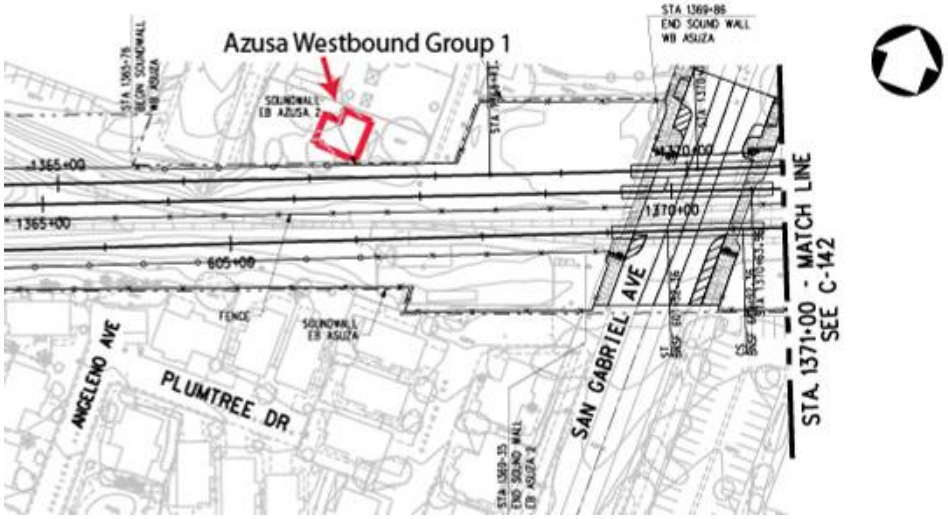

Figure 7: Location of Azusa Westbound Group 1

Table 8: Vibration Prediction for Azusa Westbound Group 1	
Engineering Station	1368+00
Speed:	55 mph
Distance to Near Track:	15 ft
Threshold[1]:	72 VdB
Predicted Vibration Level[1]:	88 VdB
Predicted Vibration Level[1] with TDA:	79 VdB
[1]Band maximum vibration velocity in decibels using a decibel reference of 1 µin/sec	

APPENDIX A: NOISE MEASUREMENT RESULTS (JULY 2011)

A.1. Duarte Sound Wall Existing Noise Measurement

A 24-hour noise measurement was conducted at the intersection of Duarte Road and Citrus View Avenue, outside the single-family residence at 1802 Citrus View Avenue. The microphone was approximately 50 feet south of the centerline of the near lane of Duarte Road. The dominant noise source in the area was traffic on Duarte Road.

Figure 8 shows the location of the measurement. Figure 9 shows the measured 4-sec Leq and the 1-hour Leq for the measurement period. The measured Ldn was 63 dBA. Table 9 presents several noise metrics for each hour.

The FTA noise thresholds for a residential land use with an Ldn of 63 dBA are:

- Moderate Impact Threshold: 60 dBA
- Severe Impact Threshold: 65 dBA

Figure 8: Measurement Location at 1802 Citrus View Avenue

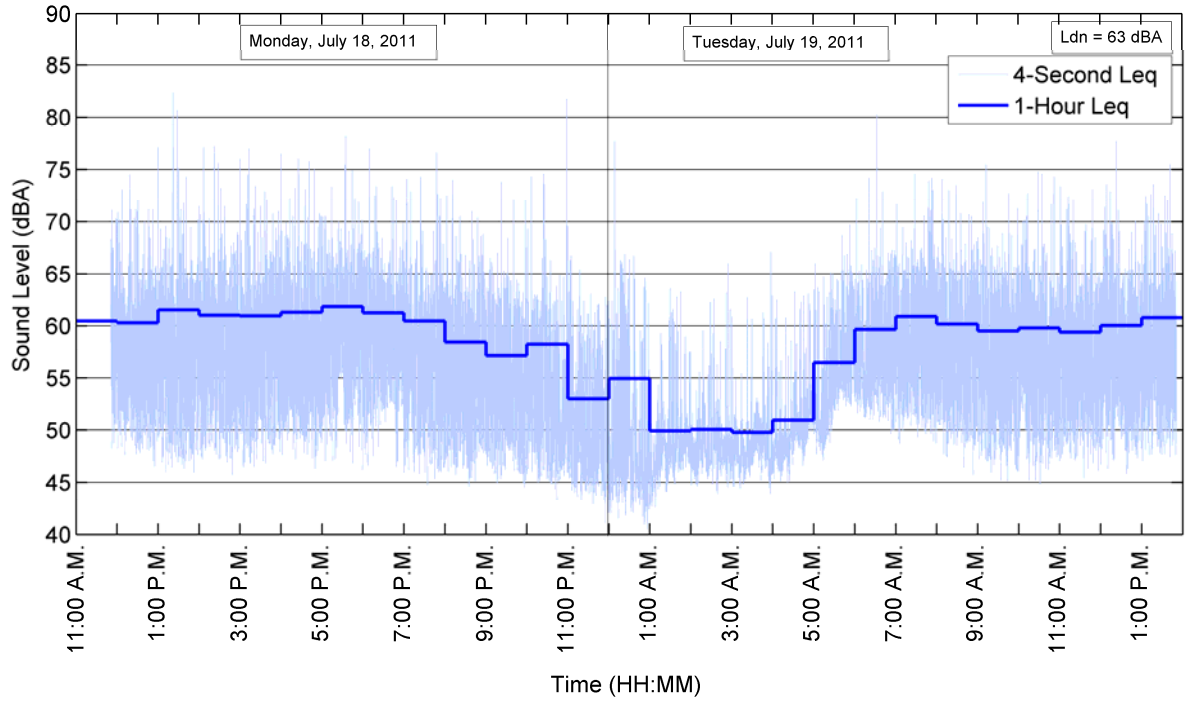

Figure 9: 24-Hour Noise Levels at 1802 Citrus View Avenue

Table 9: Measured Hourly Noise Levels at Duarte Avenue and Citrus View Avenue
July 18, 2011 to July 19, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
1:00 PM	62	82	46	49	55	59	64
2:00 PM	61	77	46	50	56	59	64
3:00 PM	61	77	46	50	55	59	64
4:00 PM	61	76	46	50	56	60	65
5:00 PM	62	78	46	52	58	61	65
6:00 PM	61	77	46	52	58	61	65
7:00 PM	60	77	45	48	55	59	64
8:00 PM	58	74	45	48	53	56	63
9:00 PM	57	74	45	47	52	55	61
10:00 PM	58	82	43	46	50	52	60
11:00 PM	53	67	41	45	48	51	57
12:00 AM	55	78	41	43	46	48	59

Table 9: Measured Hourly Noise Levels at Duarte Avenue and Citrus View Avenue

July 18, 2011 to July 19, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
1:00 AM	50	64	43	46	48	49	51
2:00 AM	50	66	44	46	48	49	51
3:00 AM	50	67	44	46	48	49	51
4:00 AM	51	63	45	47	49	50	52
5:00 AM	56	70	47	49	54	55	60
6:00 AM	60	80	50	52	55	58	63
7:00 AM	61	75	49	52	57	60	65
8:00 AM	60	74	46	51	56	59	64
9:00 AM	60	76	45	49	55	58	64
10:00 AM	60	75	45	49	54	57	63
11:00 AM	59	73	45	50	55	58	63
12:00 PM	60	78	46	50	55	58	64

Source: ATS Consulting, 2011

A.2. TPSS Units Existing Noise Measurements

Michillinda Option A and Option B

The nearest noise sensitive receivers to the Michillinda option A and B TPSS sites are the single-family residences on Arboleda Street. The dominant noise source in the area is traffic noise from the 210 West off-ramp. A 24-hour noise measurement was performed in the front yard of the single-family residence at 3855 Arboleda Street.

Figure 10 shows the location of the measurement with respect to the proposed TPSS locations. Figure 11 shows the measured 1-second Leq and the 1-hour Leq for the measurement period. The measured Ldn was 66 dBA. Table 10 presents several noise metrics for each hour.

Figure 10: Measurement Location at 3855 Arboleda Street

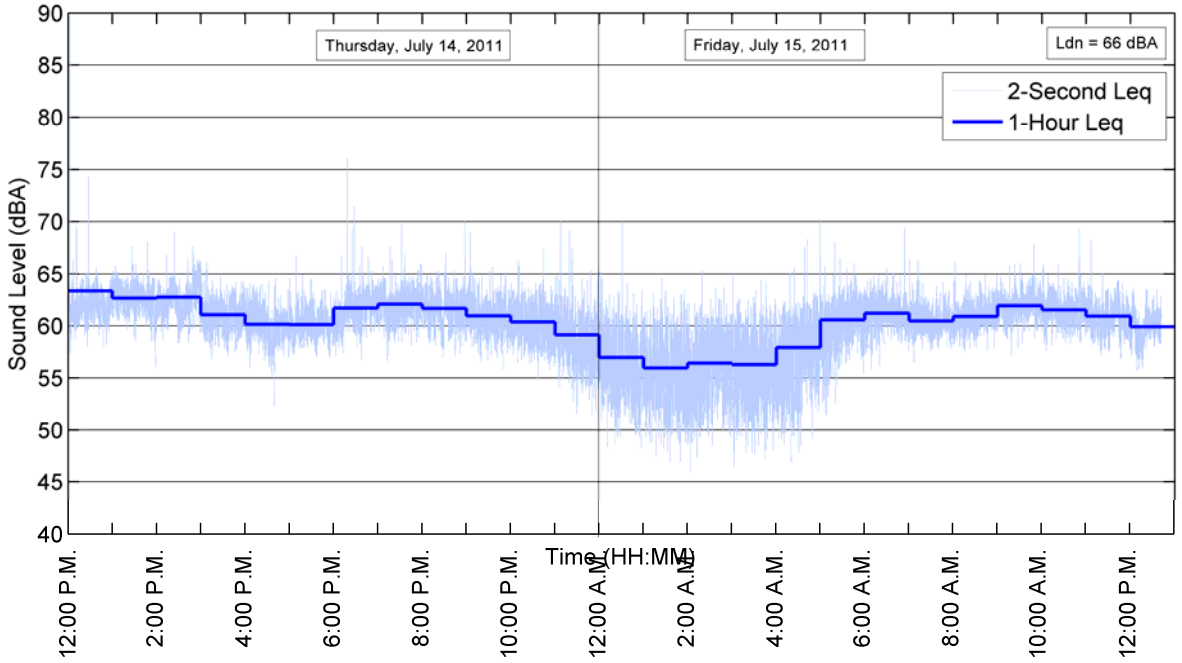

Figure 11: Measured Sound Levels at 3855 Arboleda Street Near Michillinda TPSS Option A

Table 10: Measured Hourly Noise Levels at 3855 Arboleda Street

July 14, 2011 to July 15, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
12:00 PM	63	90	57	60	62	62	63
1:00 PM	63	68	56	61	63	63	64
2:00 PM	63	69	58	61	62	63	65
3:00 PM	61	66	57	59	61	61	63
4:00 PM	60	65	52	58	60	61	62
5:00 PM	60	67	57	59	60	60	61
6:00 PM	62	76	57	60	61	62	63
7:00 PM	62	70	57	60	62	62	63
8:00 PM	62	70	57	60	61	62	63
9:00 PM	61	69	56	59	61	61	62
10:00 PM	60	67	55	58	60	61	62
11:00 PM	59	70	51	56	58	59	61
12:00 AM	57	70	48	53	56	57	60
1:00 AM	56	65	47	51	55	56	59
2:00 AM	56	65	46	52	56	57	59
3:00 AM	56	65	46	52	55	57	59
4:00 AM	58	70	47	53	57	59	61
5:00 AM	61	68	51	58	60	61	62
6:00 AM	61	69	56	60	61	62	63
7:00 AM	61	66	56	59	60	61	62
8:00 AM	61	66	57	60	61	61	62
9:00 AM	62	68	57	61	62	62	63
10:00 AM	62	69	58	60	61	62	63
11:00 AM	61	68	57	59	61	61	62

Source: ATS Consulting, 2011

Michillinda TPSS Option C

The nearest noise sensitive receivers to the Michillinda option C TPSS site are the single-family residences on Quigley Avenue north of Colorado Boulevard. The dominant noise source in the area is traffic noise from the 210 East off-ramp. A 24-hour noise measurement was performed in the back yard of the single-family residence at 34 North Quigley Avenue from 21 pm August 15, 2011 to 12 pm August 16, 2011.

Figure 12 shows the location of the measurement with respect to the proposed TPSS location. Figure 13 shows the measured 2-second Leq and the 1-hour Leq for the measurement period. The measured Ldn was 57 dBA. Table 10 presents several noise metrics for each hour. The noise levels at this site are significantly lower than noise measured north of the 210 Freeway for TPSS options A and B. The lower sound levels are most likely due to a sound wall running along the south side of the freeway.

Figure 12: Measurement Location at 34 Quigley Avenue

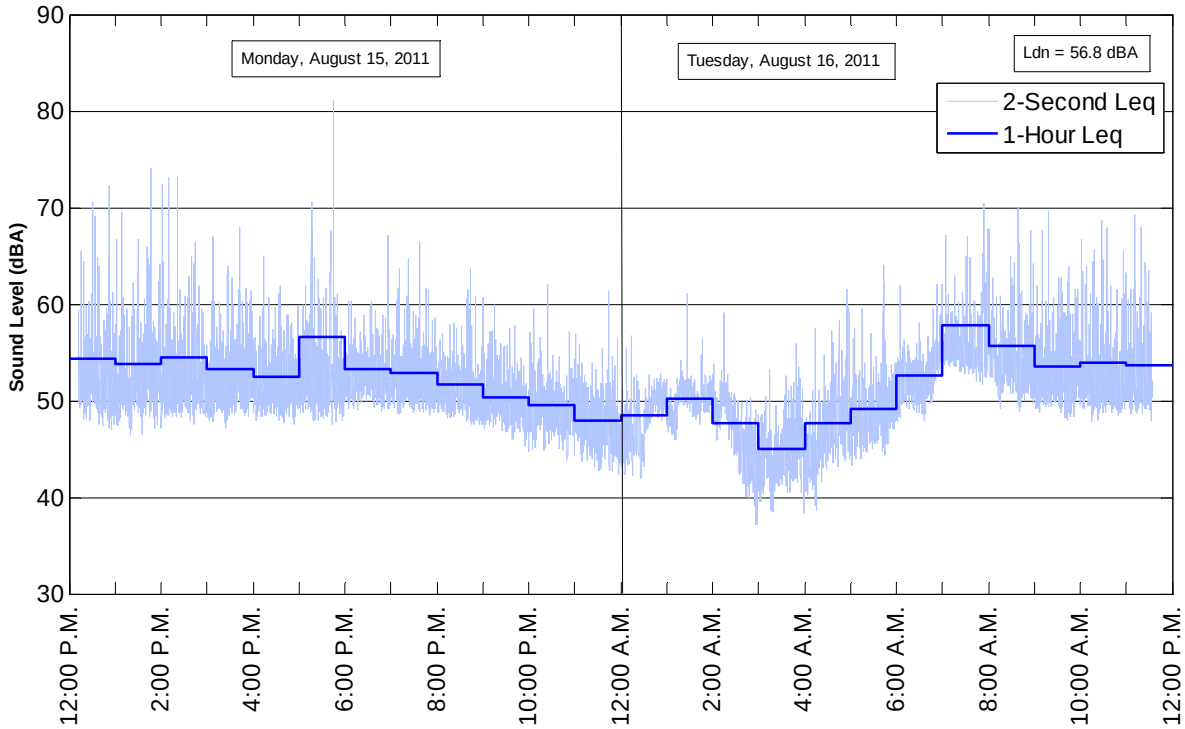

Figure 13: Measured Sound Levels at 34 Quigley Avenue Near Michillinda TPSS Option C

Table 11: Measured Hourly Noise Levels at 34 Quigley Avenue

August 15, 2011 to August 16, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
12:00 PM	54	72	47	49	52	53	56
1:00 PM	54	74	46	49	52	53	55
2:00 PM	55	73	47	49	51	53	56
3:00 PM	53	68	47	50	52	53	55
4:00 PM	52	65	48	50	51	52	54
5:00 PM	57	81	48	50	52	53	55
6:00 PM	53	67	49	51	52	53	55
7:00 PM	53	66	49	50	52	53	55
8:00 PM	52	64	48	43	51	52	53
9:00 PM	50	60	45	48	50	51	52
10:00 PM	50	62	44	47	49	50	51
11:00 PM	48	61	42	45	47	48	50

Table 11: Measured Hourly Noise Levels at 34 Quigley Avenue

August 15, 2011 to August 16, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
12:00 AM	48	57	42	44	48	49	51
1:00 AM	50	61	46	48	50	51	52
2:00 AM	48	59	37	42	47	49	50
3:00 AM	45	56	38	42	44	45	47
4:00 AM	48	62	39	43	46	47	50
5:00 AM	49	64	43	46	48	49	51
6:00 AM	53	62	48	50	52	53	55
7:00 AM	58	71	52	54	55	56	59
8:00 AM	56	70	49	52	54	55	58
9:00 AM	54	70	48	50	52	53	55
10:00 AM	54	69	48	50	52	53	56
11:00 AM	54	69	48	50	52	53	55

Source: ATS Consulting, 2011

Soldano TPSS

The proposed Soldano TPSS location is bounded on the south by the proposed tracks and on the north by a multi-family residential complex. The residences in the complex are the nearest noise sensitive receivers. The dominant noise source in the area is light vehicular traffic on 9th Street and occasional activity at Azusa Heating and Plumbing Supply, located across the street from the residential complex. In addition, two freight trains pass daily on the existing track in the project right-of-way. A 24-hour measurement was performed at the back of the residential complex, facing the project right-of-way from July 18, 2011 to July 19, 2011.

Figure 14 shows the location of the measurement with respect to the proposed TPSS location. Figure 15 shows the measured 1-second Leq and the 1-hour Leq for the measurement period. The measured Ldn was 57 dBA. Table 12 presents several noise metrics for each hour of the measurement.

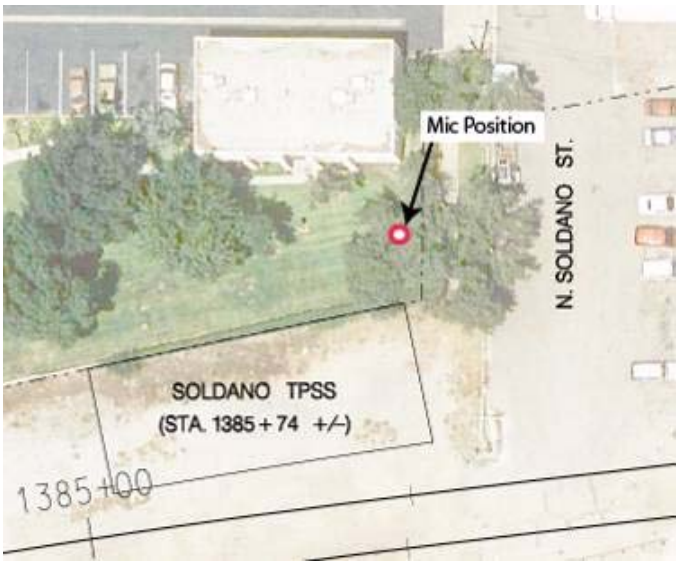

Figure 14: Measurement Location at Soldano Avenue and 9th Street

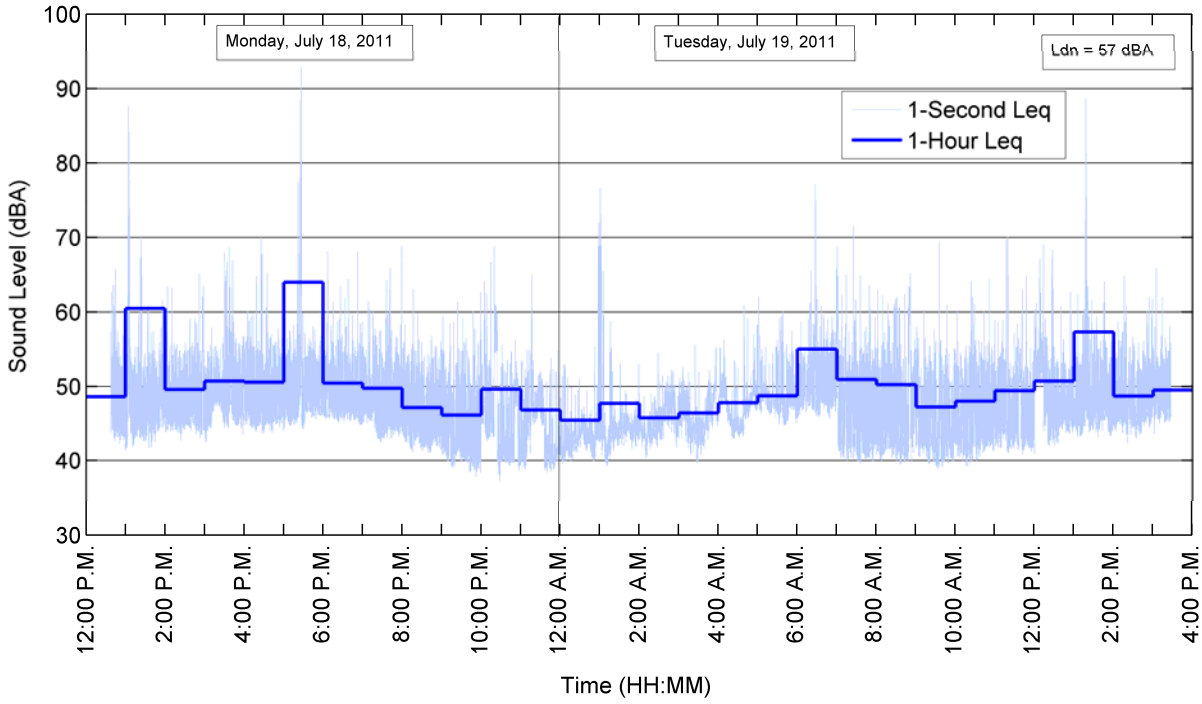

Figure 15: Measured Sound Levels at Soldano Avenue and 9th Street, Azusa

Table 12: Measured Hourly Noise Levels at Soldano Avenue and 9th Street

July 18, 2011 to July 19, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
1:00 PM	60	88	41	44	46	48	53
2:00 PM	50	65	43	45	47	48	52
3:00 PM	51	69	43	45	48	50	53
4:00 PM	51	70	44	45	47	49	53
5:00 PM	64	93	44	46	48	50	53
6:00 PM	50	68	45	46	48	49	53
7:00 PM	50	69	42	44	47	48	52
8:00 PM	47	63	41	43	45	46	51
9:00 PM	46	63	38	40	42	44	49
10:00 PM	50	69	37	40	44	46	55
11:00 PM	47	65	38	40	43	46	49
12:00 AM	45	72	40	41	43	43	45
1:00 AM	48	77	39	42	44	45	46
2:00 AM	46	55	40	43	45	46	48
3:00 AM	46	56	40	43	46	47	49
4:00 AM	48	61	43	44	47	48	50
5:00 AM	49	62	45	46	48	48	50
6:00 AM	55	77	46	47	49	50	54
7:00 AM	51	72	40	42	46	48	53
8:00 AM	50	65	39	41	45	47	52
9:00 AM	47	69	39	41	44	45	50
10:00 AM	48	64	39	42	44	47	51
11:00 AM	49	70	41	42	45	46	51
12:00 PM	51	69	41	44	47	50	53

Source: ATS Consulting, 2011

A.3. Duarte Parking Facility Existing Noise Measurement

A 24-hour noise measurement was conducted at a nearby residence to determine the existing noise conditions near the Duarte Parking Facility. The measurement was performed at 1609 Denning Avenue on July 19, 2011 and July 20, 2011. The dominant noise source in the area was traffic noise from the 210 Freeway, located approximately 300 feet north of the residence, and intermittent vehicular traffic on Denning Avenue and Business Center Drive.

Figure 16 shows the location of the measurement. Figure 17 shows the measured 1-second Leq and the 1-hour Leq for the measurement duration. The measured Ldn was 66 dBA. Table 13 presents several noise metrics for each hour.

Figure 16: Measurement Location at 1609 Denning Avenue

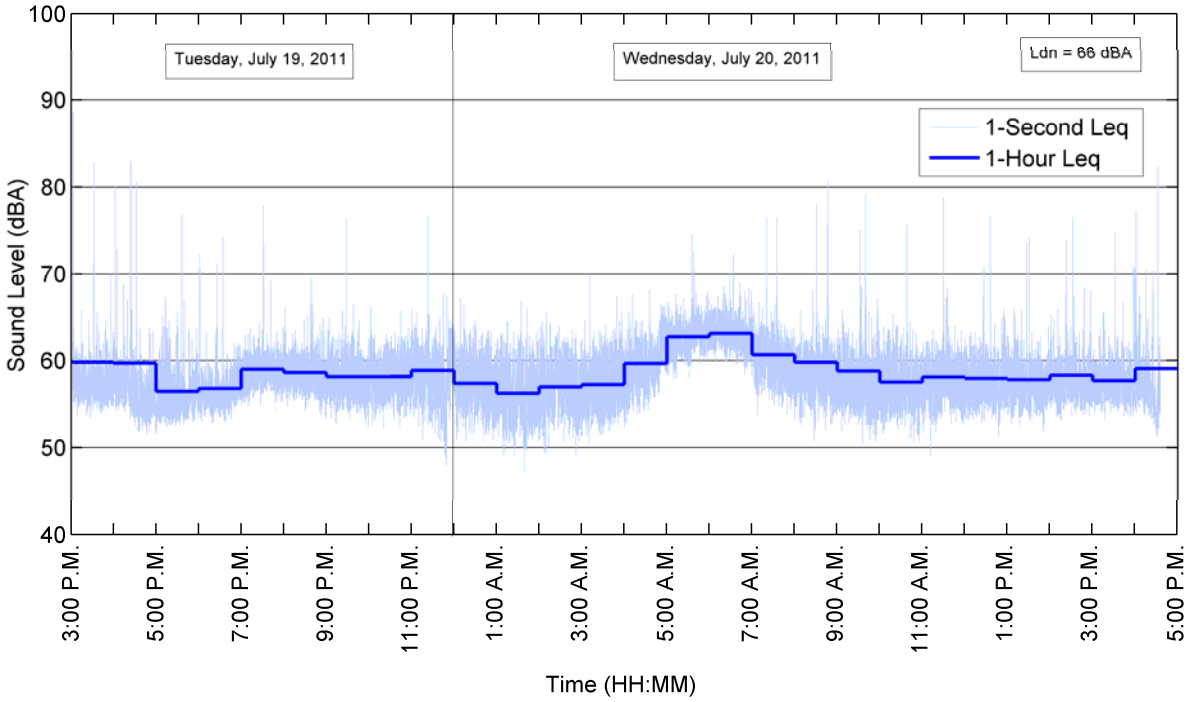

Figure 17: Measured Sound Levels at 1609 Denning Avenue, Near the Duarte Parking Facility

Table 13: Measured Hourly Noise Levels at 1609 Denning Avenue

July 19, 2011 and July 20, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
4:00 PM	60	83	52	54	56	57	59
5:00 PM	56	77	52	54	55	56	58
6:00 PM	57	74	53	54	56	57	58
7:00 PM	59	78	54	57	58	59	60
8:00 PM	59	70	53	57	58	59	60
9:00 PM	58	76	52	56	58	58	60
10:00 PM	58	66	52	55	58	58	60
11:00 PM	59	77	48	54	58	59	61
12:00 AM	57	67	51	54	57	58	60
1:00 AM	56	67	47	52	55	56	59
2:00 AM	57	66	49	53	56	57	60
3:00 AM	57	70	50	54	56	57	60

Table 13: Measured Hourly Noise Levels at 1609 Denning Avenue

July 19, 2011 and July 20, 2011

Hour Start Time	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	L90 (dBA)	L50 (dBA)	L33 (dBA)	L10 (dBA)
4:00 AM	60	68	52	56	59	60	62
5:00 AM	63	75	58	61	62	63	64
6:00 AM	63	72	59	61	63	63	65
7:00 AM	61	77	54	57	60	61	62
8:00 AM	60	81	51	56	58	59	61
9:00 AM	59	79	50	55	57	58	60
10:00 AM	58	76	51	54	57	57	59
11:00 AM	58	79	49	55	57	58	60
12:00 PM	58	77	51	55	57	58	59
1:00 PM	58	74	52	55	57	58	59
2:00 PM	58	77	53	55	57	58	60
3:00 PM	58	75	53	55	57	57	59

Source: ATS Consulting, 2011

A.4. Azusa Vibration Impact Existing Noise Measurement

A 24-hour noise measurement was conducted at 736 Angeleno Avenue to determine the current existing noise condition. The measurement was performed on July 19, 2011 and July 20, 2011. The dominant noise source in the area was light traffic on 9th Street and intermittent activity at the Azusa Public Works Department.

Figure 18 shows the location of the measurement. Figure 19 shows the measured 1-second Leq and 1-hour Leq for the measurement duration. The measured Ldn was 56 dBA. Table 14 presents several noise metrics for each hour.

Figure 18: Measurement Location at 736 Angeleno Avenue

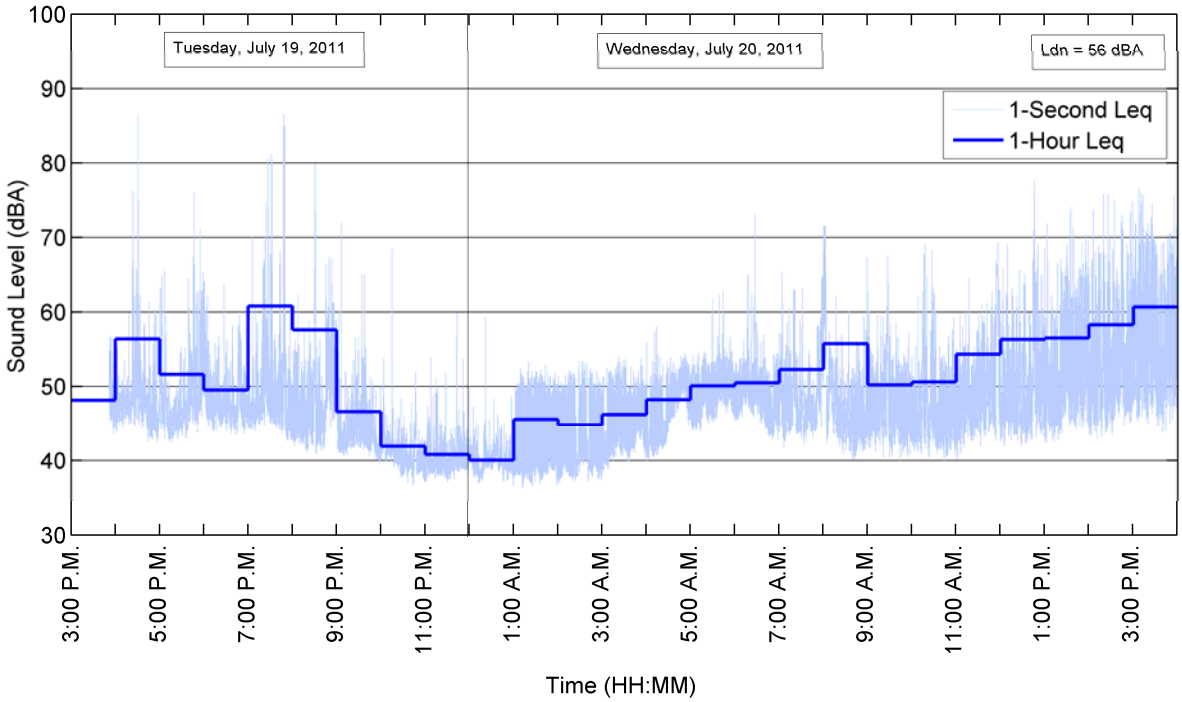

Figure 19: Measure Sound Levels at736 Angeleno Avenue