FINAL ENVIRONMENTAL IMPACT STATEMENT

INTERNATIONAL MARKET PLACE REVITALIZATION PROJECT

Appendix 2

Acoustic Study for the International Market Place Revitalization Project

ACOUSTIC STUDY FOR THE INTERNATIONAL MARKET PLACE REVITALIZATION PROJECT WAIKIKI, OAHU, HAWAII

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed International Market Place Revitalization Project in Waikiki (see FIGURE 1) were evaluated for their potential noise impacts and their relationship to current FHA/HUD noise standards. The traffic noise level increases along the major access roadways to and from the project site were calculated. No significant increases in traffic noise are predicted to occur along Kalakaua Avenue, Kuhio Avenue, Ala Wai Boulevard, and the various mauka-makai cross streets as a result of project traffic following project build-out by CY 2015. Traffic noise from Kalakaua Avenue and Kuhio Avenue will continue to control background ambient noise levels in the project environs, with traffic noise levels exceeding 65 DNL at existing resort units which front Kalakaua Avenue and Kuhio Avenue.

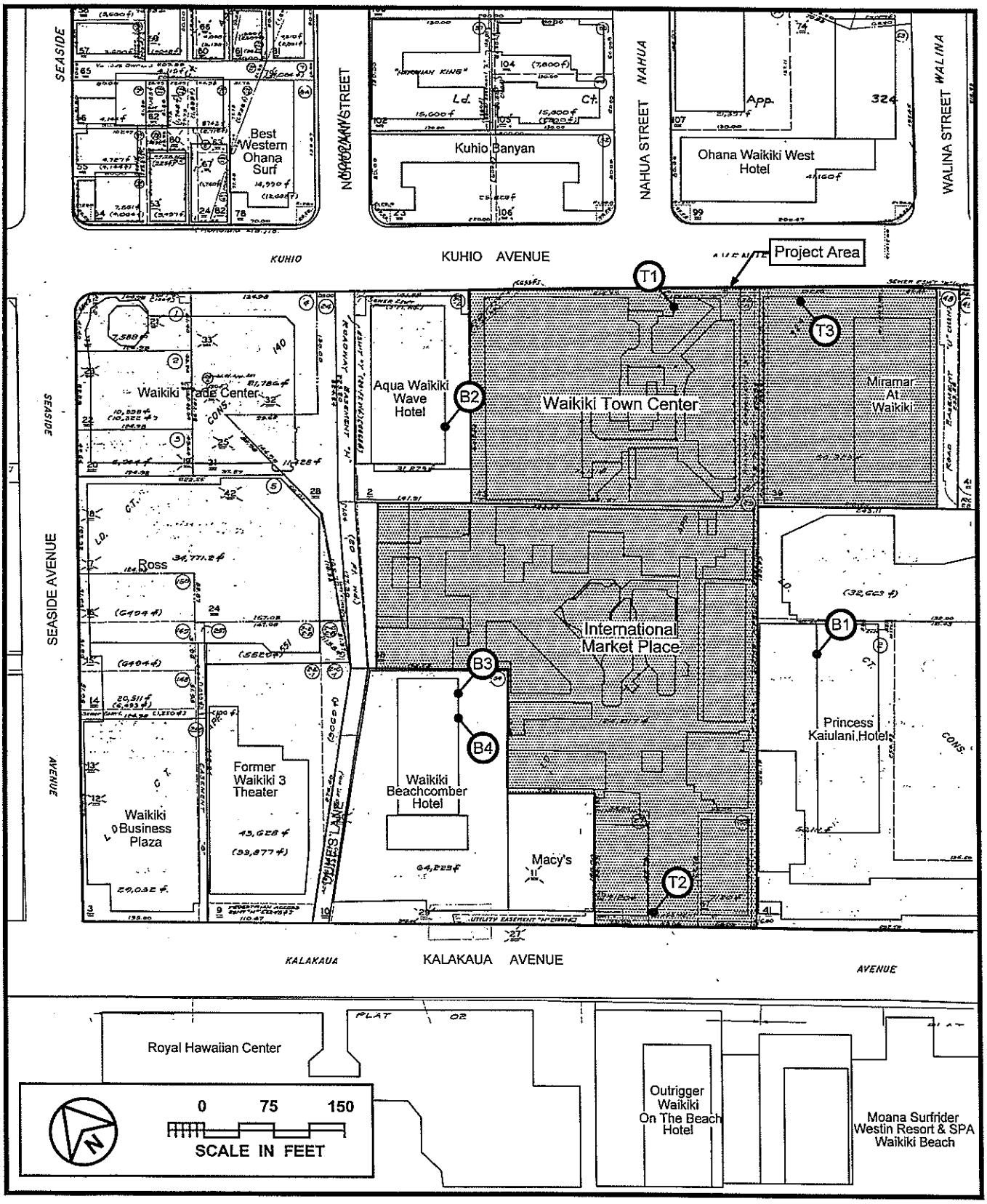
Project traffic will add less than 0.3 DNL additional units of noise along Kalakaua Avenue, Kuhio Avenue, and Ala Wai Boulevard. Along the cross streets where existing traffic noise levels are relatively low, project traffic will add 0.0 to 2.5 DNL units of noise. The increases in future traffic noise levels resulting from project generated traffic are not considered to be significant.

Increases in traffic noise levels of 0.2 to 0.6 DNL are predicted to occur along Kalakaua Avenue, Kuhio Avenue, and Ala Wai Boulevard as a result of the increases in non-project traffic by CY 2015. These increases are expected to occur with or without the proposed revitalization project, are considered to be small, and will be difficult to perceive between 2011 and 2015.

Unavoidable, but temporary, noise impacts may occur during the demolition and construction activities within the project area, and particularly during the demolition and excavation activities on the project site. Because construction activities are predicted to be audible within the project site and at adjoining properties, the quality of the acoustic environment may be degraded 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 (i.e., construction equipment with factory supplied mufflers and with enclosed engine compartments) is recommended as a standard mitigation measure. The implementation of Hawaii State Department of Health permit procedures and curfew periods for construction activities is also expected for this project.

Concrete pile driving operations will not be required on this project because the use of Auger Cast piles is planned to minimize potential noise and vibration impacts at adjacent properties during construction of the project.

Potential noise impacts from on site mechanical equipment and activities may be minimized through the use of sound attenuating devices at the mechanical equipment, scheduling of maintenance activities to daylight hours, and properly managing the use



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

of any outdoor entertainment areas to avoid noise complaints. The proposed activities within the redevelopment area are very similar to existing retail activities, so maintaining the status quo in respect to noise emissions should not be difficult.

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future noise environment in the environs of the proposed International Market Place Revitalization Project in Waikiki on the island of Oahu. Traffic noise level increases and impacts associated with the proposed development were to be determined along the public roadways which are expected to service the project related 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.

Potential noise impacts from the activities and equipment associated with the new seven-level retail/parking complex on the site of the existing International Market Place and Waikiki Town Center were also evaluated. Potential noise impacts associated with the future tenants of the new complex were also evaluated. Assessments of possible future impacts from 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 (Ldn or 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. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in FIGURE 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 Kalakaua Avenue and Kuhio Avenue are greater than 70 DNL along their Rights-of-Way due to the large volumes of traffic and heavy vehicles (trucks and buses) on those major thoroughfares. Adding to the traffic noise from the roadways are the relatively high noise levels of sirens on police and emergency vehicles, outdoor mechanical equipment (fans and air conditioning equipment) at the commercial and resort buildings, maintenance activities, and garbage and delivery truck operations.

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 2), 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 3, 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

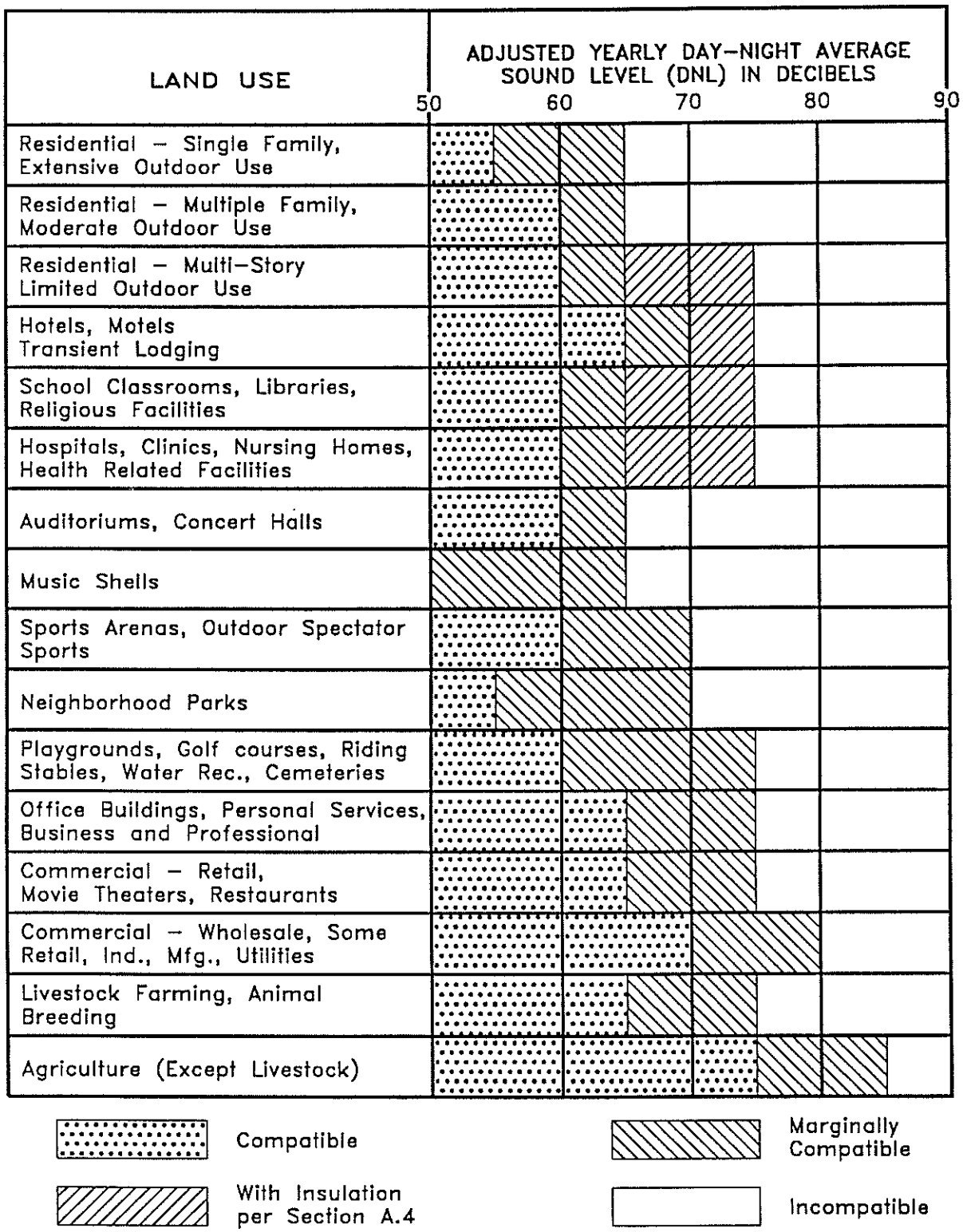
TABLE 1

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.



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

occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Oahu, the State Department of Health (DOH) regulates noise from fixed mechanical equipment and construction activities. State DOH noise regulations are expressed in maximum allowable noise limits rather than DNL (see Reference 4). Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for single family residential lands equate to approximately 55 DNL. For multifamily residential, commercial, and resort lands, the State DOH noise limits equate to approximately 60 DNL. For light and heavy industrial lands, the State DOH noise limits equate to approximately 76 DNL. Construction activities, which are typically noisier than the State DOH noise limits, are regulated through the issuance of permits for allowing excessive construction noise during limited time periods.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Historical existing traffic and background ambient noise levels were obtained in the project environs during April 2004, June 2007, May 2011, and November 2011. These readings were used to provide a basis for describing the existing noise environment in the project environs. Traffic noise measurements along Kuhio Avenue and Kalalaua Avenue were obtained at Locations T1, T2, and T3 as shown in TABLE 2. The locations of these measurement sites are shown in FIGURE 1. Location T1 was on the second floor walkway of the Waikiki Town Center fronting Kuhio Avenue at Nahua Street, and Location T2 was at ground level at the makai entrance of the International Market Place fronting Kalakaua Avenue. Location T3 was at the fifth floor lanai of Suite 546 at the Miramar At Waikiki. Additional daytime and nighttime traffic noise measurements along Kuhio Avenue were obtained from the lanai of the Ohana Waikiki West Hotel (May 18-19, 2011). Daytime and nighttime background ambient noise measurements were obtained at four locations overlooking the International Market Place site. Location B1 was at the Ewa lanai of Suite 2743 of the Sheraton Princess Kaiulani Hotel. Location B2 was at the Diamond Head lanai of Suite 1212 of the Aqua Waikiki Wave Hotel. Locations B3 and B4 were at the Diamond Head lanais of Suite 600 and 601, respectively of the Waikiki Beachcomber Hotel. Background ambient noise measurements between 7:00 and 10:00 p.m. were also performed during walk-throughs of the International Market Place and Waikiki Town Center during the nights of November 22 and 25, 2011.

Traffic noise calculations for the existing conditions as well as noise predictions for CY 2015 for a weekday were performed using the Federal Highway Administration (FHWA) Traffic Noise Model Version 2.5 (Reference 5). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Pavement" propagation loss factor. The weekday traffic data and forecasts for the project (Reference 6) were the primary sources of data inputs to the model. APPENDIX C summarizes the weekday and Saturday PM peak hour traffic volumes for CY 2011 and 2015 which were available from the project's traffic study. The Saturday traffic data and forecasts were not sufficiently different from the weekday values to warrant their use in the DNL calculations. For existing and future traffic along the streets surrounding the project site, it was assumed that the average noise levels, or Leq(h), during the weekday PM peak traffic hour were approximately 2 dB less than the 24-hour DNL along Kalakaua Avenue; equal to the 24-hour DNL along Kuhio Avenue; and 1 dB less than the 24-hour DNL along Ala Wai Boulevard. These assumptions were based on calculated traffic noise levels using the traffic counts from References 7 through 9, which are shown graphically in FIGURES 3 through 5.

Traffic noise calculations for both the existing and future conditions in the project environs were developed at various distances from the centerlines of the roadways. Traffic noise levels were also calculated for future conditions with (Build Alternative) and without (No Build Alternative) the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise

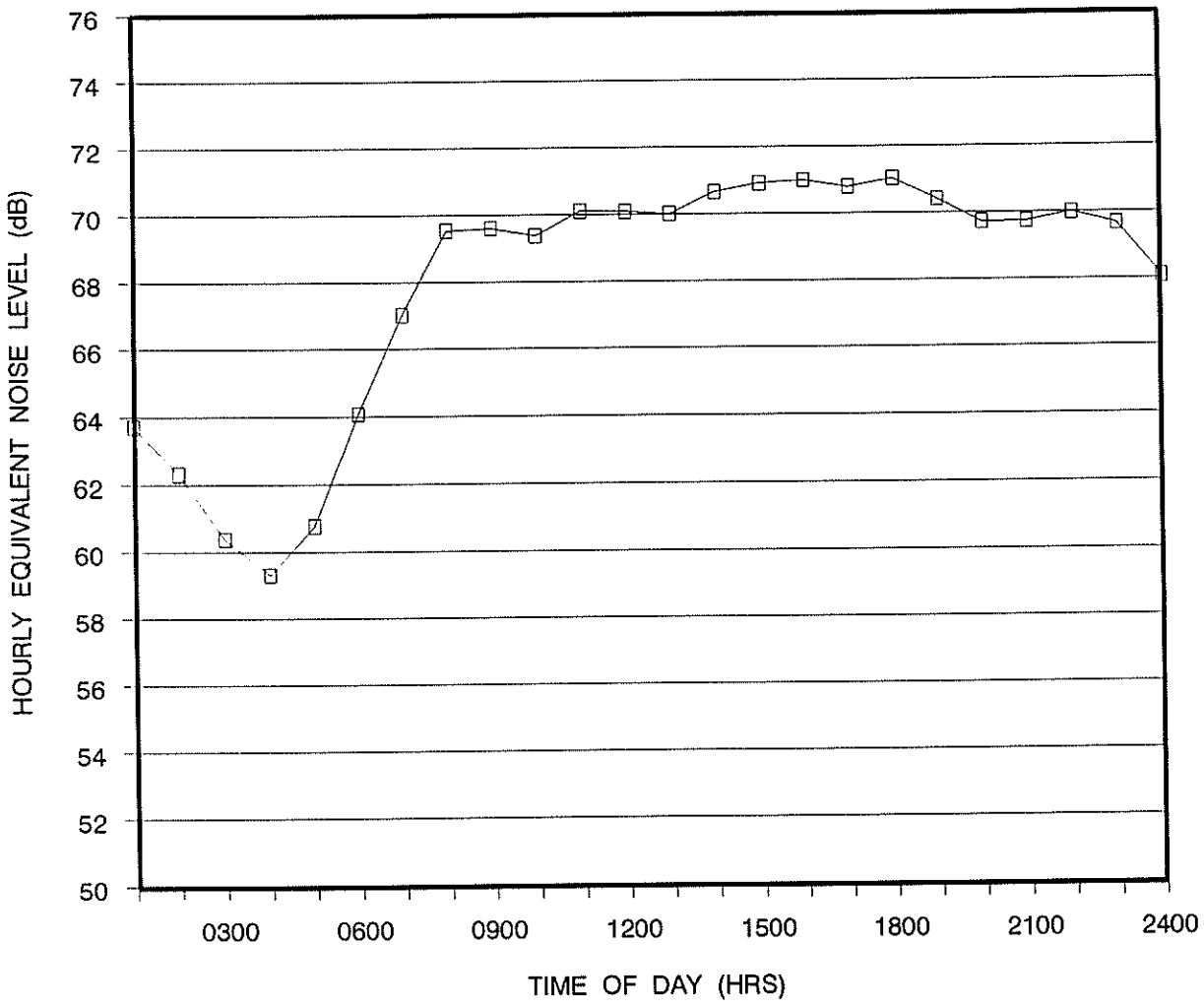
TABLE 2

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)
T1. 69 FT from the center-line of Kuhio Avenue (4/15/04)	1538 TO 1638	32	1,111 88.2%	38 3.0%	111 8.8%	70.5	70.4
T2. 60 FT from the center-line of Kalakaua Avenue (4/15/04)	1646 TO 1744	32	1,604 96.3%	45 2.7%	17 1.0%	69.2	68.9
T1. 69 FT from the center-line of Kuhio Avenue (4/16/04)	0633 TO 0733	32	653 81.9%	46 5.8%	98 12.3%	69.3	69.6
T3. 69 FT from the center-line of Kuhio Avenue (11/22/11)	1600 TO 1700	32	957 87.9%	30 2.8%	102 9.4%	68.9	68.6
T3. 69 FT from the center-line of Kuhio Avenue (11/23/11)	0700 TO 0800	32	627 84.4%	44 5.9%	72 9.7%	67.3	67.7

FIGURE 3

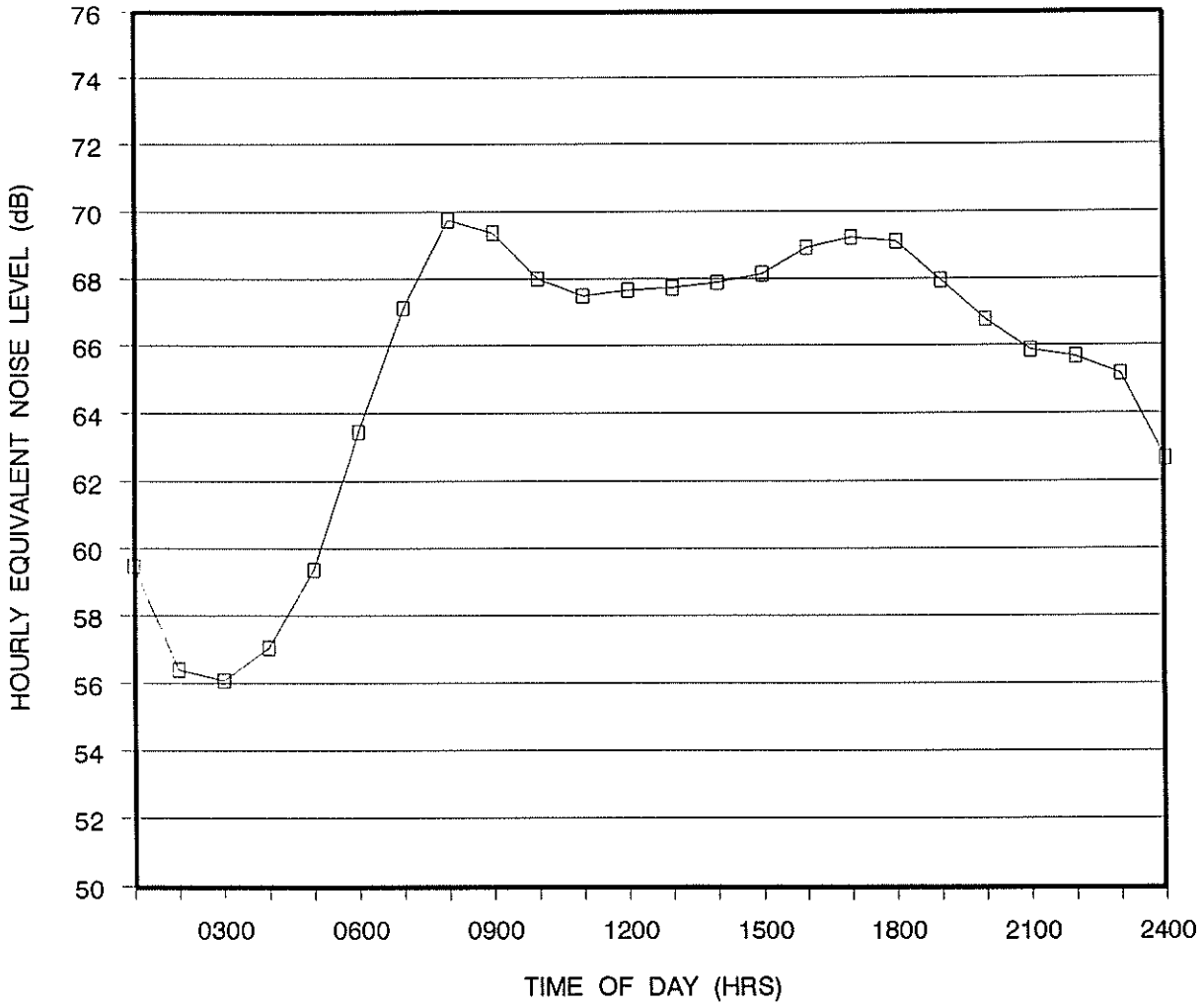
HOURLY VARIATIONS OF TRAFFIC NOISE LEVELS AT 50 FEET FROM THE CENTERLINE OF KALAKAUA AVENUE BETWEEN LEWERS AND BEACHWALK (FEBRUARY 4, 2011)



□ 72.9 DNL at 50 feet from centerline

FIGURE 4

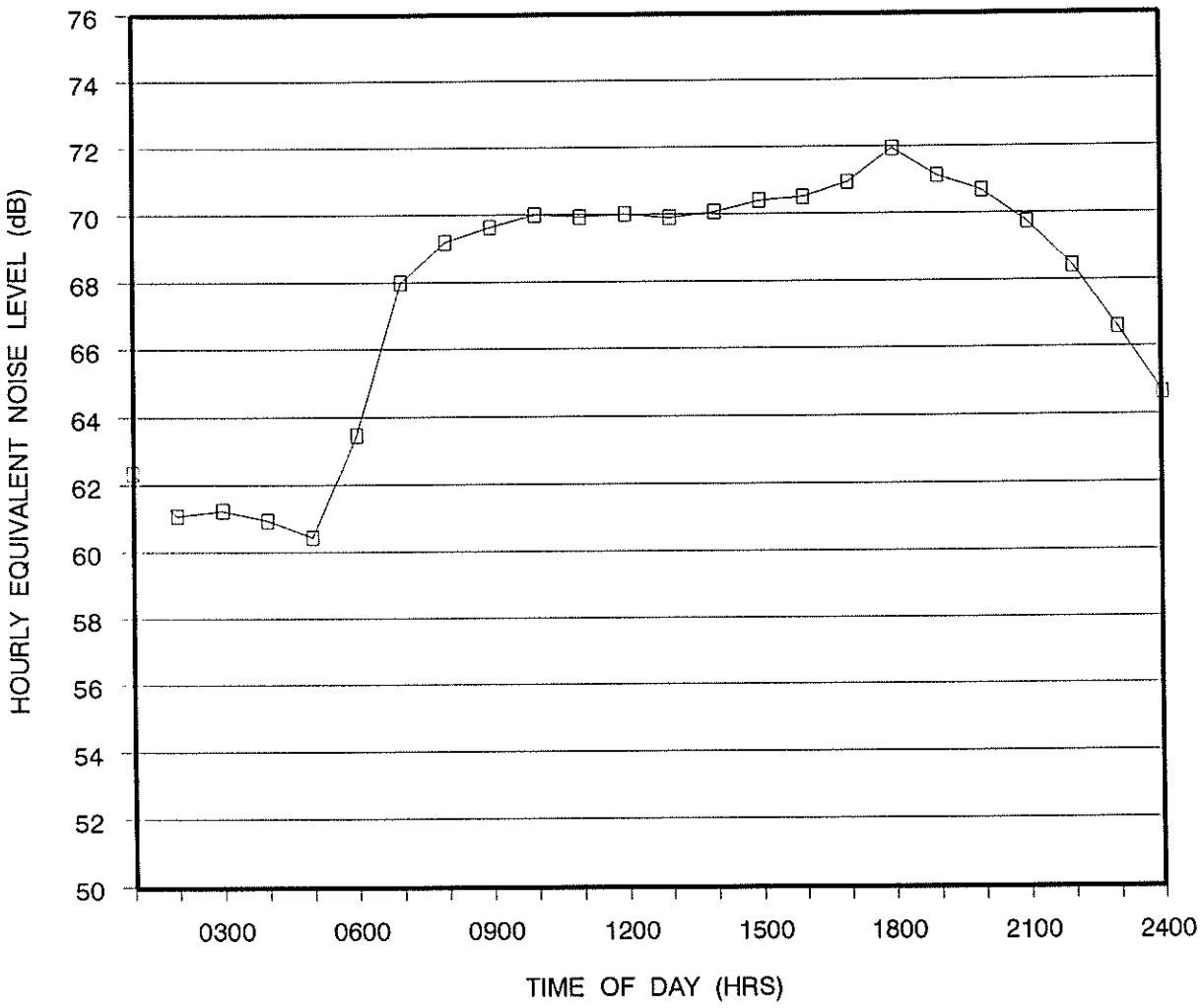
HOURLY VARIATIONS OF TRAFFIC NOISE LEVELS AT 50 FEET FROM THE CENTERLINE OF ALA WAI BOULEVARD BETWEEN OHUA AND LILIUOKALANI (APRIL 22, 2010)



□ 70.2 DNL at 50 feet from centerline

FIGURE 5

HOURLY VARIATIONS OF TRAFFIC NOISE LEVELS AT 50 FEET FROM THE CENTERLINE OF KUHIO AVENUE BETWEEN NAHUA AND WALINA (MAY 5, 2010)



□ 72.1 DNL at 50 feet from centerline

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.

In addition to the traffic noise measurements, background ambient noise measurements were obtained at Locations B1 through B4 (see FIGURE 1), where the noise from distant traffic, refuse trucks, emergency sirens, outdoor mechanical equipment, and loud voices controlled the background ambient noise levels. The results of these measurements plus the results of the traffic noise measurements and predictions were used to describe the existing and future noise levels in the project environs.

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

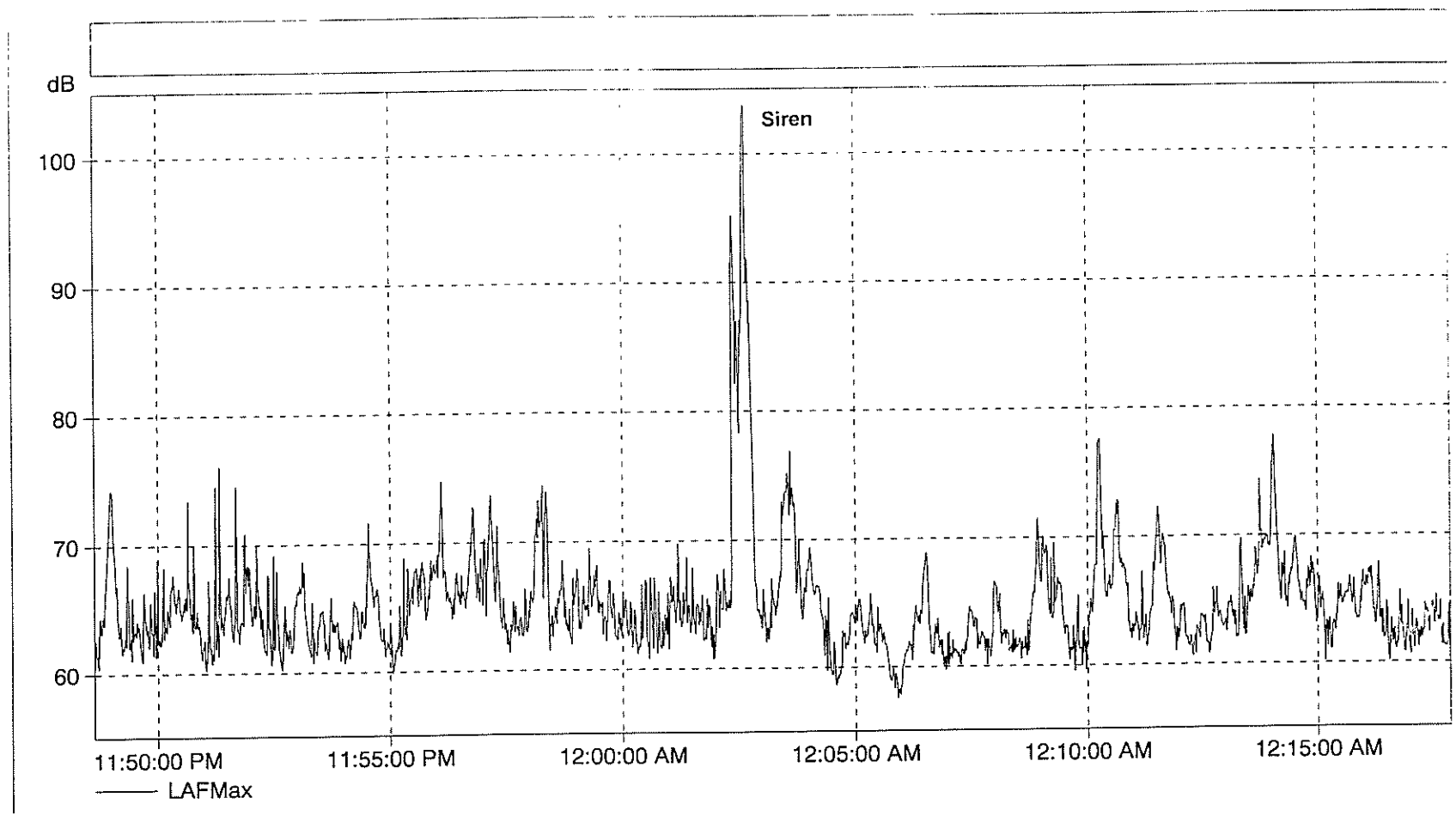
V. EXISTING ACOUSTICAL ENVIRONMENT

Major contributors to the existing background ambient noise levels within the project area are: traffic along Kalakaua Avenue and Kuhio Avenue; refuse collection trucks; tour buses and delivery trucks which are idling or positioning at curbside; loud motorcycles; the sirens of emergency and police vehicles; outdoor mechanical equipment, and nearby construction activities. Sample strip charts of the typical noise events which were recorded at the noise measurement locations are shown in FIGURES 6 through 13. The louder noise events, such as the sirens, refuse trucks, and live music, were clearly audible above the other background ambient noise sources.

The typical hourly variations in noise levels within the project environs are controlled by motor vehicle traffic along the high volume roadways such as Kalakaua Avenue and Kuhio Avenue, loud sirens, outdoor entertainment events at the International Market Place, or by nearby operating mechanical equipment. FIGURES 14 through 17 depict the hourly variations in average background noise levels at hotel suites (Locations B1 through B4) which overlook the International Market Place. Nighttime background noise levels at the International Market Place are currently lower due to the absence of live music performances at the former Coconut Willy's and Sparky's nightclubs. Live music performances currently continue at the Food Court Stage. Background ambient noise levels tend to be lowest during the early morning hours between 3:00 and 5:00 AM, and are typically near 60 dBA. At Location B3, the Waikiki Beachcomber's cooling tower's noise level of 67 to 70 dBA dominated the background noise levels at the mauka end of the tower building (see FIGURE 16). At Location B4, one suite makai of the corner suite (Location B3), background ambient noise levels were lower at 60 dBA during the quieter periods and less influenced by the noise from the cooling tower (see FIGURE 17).

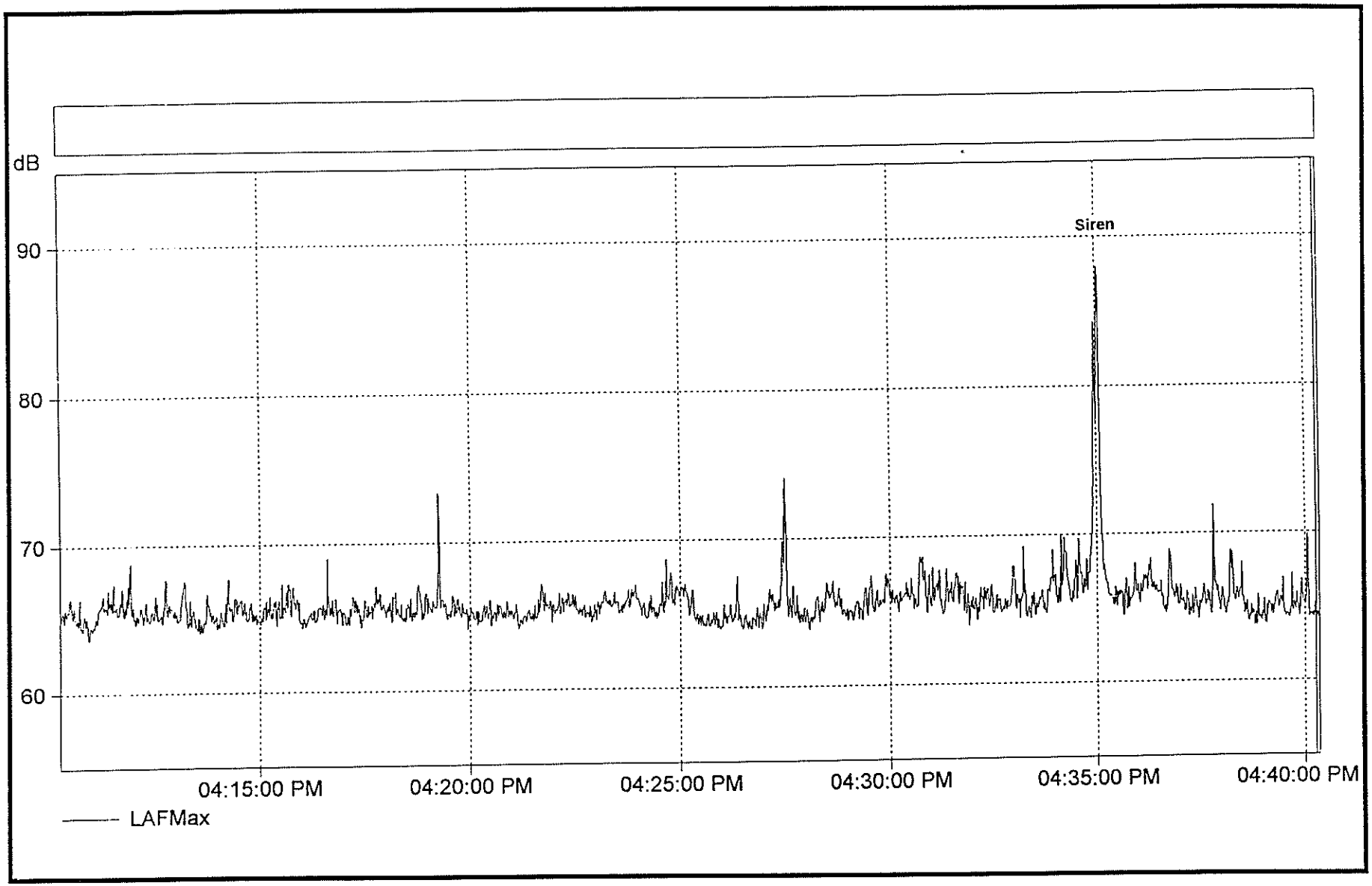
Traffic noise levels tend to be lowest during the early morning hours between 3:00 and 5:00 AM, and tend to be highest during the PM commuting hours. The measured variations in average hourly noise levels at locations overlooking Kuhio Avenue are shown in FIGURES 18 and 19. During the quietest early morning hours, background noise levels also hovered near 60 dBA as was characteristic of the quietist times at the interior locations (B1, B2, and B4) surrounding the International Market Place. Superimposed on the hourly variations associated with traffic noise along Kuhio Avenue are the very large increases in average hourly noise levels caused by the louder noise sources, such as the sirens and refuse trucks.

FIGURES 20 and 21 present the variations of measured average (or Leq) sound levels at ground level within the existing International Market Place and Waikiki Town Center. The measured sound levels tend to be highest along Kalakaua Avenue and Kuhio Avenue due to road traffic noise, as well as street vendors playing musical instruments at the Kalakaua Avenue entrance to the International Market Place. Sound levels were also highest along the east alley adjoining the Sheraton Princess Kaiulani



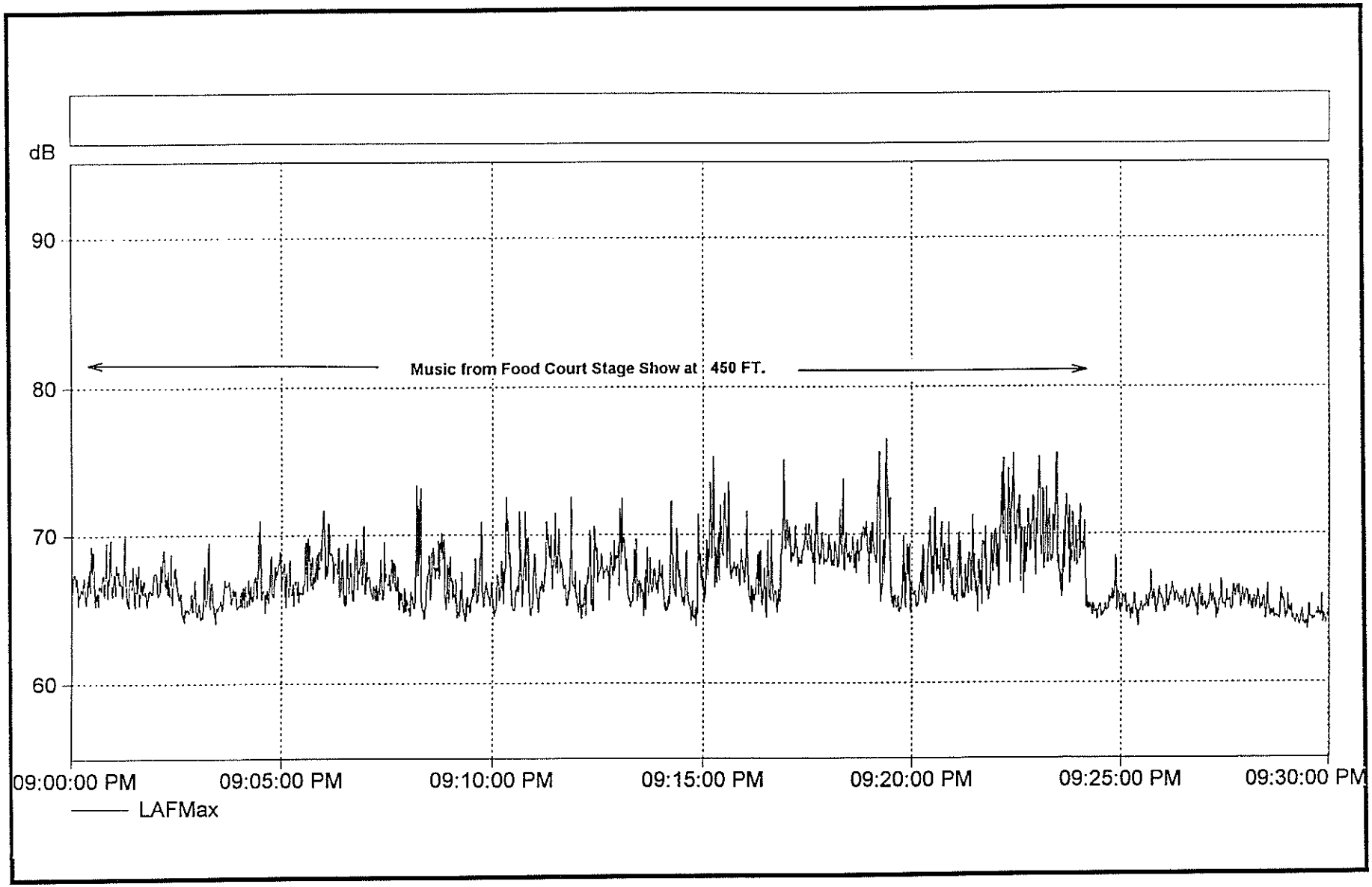
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "T3" (11/23/11; 12:02 AM)

FIGURE 6



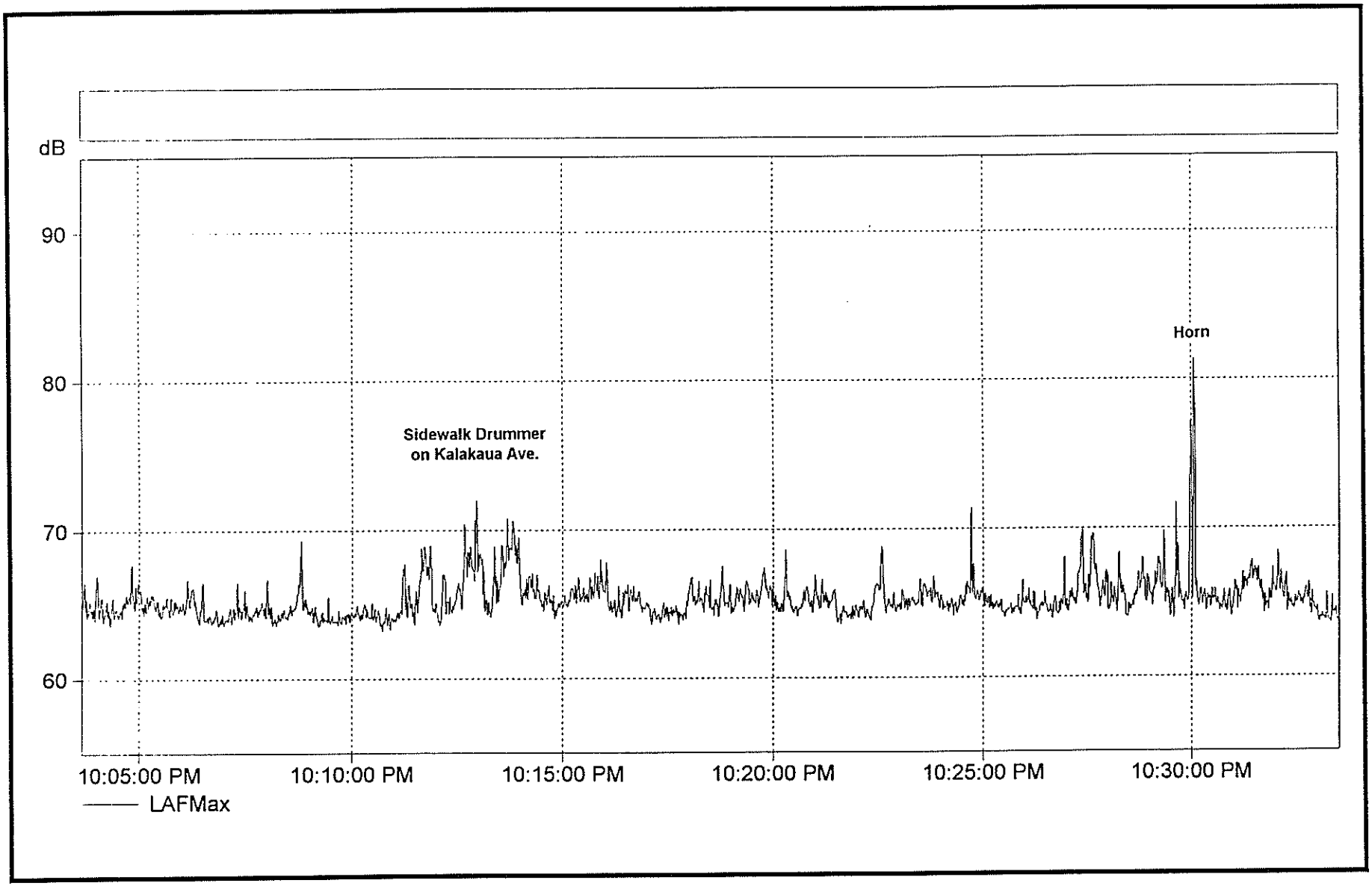
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B1" (4/19/04; 4:25 PM)

FIGURE 7



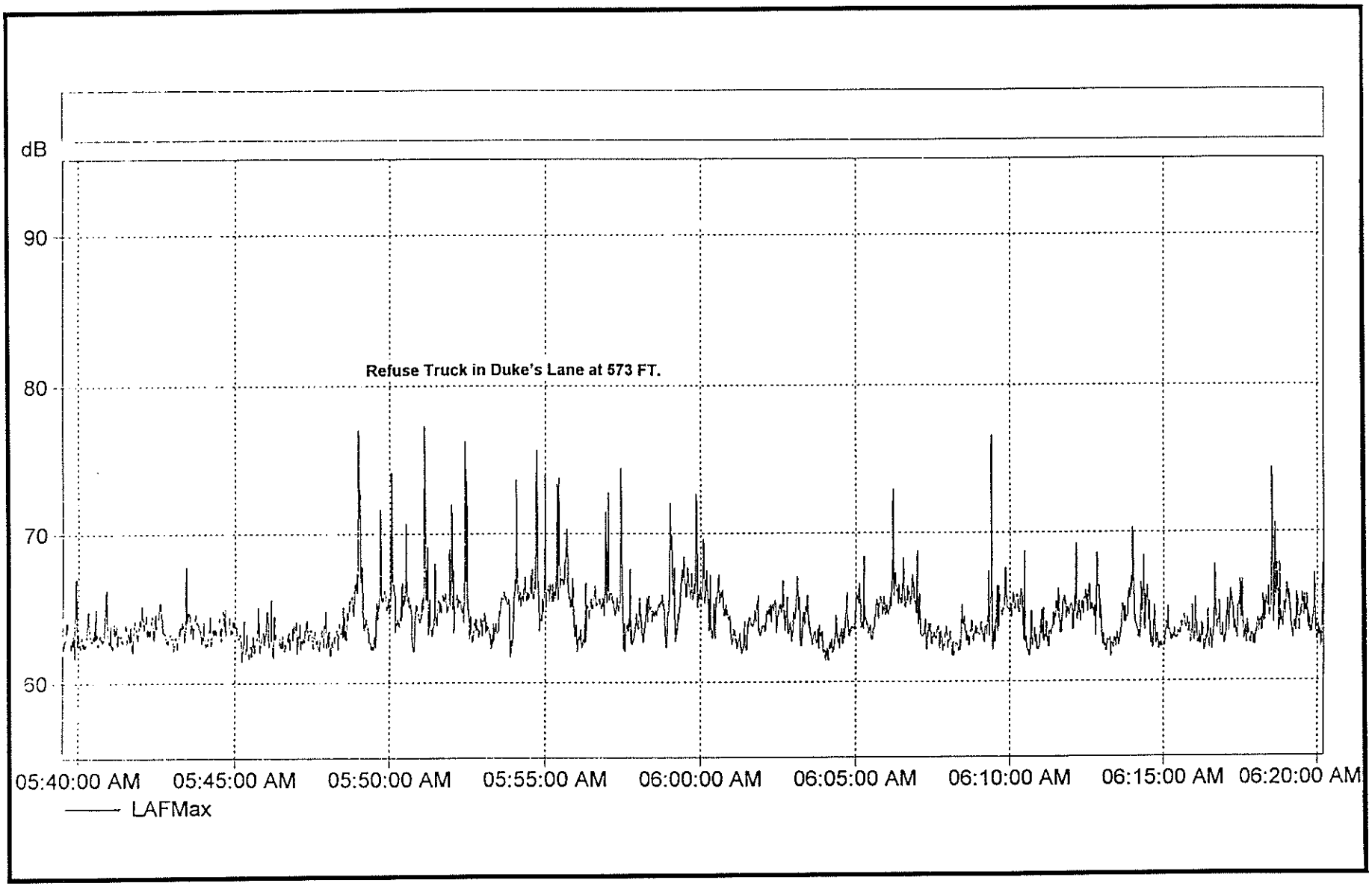
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B1" (4/19/04; 9:15 PM)

FIGURE 8



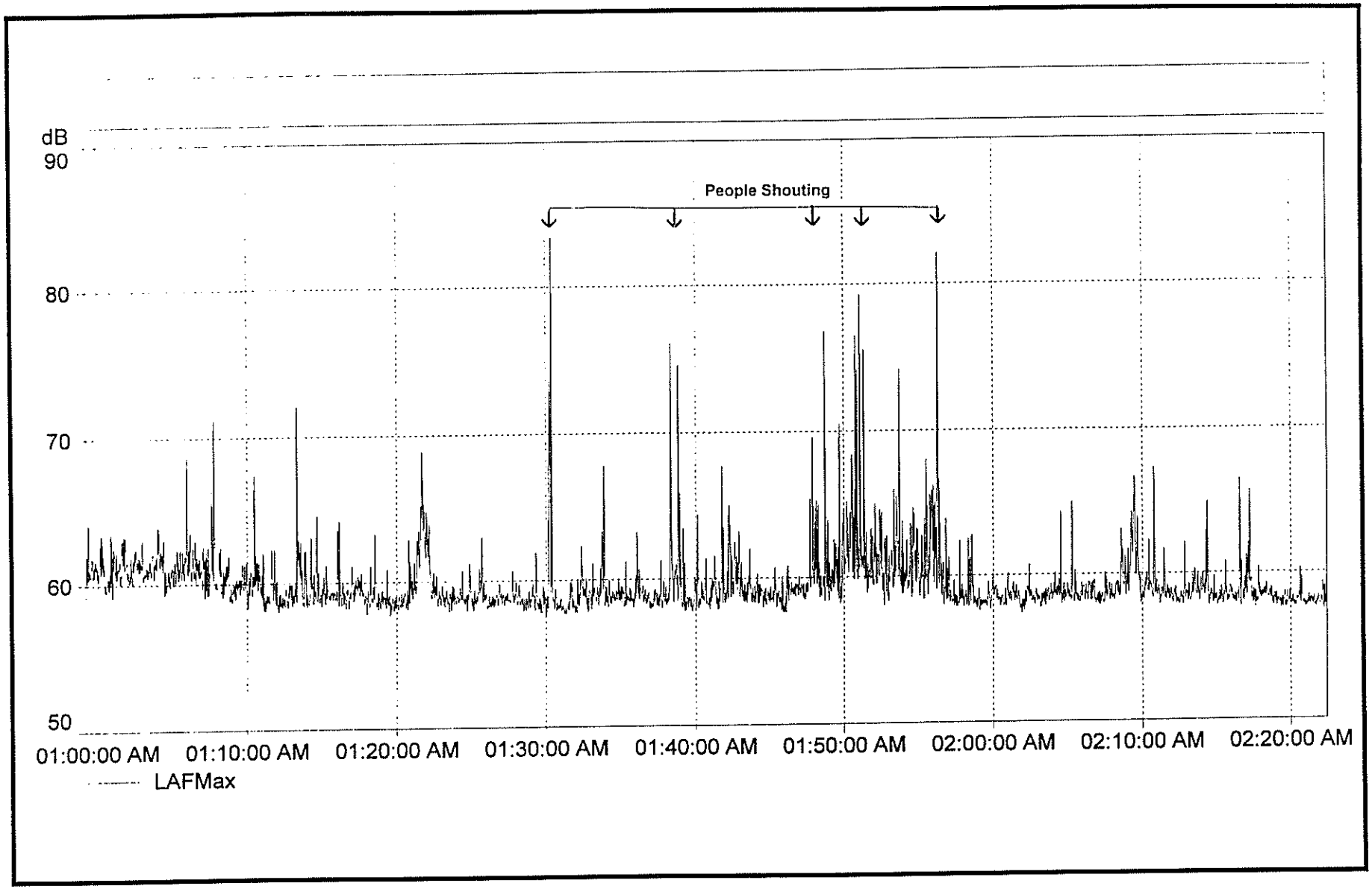
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B1" (4/19/04; 10:20 PM)

FIGURE 9



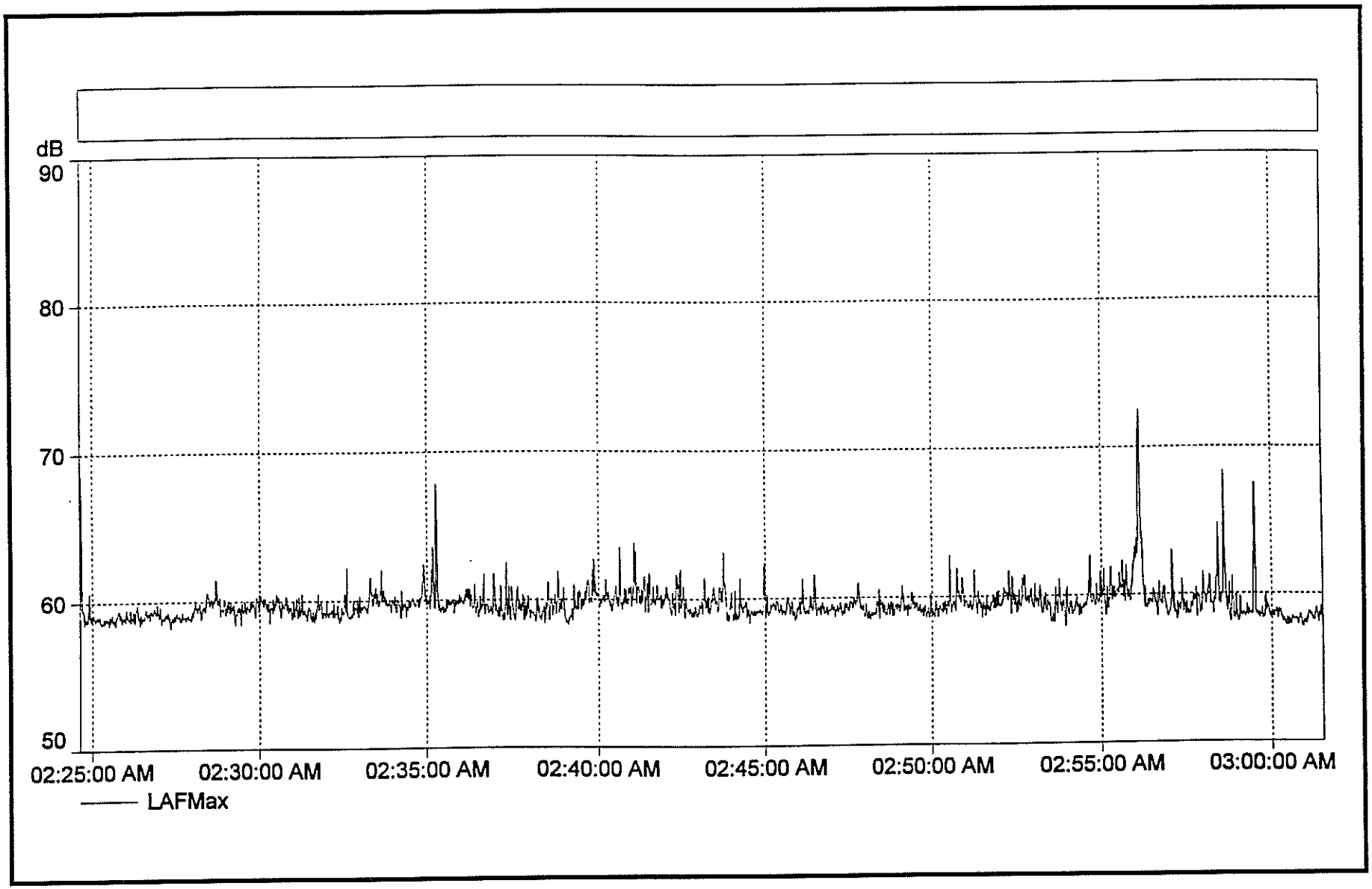
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B1" (4/20/04; 6:00 AM)

FIGURE 10



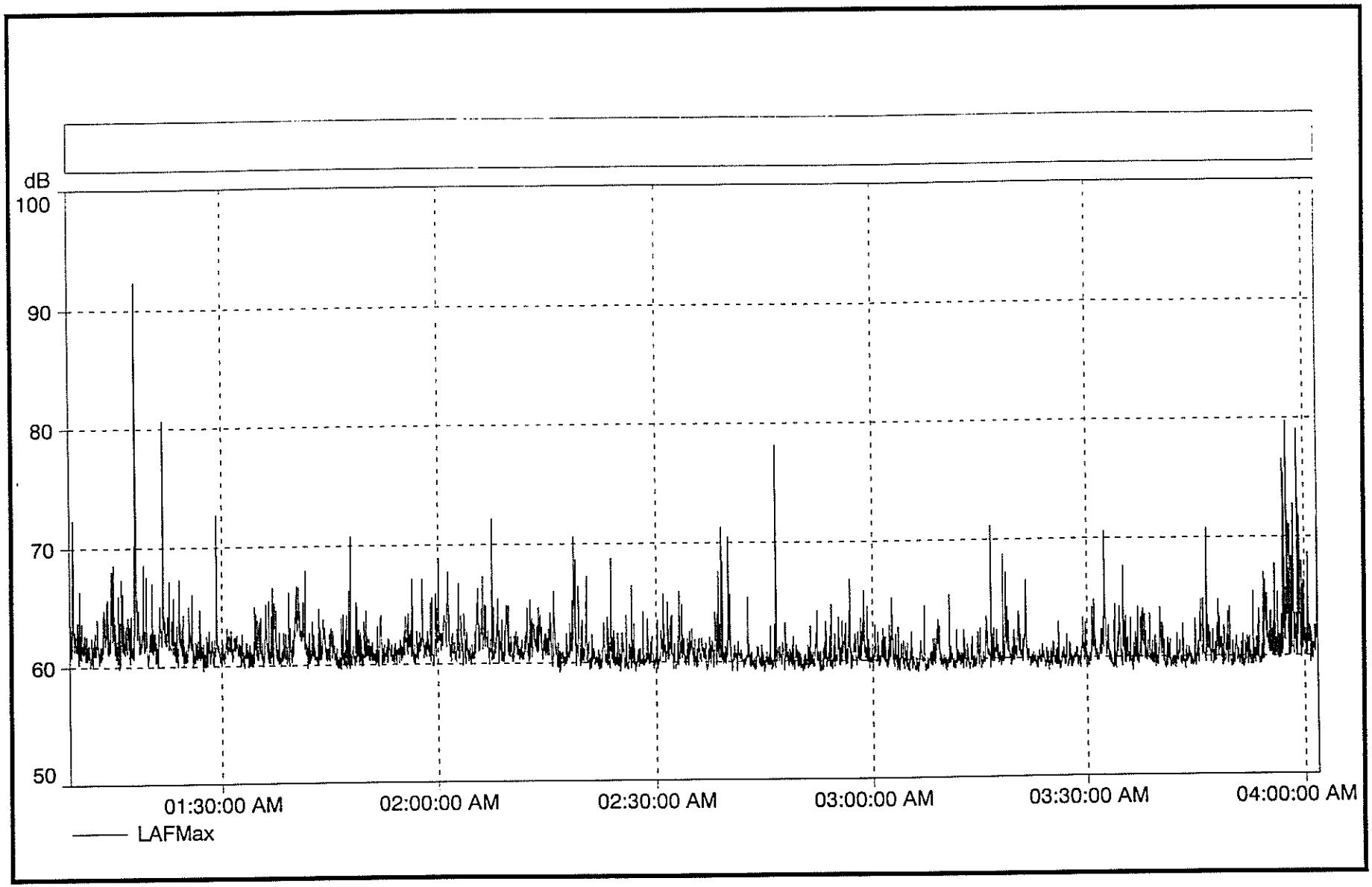
MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B4" (6/17/07; 1:40 AM)

FIGURE 11



MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B4" (6/17/07; 2:45 AM)

FIGURE 12



MAXIMUM SOUND LEVEL VS. TIME MEASURED AT LOCATION "B2" (6/14/07; 2:30 AM)

FIGURE 13

FIGURE 14

MEASURED HOURL VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 2743 OF SHERATON PRINCESS KAIULANI HOTEL (APRIL 19–20, 2004)

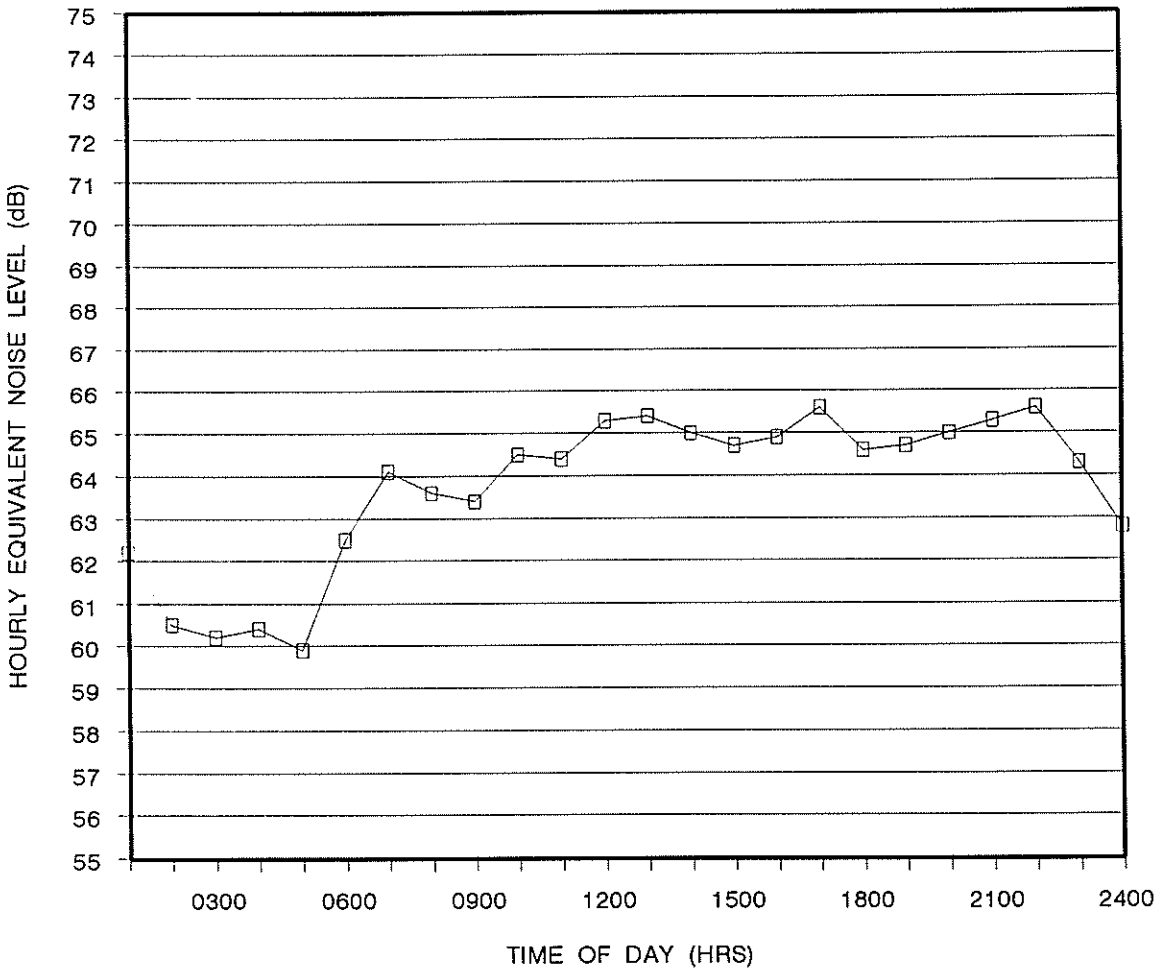


FIGURE 15

MEASURED HOURLY VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 1212 OF AQUA WAIKIKI WAVE HOTEL (JUNE 13 – 14, 2007)

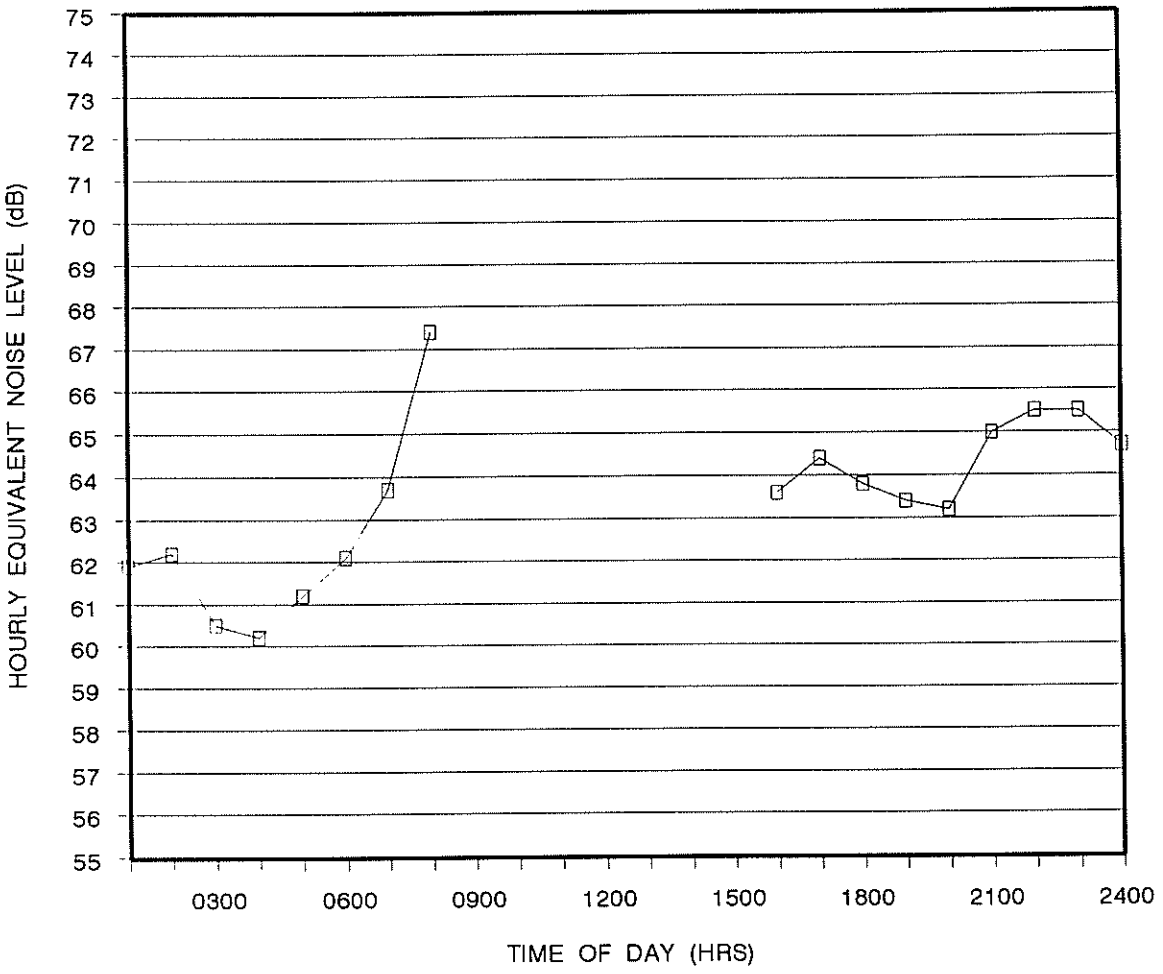


FIGURE 16

MEASURED HOURLY VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 600 OF WAIKIKI BEACHCOMBER HOTEL (NOVEMBER 25 – 26, 2011)

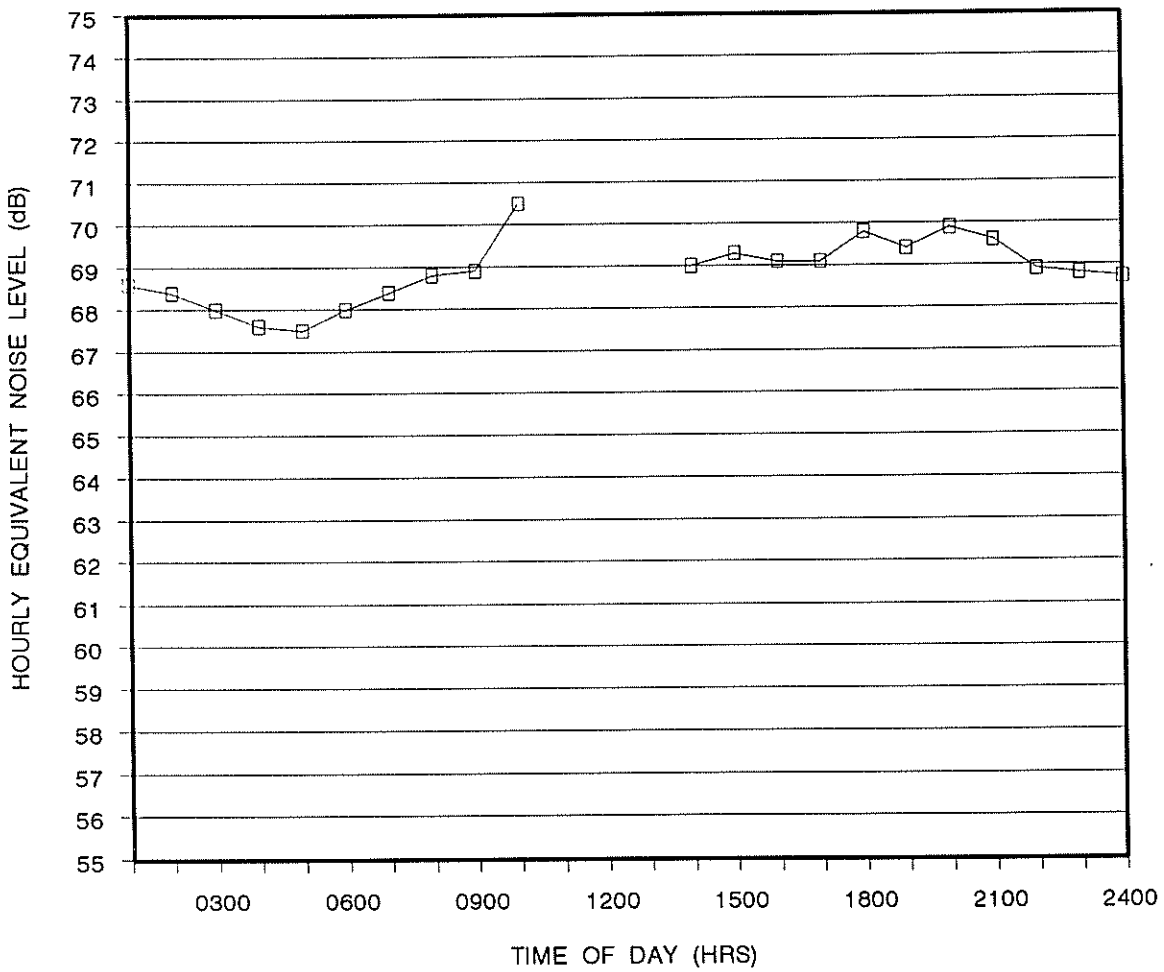


FIGURE 17

MEASURED HOURLY VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 601 OF WAIKIKI BEACHCOMBER HOTEL (JUNE 17 – 18, 2007)

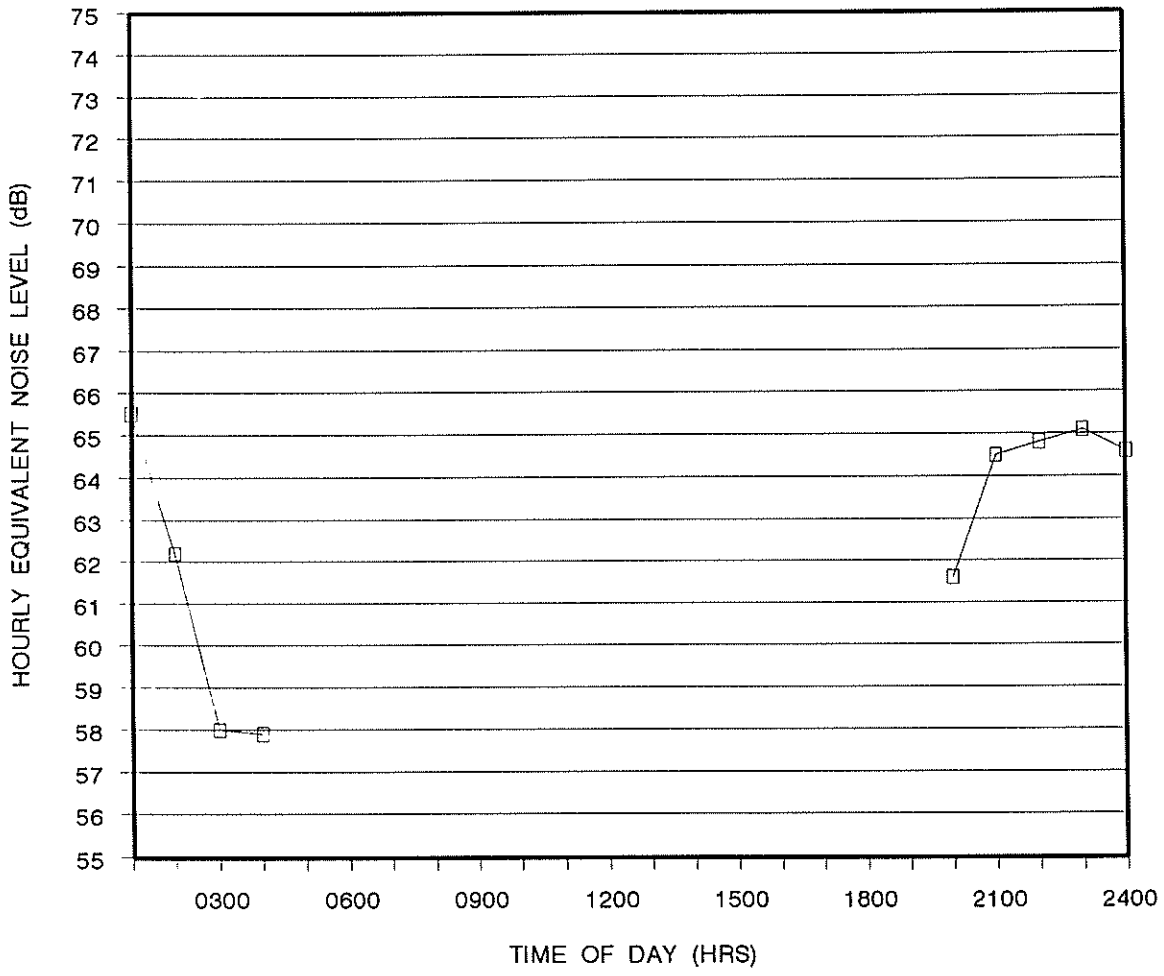


FIGURE 18

MEASURED HOURLY VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 936 OF OHANA WAIKIKI WEST HOTEL (MAY 18 – 19, 2011)

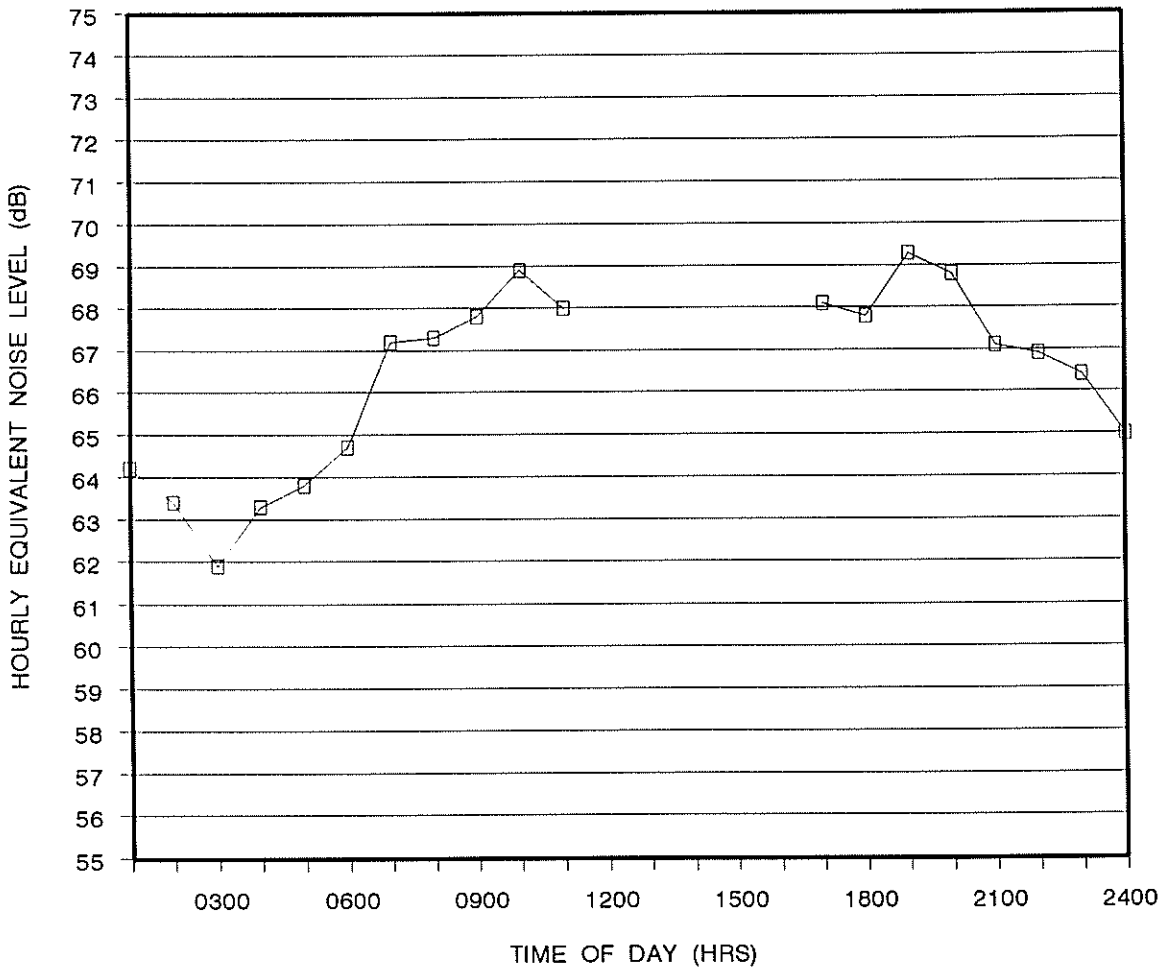
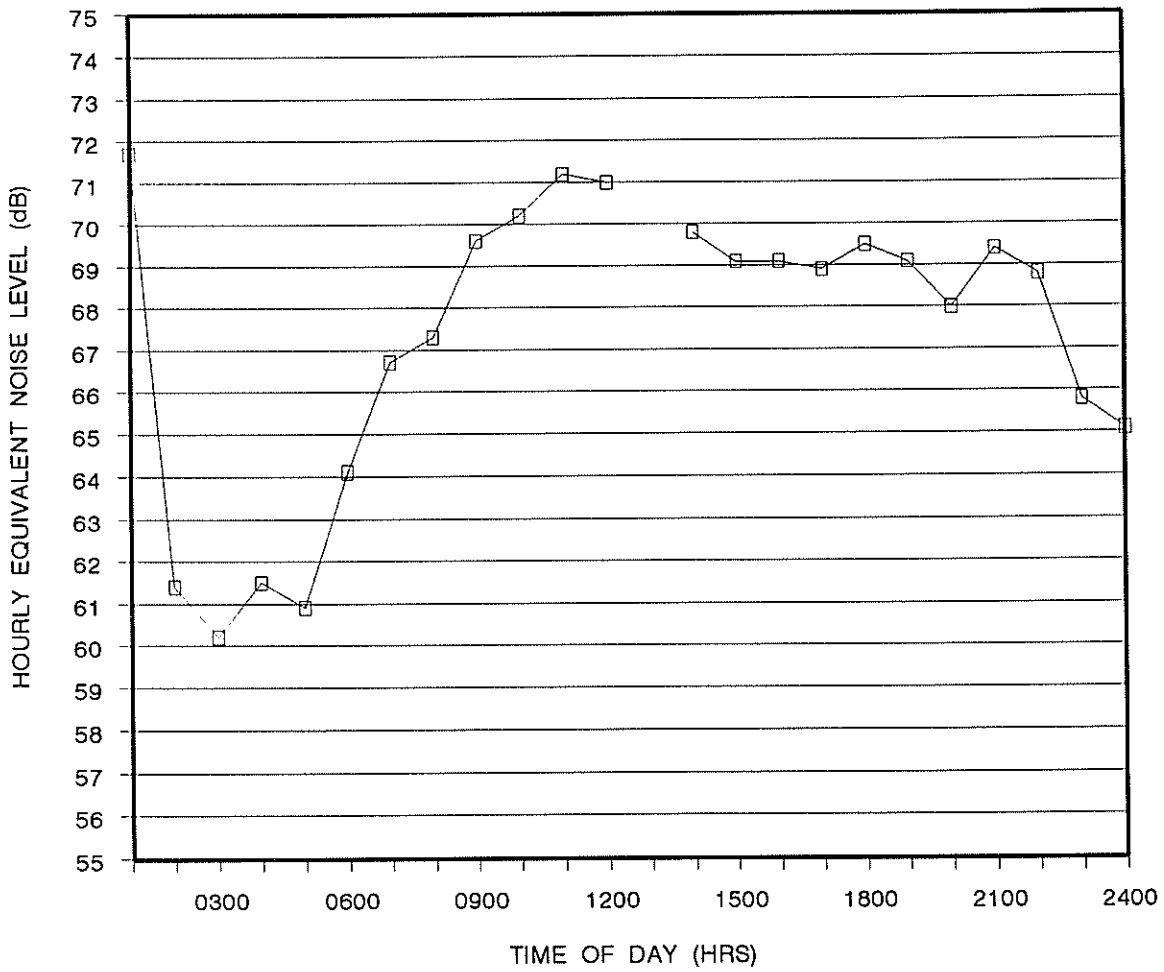
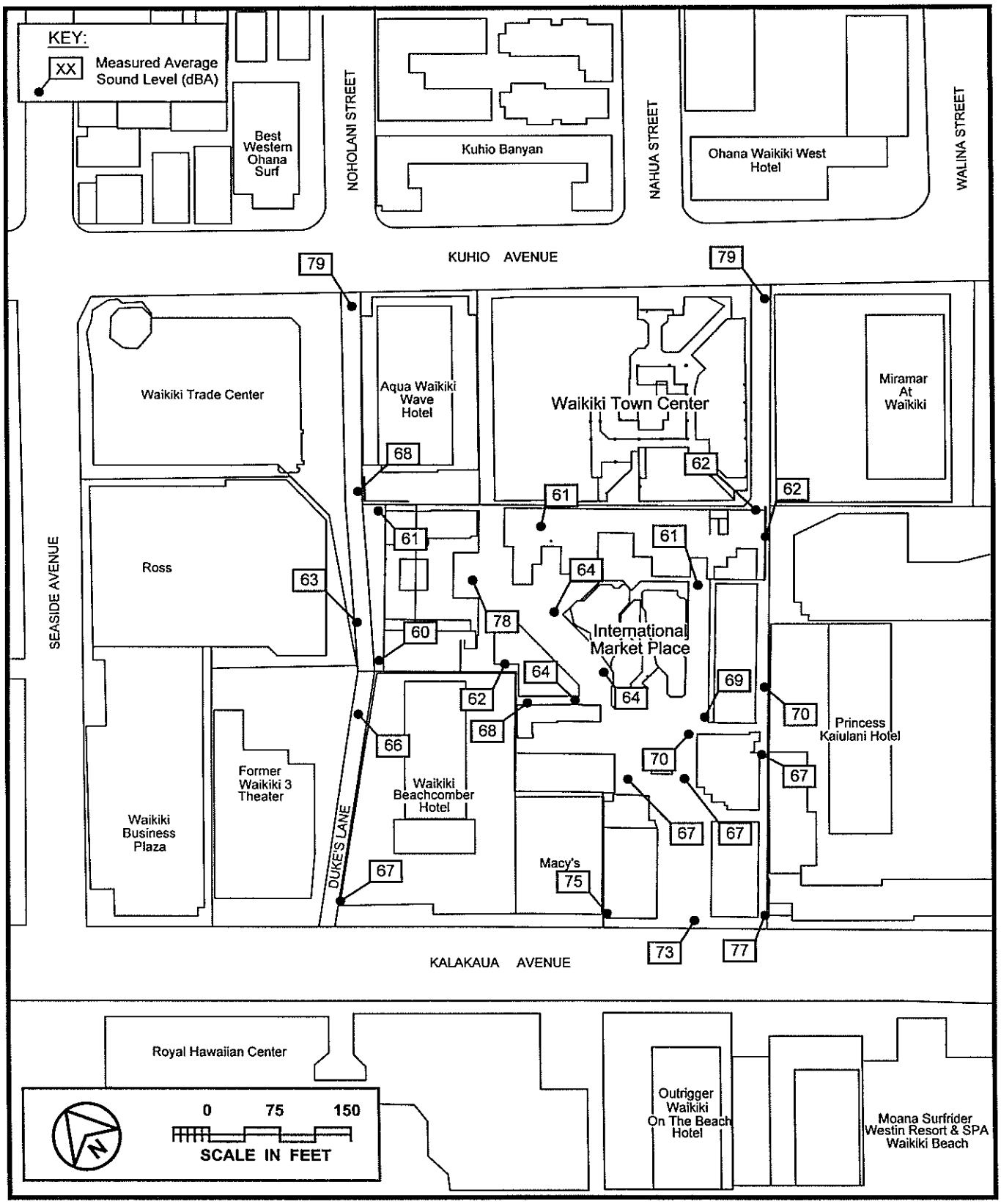


FIGURE 19

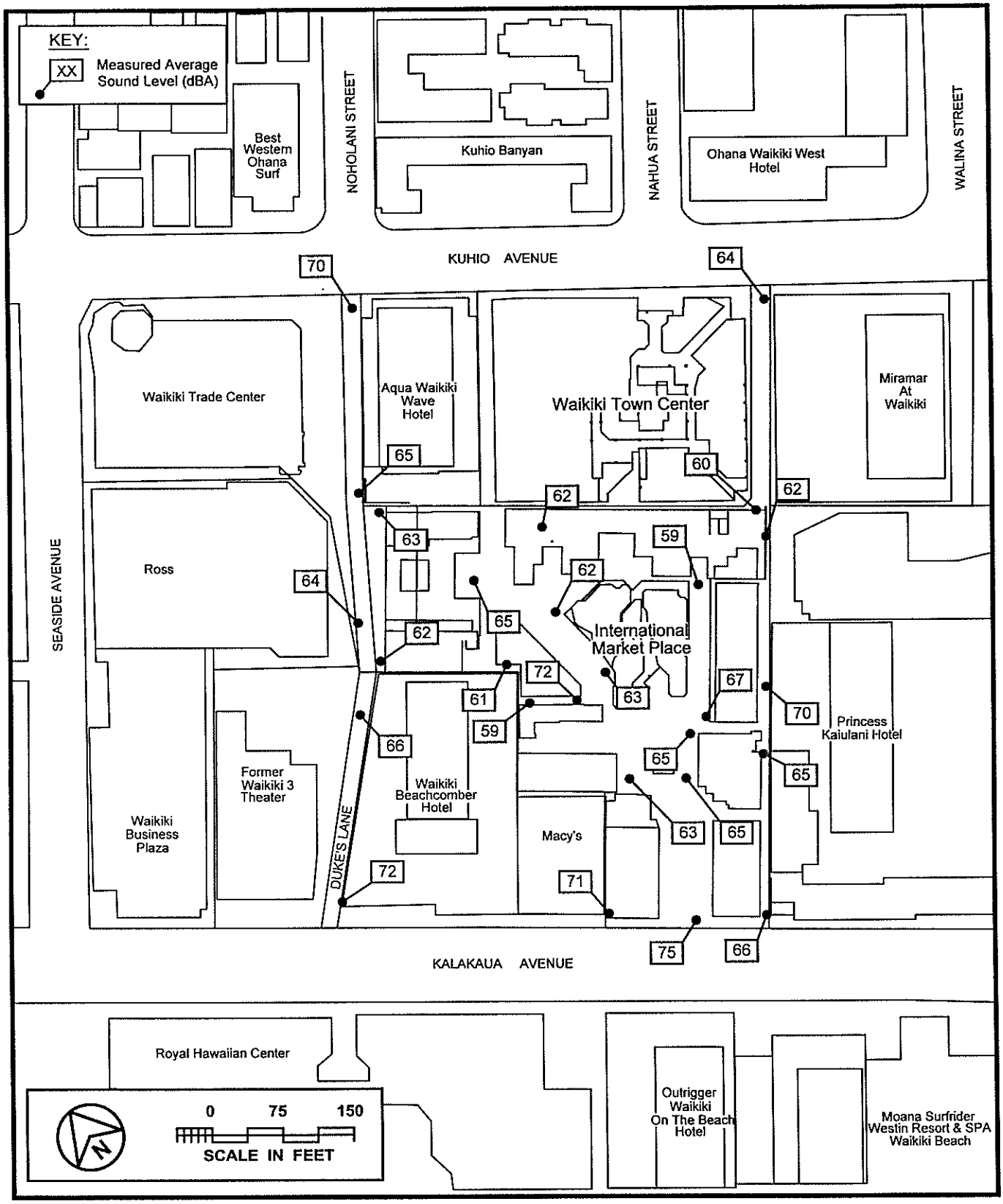
MEASURED HOURLY VARIATIONS OF AVERAGE NOISE LEVELS AT LANAI OF SUITE 546 OF MIRAMAR AT WAIKIKI HOTEL (NOVEMBER 22 – 23, 2011)





MEASURED VARIATIONS OF BACKGROUND NOISE LEVELS THROUGHOUT INTERNATIONAL MARKET PLACE (11/22/11; 7:15 PM)

FIGURE 20



MEASURED VARIATIONS OF BACKGROUND NOISE LEVELS THROUGHOUT INTERNATIONAL MARKET PLACE (11/25/11; 9:15 PM)

FIGURE 21

Hotel, where air conditioning equipment are located. At other locations within the International Market Place, music over the PA system or music from vendor equipment and the voices of shoppers and merchants controlled the background ambient levels.

The existing traffic volumes and their noise contributions at 50, 75, and 100 feet setback distances from the centerlines of the roadways servicing the project are shown in TABLE 3 for the weekday PM peak traffic hour. The corresponding setback distances from the roadways' centerlines to their corresponding 65, 70, and 75 DNL traffic noise contours for ground level receptors are shown in TABLE 4. Based on the results shown in TABLES 3 and 4, as well as the predicted (see FIGURES 3 through 5) and measured (see FIGURES 18 and 19) sound levels at the various locations along the major roadways, it was concluded that existing background noise levels in the project environs currently exceed 65 DNL at essentially all buildings which front Ala Wai Boulevard, Kalakaua Avenue, and Kuhio Avenue. In addition, at the upper floors of buildings located between Kalakaua Avenue and Kuhio Avenue, distant traffic plus the other non-traffic noise sources in the area cause ambient noise levels to exceed 65 DNL. At those receptor locations which front Kalakaua Avenue and Kuhio Avenue, existing background ambient noise levels exceed 70 DNL, but are less than 75 DNL. For those high-rise receptor locations with visual line of sight to Kalakaua Avenue or Kuhio Avenue, background ambient noise levels can be expected to exceed 65 DNL due to the extremely large setback distances from these two roadways to their 65 DNL noise level contours.

At receptor locations which front roadways, emergency and police vehicles, noisy motorcycles, mopeds, and buses, and garbage trucks are typically the loudest noise sources, with intermittent noise levels ranging as high as 90 to 103 dBA. Parked tour buses idling at curbside were also relatively noisy at 70 to 80 dBA. Noise from delivery truck movements and loading dock activities can also be relatively loud at 70 to 90 dBA.

At receptor locations which are shielded from roadway or loading area noise, existing background ambient noise levels are lower due to the noise shielding effects of surrounding buildings. Noise reductions of 5 to 20 dBA can be expected from these noise shielding effects. Background ambient noise levels at these locations can range from 55 to 65 DNL, and are controlled by nearby mechanical equipment or nearby human activities rather than by traffic noise. At receptor locations which are more elevated above ground level, the noise shielding effects from surrounding buildings can diminish as the visual field of views to nearby roadways (and resulting noise levels) increase with increasing elevations. Under these conditions with unobstructed field of views, the traffic noise level contributions and setback distances will tend to approach those for the ground level receptors shown in TABLES 3 and 4.

TABLE 3

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR, WEEKDAY)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	75' Leq	100' Leq
Ala Wai Blvd. W. of Seaside Ave.	30	2,078	2,026	35	17	69.8	67.8	66.5
Ala Wai Blvd. Between Seaside & Nohonani	30	1,896	1,849	32	15	69.3	67.4	66.1
Ala Wai Blvd. Between Nohonani & Nahua	30	1,992	1,942	34	16	69.5	67.5	66.2
Ala Wai Blvd. Between Nahua & Walina	30	1,798	1,753	31	14	68.9	66.9	65.6
Ala Wai Blvd. Between Walina & Kanekapolei	30	1,983	1,933	34	16	69.5	67.6	66.3
Ala Wai Blvd. E. of Kanekapolei St.	30	1,828	1,782	31	15	69.2	67.2	65.9
Kuhio Ave. W. of Seaside Ave.	32	1,067	917	43	107	72.0	69.4	68.0
Kuhio Ave. Between Seaside & Nohonani	32	1,066	916	43	107	72.0	69.4	68.0
Kuhio Ave. Between Nohonani & Nahua	32	1,071	921	43	107	72.0	69.5	68.0
Kuhio Ave. Between Nahua & Walina	32	1,016	873	41	102	71.9	69.3	67.8
Kuhio Ave. Walina & Kanekapolei	32	1,088	935	44	109	72.2	69.6	68.1
Kuhio Ave. E. of Kanekapolei	32	1,009	868	40	101	71.8	69.2	67.7
Kalakaua Ave. W. of Seaside Ave.	32	1,616	1,537	47	32	70.2	68.3	67.0
Kalakaua Ave. Between Seaside & Duke's Ln.	32	1,469	1,397	43	29	69.8	67.9	66.6
Kalakaua Ave. Between Duke's Ln. & Kaiulani	32	1,459	1,388	42	29	69.8	67.9	66.6
Kalakaua Ave. E. of Kaiulani Ave.	32	1,101	1,047	32	22	68.6	66.6	65.3
Seaside Ave. Between Ala Wai & Kuhio	25	593	564	17	12	63.6	61.8	60.6
Nohonani St. Between Ala Wai & Kuhio	25	208	202	4	2	57.8	56.1	54.8
Nahua St. Between Ala Wai & Kuhio	25	201	197	3	1	56.9	55.2	54.0
Walina St. Between Ala Wai & Kuhio	25	125	115	5	5	58.3	56.5	55.3
Kanekapolei St. Between Ala Wai & Kuhio	25	492	452	20	20	64.3	62.5	61.3
Seaside Ave. Between Kalakaua & Kuhio	25	291	284	5	2	58.9	57.2	55.9
Duke's Ln. Between Kalakaua & Kuhio	10	64	64	0	0	45.8	44.1	42.9
Kaiulani Ave. Between Kalakaua & Kuhio	25	456	444	8	4	61.1	59.3	58.1

TABLE 4

EXISTING AND CY 2015 DISTANCES TO 65, 70, AND 75 DNL CONTOURS (WEEKDAY)

STREET SECTION	65 DNL SETBACK (FT)		70 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	EXISTING	CY 2015	EXISTING	CY 2015	EXISTING	CY 2015
Ala Wai Blvd. W. of Seaside Ave.	174	178	59	60	21	22
Ala Wai Blvd. Between Seaside & Nohonani	159	166	53	56	18	20
Ala Wai Blvd. Between Nohonani & Nahua	163	174	55	59	20	21
Ala Wai Blvd. Between Nahua & Walina	142	156	49	53	18	19
Ala Wai Blvd. Between Walina & Kanekapolei	166	186	56	62	19	23
Ala Wai Blvd. E. of Kanekapolei St.	152	166	52	56	19	20
Kuhio Ave. W. of Seaside Ave.	185	185	68	68	31	31
Kuhio Ave. Between Seaside & Nohonani	185	174	68	68	31	30
Kuhio Ave. Between Nohonani & Nahua	178	174	69	68	31	31
Kuhio Ave. Between Nahua & Walina	171	174	67	68	31	31
Kuhio Ave. Walina & Kanekapolei	181	199	70	76	32	34
Kuhio Ave. E. of Kanekapolei	168	185	66	72	30	33
Kalakaua Ave. W. of Seaside Ave.	242	259	80	86	28	31
Kalakaua Ave. Between Seaside & Duke's Ln.	222	237	73	78	25	28
Kalakaua Ave. Between Duke's Ln. & Kaiulani	222	237	73	78	25	27
Kalakaua Ave. E. of Kaiulani Ave.	166	182	56	61	20	21
Seaside Ave. Between Ala Wai & Kuhio	46	46	15	15	< 12	< 12
Nohonani St. Between Ala Wai & Kuhio	< 12	12	< 12	< 12	< 12	< 12
Nahua St. Between Ala Wai & Kuhio	< 12	< 12	< 12	< 12	< 12	< 12
Walina St. Between Ala Wai & Kuhio	14	24	< 12	< 12	< 12	< 12
Kanekapolei St. Between Ala Wai & Kuhio	53	51	17	16	< 12	< 12
Seaside Ave. Between Kalakaua & Kuhio	15	16	< 12	< 12	< 12	< 12
Duke's Ln. Between Kalakaua & Kuhio	< 12	< 12	< 12	< 12	< 12	< 12
Kaiulani Ave. Between Kalakaua & Kuhio	26	24	< 12	< 12	< 12	< 12

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 3 and 5 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.
(4) "Pavement" conditions assumed along all roadways.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 6 for CY 2015 with and without the proposed project. The future projections of non-project and project traffic volumes for the No Build and Build Alternatives are shown in APPENDIX C. Future traffic volumes were provided for a weekday and a Saturday PM peak traffic hour, but future traffic noise level predictions were performed only for the weekday PM peak traffic hour.

TABLE 5 contains the CY 2015 traffic volumes and noise levels at 50, 75, and 100 feet from the roadways' centerlines for the Build Alternative during a weekday PM peak hour. TABLE 4 contains the setback distances to the 65, 70, and 75 DNL contours for CY 2015 on a weekday. Future average vehicle speeds along all roadways were assumed to be identical to those used for CY 2011 (see TABLE 3).

In CY 2015, the dominant traffic noise sources in the project area will continue to be traffic along Kalakaua Avenue and Kuhio Avenue. Future traffic noise levels are expected to increase by less than 1.0 dB (or DNL) along the major roadways in the project area (including Ala Wai Boulevard) by CY 2015 due to non-project traffic (see TABLE 6). Project traffic will add 0.2 dB or less to the noise levels along Kuhio Avenue, and will not contribute to traffic noise levels along Kalakaua Avenue. Along Ala Wai Boulevard, project traffic noise contributions should not exceed 0.3 dB by CY 2015. Project related traffic noise increases will typically be lower than those associaed with non-project traffic along the three major roadways. The predicted increases in future traffic noise levels attributable to project traffic are considered to be minimal, and will be difficult to measure or perceive.

The greatest increase in traffic noise from project traffic is expected to occur along Walina Street between Ala Wai Boulevard and Kuhio Avenue. Although a 2.5 dB increase in traffic noise is predicted by CY 2015, the existing traffic volumes and noise levels along Walina Street are relatively low, so the future traffic noise levels should remain below 65 DNL at 50 feet setback distance from the roadway's centerline.

In CY 2015, traffic noise from Kalakaua Avenue and Kuhio Avenue will continue to be the dominant traffic noise sources in the project area. Significant increases in traffic noise levels in the project environs are not expected to occur by CY 2015 under the No Build or Build Alternatives. The other loud noise sources in the project area are not expected to change between CY 2011 and CY 2015, and will continue to be emergency and police sirens, motorcycles and mopeds, garbage and delivery trucks, and tour buses.

Essentially all locations which front Kalakaua Avenue and Kuhio Avenue will continue to experience relatively high noise levels above 70 DNL. Lower elevation receptors which benefit from the noise shielding from existing and new buildings may experience traffic noise levels less than 70 DNL. In addition, those receptor locations which are also removed from the major roadways as well as those shielded by existing

TABLE 5

FUTURE (CY 2015) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (WEEKDAY PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	75' Leq	100' Leq
Ala Wai Blvd. W. of Seaside Ave.	30	2,170	2,116	37	17	69.9	67.9	66.6
Ala Wai Blvd. Between Seaside & Nohonani	30	1,988	1,938	34	16	69.6	67.6	66.3
Ala Wai Blvd. Between Nohonani & Nahua	30	2,108	2,055	36	17	69.8	67.8	66.5
Ala Wai Blvd. Between Nahua & Walina	30	1,887	1,840	32	15	69.3	67.3	66.0
Ala Wai Blvd. Between Walina & Kanekapolei	30	2,164	2,110	37	17	70.1	68.1	66.8
Ala Wai Blvd. E. of Kanekapolei St.	30	2,020	1,970	34	16	69.6	67.6	66.3
Kuhio Ave. W. of Seaside Ave.	32	1,065	915	43	107	72.0	69.4	68.0
Kuhio Ave. Between Seaside & Nohonani	32	1,043	897	42	104	71.9	69.4	67.9
Kuhio Ave. Between Nohonani & Nahua	32	1,049	902	42	105	72.0	69.4	67.9
Kuhio Ave. Between Nahua & Walina	32	1,045	898	42	105	72.0	69.4	67.9
Kuhio Ave. Walina & Kanekapolei	32	1,230	1,058	49	123	72.6	70.1	68.6
Kuhio Ave. E. of Kanekapolei	32	1,124	967	45	112	72.3	69.7	68.2
Kalakaua Ave. W. of Seaside Ave.	32	1,732	1,647	50	35	70.6	68.6	67.3
Kalakaua Ave. Between Seaside & Duke's Ln.	32	1,584	1,506	46	32	70.2	68.2	66.9
Kalakaua Ave. Between Duke's Ln. & Kaiulani	32	1,568	1,492	45	31	70.1	68.2	66.9
Kalakaua Ave. E. of Kaiulani Ave.	32	1,194	1,135	35	24	68.9	67.0	65.7
Seaside Ave. Between Ala Wai & Kuhio	25	593	564	17	12	63.6	61.8	60.6
Nohonani St. Between Ala Wai & Kuhio	25	232	226	4	2	58.1	56.4	55.1
Nahua St. Between Ala Wai & Kuhio	25	228	223	4	1	57.5	55.8	54.6
Walina St. Between Ala Wai & Kuhio	25	217	199	9	9	60.8	59.0	57.8
Kanekapolei St. Between Ala Wai & Kuhio	25	481	443	19	19	64.1	62.4	61.1
Seaside Ave. Between Kalakaua & Kuhio	25	294	287	5	2	59.0	57.2	56.0
Duke's Ln. Between Kalakaua & Kuhio	10	80	80	0	0	46.8	45.1	43.9
Kaiulani Ave. Between Kalakaua & Kuhio	25	450	438	8	4	61.0	59.3	58.0

TABLE 6

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2015) (WEEKDAY PM PEAK HOUR; LEQ OR DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Ala Wai Blvd. W. of Seaside Ave.	0.2	-0.1
Ala Wai Blvd. Between Seaside & Nohonani	0.4	-0.1
Ala Wai Blvd. Between Nohonani & Nahua	0.4	-0.1
Ala Wai Blvd. Between Nahua & Walina	0.6	-0.2
Ala Wai Blvd. Between Walina & Kanekapolei	0.3	0.3
Ala Wai Blvd. E. of Kanekapolei St.	0.3	0.1
Kuhio Ave. W. of Seaside Ave.	0.4	-0.4
Kuhio Ave. Between Seaside & Nohonani	0.3	-0.4
Kuhio Ave. Between Nohonani & Nahua	0.4	-0.4
Kuhio Ave. Between Nahua & Walina	0.3	-0.2
Kuhio Ave. Walina & Kanekapolei	0.3	0.1
Kuhio Ave. E. of Kanekapolei	0.3	0.2
Kalakaua Ave. W. of Seaside Ave.	0.4	0.0
Kalakaua Ave. Between Seaside & Duke's Ln.	0.4	0.0
Kalakaua Ave. Between Duke's Ln. & Kaiulani	0.3	0.0
Kalakaua Ave. E. of Kaiulani Ave.	0.3	0.0
Seaside Ave. Between Ala Wai & Kuhio	0.0	0.0
Nohonani St. Between Ala Wai & Kuhio	0.0	0.3
Nahua St. Between Ala Wai & Kuhio	0.0	0.6
Walina St. Between Ala Wai & Kuhio	0.0	2.5
Kanekapolei St. Between Ala Wai & Kuhio	0.0	-0.2
Seaside Ave. Between Kalakaua & Kuhio	0.0	0.1
Duke's Ln. Between Kalakaua & Kuhio	0.0	1.0
Kaiulani Ave. Between Kalakaua & Kuhio	0.2	-0.3

and new buildings should experience traffic noise levels less than 70 DNL. The relatively high traffic noise levels within the project area are characteristic of Waikiki, and will remain high through CY 2015, with or without the project.

The future project tenant spaces which front Kalakaua Avenue and Kuhio Avenue are predicted experience traffic noise levels between 65 to 75 DNL and are exptected to be in the "Marginally Compatible" noise category for commercial uses (see FIGURE 2). Closure and air conditioning of the affected spaces would mitigate the high noise levels from the two roadways at the storefronts along Kalakaua Avenue and Kuhio Avenue. The interior tenant spaces benefit from their greater setback distances from the two major roadways and should also be shielded from traffic noise by the planned structures within the revitalized International Market Place. Noise levels within the interior areas of the project should be similar to those shown in FIGURES 20 and 21, with the ambient noise levels controlled by pedestrian traffic conversations, background music amplifier/speakers, water features, and live entertainment.

The proposed outdoor dining areas of the revitalized International Market Place complex may need to be insulated from the noise of existing elevated air conditioning equipment (cooling towers, air cooled condensers, etc.), which are located on the mid-rise structures of the Waikiki Beachcomber Hotel, Macy's, and the Sheraton Princess Kaiulani Hotel. The planned renovations at the Sheraton Princess Kaiulani Hotel may result in changes to the existing rooftop equipment at that hotel. The noise from the existing cooling towers of the Waikiki Beachcomber Hotel, in particular, are relatively high at 76 dBA at 50 feet, and could adversely affect the outdoor dining area R-5. Enclosed retail and indoor dining areas can be insulated from the outdoor equipment on the neighboring properties, but it will be difficult to provide a high degree of sound attenuation at the outdoor dining areas.

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

Traffic Noise. Noise impacts from project related traffic along the roadways which are expected to service the project traffic (Kalakaua Avenue, Kuhio Avenue, and Ala Wai Boulevard) are not expected due to the relatively low levels of project related traffic noise when compared to the noise levels of non-project related traffic and other noise sources. In addition, the existing resort units which are located in the immediate vicinity of the project are currently provided with air conditioning.

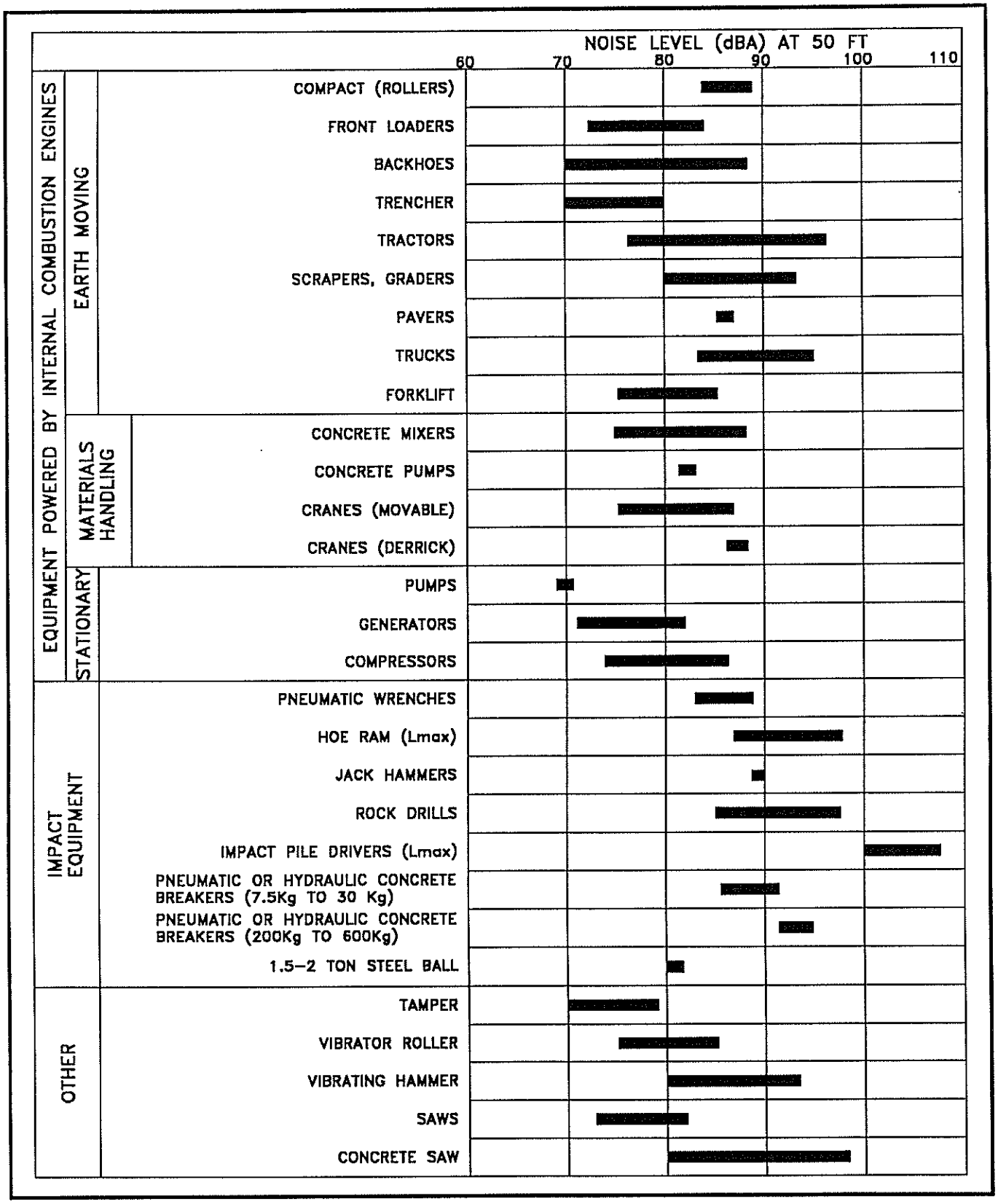
For those new tenant spaces in the revitalized International Market Place complex which front Kuhio Avenue and Kalakaua Avenue, as well as those spaces which may be close to existing air conditioning equipment, noise mitigation measures are recommended. Closure and air conditioning of the affected spaces can be an effective noise mitigation measure for this project.

General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for demolition and construction is anticipated to be 24 months. It is anticipated that actual construction 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. FIGURE 22 depicts the range of noise levels of various types of construction equipment when measured at 50 FT distance from the equipment.

Demolition of the existing structures on the International Market Place and Waikiki Town Center complex, and the Miramar At Waikiki Hotel will occur during the initial phase of work. The International Market Place, Waikiki Town Center complex, and Miramar At Waikiki Hotel will probably be demolished using excavators, wrecking ball, bulldozers, front end loaders, saws, and/or jack hammers. Noise during preparation for the actual demolition of the structures, during the actual demolition by jack hammer, wrecking ball, excavator, and/or front end loaders, and during site cleanup and removal of the debris can be expected.

Following demolition and cleanup, the noise from site excavation, grading, and preparation activities will be present. Typical levels of exterior noise from construction activity (excluding building implosion or pile driving activity) at various distances from the job sites are shown in FIGURE 23. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 23, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

FIGURE 23 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 equipment and the receptor. Direct line-of-sight distances from the construction



RANGES OF CONSTRUCTION EQUIPMENT NOISE LEVELS

FIGURE 22

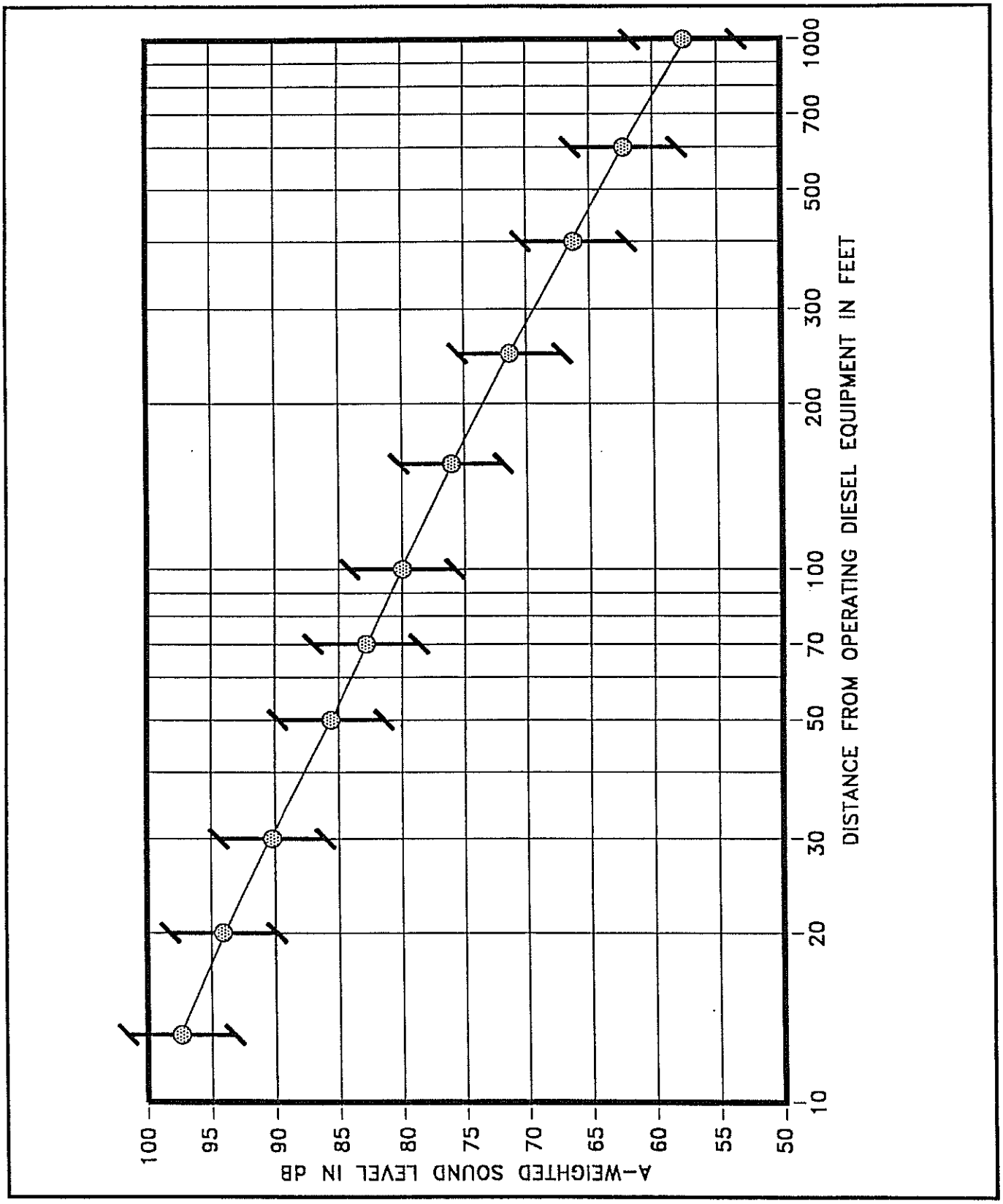
Following demolition and cleanup, the noise from site excavation, grading, and preparation activities will be present. Typical levels of exterior noise from construction activity (excluding building implosion or pile driving activity) at various distances from the job sites are shown in FIGURE 23. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 23, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

FIGURE 23 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 equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing resort, apartment, and commercial buildings will range from 20 FT to 600+ FT, with corresponding average noise levels of 94 to 62 dBA (plus or minus 5 dBA). For receptors along a cross-street, the construction noise level vs. distance curve of FIGURE 23 should be reduced by approximately 8 dBA when the work is occurring at the intersection with the cross street, and should be reduced by 15 dBA when work is occurring at least 100 FT from the intersection (and the visual line-of-sight is blocked by intervening buildings). 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 23.

TABLE 7 presents the predicted ranges of construction noise during three phases of work (demolition/site preparation, and building erection) at receptor locations in the three hotels which surround the project site. The demolition by implosion of the Miramar At Waikiki Hotel should not result in comparable average noise levels to the other construction noise activities anticipated at the adjacent "Anchor" location due to the relatively short duration of the implosion noise event. The risks of adverse noise impacts would be greatest during the site preparation phase, and the risks would be least during the building erection phase. During the building erection phase, the noise levels at the three receptor locations should be more similar to existing background noise.

The units in the resort and commercial buildings which are adjacent to the project site are predicted to experience the highest noise levels during construction activities due to their close proximity to the construction sites. 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, the availability of closure and air conditioning for noise mitigation at the majority of the resort and commercial units in the project area, 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 to 90+ dB at 50 FT



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 23

equipment to existing resort, apartment, and commercial buildings will range from 20 FT to 600+ FT, with corresponding average noise levels of 94 to 62 dBA (plus or minus 5 dBA). For receptors along a cross-street, the construction noise level vs. distance curve of FIGURE 23 should be reduced by approximately 8 dBA when the work is occurring at the intersection with the cross street, and should be reduced by 15 dBA when work is occurring at least 100 FT from the intersection (and the visual line-of-sight is blocked by intervening buildings). 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 23.

TABLE 7 presents the predicted ranges of construction noise during three phases of work (demolition/site preparation, and building erection) at receptor locations in the three hotels which surround the project site. The demolition of the Miramar At Waikiki Hotel should result in comparable average noise levels to the other construction noise activities anticipated at the nearby "Anchor" location. The risks of adverse noise impacts would be greatest during the site preparation phase, and the risks would be least during the building erection phase. During the building erection phase, the noise levels at the three receptor locations should be more similar to existing background noise.

The units in the resort and commercial buildings which are adjacent to the project site are predicted to experience the highest noise levels during construction activities due to their close proximity to the construction sites. 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, the availability of closure and air conditioning for noise mitigation at the majority of the resort and commercial units in the project area, 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 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (demolition, excavation, grading, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site.

Severe noise impacts are not expected to occur inside air conditioned structures which are beyond 70 to 450 FT of the project construction sites. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 73 to 55 dBA at 70 FT to 450 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 4), is

TABLE 7
SUMMARY OF PREDICTED NOISE LEVELS DURING CONSTRUCTION

Receptor Location	-------- Location of Construction Work --------			
	Puka 1	Puka 2	Puka 3	Anchor
Demolition, Earthwork, & Site Prep. Phase (Range of Ave. Levels, dBA):				
Princess Kaiulani	72 to 80	67 to 75	66 to 74	63 to 76
Waikiki Beachcomber	70 to 78	70 to 78	64 to 72	61 to 72
Aqua Waikiki Wave	64 to 72	72 to 80	70 to 78	66 to 76
Building Erection Phase (Range of Ave. Levels, dBA):				
Princess Kaiulani	59 to 67	54 to 62	53 to 61	52 to 60
Waikiki Beachcomber	57 to 65	57 to 65	51 to 59	48 to 56
Aqua Waikiki Wave	51 to 59	59 to 67	57 to 65	53 to 61

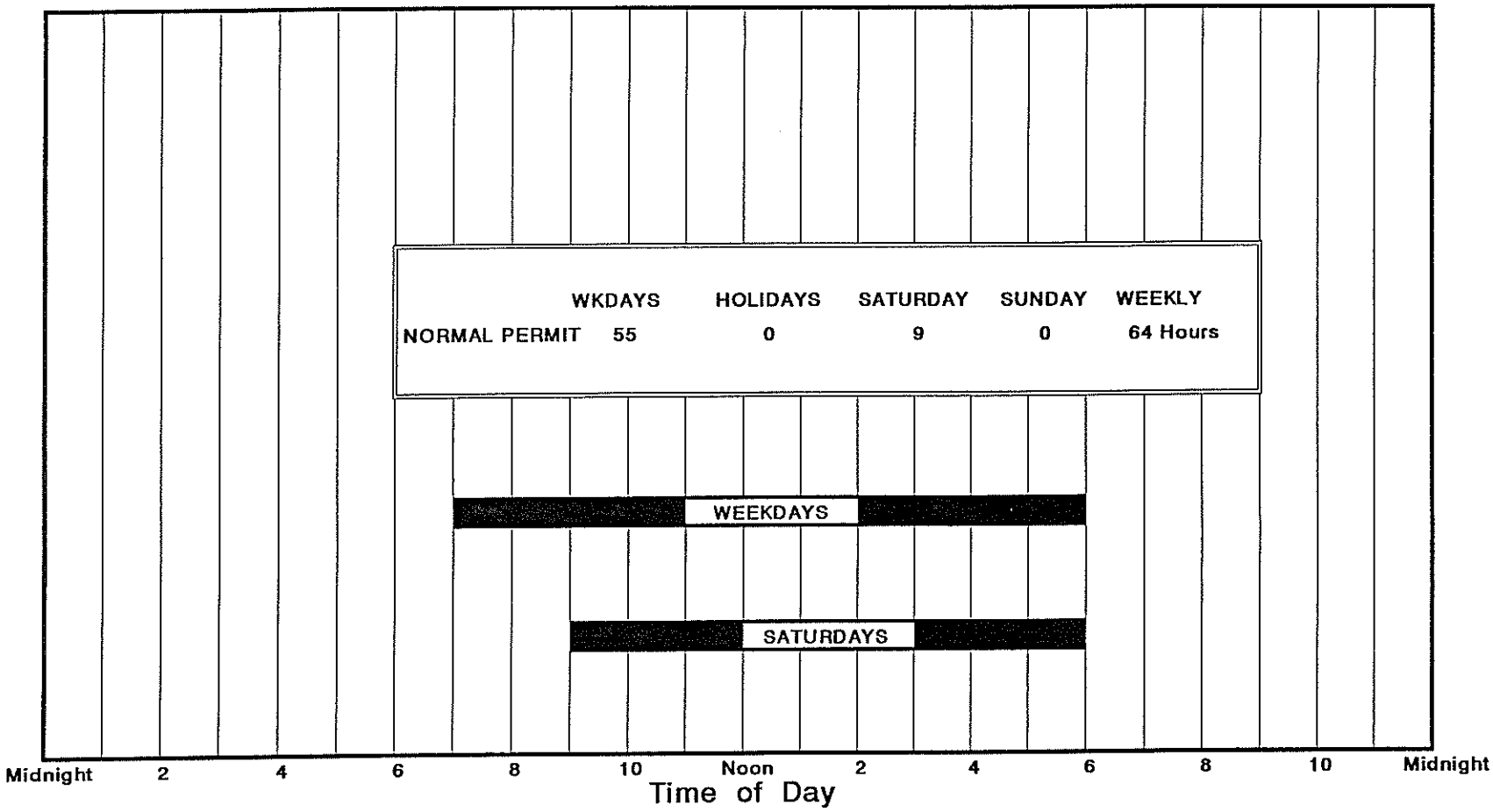
Notes:

1. Receptor at Princess Kaiulani Hotel located 90 feet above ground and at center of Ewa face of tower building.
2. Receptor at Waikiki Beachcomber Hotel located 90 feet above ground and at center of Diamond Head face of tower building.
3. Receptor at Aqua Waikiki Wave Hotel located 90 feet above ground and at makai/Diamond Head corner of tower building.

another noise mitigation measure which is normally applied to construction activities. FIGURE 24 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.

New On Site Activities. The retail shops, restaurants, and any impromptu outdoor entertainment areas do not represent totally new activity centers for the project site. Risks of adverse noise impacts from the new shops, restaurants, and entertainment areas are therefore considered to be low. Compliance with local noise regulations will be required at the new establishments. The applicable State Department of Health (DOH) noise limits (see Reference 4) are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively, and these limits apply to fixed machinery and equipment, such as outdoor air conditioning equipment, emergency generator, and exhaust fans. Control of noise emissions from the new outdoor equipment will be required during the design of the new facilities. The Honolulu Liquor Commission also applies similar noise limits to music and other noises which may emanate from an establishment where alcohol is served. Because existing background ambient noise levels in Waikiki and within the International Market Place and Waikiki Town Center revitalization project area are generally higher than the State Department of Health noise limits, the noise limits of 60 and 50 dBA will probably not apply to the project area, and noise levels from project sources will generally be allowed to be as high as existing daytime and nighttime background ambient noise levels.

Tire squeal noise can occur if the circulation roadway surfaces within the planned parking garage structure are smooth or slick. In general, the use of coarse or brush concrete finishes, asphalt, or nonskid coatings on these circulation roadway surfaces will prevent the inception of tire squeal noise for typical circulation speeds within the parking garage structure. The use of these types of surfaces is recommended to prevent tire squeal noise.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 24

APPENDIX A. REFERENCES

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

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, l979.

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

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

(5) "FHWA Traffic Noise Model User's Guide;" FHWA-PD-96-009, DOT-VNTSC-FHWA-98-1, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(6) Traffic Impact Report; International Market Place Revitalization Project; Wilson Okamoto Corporation; October 2011.

(7) Hourly traffic counts at Station #B72761200109, Kalakaua Avenue Between Lewers and Beachwalk; Hawaii State Department of Transportation; February 4, 2011.

(8) Hourly traffic counts at Station #B72771000000, Ala Wai Boulevard Between Ohua and Liliuokalani; Hawaii State Department of Transportation; April 22, 2010.

(9) Hourly traffic counts at Station #B72771100000, Kuhio Avenue Between Nahua and Walina; Hawaii State Department of Transportation; May 5, 2010.

(10) Wiss, John F., Janney, Elstner and Assoc.; "Damage of Pile Driving Vibration;" Highway Research Record, Number 155.

(11) Gutowski, T.G.; Wittig, L.E.; and Dym, C.L.; "Some Aspects of the Ground Vibration Problem;" Noise Control Engineering; May-June 1978.

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).

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,

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 YEAR 2015
TRAFFIC VOLUMES DURING PM PEAK HOUR

ROADWAY LANES	******** CY 2011 ********		*** CY 2015 (NO BUILD) **		*** CY 2015 (BUILD) ****	
	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY
Ala Wai Blvd. W. of Seaside Ave. (WB)	2,078	1,803	2,220	1,968	2,170	1,912
Ala Wai Blvd. Btwn. Seaside & Nohonani (WB)	1,896	1,713	2,038	1,878	1,988	1,822
Ala Wai Blvd. Btwn. Nohonani & Nahua (WB)	1,992	1,810	2,134	1,975	2,108	1,947
Ala Wai Blvd. Btwn. Nahua & Walina (WB)	1,798	1,641	1,940	1,806	1,887	1,747
Ala Wai Blvd. Btwn. Walina & Kanekapolei (WB)	1,983	1,768	2,125	1,933	2,164	1,916
Ala Wai Blvd. E. of Kanekapolei St. (WB)	1,828	1,554	1,970	1,718	2,020	1,775
Kuhio Ave. W. of Seaside Ave. (EB)	673	652	721	711	631	609
Kuhio Ave. W. of Seaside Ave. (WB)	394	409	427	455	434	409
Two-Way	1,067	1,061	1,148	1,166	1,065	1,018
Kuhio Ave. Btwn. Seaside & Nohonani (EB)	658	651	706	710	619	612
Kuhio Ave. Btwn. Seaside & Nohonani (WB)	408	428	441	474	424	428
Two-Way	1,066	1,079	1,147	1,184	1,043	1,040
Kuhio Ave. Btwn. Nohonani & Nahua (EB)	721	729	383	433	707	719
Kuhio Ave. Btwn. Nohonani & Nahua (WB)	350	385	769	431	342	385
Two-Way	1,071	1,114	1,152	864	1,049	1,104
Kuhio Ave. Btwn. Nahua & Walina (EB)	599	611	450	670	585	601
Kuhio Ave. Btwn. Nahua & Walina (WB)	417	486	647	532	460	517
Two-Way	1,016	1,097	1,097	1,202	1,045	1,118
Kuhio Ave. Btwn. Walina & Kanekapolei (EB)	721	647	769	706	830	776
Kuhio Ave. Btwn. Walina & Kanekapolei (WB)	367	429	398	475	400	451
Two-Way	1,088	1,076	1,167	1,181	1,230	1,227
Kuhio Ave. E. of Kanekapolei St. (EB)	720	552	768	611	823	674
Kuhio Ave. E. of Kanekapolei St. (WB)	289	343	317	382	301	366
Two-Way	1,009	895	1,085	993	1,124	1,040
Kalakaua Ave. W. of Seaside Ave. (EB)	1,616	1,721	1,729	1,864	1,732	1,868
Kalakaua Ave. Btwn. Seaside & Duke's Ln. (EB)	1,469	1,474	1,584	1,617	1,584	1,617
Kalakaua Ave. Btwn. Duke's Ln. & Kaiulani (EB)	1,459	1,416	1,568	1,550	1,568	1,550
Kalakaua Ave. E. of Kaiulani Ave. (EB)	1,101	1,063	1,194	1,174	1,194	1,174
Seaside Ave. Btwn. Ala Wai & Kuhio. (NB)	392	314	392	314	392	314
Seaside Ave. Btwn. Ala Wai & Kuhio. (SB)	201	194	201	194	201	194
Two-Way	593	508	593	508	593	508

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2015
TRAFFIC VOLUMES DURING PM PEAK HOUR

ROADWAY LANES	******** CY 2011 *********		*** CY 2015 (NO BUILD) **		*** CY 2015 (BUILD) ****	
	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY
Nohonani St. Btwn. Ala Wai & Kuhio (NB)	60	56	60	56	60	56
Nohonani St. Btwn. Ala Wai & Kuhio (SB)	148	129	148	129	172	157
Two-Way	208	185	208	185	232	213
Nahua St. Btwn. Ala Wai & Kuhio (NB)	201	194	201	194	228	225
Walina St. Btwn. Ala Wai & Kuhio (SB)	125	129	125	129	217	170
Kanekapolei St. Btwn. Ala Wai & Kuhio (NB)	323	358	323	359	312	348
Kanekapolei St. Btwn. Ala Wai & Kuhio (SB)	169	162	169	162	169	162
Two-Way	492	520	492	521	481	510
Seaside Ave. Btwn. Kalakaua & Kuhio. (NB)	291	285	291	285	294	289
Duke's Ln. Btwn. Kalakaua & Kuhio. (NB)	64	58	64	58	80	77
Kaiulani Ave. Btwn. Kalaukaua & Kuhio (NB)	310	334	314	345	304	332
Kaiulani Ave. Btwn. Kalaukaua & Kuhio (SB)	146	162	146	162	146	162
Two-Way	456	496	460	507	450	494