Appendix I

Acoustic Study for the Kīhei High School Project Kīhei, Maui

Y. Ebisu & Associates – September 2011

ACOUSTIC STUDY FOR THE KIHEI HIGH SCHOOL PROJECT KIHEI, MAUI

Prepared for:

GROUP 70 INTERNATIONAL

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

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CHAPTER I. SUMMARY

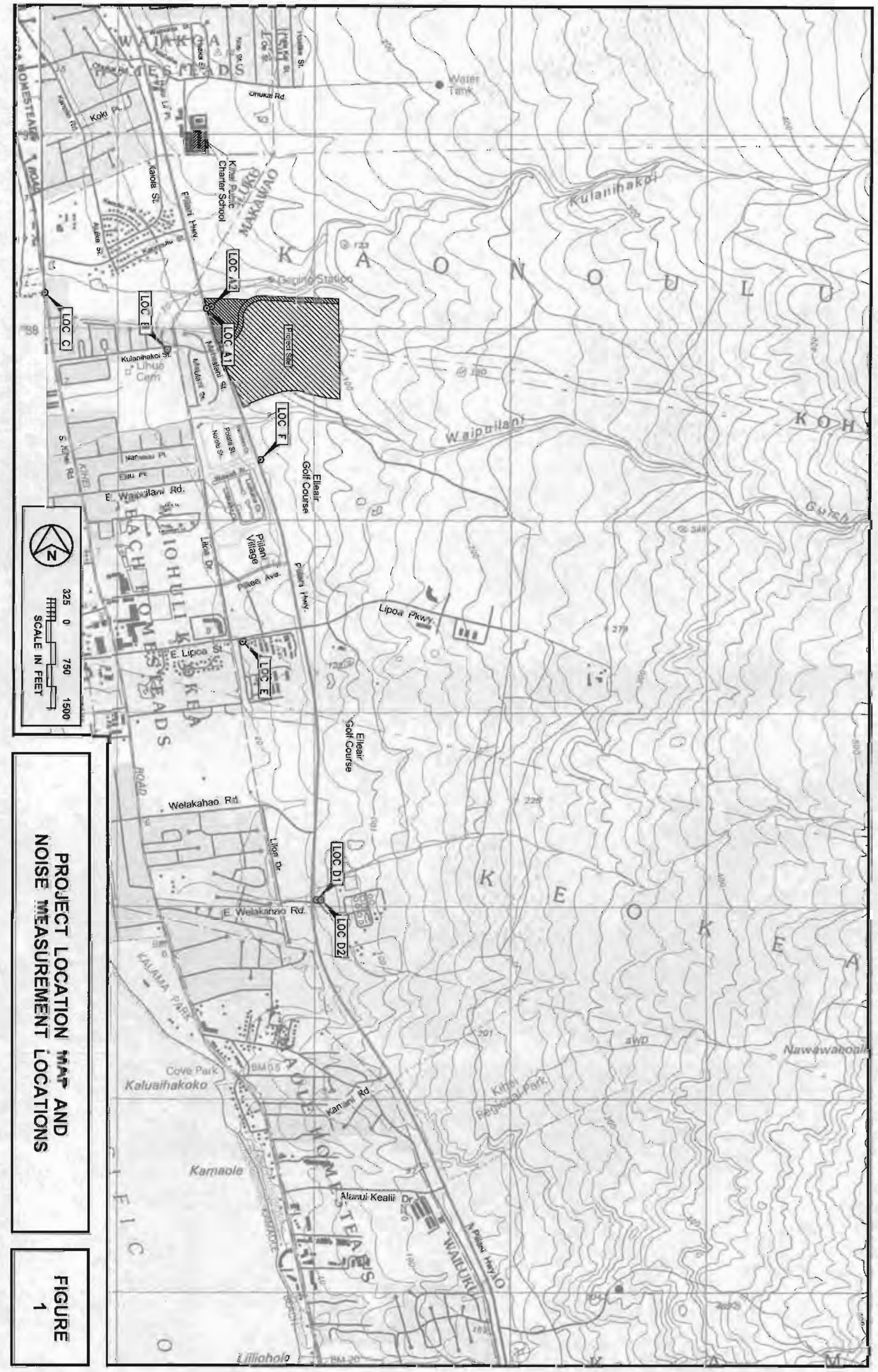
The existing and future traffic noise levels in the vicinity of the planned Kihei High School in Kihei, Maui were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards and classroom background noise level requirements. The traffic noise level increases along the roadways servicing the project site (see Figure 1) were calculated. No significant increases in traffic noise levels are predicted to occur as a result of project traffic following project build-out by CY 2025.

Along Piilani Highway fronting the school site, traffic noise levels are expected to increase from approximately 70 to 71 DNL at 100 foot distance from the centerline by CY 2025 as a result of project and non-project traffic. The 0.7 DNL increase is relatively small due to the relatively high existing traffic volumes on the highway when compared to the projected increases in future traffic volumes along the highway by CY 2025. Project traffic will account for approximately 0.1 of the 0.7 DNL units of noise increase along Piilani Highway in the immediate vicinity of the project. Along Kulanihakoi Street west of Piilani Highway, traffic noise levels are expected to increase by 0.7 DNL by CY 2025 as a result of project traffic. Along South Kihei Road north and south of Kulanihakoi Street, traffic noise levels are expected to increase by 0.5 to 0.6 DNL by CY 2025 as a result of non-project traffic. These levels of traffic noise increases resulting from project generated traffic are not considered to be significant. The predicted increases in project generated traffic noise levels are not expected to generate adverse noise impacts by CY 2025.

The school site is planned such that noise sensitive buildings of the school are situated at very large setback distances from Piilani Highway, where existing and future traffic noise levels are predicted to be less than 55 DNL. The large buffer distances to the highway will allow for the use of naturally ventilated buildings on the school campus.

Potential noise impacts from outdoor activities and central plant equipment are possible on adjacent properties. Compliance with State Department of Health noise regulations are recommended to minimize adverse noise impacts on adjacent properties.

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the excavation and earth moving activities on the project site. Because construction activities are predicted to be audible within the project site and at nearby properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment and compliance with State Department of Health construction noise regulations are recommended as standard mitigation measures.



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future traffic noise environment in the environs of the proposed Kihei High School in Kihei on the island of Maui. Traffic forecasts for 2025 were used. Traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases.

Impacts from on-site activities and short term construction noise at the project site were also included as noise study objectives. Recommendations for minimizing identified noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies (such as FHA/HUD) to assess environmental noise is the Day-Night Average Sound Level (DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. A more complete list of noise descriptors is provided in APPENDIX B to this report.

Table 1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. Table 2, also extracted from Reference 1, presents the general effects of noise on people in residential use situations. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in Figure 2 (from Reference 2). As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. In the project area, traffic noise levels associated with Piilani Highway and South Kihei Road are typically greater than 65 DNL along the Right-of-Way due to the relatively large volumes of traffic on these major thoroughfares.

For purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 DNL or less is considered acceptable for residences. This standard is applied nationally (Reference 3), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 4, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Maui, the State Department of Health (DOH) regulates noise from construction activities through the issuance of permits for allowing excessive

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY–NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.

TABLE 2

EFFECTS OF NOISE ON PEOPLE (Residential Land Uses Only)

EFFECTS[1] / DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS	Hearing Loss	Speech Interference		Annoyance[2]	Average Community Reaction[4]	General Community Attitude Towards Area
	Qualitative Description	Indoor %Sentence Intelligibility	Outdoor Distance In Meters for 95% Sentence Intelligibility	% of Population[3] Highly Annoyed		
75 and above	May Begin to Occur	98%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.9	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

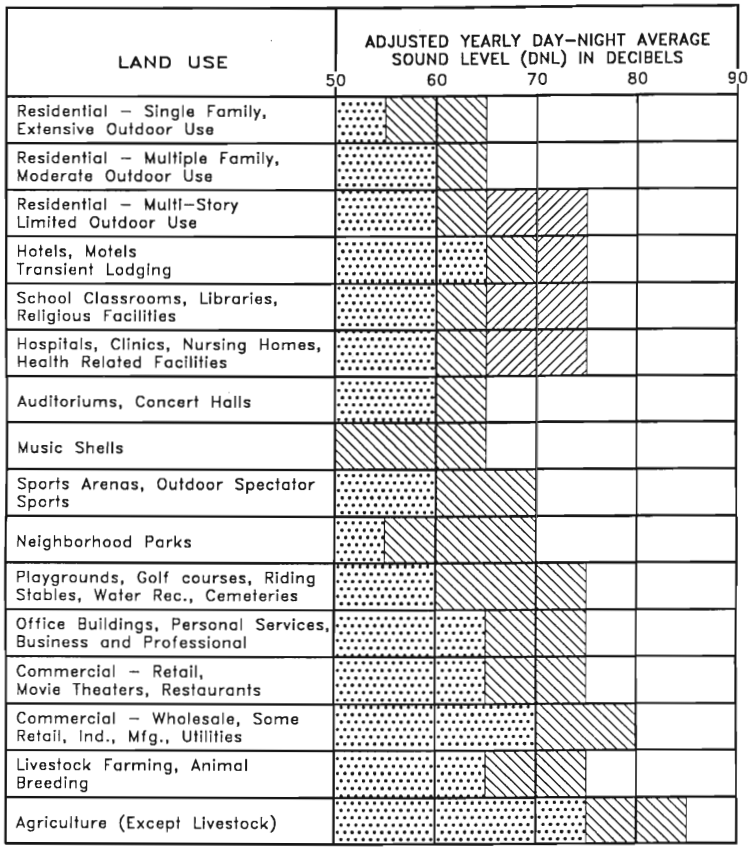
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise. Report of Working Group 69 on Evaluation of Environmental Impact of Noise."

2. Depends on attitudes and other factors.

3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY–NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9–1998/Part 5)

FIGURE 2

noise during limited time periods. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 5). Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for residential, commercial, and industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

TABLE 3

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume -------- AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A1. 60 FT from the center line of Piilani Highway (9/12/11)	0634 TO 0734	55	2,358	29	17	74.2	72.9
A2. 120 FT from the center line of Piilani Highway (9/12/11)	0634 TO 0734	55	2,358	29	17	67.7	68.0
B. 50 FT from the center line of Kulanihakoi Street (9/12/11)	0757 TO 0857	35	152	2	0	57.9	55.9
C. 50 FT from the center line of South Kihei Road (9/12/11)	0917 TO 1017	40	802	13	7	64.6	64.8
A1. 60 FT from the center line of Piilani Highway (9/12/11)	1539 TO 1639	55	2,832	28	10	74.0	73.5

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic noise levels were measured at eight locations (A1, A2, B, C, D1, D2, E, and F) in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development. The locations of the measurement sites are shown in Figure 1. Noise measurements were performed during the month of September 2011. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 3.

Traffic noise calculations for the existing conditions as well as noise predictions for the Year 2025 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 6). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Loose Soil" propagation loss factor. The traffic data and forecasts for the project (Reference 7), plus the spot traffic counts obtained during the noise measurement periods were the primary sources of data inputs to the model. Appendix C summarizes the AM and PM peak hour traffic volumes for CY 2010 and 2025 which were used to model existing and future traffic noise along the streets in the vicinity of the project site. For existing and future traffic along the streets in the vicinity of the project site, it was assumed that the average noise levels, or Leq(h), during the AM or PM peak traffic hour were equal to the 24-hour DNL along those roadways. This assumption was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Piilani Highway (see Figure 3) using State of Hawaii hourly traffic counts from Reference 8.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors with and without the benefit of shielding from natural terrain features or man made obstructions. Traffic noise levels were also calculated for future conditions with and without the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

Calculations of average exterior and interior noise levels from construction activities were performed for typical naturally ventilated and air conditioned dwellings. Predicted noise levels were compared with existing background ambient noise levels, and the potential for noise impacts was assessed.

TABLE 3 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
D1. 75 FT from the center line of Piilani Highway (9/13/11)	1540 TO 1640	53	2,356	21	15	71.4	69.8
D2. 150 FT from the center line of Piilani Highway (9/13/11)	1540 TO 1640	53	2,356	21	15	62.5	62.4

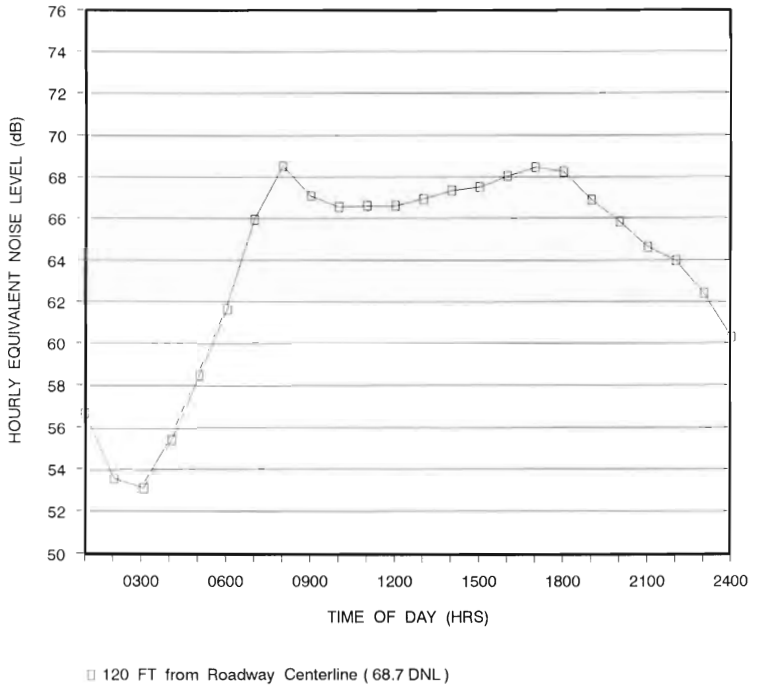
TABLE 3 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A2. 120 FT from the center line of Piilani Highway (9/12/11)	1539 TO 1639	55	2,832	28	10	68.0	68.3
D1. 75 FT from the center line of Piilani Highway (9/13/11)	0646 TO 0746	55	1,863	18	35	72.0	69.4
D2. 150 FT from the center line of Piilani Highway (9/13/11)	0646 TO 0746	55	1,863	18	35	62.1	62.5
E. 50 FT from the center line of Lipoa Street (9/13/11)	0809 TO 0909	35	402	6	12	61.7	61.1
F. 78 FT from the center line of Piilani Highway (9/13/11)	1030 TO 1130	53	1,950	34	31	69.7	69.7

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 120 FT SETBACK DISTANCE FROM THE CENTERLINE OF PIILANI HIGHWAY BETWEEN MOKULELE HWY. AND LIPOA ST. (STA. B74003100000; APRIL 21, 2009)



V. EXISTING ACOUSTICAL ENVIRONMENT

The existing background ambient noise levels within the project site are relatively low at the mauka (east) end and relatively high on the makai (west) end of the site. Traffic along Piilani Highway controls the background noise levels at the makai end of the project site, and diminishes to relatively low levels at the mauka end of the project site. On the makai side of Piilani Highway, existing traffic noise levels also diminish with increasing distances from Piilani Highway, and are controlled by the traffic on connector roads and South Kihei Road in areas between Piilani Highway and the shoreline.

Traffic and background ambient noise measurements were obtained in September 2011 at eight locations (A1, A2, B, C, D1, D2, E, and F) in the project environs. These locations are shown in Figure 1. The results of the traffic and background ambient noise measurements are summarized in Table 3, with measurement locations identified in Figure 1. The measurement locations were typically located at street level. As shown in Table 3, correlation between measured and predicted traffic noise levels was good. The Traffic Noise Model's "Loose Soil" and "Field Grass" propagation loss factors were used to obtain the good correlation.

Calculations of existing traffic noise levels during the AM and PM peak traffic hours are presented in Table 4. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. In Table 4, the Leq values shown also represent the DNL values for the roadways shown. The existing setback distances from the roadways' centerlines to their associated 65 and 75 DNL contours were also calculated as shown in Table 5. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections.

The existing traffic noise levels in the project environs along Piilani Highway are in the "Significant Exposure, Normally Unacceptable" category, and at or greater than 65 DNL at the first row of existing homes on the makai side of the highway. The existing traffic noise levels in the project environs along South Kihei Road are in the "Significant Exposure, Normally Unacceptable" categories, and at or greater than 65 DNL within 50 feet of the roadway's centerline. Along the lower volume connector streets, existing traffic noise levels are in the "Moderate Exposure, Acceptable" category, and less than 65 DNL at 50 feet or greater distance from the roadways' centerlines.

The existing background noise levels at the school site were estimated to range from approximately 56 to 62 DNL near the proposed Practice Fields to approximately 45 DNL at the mauka end of the project site. These estimates were based on traffic noise model calculations of existing noise levels along Piilani Highway.

TABLE 4

EXISTING (CY 2010) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Piilani Hwy. North of Kaonoulu St. (AM)	55	2,808	2,763	31	14	74.6	69.6	64.0
Piilani Hwy. North of Kaonoulu St. (PM)	55	3,151	3,100	35	16	75.1	70.1	64.5
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (AM)	55	3,034	2,989	30	15	74.9	69.9	64.3
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (PM)	55	3,247	3,199	32	16	75.2	70.2	64.6
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (AM)	55	3,100	3,023	31	46	75.3	70.3	64.8
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (PM)	55	3,275	3,226	33	16	75.2	70.2	64.6
Piilani Hwy. Between E. Waipulani & Piikea Ave. (AM)	55	3,093	3,016	31	46	75.3	70.3	64.8
Piilani Hwy. Between E. Waipulani & Piikea Ave. (PM)	55	3,207	3,159	32	16	75.1	70.1	64.5
Piilani Hwy. South of Piikea Ave. (AM)	55	2,786	2,716	28	42	74.8	69.9	64.3
Piilani Hwy. South of Piikea Ave. (PM)	55	3,073	3,027	31	15	74.9	70.0	64.3
Kulanihakoi St. E. of Piilani Hwy. (AM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kulanihakoi St. W. of Piilani Hwy. (AM)	35	302	298	4	0	58.4	52.5	46.4
Kulanihakoi St. E. of South Kihei Rd. (AM)	35	171	169	2	0	55.9	50.0	43.9
South Kihei Rd. N. of Kulanihakoi St. (AM)	40	825	805	12	8	64.9	59.1	53.1
South Kihei Rd. N. of Kulanihakoi St. (PM)	40	1,055	1,028	16	11	66.0	60.2	54.3
South Kihei Rd. S. of Kulanihakoi St. (AM)	40	834	813	13	8	65.0	59.2	54.5
South Kihei Rd. S. of Kulanihakoi St. (PM)	40	1,114	1,086	17	11	66.2	60.4	54.3

TABLE 5

EXISTING AND CY 2025 DISTANCES TO 65 AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT) EXISTING	65 DNL SETBACK (FT) CY 2025	75 DNL SETBACK (FT) EXISTING	75 DNL SETBACK (FT) CY 2025
Piilani Hwy. North of Kaonoulu St. (AM)	328	345	47	50
Piilani Hwy. North of Kaonoulu St. (PM)	349	371	51	54
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (AM)	341	354	49	53
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (PM)	353	376	51	55
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (AM)	366	405	52	58
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (PM)	353	376	51	57
Piilani Hwy. Between E. Waipulani & Piikea Ave. (AM)	366	390	52	58
Piilani Hwy. Between E. Waipulani & Piikea Ave. (PM)	349	381	51	56
Piilani Hwy. South of Piikea Ave. (AM)	336	380	49	54
Piilani Hwy. South of Piikea Ave. (PM)	333	371	49	54
Kulanihakoi St. E. of Piilani Hwy. (AM)	N/A	35	N/A	< 12
Kulanihakoi St. W. of Piilani Hwy. (AM)	23	25	< 12	< 12
Kulanihakoi St. E. of South Kihei Rd. (AM)	17	19	< 12	< 12
South Kihei Rd. N. of Kulanihakoi St. (AM)	49	52	< 12	< 12
South Kihei Rd. N. of Kulanihakoi St. (PM)	56	60	< 12	< 12
South Kihei Rd. S. of Kulanihakoi St. (AM)	50	54	< 12	< 12
South Kihei Rd. S. of Kulanihakoi St. (PM)	58	62	< 12	< 12

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 4 and 6 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.

TABLE 6

FUTURE (CY 2025) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Piilani Hwy. North of Kaonoulu St. (AM)	55	3,097	3,048	34	15	75.0	70.0	64.4
Piilani Hwy. North of Kaonoulu St. (PM)	55	3,545	3,488	39	18	75.6	70.6	65.0
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (AM)	55	3,372	3,321	34	17	75.4	70.4	64.7
Piilani Hwy. Between Kaonoulu & Kulanihakoi St. (PM)	55	3,655	3,600	37	18	75.7	70.7	65.1
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (AM)	55	3,737	3,644	37	56	76.1	71.1	65.6
Piilani Hwy. Between Kulanihakoi & E. Waipulani St. (PM)	55	3,780	3,723	38	19	75.9	70.9	65.2
Piilani Hwy. Between E. Waipulani & Piikea Ave. (AM)	55	3,666	3,574	37	55	76.0	71.1	65.5
Piilani Hwy. Between E. Waipulani & Piikea Ave. (PM)	55	3,705	3,649	37	19	75.8	70.8	65.2
Piilani Hwy. South of Piikea Ave. (AM)	55	3,307	3,224	33	50	75.6	70.6	65.1
Piilani Hwy. South of Piikea Ave. (PM)	55	3,571	3,517	36	18	75.6	70.6	65.0
Kulanihakoi St. E. of Piilani Hwy. (AM)	35	693	683	9	1	62.0	56.2	50.2
Kulanihakoi St. W. of Piilani Hwy. (AM)	35	360	355	5	0	59.1	53.3	47.2
Kulanihakoi St. E. of South Kihei Rd. (AM)	35	198	195	3	0	56.6	50.7	44.6
South Kihei Rd. N. of Kulanihakoi St. (AM)	40	929	906	14	9	65.4	59.6	53.7
South Kihei Rd. N. of Kulanihakoi St. (PM)	40	1,196	1,166	18	12	66.5	60.7	54.8
South Kihei Rd. S. of Kulanihakoi St. (AM)	40	965	941	14	10	65.6	59.8	53.9
South Kihei Rd. S. of Kulanihakoi St. (PM)	40	1,261	1,229	19	13	66.8	61.0	55.0

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7 for CY 2025 with the proposed project. Estimates of CY 2025 traffic volumes without the project were made by subtracting the project traffic from the total traffic volumes for CY 2025 as contained in Reference 7. The future projections of project plus non-project traffic noise levels on the roadways which would service the project are shown in Table 6 for the AM and PM peak hours of traffic, under the Build Alternative. Predicted increases in the setback distances to the 65 and 75 DNL contours are shown in Table 5. The separate non-project and project traffic noise contributions for the Build Alternative are shown in Table 7.

Very small changes in traffic noise levels (0.0 to 0.1 DNL) are expected along Piilani Highway in the project environs between CY 2010 and 2025 as a result of project traffic. The growth in non-project traffic by CY 2025 is predicted to result in traffic noise level increases of 0.5 to 0.6 DNL along Piilani Highway. Similar increases in future traffic noise levels are predicted to occur along South Kihei Road. By CY 2025, traffic noise levels in the project area along these two major roadways are expected to increase primarily due to the anticipated growth in non-project traffic, and it will be difficult to determine the increases in future traffic noise associated with the project traffic.

Along Kulanihakoi Street makai of Piilani Highway, increases in future traffic noise levels of 0.7 DNL are predicted by CY 2025, and primarily as a result of project traffic. No increases in traffic noise levels from non-project traffic are predicted along Kulanihakoi Street makai of Piilani Highway. Traffic noise level increases on the mauka side of the Piilani Highway along the future entrance road to the project site are associated only with project traffic.

The dominant traffic noise sources in the project environs will continue to be traffic along Piilani Highway and South Kihei Road, with the increases in future traffic noise levels being relatively small along these two roadways and primarily associated with non-project traffic.

Future traffic noise levels on the proposed school site from forecasted traffic along Piilani are anticipated to range from 45 DNL near the mauka property line to 63 DNL near the makai edge of the Practice Baseball Field. The future campus of Kihei High School is planned so that the noise sensitive buildings and classrooms are set back at least 650 feet from Piilani Highway, where future traffic noise levels are predicted to be less than 55 DNL. The terracing of the school grounds plus the noise shielding effects from buildings which are closest to the highway should further reduce traffic noise levels from Piilani Highway.

TABLE 7

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2025) (DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Piilani Hwy. North of Kaonoulu St.	0.5	0.0
Piilani Hwy. Between Kaonoulu & Kulanihakoi St.	0.5	0.0
Piilani Hwy. Between Kulanihakoi & E. Waipulani St.	0.6	0.1
Piilani Hwy. Between E. Waipulani & Piikea Ave.	0.6	0.1
Piilani Hwy. South of Piikea Ave.	0.5	0.1
Kulanihakoi St. E. of Piilani Hwy.	N/A	62.0
Kulanihakoi St. W. of Piilani Hwy.	0.0	0.7
Kulanihakoi St. E. of South Kihei Rd.	0.0	0.7
South Kihei Rd. N. of Kulanihakoi St.	0.5	0.0
South Kihei Rd. S. of Kulanihakoi St.	0.6	0.0

CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE IMPACTS AND POSSIBLE MITIGATION MEASURES

Traffic Noise. Existing traffic noise levels along Piilani Highway and South Kihei Road are very high, and are expected to remain so through CY 2025. Traffic noise impacts along those two roadways will continue to occur at noise sensitive receptors which are not provided with noise mitigation measures such as sound attenuating walls and/or closure and air conditioning.

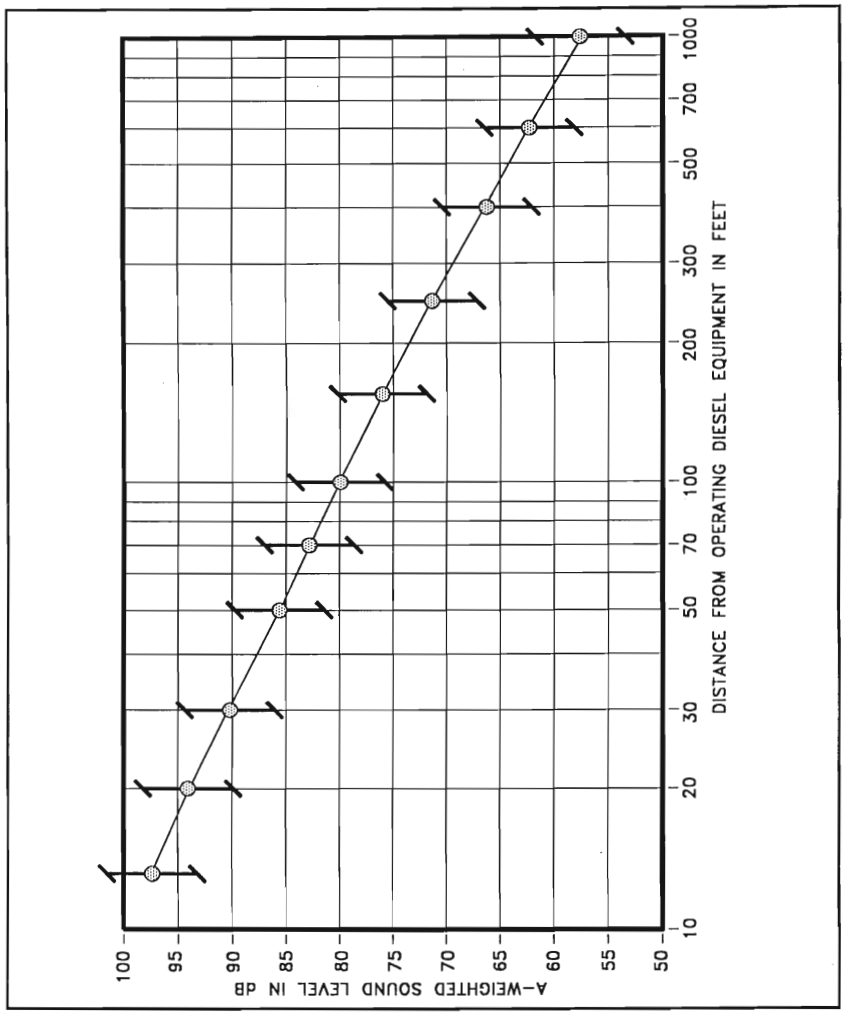
Project related traffic along Piilani Highway and South Kihei Road are not expected to cause measurable increases in future traffic noise levels. The largest increases (of 0.7 DNL) in project related traffic noise are predicted to occur along Kulanihakoi Street makai of Piilani Highway, where future traffic noise levels should remain in the "Moderate Exposure, Normally Acceptable" category. For these reasons, traffic noise mitigation measures should not be required.

On-Site Noise Sources. The potential noise from playground, practice field, pool, and athletic stadium activities could disturb neighboring residences. Noise levels associated with these outdoor facilities tend to be high due to the shouting and screaming which occur during these outdoor activities and play periods. The neighboring properties to the south and across Piilani Highway to the west are the most likely areas to experience the highest noise levels (53 to 65 dBA) from these outdoor activities. In addition, potential noise levels from the school's central plant equipment may also cause adverse noise impacts if the noise levels are not controlled.

Noise mitigation measures which limit the noise from fixed mechanical equipment to those allowed by the State Department of Health (Reference 5) should be incorporated into the project. In addition, public address systems installed at the outdoor facilities should be designed to minimize sound spillover into adjacent properties.

General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of exterior noise from construction activity (excluding pile driving activity) at various distances from the job site are shown in Figure 4. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in Figure 4, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

Figure 4 is useful for predicting exterior noise levels at short distances (within 100 FT) from the work when visual line of sight exists between the construction



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 4

equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing residential buildings will range from 200 FT to 1,400 FT, with corresponding average noise levels of 74 to 57 dBA (plus or minus 5 dBA). Typical levels of construction noise inside naturally ventilated and air conditioned structures are approximately 10 and 20 dB less, respectively, than the levels shown in Figure 4.

The existing residences across Piilani Highway west of the school site are the closest existing residences to the potential construction activities within the school site. The highest noise levels from construction activities of 69 to 79 dBA are expected to occur during earthwork and site preparation activities at the west end of the school site. The noise from construction activities will decrease and be masked by traffic noise along Piilani Highway at these residences as school construction activities move toward the east end of the project site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work, and due to the administrative controls available for regulation of construction noise. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 dB at 100 FT distance), and due to the exterior nature of the work (pile driving, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site.

Peak airborne noise levels from pile diving may be as much as 15 dBA greater than noise levels shown in Figure 4 for non-impulsive (steady) construction noise sources. Although the pile driving can produce more intense noise levels, each pulse is of short individual duration (less than one second). Therefore, its impact on speech communication is not as severe as that of a steady source of the same noise level.

Severe noise impacts are not expected to occur inside air conditioned structures which are beyond 200 FT of the project construction site. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 65 to 53 dBA at 200 FT to 600 FT distances from the construction site. Closure of all doors and windows facing the construction site would generally reduce interior noise levels by an additional 5 to 10 dBA.

The incorporation of State Department of Health construction noise limits and curfew times, which are applicable throughout the State of Hawaii (Reference 5), is another noise mitigation measure which is normally applied to construction activities. Figure 5 depicts the normally permitted hours of construction. Noisy construction activities are not allowed on Sundays and holidays, during the early morning, and during the late evening and nighttime periods under the DOH permit procedures.

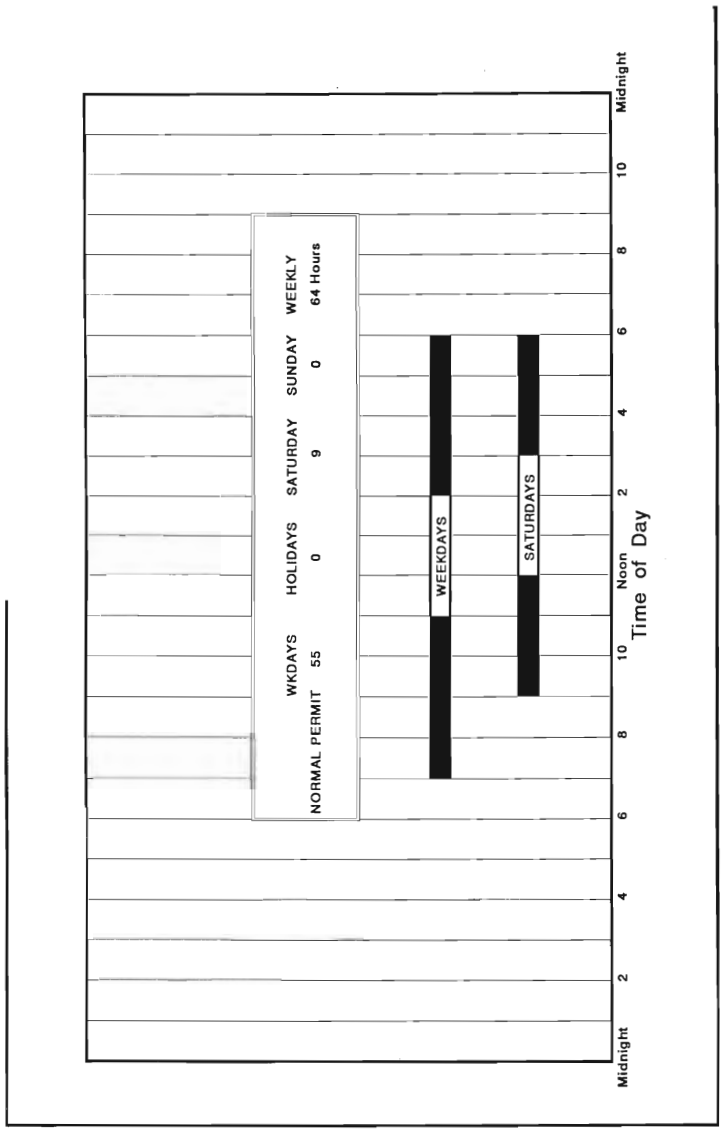


FIGURE 5

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74- 004; March 1974.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(6) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(7) "Kihei High School, Traffic Impact Report;" Wilson Okamoto Corporation; September 2011.

(8) Hourly Traffic Counts At Station B74003100000, Piilani Highway - Mokulele Highway To Lipoa Street; Hawaii State Department of Transportation; April 21, 2009.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

	TERM	SYMBOL
1.	A-Weighted Sound Level	L_A
2.	A-Weighted Sound Power Level	L_{WA}
3.	Maximum A-Weighted Sound Level	L_{max}
4.	Peak A-Weighted Sound Level	L_{Apk}
5.	Level Exceeded x% of the Time	L_x
6.	Equivalent Sound Level	L_{eq}
7.	Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8.	Day Sound Level	L_d
9.	Night Sound Level	L_n
10.	Day-Night Sound Level	L_{dn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$
12.	Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

	TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1.	Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2.	Sound Power Level	L_{WA}		L_{WB}	L_W
3.	Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4.	Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5.	Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6.	Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7.	Equivalent Sound Level Over Time(T)[4]	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8.	Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9.	Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10.	Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12.	Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13.	Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14.	Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15.	Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2025 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2010 ***** AM VPH	PM VPH	CY 2025 (NO BUILD) AM VPH	PM VPH	CY 2025 (BUILD) AM VPH	PM VPH
Piilani Hwy., N. of Kaonoulu (NB)	1,334	1,497	1,378	1,681	1,401	1,693
Piilani Hwy., N. of Kaonoulu (SB)	1,474	1,654	1,647	1,842	1,696	1,852
Two-Way	2,808	3,151	3,025	3,523	3,097	3,545
Piilani Hwy., Between Kaonolulu & Kulanihakoi (NB)	1,367	1,593	1,426	1,781	1,455	1,796
Piilani Hwy., Between Kaonoiulu & Kulanihakoi (SB)	1,667	1,654	1,856	1,846	1,917	1,859
Two-Way	3,034	3,247	3,282	3,627	3,372	3,655
Piilani Hwy., Between Kulanihakoi & E. Waipulani (NB)	1,344	1,633	1,543	1,844	1,689	1,875
Piilani Hwy., Between Kulanihakoi & E. Waipulani (SB)	1,756	1,642	1,969	1,864	2,048	1,905
Two-Way	3,100	3,275	3,512	3,708	3,737	3,780
Piilani Hwy., Between E. Waipulani & Piikea (NB)	1,396	1,633	1,543	1,844	1,689	1,875
Piilani Hwy., Between E. Waipulani & Piikea (SB)	1,697	1,574	1,909	1,795	1,977	1,830
Two-Way	3,093	3,207	3,452	3,639	3,666	3,705
Piilani Hwy., S. of Piikea (NB)	1,277	1,596	1,372	1,807	1,518	1,838
Piilani Hwy., S. of Piikea (SB)	1,509	1,477	1,721	1,698	1,789	1,733
Two-Way	2,786	3,073	3,093	3,505	3,307	3,571
Kaonoului St. W. of Piilani (EB)	237	129	238	129	250	132
Kaonoului St. W. of Piilani (WB)	77	225	77	225	83	228
Two-Way	314	354	315	354	333	360
Kulanihakoi St. E. of Piilani (EB)	N/A	N/A	N/A	N/A	471	101
Kulanihakoi St. E. of Piilani (WB)	N/A	N/A	N/A	N/A	222	114
Two-Way	N/A	N/A	N/A	N/A	693	215
Kulanihakoi St. W. of Piilani (EB)	207	121	212	122	248	130
Kulanihakoi St. W. of Piilani (WB)	95	173	96	173	102	176
Two-Way	302	294	308	295	350	306
E. Waipulani Rd. W. of Piilani (EB)	23	32	23	32	23	32
E. Waipulani Rd. W. of Piilani (WB)	81	100	82	101	93	107
Two-Way	104	132	105	133	116	139
Piikea Ave. W. of Piilani (EB)	427	547	427	547	427	547
Piikea Ave. W. of Piilani (WB)	444	607	444	607	444	607
Two-Way	871	1,154	871	1,154	871	1,154
S. Kihei Rd., N. of Kulanihakoi (NB)	480	585	539	663	539	663
S. Kihei Rd., N. of Kulanihakoi (SB)	345	470	390	533	390	533
Two-Way	825	1,055	929	1,196	929	1,196
S. Kihei Rd., S. of Kulanihakoi (NB)	467	611	529	694	553	695
S. Kihei Rd., S. of Kulanihakoi (SB)	367	503	412	566	412	566
Two-Way	834	1,114	941	1,260	965	1,261

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2025
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2010 ***** AM VPH	PM VPH	CY 2025 (NO BUILD) AM VPH	PM VPH	CY 2025 (BUILD) AM VPH	PM VPH
Kulanihakoi St. E. of S. Kihei (EB)	68	76	71	81	95	82
Kulanihakoi St. E. of S. Kihei (WB)	103	83	103	83	103	83
Two-Way	171	159	174	164	198	165