Appendix L

Acoustic Study for the Proposed Kaloko Makai Project
Y. Ebisu & Associates
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ACOUSTIC STUDY FOR THE PROPOSED KALOKO MAKAI PROJECT

NORTH KONA, HAWAII

Prepared for:

STANFORD CARR DEVELOPMENT

Prepared by:

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

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CHAPTER I. SUMMARY

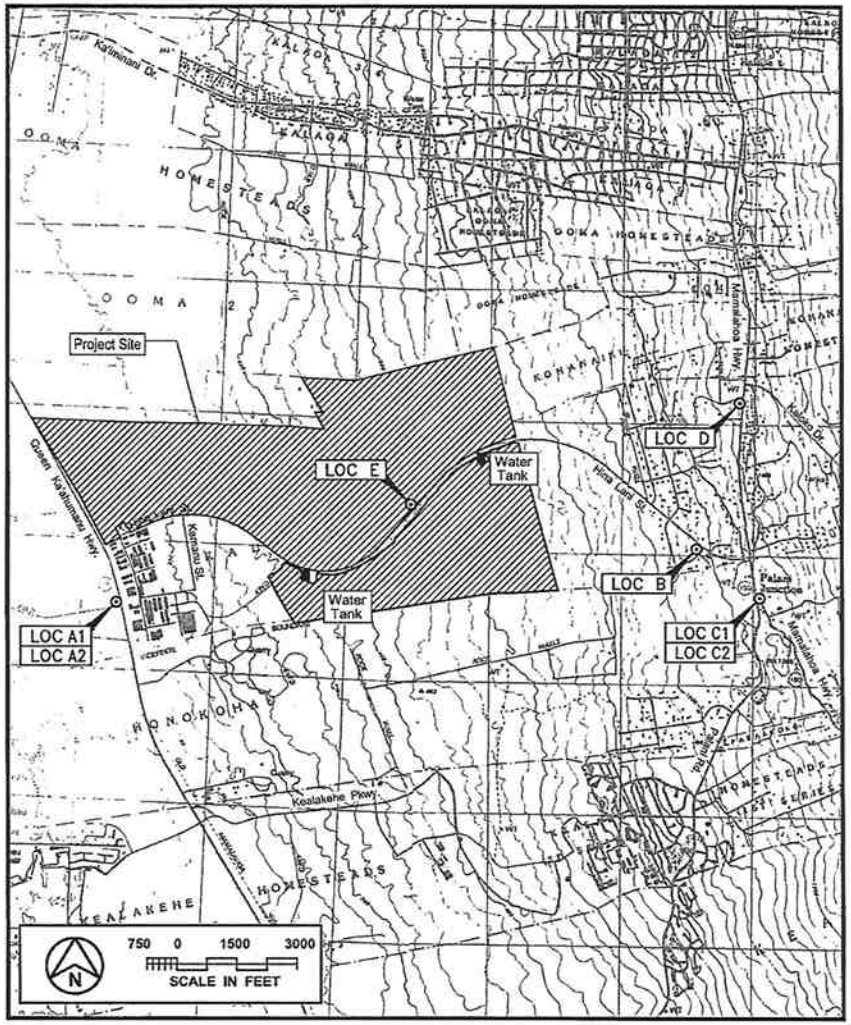
The existing and future traffic noise levels in the vicinity of the proposed Kaloko Makai Project in North Kona, Hawaii were evaluated for their potential impact on present and future noise sensitive areas. Figure 1 depicts the location of the project site. The future traffic noise levels along the primary access roadways to the project were calculated for the year 2045.

Along the existing Queen Kaahumanu Highway, traffic noise levels are expected to increase by 6.3 to 7.1 DNL between CY 2011 and CY 2045 as a result of both project and non-project traffic. Along Hina Lani Street, traffic noise levels are predicted to increase by 6.0 to 9.4 DNL. Traffic noise increases due to project traffic are predicted to range from 1.1 to 7.4 DNL, which are typically greater than the range of the noise increases caused by non-project traffic on these two roadways. These increases in traffic noise levels associated with project traffic range from the moderate to the moderately significant. The larger and more significant increases in traffic noise levels are expected to occur along Queen Kaahumanu Highway, where the lands along the highway Rights-of-Way are generally undeveloped or are developed with commercial uses. Adequate setback distances have been provided between the project's noise sensitive uses and Queen Kaahumanu Highway.

Along Mamalahoa Highway, noise impacts from project traffic should be difficult to measure or quantify, and should be much less than those associated with non-project traffic. Traffic noise mitigation measures in the form of increased setbacks, sound attenuation walls, and/or closure and air conditioning will probably be required at proposed residences and hospital facilities which front Hina Lani Street and Ane Keahokalole Highway.

Based on previously published 14 CFR Part 150 aircraft noise contours for Kona International Airport at Keahole (KOA), the project site is located outside of the existing and forecasted 60 and 55 DNL noise contours, and is considered to be acceptable for the development of noise sensitive uses as planned. Noise contours for CY 2008, CY 2013, and CY 2030, which were developed during the 2009 Master Plan and 14 CFR Part 150 Study updates for KOA, confirm that the project site is outside of the airport noise contours, and special aircraft noise attenuation measures are not required over the project area. The implementation of the airport noise disclosure provisions of Act 208 is not considered to be necessary over the entire project area because the existing and forecasted 55 DNL noise contours are not expected to encompass noise sensitive developments within the project area.

Unavoidable, but temporary, noise impacts may occur during the construction of the proposed project. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce



LOCATIONS OF PROJECT SITE AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.

CHAPTER II. PURPOSE

The objectives of this study were to describe the existing and future noise environment in the environs of the proposed Kaloko Makai Project in North Kona on the island of Hawaii. 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 expected to service the project traffic. A specific objective was to determine the future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Assessments of possible impacts from noise resulting from fixed and rotary wing aircraft operations at nearby Kona International Airport at Keahole, and from short term construction noise at the project site were also included in the noise study objectives. Recommendations for minimizing these 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 to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. The maximum A-Weighted sound level occurring while a noise source such as a heavy truck or aircraft is moving past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

The DNL values represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

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. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA. A more complete list of noise descriptors is provided in Appendix B to this report. In Appendix B, the Ldn descriptor symbol is used in place of the DNL descriptor symbol.

Table 1, extracted from Reference 1, categorizes the various DNL levels of outdoor noise exposure with severity classifications. Table 2, also extracted from Reference 1, presents the general effects of noise on people in residential use situations. Figure 2, extracted from Reference 2, presents suggested land use compatibility guidelines for residential and nonresidential land uses. A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 DNL. This value of 65 DNL is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

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

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
		Indoor	Outdoor			
	Qualitative Description	%Sentence Intelligibility	Distance in Meters for 95% Sentence Intelligibility	% of Population Highly Annoyed[3]		
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.

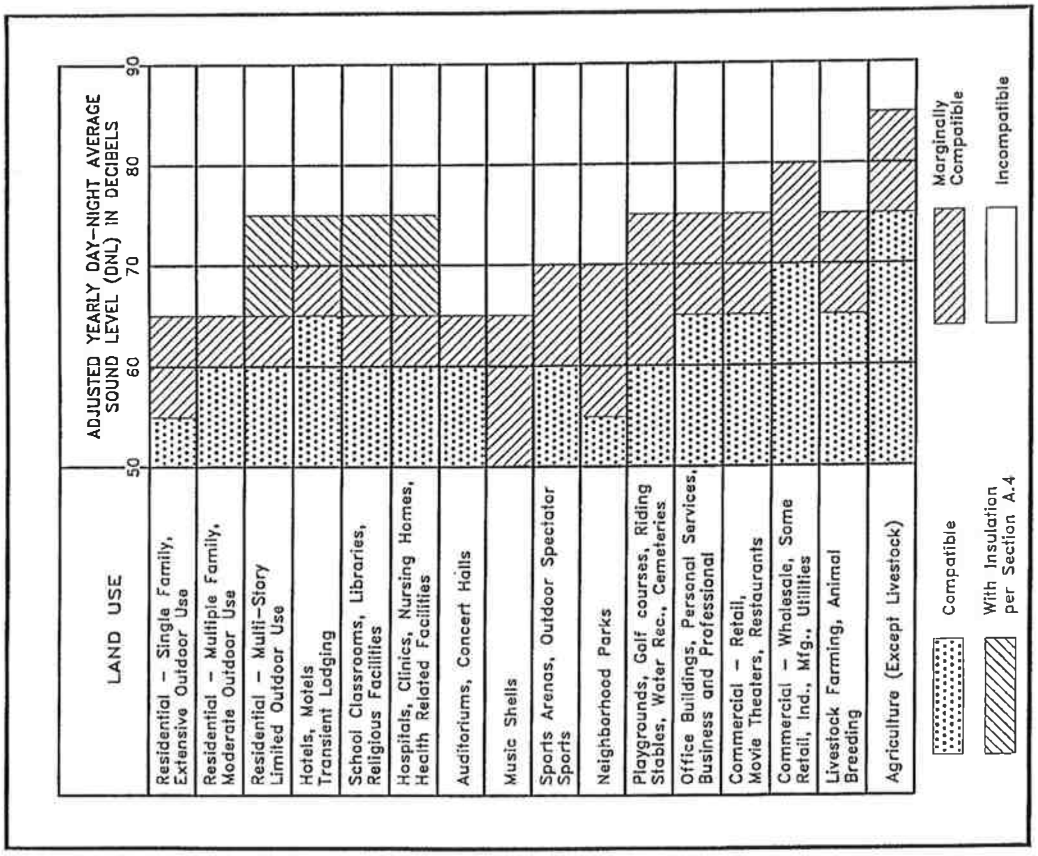
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation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

roadway is a high speed freeway. Due to noise shielding effects from intervening structures, interior lots are usually exposed to 3 to 10 DNL lower noise levels than the front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), Department of Defense (DOD); Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally (see 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, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise (see Reference 4). For typical, naturally ventilated structures in Hawaii, an exterior noise level of 55 DNL results in an interior level of approximately 45 DNL, which is considered to be the "Unconditionally Acceptable" (or "Near-Zero Risk") level of interior 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 aircraft noise, the Hawaii State Department of Transportation, Airports Division (HDOTA), has recommended that 60 DNL be used as the common level for determining land use compatibility in respect to noise sensitive uses near its airports. Table 3 summarizes the recommendations for compatible land uses at various levels of aircraft noise. For those noise sensitive land uses which are exposed to aircraft noise greater than 55 DNL, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions. Reference 5 requires that such disclosure be provided prior to real property transactions concerning properties located within Air Installation Compatibility Use Zones (AICUZ) or located within airport noise maps developed under Federal Aviation Regulation (FAR) Part 150 - Airport Noise Compatibility Planning (14 CFR Part 150). The most recent FAR Part 150 noise contours for Kona International Airport at Keahole were completed in 2009 and reflect conditions through 2013 (Reference 6). Additional airport noise contours for 2030 were developed by the HDOTA for information purposes only. These airport noise contours do not indicate that significant increases in aircraft noise will occur over the project site.

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.

TABLE 3

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY–NIGHT AVERAGE SOUND LEVELS (DNL)

TYPE OF LAND USE	**** Yearly Day-Night Average Sound Level ****					
	< 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL						
Low density residential, resorts, and hotels (outdoor facil.)	Y(a)	N(b)	N	N	N	N
Low density apartment with moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings with limited outdoor use	Y	N(b)	N(b)	N	N	N
PUBLIC USE						
Schools, day-care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and office buildings serving the general public	Y	Y	Y(d)	Y(d)	N	N
Transportation and Parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL AND GOVERNMENT USE						
Offices - government, business, and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale and retail - building materials, hardware and heavy equipment	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, tours, lei stands, ticket offices, etc.	Y	Y	Y(d)	Y(d)	N	N
Retail, restaurants, shopping centers, financial institutions, etc.	Y	Y	Y(d)	Y(d)	N	N
Power plants, sewage treatment plants, and base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios without outdoor sets, broadcasting, production facilities, etc.	Y(c)	Y(c)	N	N	N	N
MANUFACTURING, PRODUCTION, AND STORAGE						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc.	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc.	Y	Y	N	N	N	N
Professional/resort sport facilities, locations of media events, etc.	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Numbers in parentheses refer to notes.

KEY TO TABLE 3:

Y(Yes) = Land Use and related structures compatible without restrictions.
N(No) = Land Use and related structures are not compatible and should be prohibited.

TABLE 3 (CONTINUED)

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY–NIGHT AVERAGE SOUND LEVELS (DNL)

NOTES FOR TABLE 3:

(a) A noise level of 60 DNL does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 DNL planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk level of 55 DNL and the significant risk level of 65 DNL.

(b) Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 DNL or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems.

(c) Because the DNL noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior DNL exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where noise is greater than 65 DNL.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

In the State of Hawaii, the State Department of Health (DOH) regulates noise from on-site activities. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 7). The noise limits apply on all islands of the State, including Hawaii. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for preservation/residential, apartment/commercial, and agricultural/industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

Because the proposed project site is located on lands designated for single family and multifamily residential, and commercial uses, various DOH noise limits would be applicable along the lot boundary lines or receptor locations for any stationary machinery, or equipment related to commercial or construction activities. These property line limits are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively, for commercial lots or receptors. For multifamily or apartment use, the State DOH limits are also 60 dBA and 50 dBA during the daytime and nighttime periods, respectively. For single family residential and public facility uses, the State DOH limits are 55 dBA and 45 dBA during the daytime and nighttime periods, respectively. These noise limits cannot be exceeded for more than 2 minutes in any 20-minute time period under the State DOH noise regulations. The State DOH noise regulations do not apply to aircraft or motor vehicles.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic and background ambient noise levels were measured at seven locations in the project environs to provide a basis for developing the traffic noise contours along the roadways which will service the proposed development: Queen Kaahumanu Highway, Hina Lani Street, and Mamalahoa Highway; and for determining the existing background ambient noise levels in the project area.

The locations of the measurement sites are shown in Figure 1. Noise measurements were performed during April 2009. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 4. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used.

Traffic noise calculations for the existing conditions as well as noise predictions for the future conditions with and without the project were performed using the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 8). Traffic data entered into the noise prediction model were: hourly traffic volumes, average vehicle speeds, estimates of traffic mix, and loose soil propagation loss factor. The traffic assignments for the project (Reference 9) and Hawaii State Department of Transportation counts on Queen Kaahumanu Highway (Reference 10) were the primary sources of data inputs to the model. For existing and future traffic, it was assumed that the average noise levels, or Leq(h), during the AM peak hour were equal to the 24-hour DNL along Queen Kaahumanu and Mamalahoa Highways. This assumption was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Queen Kaahumanu Highway (see Figure 3). For the other roadways, it was assumed that the 24-hour DNL was equal to the average noise level during the PM peak hour.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors without the benefit of shielding effects. Traffic assignments with and without the project were obtained from the project's traffic turning movements (Reference 9). The forecasted increases in traffic noise levels over existing levels were calculated for both scenarios, and noise impact risks evaluated. The relative contributions of non-project and project related traffic to the total noise levels were also calculated, and an evaluation was made of possible traffic noise impacts resulting from the project.

The relationships of the aircraft flight tracks and noise contours for Kona International Airport at Keahole to the project site and its proposed land uses were examined to determine if potential noise impacts were possible at the project site. The locations of the airport noise contours for 2008, 2013, and 2030 were compared with the location of the project site, and risks of noise impacts were evaluated. The need for special aircraft noise attenuation measures or disclosures of aircraft noise level at the project site was determined by comparing the locations of the most recently published

TABLE 4
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 50 FT from centerline of Q. Kaahumanu Hwy. (4/27/09)	0700 TO 0800	58	1,565	46	49	73.3	73.3
A2 100 FT from centerline of Q. Kaahumanu Hwy. (4/27/09)	0700 TO 0800	58	1,565	46	49	67.9	67.8
B 50 FT from centerline of Hina Lani Street (4/27/09)	0820 TO 0920	58	336	5	8	66.3	66.2
C1 50 FT from centerline of Mamalahoa Hwy. (4/27/09)	0935 TO 1035	50	682	3	6	66.0	66.6
C2 100 FT from centerline of Mamalahoa Hwy. (4/27/09)	0935 TO 1035	50	682	3	6	61.8	61.1
D 50 FT from centerline of Mamalahoa Hwy. (4/27/09)	1049 TO 1149	51	758	12	4	67.5	67.5

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 100 FT SETBACK DISTANCE FROM THE CENTERLINE OF QUEEN KAAHUMANU HWY. BETWEEN OTEC ACCESS RD. AND HULIKOA ST. AT 95 MILEPOST
(Sta. B71001909280, 5/31/06)

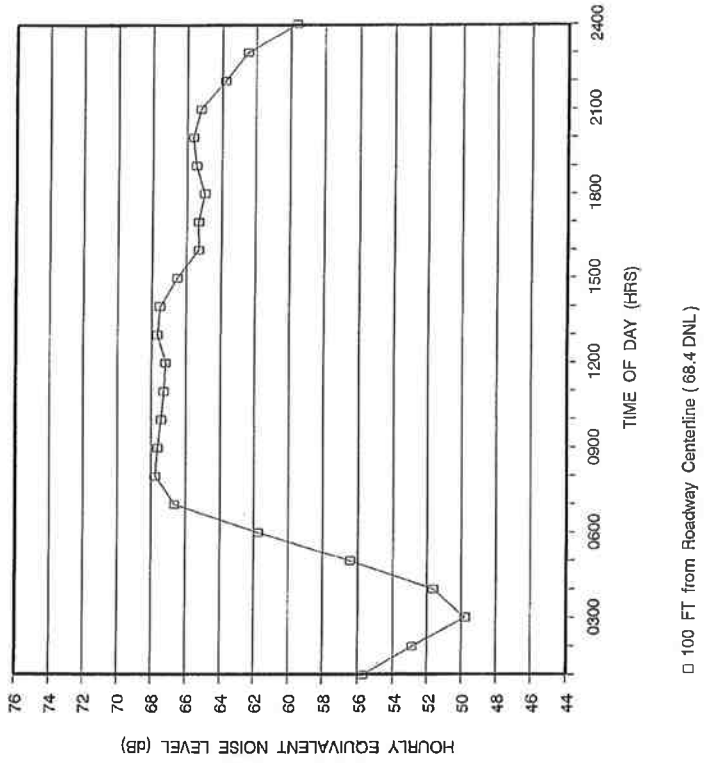


TABLE 4 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
E	50 FT from centerline of Hina Lani Street (4/27/09)	1436 TO 1536	55	547	9	12	67.5	67.6
A1	50 FT from centerline of Q. Kaahumanu Hwy. (4/27/09)	1555 TO 1655	49	1,931	27	5	71.4	70.8
A2	100 FT from centerline of Q. Kaahumanu Hwy. (4/27/09)	1555 TO 1655	49	1,931	27	5	63.2	65.3

Year 2013 14 CFR Part 150 airport noise contours with the location of the project site.

Traffic Noise. The existing traffic noise levels in the project environs vary from levels of approximately 62 DNL along the makai (west) property boundary, to less than 55 DNL at the mauka (east) property boundary and interior locations of the project site. Traffic noise levels along Queen Kaahumanu Highway are less than 65 DNL at 141 FT or greater setback distances from the highway centerline. Traffic noise levels along Mamalahoa Highway are less than 65 DNL at 95 FT or greater setback distances from the highway centerline. Along the east boundary of the project site which is removed from Hina Lani Street, existing background ambient noise levels are very low and less than 55 DNL.

Calculations of existing traffic noise levels during the AM and PM peak traffic hours are presented in Tables 5A and 5B. 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. The existing setback distances from the roadways' centerlines to their associated 65 and 75 DNL contours were also calculated as shown in Table 6. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections. Based on the results of Table 6, it was concluded that the existing 65 DNL traffic noise contour is located approximately 132 to 141 FT from the centerline of Queen Kaahumanu Highway, and approximately 93 to 95 FT from the centerline of Mamalahoa Highway in the immediate vicinity of the project site.

Existing traffic noise levels at the interior portions of the project site are controlled by the traffic along Hina Lani Street, and are approximately 65 to 69 DNL at 50 FT from the centerline of Hina Lani Street. At the interior locations on the project site which are removed from Hina Lani Street and Queen Kaahumanu Highway, existing background noise levels drop to 55 DNL or less, and aircraft noise and the natural sounds of birds and winds in foliage are the dominant noise sources. A discussion of existing aircraft noise levels on the project site is provided in the following section. Between intermittent noise events, background ambient noise levels drop to a range of 35 to 40 dB. During calm wind periods, background ambient noise levels decrease to levels less than 40 dB. The minimum background ambient noise levels at these interior locations are controlled by distant traffic and wind noise.

Aircraft Noise. Aircraft noise sources in the project environs are associated with fixed and rotary wing aircraft operations at Kona International Airport at Keahole. Figures 4 through 6 depict aircraft flight tracks in the project environs, which were similar to those reported in Reference 6. Occasionally, depending on weather, visibility, or air traffic conditions, helicopter and light, fixed wing aircraft may cross over the western boundary of project site as indicated by the average departure and arrival tracks shown in Figures 4 and 5, respectively. The noisier jet aircraft flight tracks

TABLE 5A

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (AM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Mamalahoa Hwy. - N. of Hina Lani St.	51	1,418	1,390	14	14	70.2	64.6	58.5
Mamalahoa Hwy. - S. of Hina Lani St.	50	1,428	1,400	14	14	69.9	64.4	58.3
Hina Lani St. - W. of Mamalahoa Hwy.	58	386	372	5	9	66.7	61.1	55.1
Hina Lani St. - E. of Ane Keahokalole Hwy.	55	321	309	5	7	65.1	59.6	53.6
Ane Keahokalole Hwy. - N. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ane Keahokalole Hwy. - S. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hina Lani St. - W. of Ane Keahokalole Hwy.	55	321	309	5	7	65.1	59.6	53.6
Hina Lani St. - E. of Kamanu St.	55	321	309	5	7	65.1	59.6	53.6
Hina Lani St. - W. of Kamanu St.	45	369	355	6	8	63.2	57.8	52.1
Hina Lani St. - E. of Q. Kaahumanu Hwy.	45	947	912	15	20	67.3	61.9	56.1
Kamanu St. - N. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q. Kaahumanu Hwy. - N. of Hina Lani St.	58	1,509	1,422	42	45	72.9	67.4	61.4
Q. Kaahumanu Hwy. - S. of Hina Lani St.	58	1,742	1,641	49	52	73.5	68.0	62.0

TABLE 5B

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Mamalahoa Hwy. - N. of Hina Lani St.	51	1,178	1,154	12	12	69.4	63.8	57.7
Mamalahoa Hwy. - S. of Hina Lani St.	50	1,189	1,165	12	12	69.1	63.6	57.5
Hina Lani St. - W. of Mamalahoa Hwy.	58	563	542	8	13	68.3	62.8	56.7
Hina Lani St. - E. of Ane Keahokalole Hwy.	55	499	481	8	10	67.0	61.5	55.5
Ane Keahokalole Hwy. - N. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ane Keahokalole Hwy. - S. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hina Lani St. - W. of Ane Keahokalole Hwy.	55	499	481	8	10	67.0	61.5	55.5
Hina Lani St. - E. of Kamanu St.	55	499	481	8	10	67.0	61.5	55.5
Hina Lani St. - W. of Kamanu St.	45	649	625	10	14	65.6	60.3	54.5
Hina Lani St. - E. of Q. Kaahumanu Hwy.	45	1,485	1,430	24	31	69.2	63.8	58.1
Kamanu St. - N. of Hina Lani St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q. Kaahumanu Hwy. - N. of Hina Lani St.	49	1,777	1,747	25	5	70.4	64.9	58.7
Q. Kaahumanu Hwy. - S. of Hina Lani St.	49	2,284	2,245	32	7	71.5	66.0	59.8

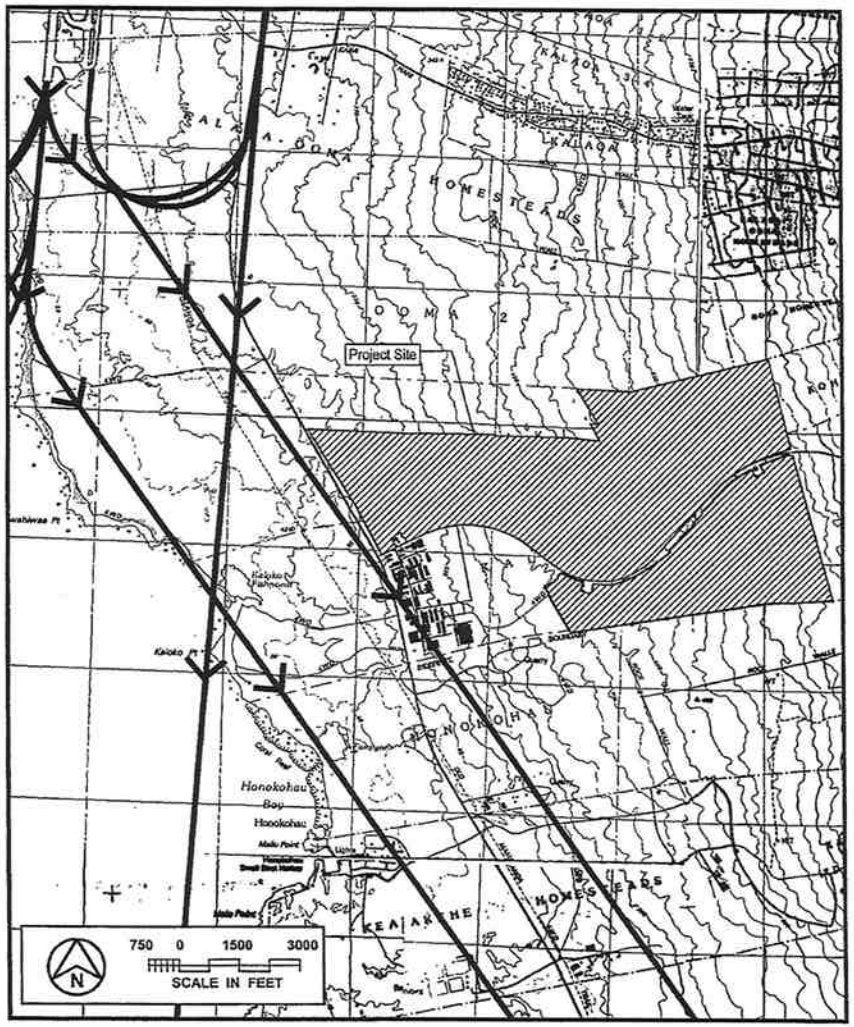
TABLE 6

YEAR 2011 AND 2045 DISTANCES TO 65 AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT) CY 2011	65 DNL SETBACK (FT) CY 2045	75 DNL SETBACK (FT) CY 2011	75 DNL SETBACK (FT) CY 2045
Mamalahoa Hwy. - N. of Hina Lani St.	95	136	28	40
Mamalahoa Hwy. - S. of Hina Lani St.	93	121	26	35
Hina Lani St. - W. of Mamalahoa Hwy.	76	159	21	48
Hina Lani St. - E. of Ane Keahokalole Hwy.	64	223	18	57
Ane Keahokalole Hwy. - N. of Hina Lani St.	N/A	96	N/A	31
Ane Keahokalole Hwy. - S. of Hina Lani St.	N/A	103	N/A	33
Hina Lani St. - W. of Ane Keahokalole Hwy.	64	197	18	50
Hina Lani St. - E. of Kamanu St.	64	208	18	52
Hina Lani St. - W. of Kamanu St.	54	172	15	42
Hina Lani St. - E. of Q. Kaahumanu Hwy.	86	197	24	48
Kamanu St. - N. of Hina Lani St.	N/A	56	N/A	17
Q. Kaahumanu Hwy. - N. of Hina Lani St.	132	292	38	92
Q. Kaahumanu Hwy. - S. of Hina Lani St.	141	348	41	107

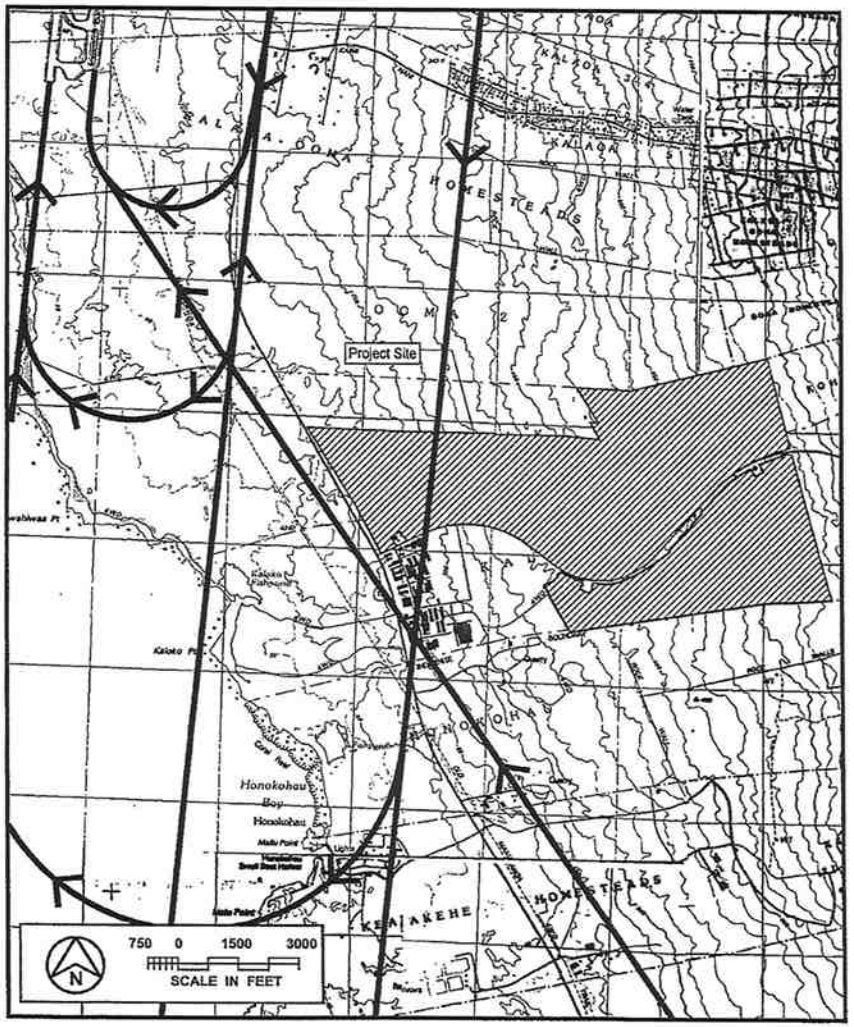
Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See Tables 5A, 5B, 7A, and 7B for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.



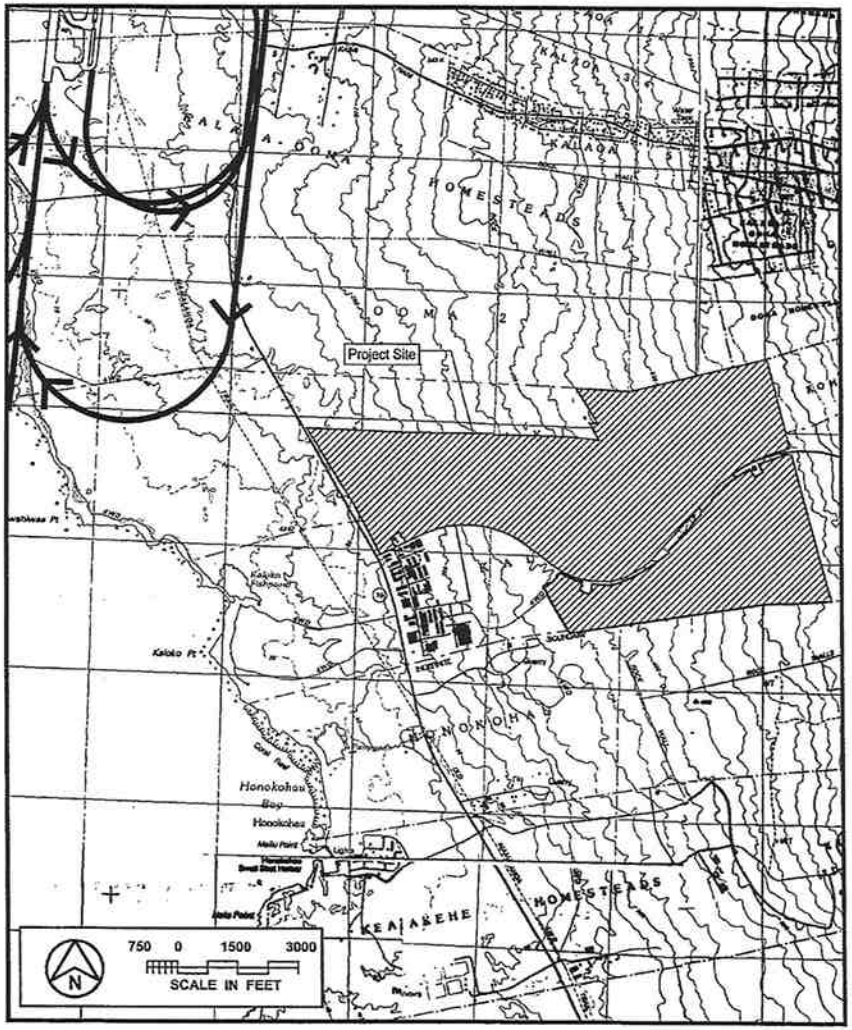
LOCATIONS OF EXISTING AVERAGE AIRCRAFT DEPARTURE FLIGHT TRACKS IN PROJECT ENVIRONS

FIGURE 4



LOCATIONS OF EXISTING AVERAGE AIRCRAFT ARRIVAL FLIGHT TRACKS IN PROJECT ENVIRONS

FIGURE 5



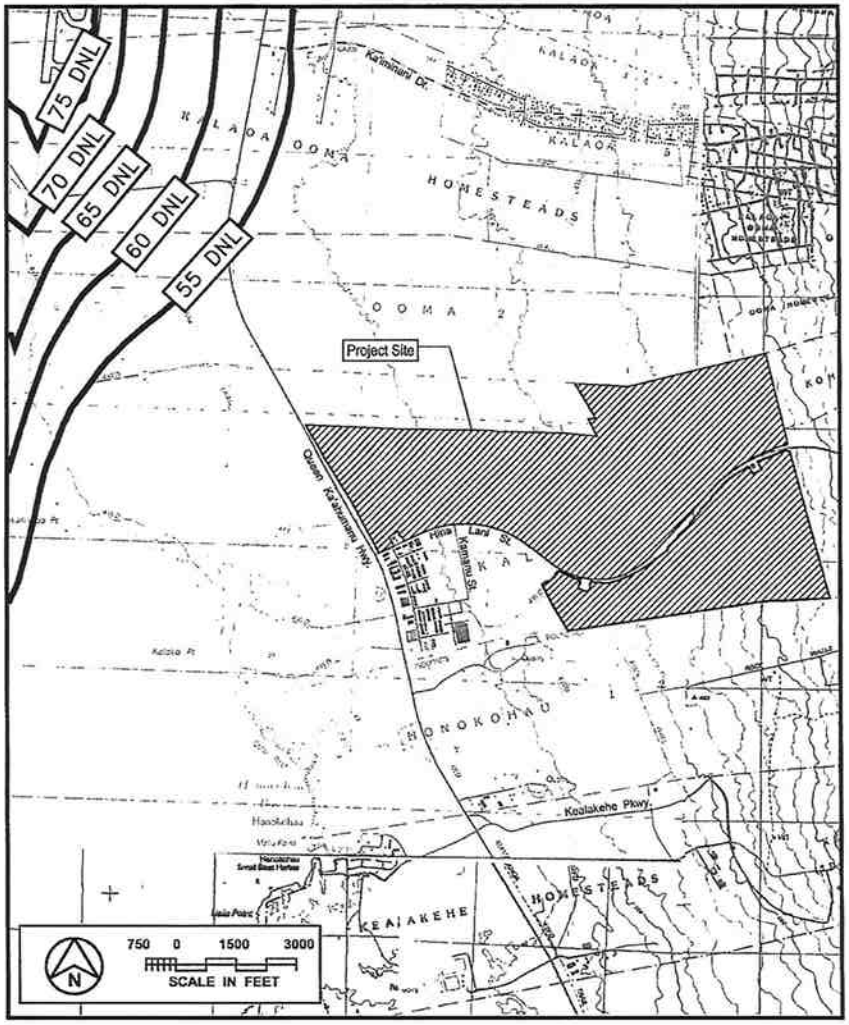
LOCATIONS OF EXISTING AVERAGE AIRCRAFT TRAINING FLIGHT TRACKS IN PROJECT ENVIRONS

FIGURE 6

typically remain offshore and west of the project site, and are aligned with Kona International Airport's single runway. However, large overseas jet aircraft may occasionally overfly the west end of the project site where shown in Figure 5 when landing while using a right hand turn during north flow pattern conditions (Runway 35 in use). This approach to the airport is used due to the presence of other aircraft traffic approaching the airport from the west.

Figure 7 depicts the locations of the 55 through 75 DNL aircraft noise contours during the CY 2008 period. These noise contours were obtained from the Kona International Airport At Keahole 14 CFR Part 150 report (Reference 6). From Figure 7, aircraft noise levels over the project site are below 55 DNL, and as such, are considered to be in the "Minimal Exposure, Unconditionally Acceptable" category for the planned land uses on the project site.

Based on the most current information on aircraft noise levels at Kona International Airport At Keahole, the location of the existing 55 DNL contour is estimated to be approximately 1 mile northwest of the project site as shown in Figure 7. The location of the existing 60 DNL contour is estimated to be approximately 1.3 miles northwest of the project site. Based on these 14 CFR Part 150 noise contours for Kona International Airport At Keahole, and their relationships to the project site, it was concluded that the 60 DNL aircraft noise contour is located outside the project site, with at least 10 DNL of margin for increased contour expansion. The 55 DNL aircraft noise contour also does not cross through the project site, and has a smaller 5 DNL of margin for increased contour expansion. Based on these airport noise contours in the project environs, it was concluded that special aircraft noise mitigation measures are not required, and existing aircraft noise levels do not place special development constraints on the project site.



2008 14 CFR PART 150 NOISE CONTOURS FOR KONA INTERNATIONAL AIRPORT AT KEAHOLE

FIGURE 7

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Traffic Noise. Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 9 for CY 2045 with and without the proposed project. The CY 2045 traffic turning movements with and without the project contained in Reference 9 were used. The future assignments of project plus non-project traffic on the roadway sections which would service the project are shown in Tables 7A and 7B for the AM and PM peak hours of traffic, respectively. As indicated in Table 8, by CY 2045 and following complete project build-out, traffic noise levels on Queen Kaahumanu Highway in the areas fronting the project are predicted to increase by approximately 6 to 7 DNL. Along Mamalahoa Highway, traffic noise levels are predicted to increase by 2 to 3 DNL. Along Hina Lani Street, traffic noise levels are predicted to increase by 6.0 to 9.4 DNL. The range of increases in traffic noise levels from 0 to 6 DNL is considered to be low to moderate, since it represents the growth in forecasted project and non-project traffic in the project environs over a 34 year period. The range of increases from 6 to 10 DNL over a 34 year period is considered to be moderate to large.

Table 6 summarizes the predicted increases in the future setback distances to the 65 and 75 DNL traffic noise contour lines along the roadways in the project environs and attributable to both project plus non-project traffic in CY 2045. The setback distances in Table 6 do not include the beneficial effects of noise shielding from terrain features and highway cuts, or the detrimental effects of additive contributions of noise from intersecting streets. As indicated in Table 6, the setback distances to the 65 DNL contour are predicted to range from 292 to 348 FT from the centerline of Queen Kaahumanu Highway following project build-out in CY 2045. Along Mamalahoa Highway, setback distances to the 65 DNL contour are predicted to range from 121 to 136 FT from the centerline of Mamalahoa Highway. Along Hina Lani Street, setback distances to the 65 DNL contour are expected to range from 159 to 223 FT.

Table 8 presents the predicted increases in traffic noise levels associated with non-project and project traffic by CY 2045, and as measured by the DNL descriptor system. As indicated in Table 8, the increases in traffic noise along Hina Lani Street west of Ane Keahokalole Highway due to project traffic are much greater than those resulting from non-project traffic. Along Mamalahoa Highway, project traffic noise contributions are expected to be much less than non-project traffic noise contributions by CY 2045. Along Hina Lani Street, project traffic is expected to increase traffic noise levels above those associated with non-project traffic by 2.2 to 7.4 DNL. The largest increases in traffic noise levels attributable to project traffic are expected to occur along Hina Lani Street near Kamanu Street. The relatively large increases in future traffic noise levels along Ane Keahokalole Highway are due to the relatively low non-project traffic volumes expected on that roadway prior to CY 2045.

By 2045 with the project, a highway interchange will probably be required on

TABLE 7A

FUTURE (CY 2045) TRAFFIC VOLUMES AND NOISE LEVELS
ALONG VARIOUS ROADWAY SECTIONS
(AM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M.TRUCKS	H.TRUCKS	50' Leq	100' Leq	200' Leq
Mamalahoa Hwy. - N. of Hina Lani St.	51	2,861	2,803	29	29	73.2	67.7	61.6
Mamalahoa Hwy. - S. of Hina Lani St.	50	2,417	2,369	24	24	72.2	66.7	60.6
Hina Lani St. - W. of Mamalahoa Hwy.	58	2,056	1,980	29	47	73.9	68.4	62.3
Hina Lani St. - E. of Ane Keahokalole Hwy.	55	2,765	2,663	44	58	75.1	70.1	65.0
Ane Keahokalole Hwy. - N. of Hina Lani St.	45	1,878	1,809	30	39	70.3	64.2	59.3
Ane Keahokalole Hwy. - S. of Hina Lani St.	45	2,171	2,090	35	46	71.0	64.9	59.9
Hina Lani St. - W. of Ane Keahokalole Hwy.	55	2,238	2,155	36	47	74.2	69.2	64.1
Hina Lani St. - E. of Kamanu St.	55	2,402	2,314	38	50	74.5	69.5	64.4
Hina Lani St. - W. of Kamanu St.	45	3,013	2,902	48	63	72.9	68.0	63.0
Hina Lani St. - E. of Q. Kaahumanu Hwy.	45	3,665	3,529	59	77	73.7	68.9	63.9
Kamanu St. - N. of Hina Lani St.	35	1,164	1,121	19	24	65.4	59.5	54.8
						100' Leq	200' Leq	300' Leq
Q. Kaahumanu Hwy. - N. of Hina Lani St.	58	3,453	3,252	97	104	74.2	67.7	64.8
Q. Kaahumanu Hwy. - S. of Hina Lani St.	58	4,690	4,418	131	141	75.6	69.1	66.1

TABLE 7B

FUTURE (CY 2045) TRAFFIC VOLUMES AND NOISE LEVELS
ALONG VARIOUS ROADWAY SECTIONS
(PM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M.TRUCKS	H.TRUCKS	50' Leq	100' Leq	200' Leq
Mamalahoa Hwy. - N. of Hina Lani St.	51	2,724	2,670	27	27	73.0	67.5	61.4
Mamalahoa Hwy. - S. of Hina Lani St.	50	2,310	2,264	23	23	72.0	66.5	60.4
Hina Lani St. - W. of Mamalahoa Hwy.	58	2,400	2,311	34	55	74.6	69.1	63.0
Hina Lani St. - E. of Ane Keahokalole Hwy.	55	3,304	3,182	53	69	75.9	70.9	65.8
Ane Keahokalole Hwy. - N. of Hina Lani St.	45	2,061	1,985	33	43	70.7	64.6	59.7
Ane Keahokalole Hwy. - S. of Hina Lani St.	45	2,358	2,270	38	50	71.4	65.2	60.3
Hina Lani St. - W. of Ane Keahokalole Hwy.	55	2,695	2,595	43	57	75.0	70.0	64.9
Hina Lani St. - E. of Kamanu St.	55	2,901	2,794	46	61	75.3	70.4	65.3
Hina Lani St. - W. of Kamanu St.	45	3,714	3,577	59	78	73.8	68.9	63.9
Hina Lani St. - E. of Q. Kaahumanu Hwy.	45	4,593	4,424	73	96	74.7	69.8	64.9
Kamanu St. - N. of Hina Lani St.	35	1,333	1,284	21	28	66.0	60.1	55.4
						100' Leq	200' Leq	300' Leq
Q. Kaahumanu Hwy. - N. of Hina Lani St.	49	4,174	4,103	58	13	71.9	65.5	62.5
Q. Kaahumanu Hwy. - S. of Hina Lani St.	49	5,869	5,769	82	18	73.4	66.9	64.0

TABLE 8

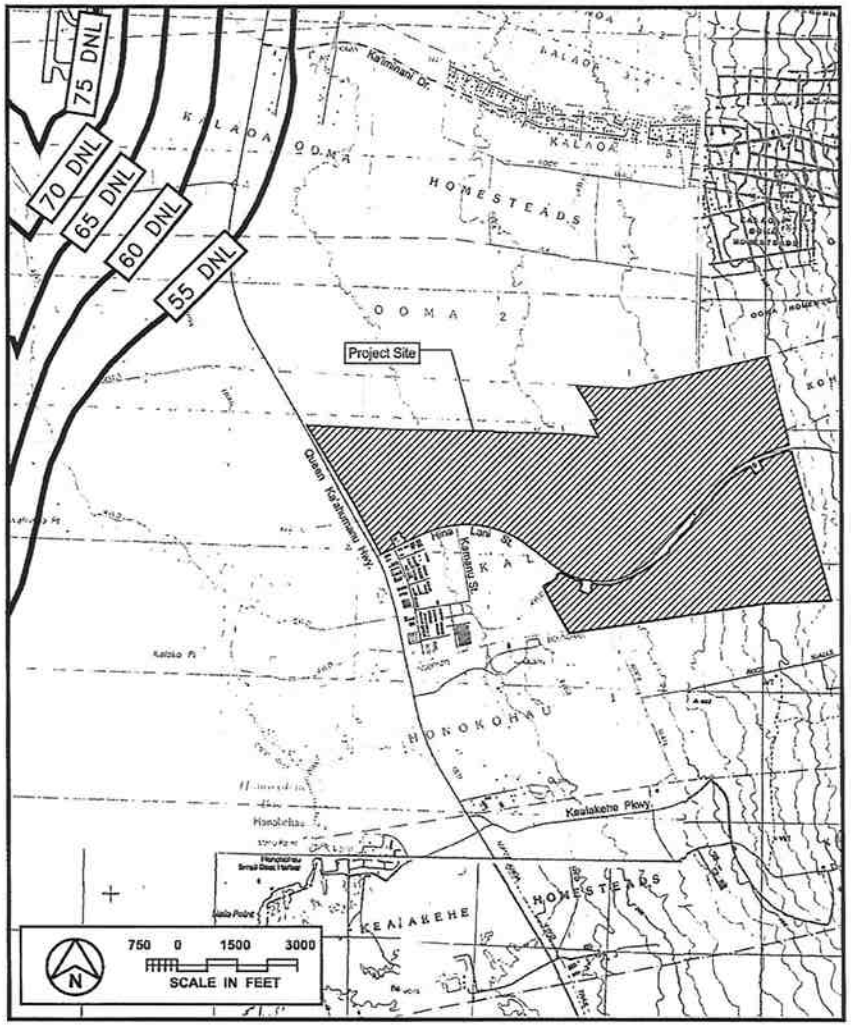
CALCULATIONS OF PROJECT AND NON-PROJECT
TRAFFIC NOISE CONTRIBUTIONS (CY 2045)

STREET SECTION	NOISE LEVEL (DNL) INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Mamalahoa Hwy. - N. of Hina Lani St.	2.2	0.9
Mamalahoa Hwy. - S. of Hina Lani St.	1.2	1.1
Hina Lani St. - W. of Mamalahoa Hwy.	4.1	2.2
Hina Lani St. - E. of Ane Keahokalole Hwy.	4.9	4.5
Ane Keahokalole Hwy. - N. of Hina Lani St.	59.5	5.1
Ane Keahokalole Hwy. - S. of Hina Lani St.	62.8	2.4
Hina Lani St. - W. of Ane Keahokalole Hwy.	3.2	5.3
Hina Lani St. - E. of Kamanu St.	2.2	6.7
Hina Lani St. - W. of Kamanu St.	1.2	7.4
Hina Lani St. - E. of Q. Kaahumanu Hwy.	0.6	5.4
Kamanu St. - N. of Hina Lani St.	N/A	60.1
Q. Kaahumanu Hwy. - N. of Hina Lani St.	5.2	1.1
Q. Kaahumanu Hwy. - S. of Hina Lani St.	4.9	2.2

Queen Kaahumanu Highway at Hina Lani Street. An overpass ramp structure will be required to go southbound on the highway from Hina Lani Street and to go eastbound on Hina Lani Street from the highway's southbound approach. A northbound on-ramp from Hina Lani Street and a northbound off-ramp to Hina Lani Street will also be required. The proposed Park at the west end of the project site is the closest land use to the future interchange which may be considered noise sensitive. In order that the CY 2045 traffic noise levels not exceed 65 DNL at the west park boundary, the centerline of the northbound on-ramp should be located at least 85 FT west of the Park's west boundary.

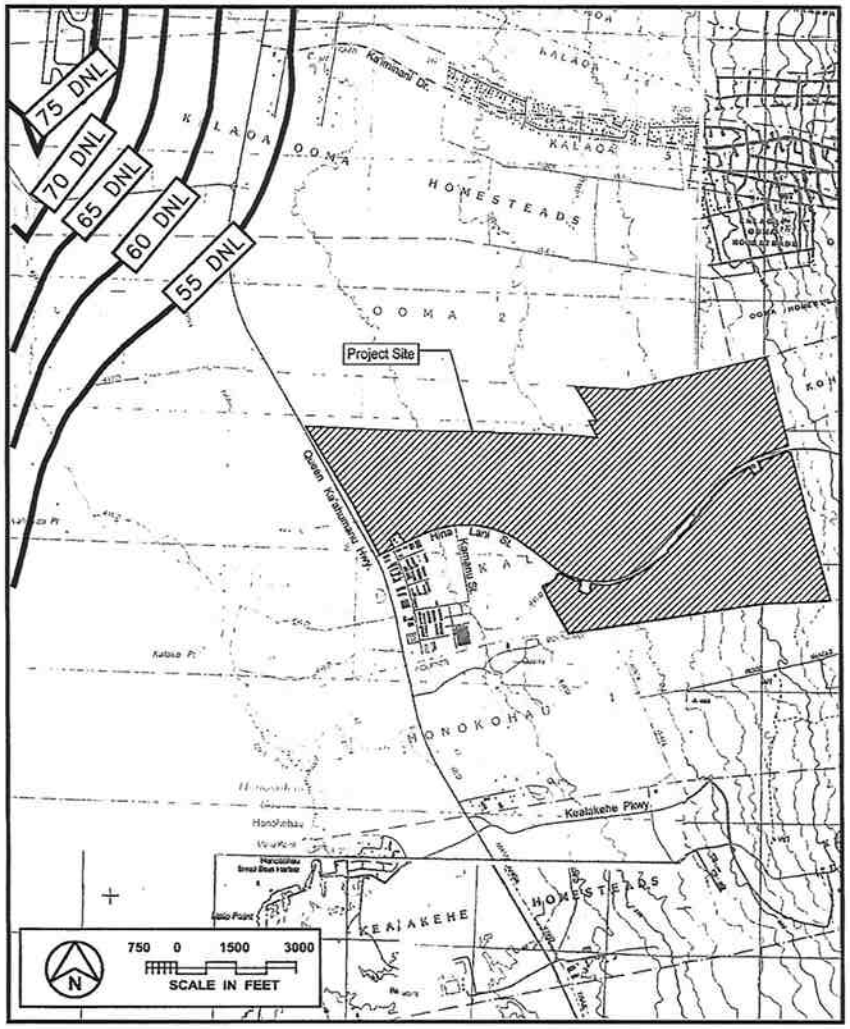
The predicted noise level from the overpass ramp structure in CY 2045 was 65 DNL at 116 FT from the centerline of the ramp structure. Because the overpass ramp structure will probably be located on the northwest quadrant of the interchange, the 65 DNL contour from Queen Kaahumanu Highway through traffic will extend between 110 to 130 FT beyond the westernmost edge of the overpass ramp structure. Beyond the future interchange at Hina Lani Street, the CY 2045 setback distances to the highway's 65 DNL contours north and south of Hina Lani Street should be similar to those shown in Table 6.

Aircraft Noise. The aircraft noise contours in the project environs for the CY 2013 and 2030 periods were developed during the most recent 14 CFR Part 150 Noise Study Update for Kona International Airport at Keahole. These airport noise contours are shown in Figures 8 and 9 and were obtained from Reference 6. These noise contours and their relationships to the project site are very similar to the existing (2008) airport noise contours shown in Figure 7. The forecasted 2013 and long range airport noise contours are expected to remain outside the project area. Based on the relationships of the project site to the forecasted airport noise contours shown in Figures 8 and 9, it was concluded that risks of adverse noise impacts from aircraft noise should be minimal at the project site, and that the proposed noise sensitive developments on the project site conforms to the land use compatibility recommendations of the State Department of Transportation, Airports Division.



2013 14 CFR PART 150 NOISE CONTOURS FOR KONA INTERNATIONAL AIRPORT AT KEAHOLE

FIGURE 8



LONG RANGE 14 CFR PART 150 NOISE CONTOURS FOR KONA INTERNATIONAL AIRPORT AT KEAHOLE

FIGURE 9

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

Traffic Noise. The increases in traffic noise levels attributable to the project from the present to CY 2045 are predicted to range from 1.1 to 2.2 DNL along Queen Kaahumanu Highway, where traffic noise levels are expected to be above 65 DNL at relatively large distances from the highway Right-of-Way. These increases in traffic noise levels along Queen Kaahumanu Highway which are attributable to the project are much lower than the traffic noise increases expected as a result of non-project traffic. The project's development plan has allowed for adequate setback distances of the project's noise sensitive parcels from Queen Kaahumanu Highway, with the light industrial properties providing both a buffer and sound attenuating structures between the highway and the noise sensitive parcels planned to the east. The lands along the highway Right-of-Way are generally vacant in the project environs except for existing commercial developments south of the Hina Lani Street intersection. For these reasons, traffic noise impacts along Queen Kaahumanu Highway and resulting from project traffic are not considered to be serious. However, setback distances to the 65 and 75 DNL contours are expected to increase as a result of both project and non-project traffic.

Relatively small increases (1.0 DNL or less) in traffic noise levels along the north and south sections of Mamalahoa Highway at the Hina Lani Street intersection are expected to occur as a result of the proposed project. Non-project traffic is expected to cause increases of 1.2 to 2.2 DNL during this same period. By CY 2045, project traffic is expected to increase traffic noise levels along the north and south sections of Mamalahoa Highway by approximately 0.9 DNL and 1.1 DNL, respectively. This level of increase is not considered significant, and traffic noise impacts resulting from project traffic along these sections of the highway will be difficult to quantify over this 34 year period.

Along Hina Lani Street, potential noise impacts from project and non-project traffic are possible, both in respect to existing and planned noise sensitive receptors along this roadway. Existing and future residences which are located along the sections of Hina Lani Street between Mamalahoa Highway and Queen Kaahumanu Highway may be impacted by the future traffic noise along the roadway if their setback distances from the highway centerline are less than 223 FT. Because traffic noise along public roadways such as Hina Lani Street are generated by non-project as well as project traffic, mitigation of offsite traffic noise impacts are generally performed by individual property owners along the roadways' Rights-of-Way or by public agencies during roadway improvement projects. These mitigation measures generally take the form of increased setbacks, sound attenuating walls, total closure and air conditioning, or the use of sound attenuating windows. Where adequate setbacks beyond the 65 DNL noise contour are not available, the construction of 6 FT high sound walls is generally effective for attenuating traffic noise at single story structures, or at the ground floors of multistory structures. Whenever mitigation of traffic noise at the upper

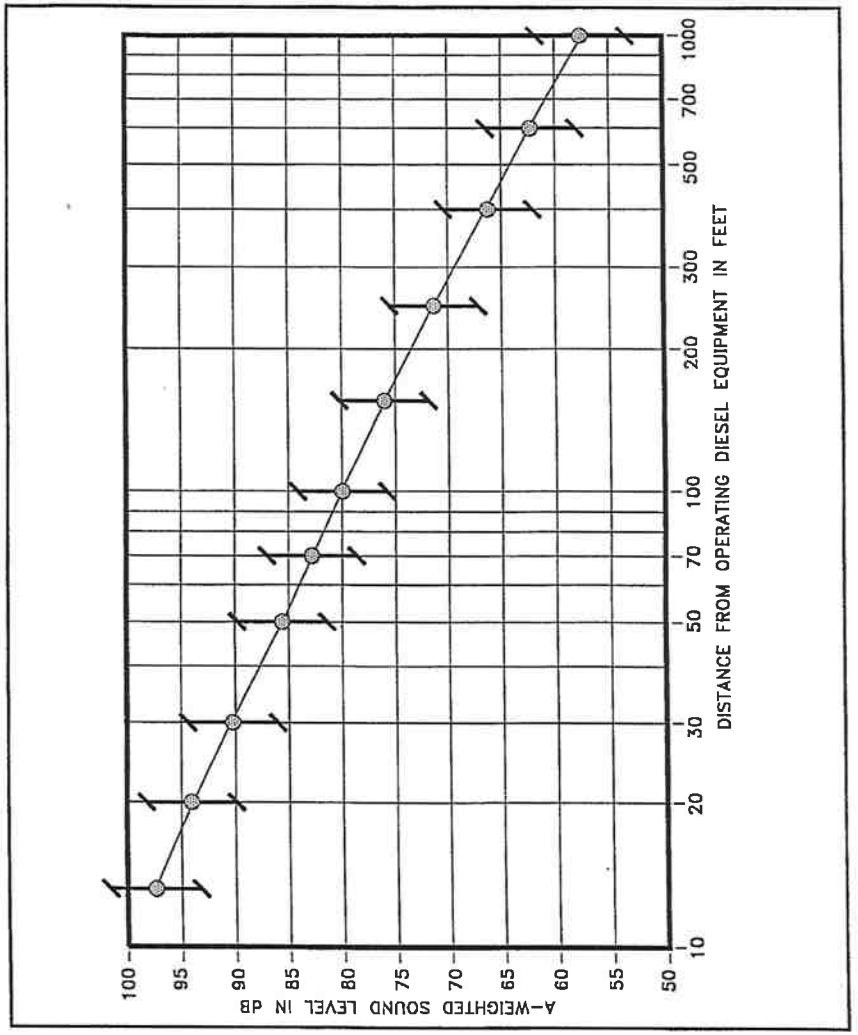
floors are required, the use of closure and air conditioning, or the use of sound attenuating windows are the more appropriate sound attenuation measures. Along the future Ane Keahokalole Highway, project residences will require setback distances in the order of 96 to 103 FT from the centerline of the highway, or sound attenuation walls constructed along the Rights-of-Way may be required for traffic noise mitigation.

Aircraft Noise. Based on currently available existing and forecasted aircraft noise contours over the project site, special aircraft noise attenuation measures are not considered mandatory on the project site. The implementation of the airport noise disclosure provisions of Act 208 is not required because the existing and forecasted 55 DNL noise contours do not enter into the project area.

Combined Traffic and Aircraft Noise. When applying for FHA/HUD financial assistance on residential developments, sound attenuation measures are normally required if total exterior noise levels exceed 65 DNL. Traffic noise levels may exceed 65 DNL along the highway corridors and major thoroughfares which service the project. If the traffic noise level equals 65 DNL and the aircraft noise level is less than 55 DNL at a project dwelling, the total noise level will also be 65 DNL, which does not exceed the FHA/HUD standard of 65 DNL. Because existing and forecasted aircraft noise levels over the project site should not exceed 55 DNL, combined traffic and aircraft noise levels should not exceed 65 DNL when traffic noise levels are equal to or less than 65 DNL. Where traffic noise levels exceed 65 DNL, the combined noise levels will be identical to the traffic noise levels over the entire project site, and will not be dependent upon the levels of aircraft noise.

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 noise from construction activity (excluding pile driving activity) are shown in Figure 10. The noise sensitive properties which are predicted to experience the highest noise levels during construction activities on the project site are the future residences who first occupy the project site following the initial phases of project completion. Existing residences to the east along Hina Lani Street may also experience audible construction noise of approximately 55 dBA or less. 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 its regulation. 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 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (grading and earth moving,



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 10

trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable on the island of Hawaii (Reference 7), is another noise mitigation measure which can be applied to this project. Figure 11 depicts the normally permitted hours of construction for normal construction noise as well as the curfew periods for construction noise. Noisy construction activities are not allowed on Sundays and holidays under the DOH permit procedures.

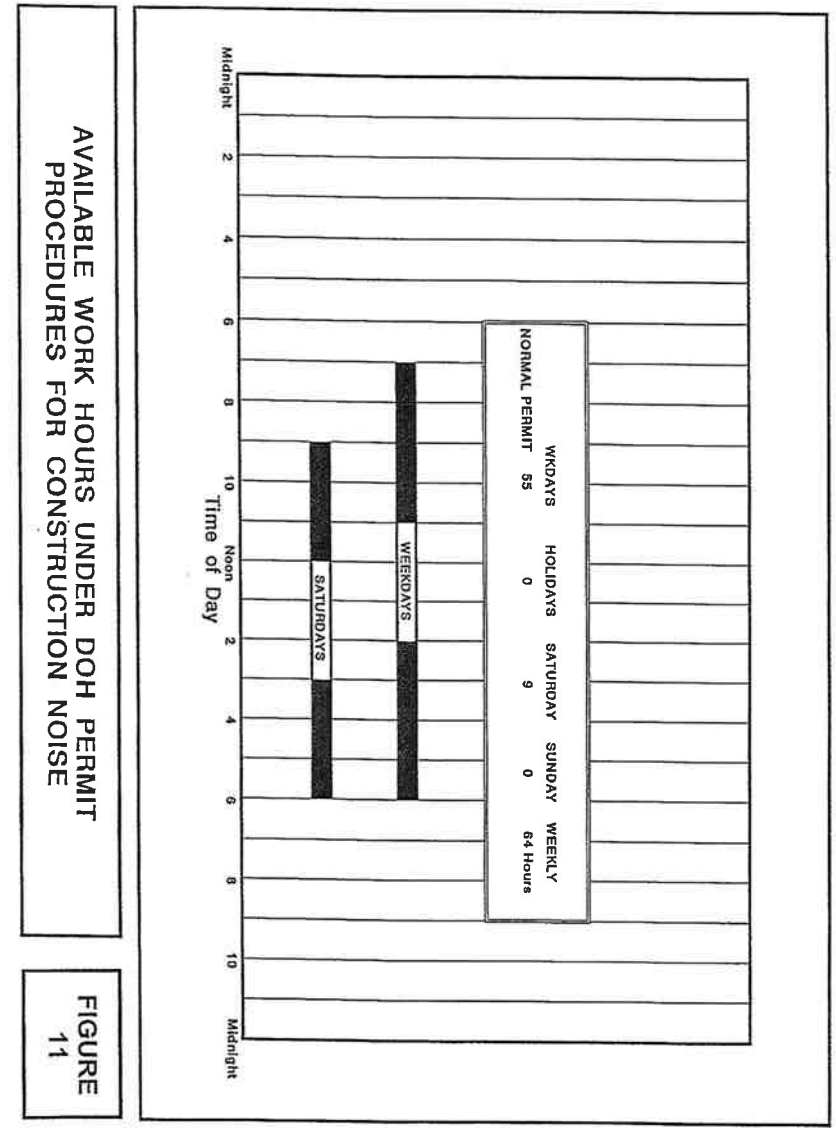


FIGURE 11

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) "Mandatory Seller Disclosures in Real Estate Transactions;" Chapter 508D, Hawaii Revised Statutes; July 1, 1996.

(6) "Kona International Airport At Keahole, 14 CFR Part 150 Noise Compatibility Study, Noise Exposure Maps Update;" State Department of Transportation, Airports Division; April 2009.

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

(8) "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).

(9) "Traffic Impact Study for Kaloko Makai in Kona, Hawaii;" KOA Corporation; August 8, 2012.

(10) 24-Hour Traffic Counts, Station B71001909280, Queen Kaahumanu Highway Between OTEC Access Road and Hulikoa Street; State Department of Transportation; May 31, 2006.

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 (4) Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
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 FUTURE YEAR (2045)
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2010 *****		CY 2045 (NO BUILD)		CY 2045 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Mamalahoa Hwy. - North of Hina Lani St. (NB)	331	701	544	1,258	823	1,535
Mamalahoa Hwy. - North of Hina Lani St. (SB)	1,087	477	1,814	883	2,038	1,189
Two-Way	1,418	1,178	2,358	2,141	2,861	2,724
Mamalahoa Hwy. - South of Hina Lani St. (NB)	393	588	492	843	738	1,181
Mamalahoa Hwy. - South of Hina Lani St. (SB)	1,035	601	1,372	824	1,679	1,129
Two-Way	1,428	1,189	1,864	1,667	2,417	2,310
Hina Lani St. - West of Mamalahoa Hwy. (EB)	136	400	305	765	891	1,347
Hina Lani St. - West of Mamalahoa Hwy. (WB)	250	163	695	409	1,165	1,053
Two-Way	386	563	1,000	1,174	2,056	2,400
Hina Lani St. - East of Ane Keahokalole Hwy. (EB)	101	339	320	980	994	1,962
Hina Lani St. - East of Ane Keahokalole Hwy. (WB)	220	160	900	541	1,771	1,342
Two-Way	321	499	1,220	1,521	2,765	3,304
Ane Keahokalole Hwy. - North of Hina Lani St. (NB)	N/A	N/A	182	375	808	1,071
Ane Keahokalole Hwy. - North of Hina Lani St. (SB)	N/A	N/A	462	253	1,070	990
Two-Way	N/A	N/A	644	628	1,878	2,061
Ane Keahokalole Hwy. - South of Hina Lani St. (NB)	N/A	N/A	429	747	829	1,264
Ane Keahokalole Hwy. - South of Hina Lani St. (SB)	N/A	N/A	878	606	1,342	1,094
Two-Way	N/A	N/A	1,307	1,353	2,171	2,358
Hina Lani St. - West of Ane Keahokalole Hwy. (EB)	101	339	194	723	856	1,613
Hina Lani St. - West of Ane Keahokalole Hwy. (WB)	220	160	605	303	1,382	1,082
Two-Way	321	499	799	1,026	2,238	2,695
Hina Lani St. - East of Kamanu St. (EB)	101	339	202	565	968	1,697
Hina Lani St. - East of Kamanu St. (WB)	220	160	442	300	1,434	1,204
Two-Way	321	499	644	865	2,402	2,901
Hina Lani St. - West of Kamanu St. (EB)	137	210	254	323	1,354	1,821
Hina Lani St. - West of Kamanu St. (WB)	232	439	339	582	1,659	1,893
Two-Way	369	649	593	905	3,013	3,714

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND FUTURE YEAR
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2010 *****		CY 2045 (NO BUILD)		CY 2045 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Hina Lani St. - East of Q. Kaahumanu Hwy. (EB)	532	741	741	906	1,840	2,404
Hina Lani St. - East of Q. Kaahumanu Hwy. (WB)	415	744	506	877	1,825	2,189
Two-Way	947	1,485	1,247	1,783	3,665	4,593
Kamanu St. - North of Hina Lani St. (NB)	N/A	N/A	N/A	N/A	585	646
Kamanu St. - North of Hina Lani St. (SB)	N/A	N/A	N/A	N/A	579	687
Two-Way	N/A	N/A	N/A	N/A	1,164	1,333
Q. Kaahumanu Hwy. North of Hina Lani St. (NB)	670	859	1,256	1,566	1,637	1,975
Q. Kaahumanu Hwy. North of Hina Lani St. (SB)	839	918	1,458	1,709	1,816	2,199
Two-Way	1,509	1,777	2,714	3,275	3,453	4,174
Q. Kaahumanu Hwy. South of Hina Lani St. (NB)	845	1,111	1,458	1,827	2,263	2,930
Q. Kaahumanu Hwy. South of Hina Lani St. (SB)	897	1,173	1,425	1,941	2,427	2,939
Two-Way	1,742	2,284	2,883	3,768	4,690	5,869