Los Angeles International Airport

Aircraft Noise Impact Analysis

City of Monterey Park

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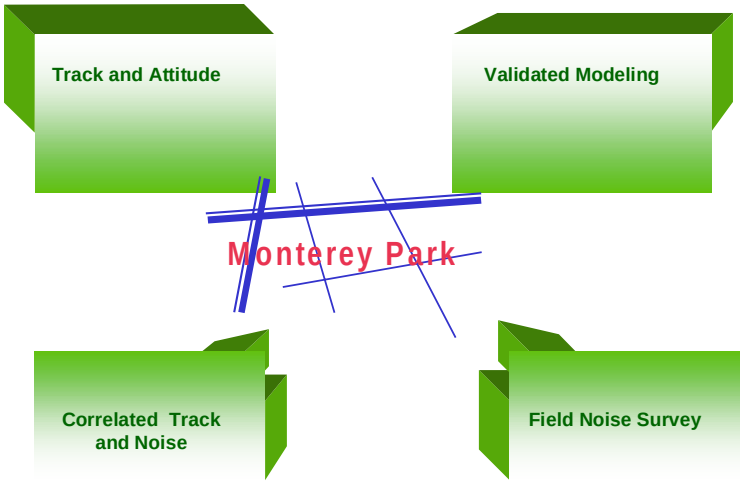
Section 1. Introduction

The Los Angeles World Airport (LAWA) Noise Management Bureau (NMB) was requested to perform an aircraft noise impact analysis for the City of Monterey Park (City) by the FAA Southern California Task Force. This analysis was a collaborative effort between the staffs of the NMB, the FAA, and the City of Monterey Park.

This report is divided into six areas. In Section 2, NMB defines the standard noise metrics terminology and the criteria set by the State of California that defines "significant noise level". In Section 3, the FAA's field validated Integrated Noise Model (INM) is used to predict noise levels. In Section 4, airplane tracks collected from the FAA Automated Radar System ar e used to determine the number of overflights and their altitude over Monterey Park. In Section 5, sample field noise data are collected to estimate the typical noise level over Monterey Park. In Section 6, correlated noise and track are evaluated to determine the noise level over Monterey Park. In Section 7, the report summarizes the results from these four analyses and presents NMB recommendations. Lastly, in Section 8, an addendum noise comparison has been added to compare the noise and overflights at 2500 feet and 4000 feet.

Schematic of Monterey Park Aircraft Noise Analysis

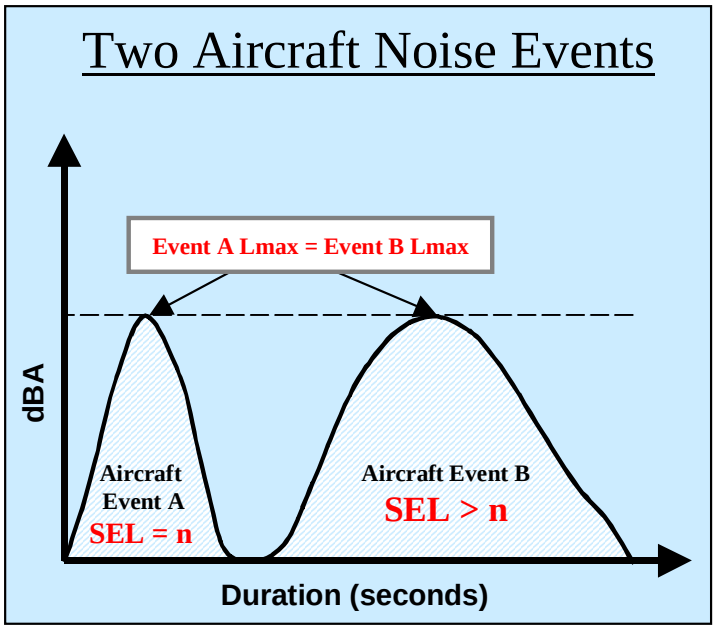


Based on the results obtained from these analyses, the NMB concludes that noise levels in Monterey Park do not exceed State airport noise standards.

Section 2. Noise Definitions

Sound is expressed in decibels (dB), which is measured on a logarithmic scale. Frequencies are weighted using the "A-weighting" scale to best match human hearing response.

Individual aircraft noises that exceed an established threshold are *noise events,* and are described using noise level and duration. The maximum instantaneous noise level during a noise event is termed the Lmax. The total noise measured during a noise event is termed the Sound Exposure Level or SEL (see Example 2.1). Noise events are collected typically over a period of an hour or more and the total volume collected is averaged to formulate a value called the *Equivalent Sound Level* or Leq. Noise averaged for a one-hour period is called the Hourly Noise Level or HNL.



Example 2.1. Two aircraft events with the same Lmax value (maximum sound level) but different SEL value (total energy). Aircraft Event B has a higher SEL value because it has a longer duration

For daily or annual averages in California, the *Community Noise Equivalent Level* (CNEL) is used. The averaged hourly Leq values are corrected to add evening (5 dB) and night (10 dB) penalties that more accurately represent the increase in perceived aircraft noise level and annoyance.

The CNEL is an energy average A-weighted sound level integrated over a 24-hour period or longer.

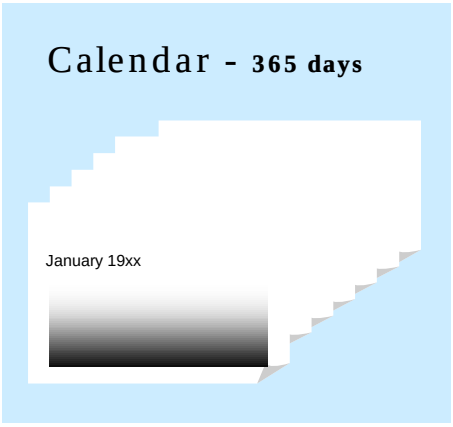
Noise Contours

Noise contours or footprints are the accepted technique for graphically displaying airport cumulative noise exposure. It is generated using a computer simulation of the annual average daily operations. Contours indicate annual average exposure using a line (band) to depict areas of equal exposure.

Noise contours are used to compare noise exposures at different study locations.

Noise Impact

The State of California defines significant aircraft noise at 65 dB CNEL. This is an annual average value.



Section 3. Integrated Noise Model

NMB used the FAA Integrated Noise Model (version 5.1a) to predict aircraft noise levels at Monterey Park. The Integrated Noise Model (INM) is an aircraft noise impact modeling software package developed by the Federal Aviation Administration (FAA).

The INM is the standard tool used throughout the United States for noise compatibility planning and environmental assessments and environmental impact studies. It is an *average-value model* and is designed to estimate short- or long-term effects (typical long-term conditions) using average daily or annual aircraft operation statistics.

3.1 Methodology

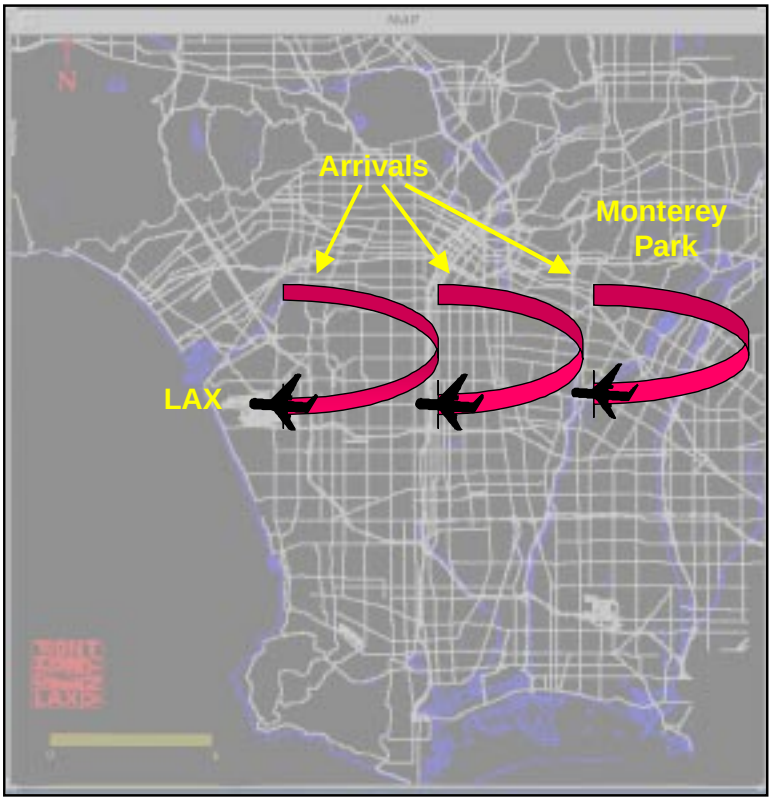
Field validation of the Integrated Noise Modeling is accomplished by first establishing assumptions and calculating predicted values in the INM. This is followed by a field survey to either validate the Integrated Noise Model and its results or adjust the assumptions if required. A validated INM prediction for Monterey Park is presented later in this Section.

3.2 Noise Model Assumptions

The INM requires input of external, location-specific data in order to predict the location's unique noise climate. Some of the assumptions used for various parameters in the INM are discussed below.

Flight Pattern

The LAX arrivals from the north fly over Santa Monica and then eastbound (downwind leg) before turning to line up for approach east of the Harbor Freeway. At times, more space is required at LAX between aircraft. This may be due to increased arrival traffic or poor visibility conditions. Arrivals are routed beyond the Harbor Freeway and aircraft may turn for landing over Monterey Park. At those times, Monterey Park experiences aircraft noise. Note that only LAX arrivals are used in the modeling because LAX departures and others airports' operations are not considered as significant.



LAX Arrival Flight Pattern Over Santa Monica

Daily Flights

The City of Monterey Park initially estimated that the most significant noise time period is from 9am to noon, roughly one day out of every three. Since all arrivals that could fly over Monterey Park first fly over Santa Monica, the NMB first analyzed arrival traffic volumes over Santa Monica. Based on a typical day (3/6/98), the NMB processed and determined that from 9 am to noon, 67 arrivals flew over Santa Monica. Therefore, 67 daily overflights in a three-hour period were used to describe a "heavy overflight day" for Monterey Park noise modeling. Table 3.2.1 shows a list of the arrivals used in the noise model.

Table 3.2.1. List of 67 Daily Arrivals used in the INM (3/6/98)

Airline	AcType	Count
United Airlines/Southwest Airlines	B73B	25
Skywest Airlines	E120	14
Japan Airlines/United Airlines	B74B	6
Trans States/United Express	BA32/JSTA	4
Air Canada/Canadian Airlines	A320	3
Alaska Airlines/Reno Air	MD80	6
American Eagle	SF34	2
China Eastern/Delta Airlines	MD11	2
Canadian Airlines	B73A	1
Varig Brazilian Airlines	B74A	1
United Airlines	B757	1
General Aviation	HS25B	1
Delta Airlines	L1011	1
Total		67

Aircraft Location (Altitude and Track)

Using data from the FAA (provided by the City of Monterey Park), the NMB estimated the aircraft altitude at 2500 feet Mean Sea Level overflying Monterey Park. This is based on typical altitude for LAX flights in the general vicinity of Monterey Park on February 10 and 11, 1997.

At the time of the modeling effort NMB had not yet independently collected radar data over Monterey Park. When such data was collected, aircraft altitudes were consistent with this assumption (see Section 4). Aircraft track East over Monterey Park, then turn south. See Figure 3.5.2.

Aircraft Type

Based on the Monterey Park "heavy overflight day", the NMB staff assigned each of the 67 overflights an INM aircraft type. The INM aircraft database contains aircraft data such as noise characteristics and performance. A list of the INM assumptions for the different aircraft type is shown in Table 3.2.2.

Table 3.2.2. List of INM Assumptions

Description	INM AcType
Air carrier jets	
Boeing 737 (Stage 2)	737D17
Boeing 737 (Stage 3)	737300
Boeing 747-200	74720B
Boeing 747-400	747400
Boeing 757	757PW
Airbus 320	A320
Lockheed Tri-Star L-1011	L1011
McDonnell-Douglas MD11	MD11PW
McDonnell-Douglas MD80	MD83
Commuter props	
Sub. for BAe Jetstreams (United Express)	CNA441
Sub. for Embraer 120 (Skywest)	DHC6
Saab-Fairchild 340 (American Eagle)	SF340
Business jets	
Gulfstream IV (business jet)	GIV

Location and Topography

Four sites were selected for the noise model calculations. All are well-known public locations. Some were selected based on their low ambient noise level and high elevation where the perceived aircraft noise impact would be greater than at a location with a high background noise level. The four locations are Sequoia Park (SQP), Schurr High School (SHS), Garvey Ranch Park (GRP), and Monterey Highland Park (MHP).

The locations used in the Integrated Noise Model are shown in the figure below.

Figure 3.2.1. Locations used in INM modeling

(Figure Not to Scale).

Model aircraft track described above and shown (Figure 3.5.2) is south of Monterey Highland Park, and turns over Sequoia Park. It turns between Garvey Ranch Park and Shurr High School.

3.3 Sequoia Park Predicted Noise Impact

Based on the INM, the average noise level in Sequoia Park is estimated at less than 50 dB CNEL on a "heavy overflight day" with overflights. The State-defined "noise impact" level is 65dB CNEL annual average. Thus, the noise level in Sequoia Park is significantly less than the State-defined "noise impact" level. Table 3.3.1 shows the INM-predicted average noise level at each monitoring point.

*Table 3.3.1. INM-predicted Average Noise Level**

Site	INM Elevation (feet)	Lmax (dBA)	HNL or Leq	CNEL (daily)
GRP	487.4	64.5	45.9	36.9
MHP	593.7	70.1	51.1	42.0
SHS	365.0	65.1	47.8	38.7
SQP	563.0	75.6	54.7	45.6

USGS Topographical map shows SQP elevation at 700 feet. The differences between USGS and INM elevations (137 ft) would have a very small impact on predicted noise levels.

**Abbreviations:*

GRP: *Garvey Ranch Park*

MHP: *Monterey Highlands Park*

SHS: *Schurr High School*

SQP: *Sequoia Park*

Definitions:

Lmax*: The highest instantaneous noise level at the site on the "heavy overflight day".*

HNL*: The hourly energy-average noise level for those hours with aircraft overflights on the "heavy overflight day".*

CNEL*: The daily energy-average noise level for the "heavy overflight day".*

In Table 3.3.2, the INM assigned aircraft types with their predicted SEL and Lmax values (in dBA) at Sequoia Park are listed.

Note that individual aircraft noise as high as 76 dB (Lmax, or greater than 80 SEL) is predicted for wide-bodied jets such as the Boeing 747-200. However, the hourly average shown in Table 3.3.1, which includes periods with and without aircraft noise, are predicted to be less than 55 (HNL or Leq) during "heavy overflight" hours.

Table 3.3.2. Predicted Single Aircraft Noise (Lmax and SEL) at Sequoia Park using INM

Description	SEL	Lmax
Air carrier jets		
Boeing 737 (Stage 2)	77	68
Boeing 737 (Stage 3)	76	67
Boeing 747-200	85	76
Boeing 747-400	83	74
Boeing 757	75	66
Airbus 320	75	66
Lockheed Tri-Star L-1011	77	68
McDonnell-Douglas MD11	80	71
McDonnell-Douglas MD80	74	65
Commuter props		
Sub. for BAe Jetstreams	66	59
Sub. for Embraer 120	73	66
Saab-Fairchild 340	69	61
Business jets		
Gulfstream IV (business jet)	70	62

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3.4. Field Survey

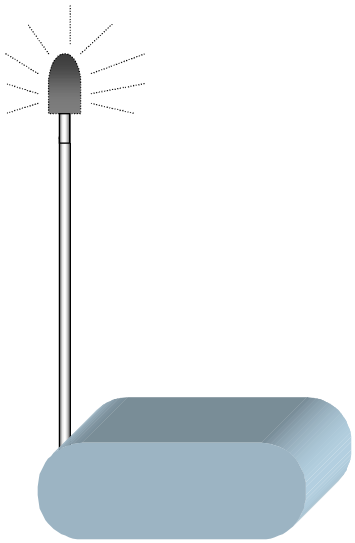
A Field Survey was performed on March 25, 1998 to validate the INM results for Sequoia Park.

Instrumentation

A Portable Noise Monitoring System (Bruel & Kjaer Type 3571 Plus with a precision integrated Sound Level Meter type 2236 and an HP Palmtop computer for data storage) was used to collect noise data. The Single Event Noise Threshold (SENT) that is used to remove the community background noise level and isolate actual aircraft noise events was estimated to be at 45 dB. While recording noise data, a strip chart is generated on the computer screen for direct visual observation.

Field Survey Plan

The field survey was conducted on March 25, 1998 at Sequoia Park between 9am to 11am. Two NMB staff collected aircraft noise data using the B&K 3571 Plus monitoring equipment and recorded observed aircraft type and airline data.



B & K Type 3571 Plus Noise Monitoring Equipment

Field Survey Results

The field survey recorded 40 flights. Of those, 6 were LAX departures that were barely visible and too high (estimated to be at least 15,000 feet above Mean Sea Level) to generate a noise event above background level. Of the remaining 34 flights, the highest recorded Lmax value was for an MD11 aircraft that generated 75 dB. The second highest was at 68 dB.

During the survey, measured HNL of 54.7 (first hour) and 51.7 (second hours) were recorded.

In two hours, the portable Noise Monitoring System recorded 128 noise events with greater than 45dB Lmax (set as community noise level). Most were attributable to non-aircraft sources (cars, lawn mowers, etc.). Of those, 10 had an Lmax of greater than 60 dB (8 matched to an aircraft overflight) and one had a Lmax of greater than 70 dB (matched to an aircraft). Aircraft overflights that matched to a 60 dB or greater Lmax value are shown in Table 4.4.1.

The cloud cover was present during the first hour and dissipated by the second hour. Aircraft overflights were observed to be at a higher altitude and the turns occurring south of Sequoia Park during the second hour. The Lmax values are observed to be lower in the second hour.

Table 3.4.1. Aircraft Overflights with greater than 60 dB Lmax.

Airline	Time	AcType	Observed Lmax
China Eastern	9:42	MD11	75
Quantas	9:44	B747	68
Southwest	9:45	B737	62
Air Canada	9:48	A320	64
Japan Airline	9:49	B747	68
Alaska	9:51	MD80	61
Skywest	9:53	E120	63
Japan Airline	10:01	B747	68
Singapore	10:44	B747	66

In Tables 3.4.2 and 3.4.3, the field survey log is shown with SEL values. Note that the Lmax-measured column in Tables 3.4.2 and 3.4.3 are recorded from direct visual observation at the time of the noise recording. The SEL-calculated column showed the calculated total energy for a single noise event. The threshold level (SENT) set to isolate individual aircraft overflight was too low.

Some SEL-calculated values included the total energy level of many aircraft overflights. In these cases, the aircraft's actual SEL value is less than shown in Tables 3.4.2 and 3.4.3.

Table 3.4.2. Field Observation Log with Measured Lmax and Calculated SEL values – First Hour (NR = Not Recorded)*

Time	AcType	Airlines	Lmax	SEL
9:06	Turboprop	Unknown	NR	NR
9:17	B737	United	NR	NR
9:18	B737	United	NR	NR
9:20	JSTA	United Express	NR	NR
9:22	JSTA	United Express	NR	NR
9:23	SF34	American Eagle	NR	NR
9:25	E120	Skywest	NR	NR
9:27	E120	Skywest	NR	NR
9:28	JSTA	United Express	NR	NR
9:32	MD80	Alaska	NR	NR
9:38	B737	United	NR	NR
9:40	B737	Alaska	NR	NR
9:42	MD11	China Eastern	75	87.8
9:44	B747	Quantas	68	
9:45	B737	Southwest	62	
9:48	A320	Air Canada	64	
9:49	B747	Japan Airline	68	
9:51	MD80	Alaska	61	
9:53	E120	Skywest	63	72.5
9:55	MD80	Alaska	50	74.5
9:56		Unknown		
9:58	E120	Skywest	58	
9:58	B737	Southwest	59	

Table 3.4.3. Field Observation Log with Measured Lmax and Calculated SEL values – Second Hour (BT = Below Threshold)*

Time	AcType	Airlines	Lmax	SEL
10:01	B747	Japan Airline	68	85
10:03		*Street sweeper*		
10:04	E120	Skywest	59	
10:06	B737	United	50	
10:07		*Departure, high*	BT	BT
10:10		*Departure, high*	BT	BT
10:11	B737	United	BT	BT
10:20		*Departure, high*	BT	BT
10:32		GA	BT	BT
10:33	B747	*not visible*	BT	BT
10:36	MD11	Delta	49	63.9
10:40		*Departure, high*	50	BT
10:42	E120	United Express	58	78.7
10:44	B747	Singapore	66	
10:47	BA32	TransAir	57	68.8
10:51	E120	Skywest?	48	62.3
10:59	MD87?	Reno Air	55	68
11:04		*Departure, high*	BT	BT

**Note: Lmax were recorded based on direct visual observation at the time of the overflight. SEL values were obtained from sound level meter calculation.*

3.5 Noise Model Validation Analysis

The INM model is validated by the field survey conducted at Sequoia Park on March 25, 1998. The INM model is accurate and the NMB staff used the model to further predict the effect of aircraft altitude on noise impact.

Field Survey vs Noise Model Comparison

The 67 arrivals used to calculate a "heavy overflight day" noise exposure were assigned to various INM aircraft types. An altitude of 2500 feet Mean Sea Level was used for all 67 arrivals. The arrival track bisected Monterey Park and initiated the aircraft turn near Sequoia Park. The noise for each aircraft at each location was calculated. These values represent the predicted noise impact at each one of the four locations with the assumption that aircraft turned for landing over Monterey Park.

An average hourly noise level (HNL) was calculated for Sequoia Park. Between 9am to noon, using actual flight track data from March 6, 1998, the INM predicted that the HNL would be 54.7 dB.

From the field survey, two hours of data were collected. The first hour HNL was recorded as 54.7 dB. The second hour HNL was recorded as 51.7 dB. (The background HNL was recorded as 45.1 dB for the first hour and 43.4 dB for the second hour.)

The HNL data predicted by the model is consistent with measured noise levels. Table 3.5.1 shows the field-measured HNL and INM-predicted HNL. Note that for the first hour, the HNL measured is exactly the same as the HNL predicted by the INM. More aircraft overflights during the first hour would generate a higher HNL value.

Table 3.5.1. Measures vs. INM-Predicted Sequoia Park Noise Levels

Field Survey (Hours)	HNL or Leq (Measured)	HNL or Leq (Predicted)	Daily CNEL (Predicted)
09:00 - 10:00	54.7	54.7	45.6
10:00 -11:00	51.7		

Table 3.5.2 includes those aircraft overflights that are identified with Lmax-observed values. Variables are always present during field surveys. Variables include the location of the aircraft, true aircraft type, and weather and climate conditions. All those variables will effect how the sound is travels and is recorded by the Sound Level Meter.

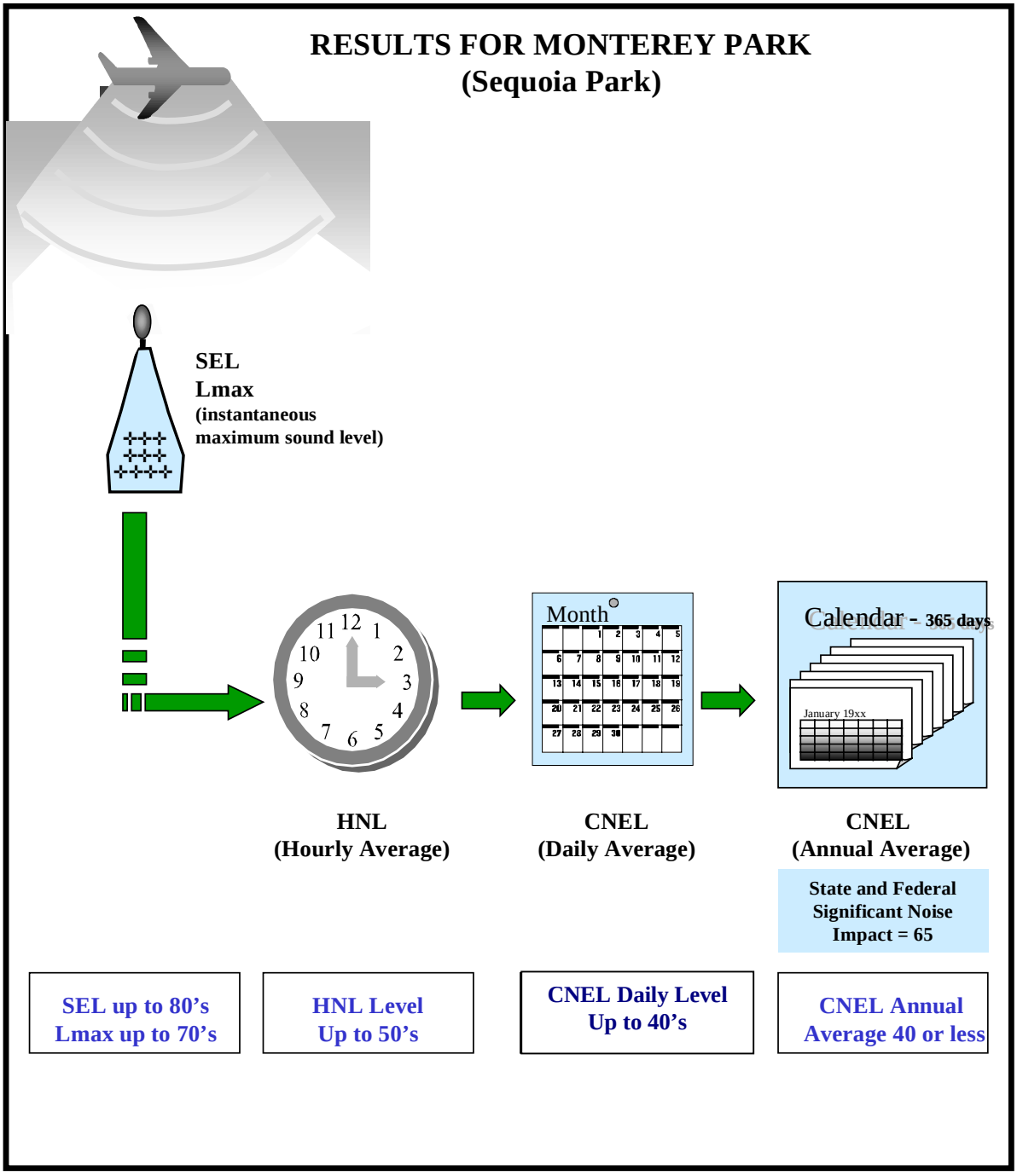
Table 3.5.2. Measured Lmax (Lmax-M) and SEL (SEL-M) vs. INM-Predicted Lmax (Lmax-P) and SEL (SEL-P) Values at Sequoia Park

Aircraft	Airline	Lmax-M	Lmax-P	SEL-M	SEL-P	Time
A320	ACA	64	66		75	09:48
B737	SWA	62			76or 77	09:45
B737	SWA	59	67or 68		76or 77	09:58
B737	UAL	50	67or 68		76or 77	10:06
B747	QFA	68	74or 76		83or 85	09:44
B747	JAL	68	74or 76		83or 85	09:49
B747	JAL	68	74or 76		83or 85	10:01
B747	SIA	66	74or 76		83or 85	10:44
BA32	LOF	57	59	68.8	66	10:47
E120	SKW	63	66	72.5	73	09:53
E120	SKW	58	66		73	09:58
E120	SKW	59	66		73	10:04
E120	SDU	58	66		73	10:42
E120	SKW	48	66	62.3	73	10:51
MD11	CES	75	71		80	09:42
MD11	DAL	49	71	64.9	80	10:36
MD80	ASA	61	65		74	09:51
MD80	ASA	50	65		74	09:55

Predicted values may be higher because these assume a direct overflight and an environment where sound propagation is uniform. Regardless of the variables present during the field survey, the similarities between the measured and predicted values are present.

The single aircraft event can be significant, and both Lmax and SEL are important measures in quantifying noise levels. However, due to the variables mentioned previously, HNL and CNEL provide consistent measure of noise that are valuable in longer term, noise mitigation planning.

Using the HNL values, the field survey accurately validated the Integrated Noise Model.



INM Estimated the Sequoia Park has an Average Annual CNEL of 40 or Less

Noise Contours

Using the validated INM model for Monterey Park, the NMB staff generated two Noise Contour Maps depicting the noise footprint of aircraft over-flying Monterey Park. The first Noise Contour Map shows the annual average noise exposure for different locations, assuming that the aircraft overfly Monterey Park on a single track, every day for a year with 60-70 aircraft per day.

The other Noise Contour Map shows the maximum predicted aircraft noise at each location (with established assumptions in the previous section).

The calculated Lmax and CNEL values for each location are shown in Table 3.5.3. Also see Figure 3.5.2 and 3.5.3 which showed the noise contours (footprints) for CNEL and Lmax, respectively.

Table 3.5.3. Estimated Lmax and CNEL Values

Location	Lmax	CNEL
Sequoia Park	75.6	45.6
Shurr High School	65.1	38.7
Garvey Ranch Park	64.5	36.9
Monterey Highland Park	70.1	42.0

Note that a value of 65 dB annual CNEL would require over 400 overflights, on average, each day of the year, and all 400 overflights would have to have a measured noise level equal to that of the loudest individual aircraft measured at Monterey Park (85 dBA SEL). The numbers currently estimated by Monterey Park staff (approximately 60 overflights every three days) would need to increase twenty-fold in order to exceed the level of significance as defined by the State of California and the Federal Aviation Administration.

Modeling at Higher Aircraft Altitude

Two aircraft types (B747-200 and B727) were modeled at a higher aircraft altitude (3000 feet) over Sequoia Park. Comparing these two aircraft at 3000 feet versus 2500 feet over Sequoia Park, the model showed approximately 1.5 dB decrease with 500 feet increase in altitude.

In practice, a change of less than 3 dB is not audible.

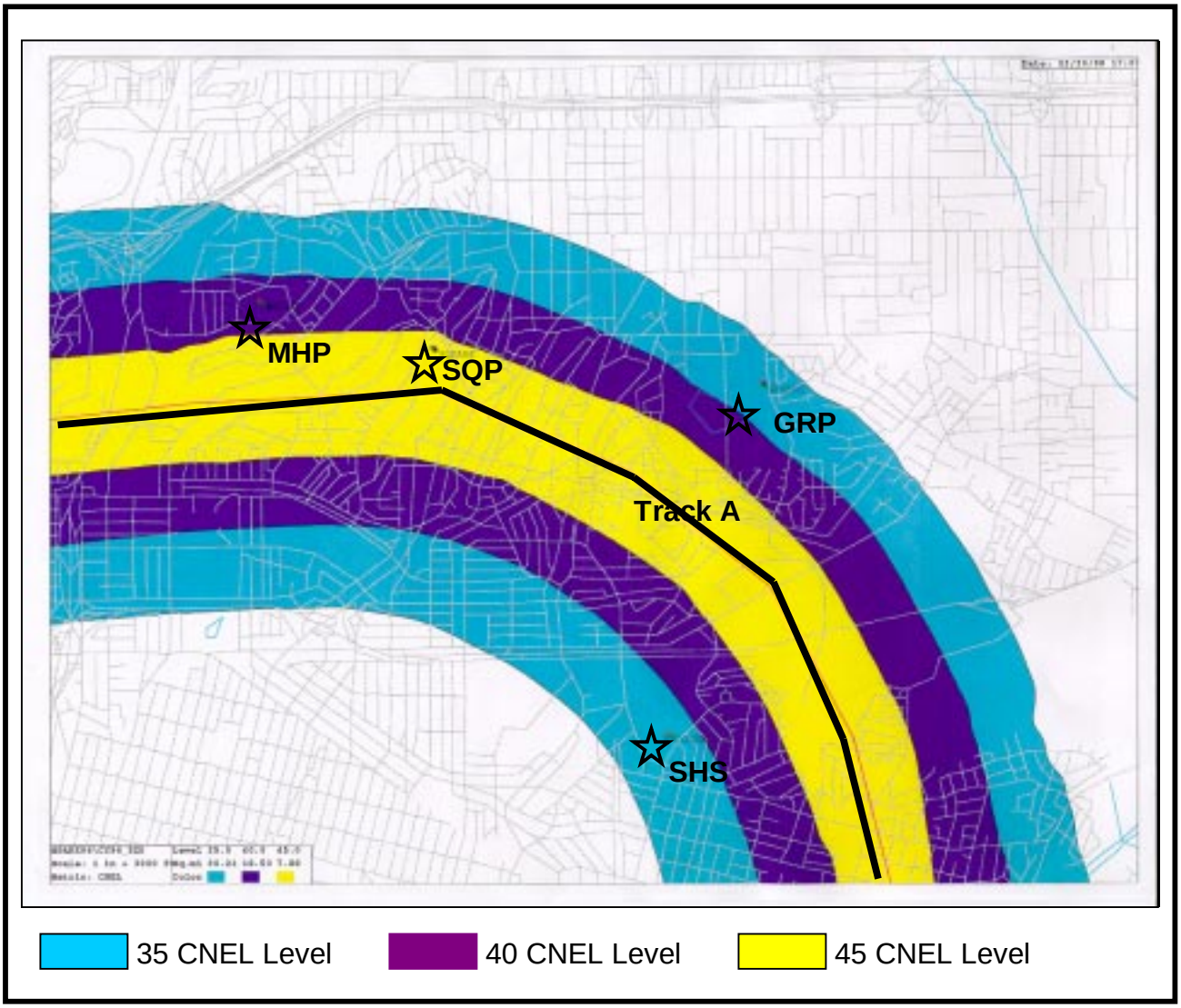


Figure 3.5.2. Noise Contour – Calculated Average CNEL (Daily) at Different Locations Using Track A (Monterey Park)

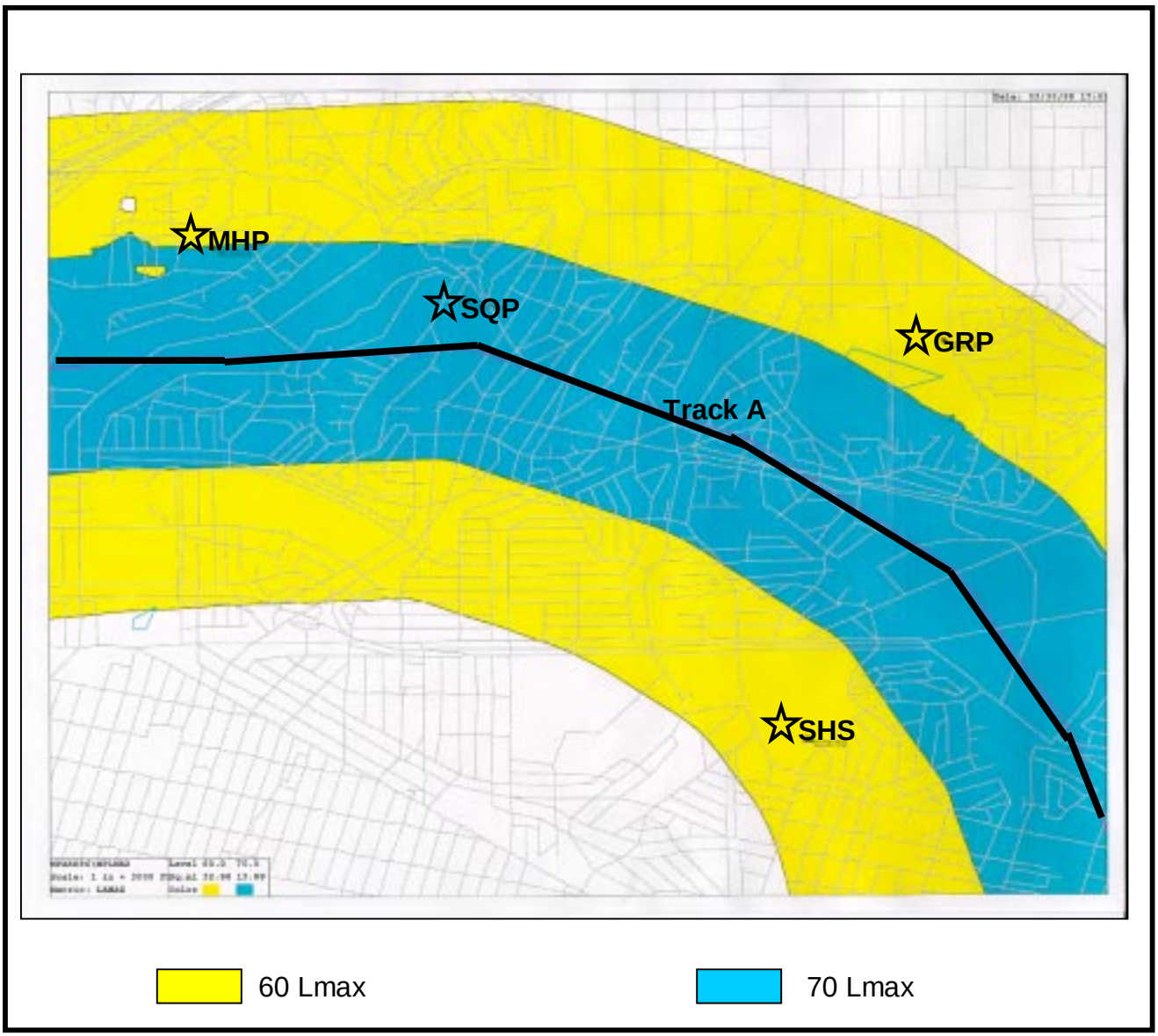


Figure 3.5.3. Noise Contour – Calculated Lmax (Instantaneous Maximum Sound Level) at Different Locations Using Track A (Monterey Park)

Section 4. Radar Flight Track Analysis

Using the aircraft data collected by the FAA Automated Radar System, NMB staff compiled aircraft data over Monterey Park. Nineteen days of data are evaluated. The result of the evaluation shows the typical fleet mix and aircraft operational time periods of LAX arrival flights over Monterey Park.

4.1. Methodology

To analyze aircraft track data, staff first sets the boundary for data evaluation. The boundary is set from West of the Long Beach freeway to East of Del Mar Avenue, and North to Santa Monica freeway and South to the 60 freeway. Based on the general flight pattern, we further limited the analysis to all LAX arrival aircraft flying below 8000 feet altitude. This establishes the Monterey Park analyses zone. A pictorial representation of this zone is shown below.

Track collection boundary for Monterey Park

Staff compiled 19 days of 24-hour data for evaluation. Data are spot checked for accuracy to eliminate false radar readings and then organized into tables. Operational data are displayed in the tables to show typical days and to further validate assumptions used in the Integrated Noise Model.

4.2. Analysis

Data are compiled to evaluate the operational pattern and fleet mix of aircraft overflying Monterey Park. Table 4.2.1 shows the number of operations for the dates and the days of the week collected. The overflight patterns are not dependent on the day of the week and appear to be random.

Table 4.2.1. Number of LAX arrivals over Monterey Park

Dates	Days	# Arrivals
2/18/98	Wednesday	0
4/7/98	Tuesday	18
4/8/98	Wednesday	70
4/9/98	Thursday	11
4/13/98	Monday	102
4/14/98	Tuesday	34
4/15/98	Wednesday	16
4/16/98	Thursday	1
4/17/98	Friday	4
4/18/98	Saturday	3
4/19/98	Sunday	3
4/20/98	Monday	12
4/21/98	Tuesday	28
4/22/98	Wednesday	167
4/23/98	Thursday	151
4/24/98	Friday	35
4/25/98	Saturday	8
4/26/98	Sunday	4
4/27/98	Monday	1
Average	19 Days	35

Further analysis of daily operations shows quantitatively Monterey Park's overflight mix. The fleet mix and its distribution throughout the day are shown in Table 4.2.2.

	Aircraft Type																																													
Hours	**A310**	**A320**	**A340**	**B350**	**B707**	**B727**	**B73A**	**B73B**	**B73C**	**B73F**	**B747**	**B74A**	**B74B**	**B74F**	**B757**	**B767**	**B777**	**BA11**	**BA32**	**BE20**	**BE90**	**C208**	**C441**	**C560**	**DC10**	**DC8**	**E120**	**FA20**	**GULF**	**HS25**	**IL96**	**JSTA**	**L101**	**L29A**	**LJ24**	**LR35**	**MD11**	**MD80**	**MD82**	**MD83**	**MD87**	**SF34**	**Unk**	**Total**
1																									1																				1
2																																													0
3																																													0
4																																													0
5																																													0
6								3											1	1						2					2	1									2		12
7								7				1	4		2				1		1					19		1			4								2	6		48
8								8		1		1							1							2													1		3		17
9								13		2		3	4							1				1		17					4					1	11			1		1	59
10		5					4	12				3	9	1		1			2							18					3					2	4		2		3	2	71
11		2					2	11				2	8						1	1			1			7			1						1	5	3	1	1	2	5		54
12		3						6		2		3	7		1				1							14					4					2		1	1		3		48
13	1							3		1		2	8			1										4				1	3					2	2				1		29
14				1				10				1	3		2				2							11											1	1	2		2		36
15								8				1	2						1						1	2											1			1	3	1	22
16								1					2				1								1	1					1										1		8
17		1	1					3			2	2	1		1		1								1		14	1				2						1				2		33
18			1				4	14				2	5						1						1		15					1		1	1			2		1	4	3	6	62
19								16		2	1		10									1			2		13		1								4	6	1	1		6	2	66
20					1			9	1			1	5		1	1						1			3		4					1	2						1			7	1	39
21						1		10							1			1	2			2			3		8					1	1					2		2		3		37
22								9	1	2															1		6						1			1				1			1	23
23								1																		1							1											3
Total	1	11	2	1	1	1	10	144	2	10	3	22	68	1	8	3	2	1	13	3	1	4	1	1	14	2	157	1	2	1	1	26	6	1	1	2	16	33	5	12	10	50	14	668

Table 4.2.2. Fleet Mix and Hourly Distribution (19 days of data)

Table 4.2.2 showed cumulative hourly overflight distribution for 19 days of data. A higher frequency of overflights occurs between 9 AM to 3 PM. Another higher overflight frequency occurs again between 6 to 8 PM. The top three most frequent overflights are B74B (a wide-body 747 jet) and B73B (a narrow-body 737 jet), both which are stage 3 aircraft types, and E120 (a commuter turboprop).

All of the overflights are also organized based on altitude level over Monterey Park. The altitude readings are recorded from the information reported by the aircraft's altimeter. The altitudes are categorized into altitude ranges. See Table 4.2.3 for the altitude distribution of Monterey Park overflights. Ninety percent of the overflights are less than 4500 feet above Mean Sea Level (MSL), with about two-thirds between 2000 and 3000 feet MSL. Given that the highest elevation points in Monterey Park are approximately 700 feet, the aircraft flying over Monterey Park between 2000 and 3000 feet MSL are actually between 1300 and 2300 feet over the homes.

Note that under the existing standard operating arrival procedures into LAX, turboprops are allowed to be as low as 2200 feet MSL and jets are normally as low as 2500 feet MSL over Monterey Park.

Table 4.2.3. Distributions of Overflights at different altitudes

Altitude Range (feet)	Number of Overflights	% of Overflights over Monterey Park
2000 up to 2500	362	54
2500 up to 3000	117	18
3000 up to 4500	148	22
Higher than 4500	41	6
Grand Total	668	100

4.3. Result

Nineteen days of Monterey Park overflight data were evaluated, and the result indicated that the overflight pattern is largely random; however, the highest frequency of overflights occurs in the late morning and early afternoon hours of the day. The number of average daily overflights over Monterey Park is 35. Most of the aircraft fly over Monterey Park under 3000 feet Mean Sea Level.

This result is consistent with the assumptions used in the Integrated Noise Model in Section 3.

Section 5. Noise Analysis

Sample field noise data were collected to determine the typical noise level in Monterey Park. Eleven days (four of them partial) of continuous noise data were collected. The result of the evaluation shows the typical range of hourly noise levels at the collection site and the daily average noise level both with added evening and nighttime penalty (CNEL) or without penalty (Leq).

5.1. Methodology

Sequoia Park is selected as the site of collection because it is a secure site where staff could leave the noise monitoring device, and for its high elevation and low ambient noise level within the city.

A portable noise monitoring system (Bruel & Kjael Type 3571 Plus with a precision Integrated Sound Level Meter type 2236 and an HP Palmtop computer for data storage) was used. This is the same system used in Section 3 of the analysis. Based on prior experience with the site environment, the threshold (SENT) was set at 60 dB for data collection after April 9, 1998.

The field survey was conducted from April 9 through 13 and again from April 22 through 27.

5.2. Analysis

Data are organized first into hourly values and then into daily values where complete 24-hour hourly values are available to calculate average daily CNEL and Leq. Note that the daily CNEL may be higher than Leq values because it also includes an evening penalty (approximately 5 dB) and a night (10 dB) penalty in the calculation.

The number of aircraft events collected for the day were summarized by hour and those that had an Lmax value greater than 70 dB(A) are tabulated.

Table 5.2.1 shows the hourly Leq or HNL values during the survey period. Note that most of the days, the hourly Leq values from 8 PM to 7 AM the next day are either 0 or very low. Consistent with track analysis in the previous section, the hourly Leq values are higher values in those hours with overflights. Most of the hourly Leq are in the 40s with some hours in the mid-50s.

Table 5.2.1. Hourly Leq or HNL Value

Hours	4/9	4/10	4/11	4/12	4/13	4/22	4/23	4/24	4/25	4/26	4/27
0		0	0	0	0		0	0	0	0	0
1		0	0	0	0		43.5	0	0	0	45.5
2		0	0	0	0		0	0	0	0	0
3		0	0	0	0		0	0	0	0	0
4		0	0	0	0		0	0	0	0	0
5		0	0	0	47.1		0	36.8	34.3	34.8	38.4
6		41.8	39.3	40.6	52.1		43.7	42.1	48.9	32.5	42.5
7		51.1	0	38.5	51.1		53	45.4	30.3	0	44.8
8		50.5	56.5	45.7	50.7		41.5	43.2	0	30.4	49
9		50.8	43.9	43.9	54.9		53.3	48.8	0	45.7	57.9*
10		52.1	43.5	46.7	55.8		58.3	50	0	49.4	
11		47.2	48.2	41.5			57.4	44.6	0	40	
12	46.9	47.5	37.9	43.7		39.3	52.4	47.2	0	39.3	
13	33.1	50.3	43.7	41.8		46.9	54.3	47.2	51.5	0	
14	32.1	51.5	40	35.4		33.4	40.7	0	43.7	0	
15	0	48.2	46	0		44.6	44.2	40.6	39.8	41.6	
16	52.6	33.5	50.9	54.2		0	49.1	37.5	44.6	41.9	
17	48	32.5	51.7	42.8		52.5	52.3	49.8	48.6	49.7	
18	48.1	48.9	53.6	35.1		56.6	48.1	50	46.4	40.3	
19	42.8	46.8	46.1	47.4		54.2	45.6	35.8	49	48.9	
20	0	0	37.2	0		56.9	47.5	41.6	0	0	
21	44.6	0	0	0		56.4	45.6	44	0	0	
22	0	0	50.4	0		46.3	33.2	31.7	0	39.9	
23	36.2	0	0	0		37.4	0	0	0	0	

*** Lawn mower operated within 100 feet of the monitor.**

Table 5.2.2 shows the daily CNEL and Leq values. Note that the daily Leq is measured in the 40s. On 4/23 the Leq is at 50.4 and is consistent with the 151 overflights recorded for that day.

Table 5.2.2. Daily CNEL and Leq Values

	4/10	4/11	4/12	4/23	4/24	4/25	4/26
CNEL	**47.4**	**50.1**	**44.9**	**51.4**	**45.9**	**47.5**	**44.4**
Leq	**46.6**	**47.3**	**43.4**	**50.4**	**44.3**	**43**	**41.9**

Table 5.2.3 shows the number of measured noise events during the survey. Note that these are noise events and not necessarily aircraft noise events. Noise events correlated to the track will validate the noise event as an aircraft event (see Section 6).

The number of greater than 70 dB Lmax noise events are also included in this table. These noise events are used to correlate the track data in Section 6. Note that 10% of the noise events collected are greater than 70 dB Lmax and few exceeded 80 dB Lmax.

Table 5.2.3. Count of daily noise events and greater than 70 dB(A) Lmax noise events

Date	Noise Events	>70 dB(A) Lmax
4/9/98	**49**	**3**
4/10/98	**95**	**17**
4/11/98	**65**	**9**
4/12/98	**49**	**3**
4/13/98	**133**	**7**
4/22/98	**108**	**17**
4/23/98	**159**	**22**
4/24/98	**118**	**7**
4/25/98	**27**	**6**
4/26/98	**39**	**3**
4/27/98	**92**	**4**
Total	**934**	**98**

5.3. Results

Eleven days of noise data collected at Sequoia Park were evaluated, and the result indicated that the hourly average aircraft noise level (Leq) is between 0 (on aircraft overflight) to 50s.

Most of the hours with some aircraft overflight had hourly average aircraft noise levels (Leq) in the 40s. Most noise events collected are less than 70 dB(A) Lmax. Aircraft noise levels recorded for the various hours are consistent with the hours determined by tracking analysis in Section 4.

This result is consistent with the assumptions used in the Integrated Noise Model in Section 3.

Section 6. Correlated Noise and Track Analysis

Using the aircraft data collected by the FAA Automated Radar System, and the field noise survey, staff correlated noise and track. Eight days of data (4 partial days) are correlated. Results of the correlation show the typical single event aircraft noise level and the approximate altitude of the aircraft.

6.1. Methodology

Days with both noise and track data were correlated. The data pool consisted of four partial days (4/9, 4/13, 4/22, and 4/27) and four full days (4/23 through 26). Only those noise events greater than 70 dB(A) Lmax were used to correlate to aircraft tracks.

Data are loaded into the Aircraft and Noise Monitoring and Management System. The system has a feature that allows animated playback of the aircraft flying over Monterey Park at different times.

Based on the time of the noise event, aircraft tracks were played back on the video monitor. All noise events greater than 70 dB(A) Lmax were checked and those that correlated to a flight were noted and the flight information was recorded.

6.2. Analysis

Table 6.2.1 and 6.2.2 showed hourly distribution of noise events collected (total and those greater than 70 dB(A) Lmax). Table 6.2.3 showed all correlated noise events greater than 70 dB(A). Out of the 98 >70 dB(A) noise events, 31 were correlated to an aircraft overflight. The average altitude over Monterey Park was 2600 feet Mean Sea Level. More than 60% of the correlated aircraft were at or above the 2500 to 3000 feet MSL altitude range. Visual inspection of the track patterns showed that the correlated aircraft were all turning over Monterey Park for final arrival to LAX.

Table 6.2.1. Number of hourly noise event collected

Hours	4/22	4/23	4/24	4/25	4/26	4/27	Total
0		1	0	0	0	2	3
1		0	0	0	0	0	0
2		0	0	0	0	0	0
3		0	0	0	0	0	0
4		0	0	0	0	0	0
5		0	3	2	1	5	11
6		3	3	3	1	6	16
7		21	15	1	0	11	48
8		5	13	0	1	11	30
9		14	9	0	2	57	82
10		22	17	0	2		41
11		25	15	0	2		42
12	3	8	10	0	3		24
13	9	6	12	5	0		32
14	1	4	0	4	0		9
15	4	5	4	1	6		20
16	0	10	2	5	5		22
17	8	11	4	3	8		34
18	18	10	3	1	4		36
19	17	5	1	2	2		27
20	19	7	4	0	0		30
21	19	1	2	0	0		22
22	9	1	1	0	2		13
23	1	0	0	0	0		1
Total	108	159	118	27	39	92	543

Table 6.2.2. Number of hourly noise events that are greater than 70 dB(A) Lmax

Hours	4/22	4/23	4/24	4/25	4/26	4/27	Total
0		0	0	0	0	0	0
1		0	0	0	0	0	0
2		0	0	0	0	0	0
3		0	0	0	0	0	0
4		0	0	0	0	0	0
5		0	0	0	0	0	0
6		0	0	1	0	0	1
7		2	0	0	0	0	2
8		1	0	0	0	0	1
9		0	1	0	0	4	5
10		5	2	0	1		8
11		5	0	0	0		5
12	0	2	1	0	0		3
13	0	5	1	2	0		8
14	0	0	0	0	0		0
15	0	0	0	0	0		0
16	0	1	0	0	0		1
17	2	1	1	1	1		6
18	4	0	1	1	0		6
19	2	0	0	1	1		4
20	5	0	0	0	0		5
21	4	0	0	0	0		4
22	0	0	0	0	0		0
23	0	0	0	0	0		0
Total	17	22	7	6	3	4	59

Table 6.2.3. Greater than 70 dB(A) noise events that correlated to an aircraft overflight

Date	Local Time	Lmax (dBA)	Duration (sec)	AcType	Altitude
4/13	9:38	72.2	20	B73B	2400
4/13	10:09	70.1	18	B73A	2300
4/22	17:35	75.1	29	B747	2700
4/22	17:57	70	33	SF34	2900
4/22	18:29	74	29	B74A	2500
4/22	18:35	77.4	29	B74A	2500
4/22	18:57	74.3	20	B73B	2400
4/22	19:03	73.3	37	B74B	2900
4/22	19:08	72	21	B73F	2500
4/22	19:59	72.7	36	B707	3100
4/22	20:03	78	28	B74B	2500
4/22	20:06	70.3	15	B73B	2500
4/22	20:28	70.1	28	B74B	4000
4/22	21:02	74.4	24	DC10	2500
4/22	21:11	79.7	33	B74A	Unknown
4/22	21:33	70.9	25	MD80	2500
4/23	7:12	73	22	B73B	2400
4/23	7:48	70.8	24	B73B	2400
4/23	10:07	70.7	22	B73B	2400
4/23	10:11	72.1	30	A320	2600
4/23	10:16	71.9	34	B74B	2400
4/23	10:25	81.3	41	B74B	2400
4/23	10:40	70	28	MD11	2800
4/23	11:20	74.7	23	B73B	2400
4/23	11:24	72.7	24	A320	2400
4/23	11:29	76.7	34	MD11	2400
4/23	11:49	77.8	37	B74B	2400
4/23	11:58	71.4	10	LR35	Unknown
4/23	12:04	72.6	25	A320	3600
4/23	12:55	71.6	36	B74B	2600
4/23	13:04	75.4	30	MD11	2600

Table 6.2.4. Aircraft Type and Altitude Distribution

Altitude Range	A320	B707	B73A	B73B	B73F	B747	B74A	B74B	DC10	LR35	MD11	MD80	SF34	Total
<2500														**0**
2500 – 3000	**1**		**1**	**7**	**1**		**2**	**4**	**1**		**1**	**1**		**19**
>3000 – 4000	**1**	**1**				**1**		**2**			**2**		**1**	**8**
>4000	**1**							**1**						**2**
Unknown							**1**			**1**				**2**
Total	**3**	**1**	**1**	**7**	**1**	**1**	**3**	**7**	**1**	**1**	**3**	**1**	**1**	**31**

6.3. Results

Eight days of noise and flight track data were correlated and the result indicated that aircraft overflying Monterey Park were typically at an average altitude of 2600 feet Mean Sea Level and were measured to have an Lmax single event level in the 70s.

Approximately one-third of the noise events that are greater than 70 dB(A) correlated to an aircraft overflight. Most of the *high* noise events collected are from non-aircraft noise source.

This result is consistent with the assumptions used in the Integrated Noise Model in Section 3.

Section 7. Summary

The NMB implemented a noise-monitoring plan for the City of Monterey Park. The plan uses four different analysis methods, a validated Noise Model, flight track analysis, noise analysis, and correlated noise and track analysis to predict aircraft noise in the city.

Table Evaluation Methods and Noise Results

Methods	# of Daily Overflights	Daily CNEL (dB)
Validated INM*	**67 (assumption)**	**45.6 (Sequoia Park)**
Track Analysis	**35**	**Not Applicable**
Noise Analysis	**Not Applicable**	**44 to 51**
Correlated Noise and Track	**Not Applicable**	**46 to 51 (slightly higher than values determined by the Noise Analysis method due to smaller sample group).**

* According to the USGS map, Sequoia Park elevation is at 700 feet which is higher than the assumed elevation in INM (less than 600 feet), thus the INM may be under-predicting noise by a decibel or less.

The results from each method further validated that the modeling was accurate. Although no model can predict or determine the psychological or annoyance effect of aircraft noise, this report concludes that the City of Monterey Park is not impacted by aircraft noise based on current regulations.

Note that over 65 dB CNEL "significant noise impact" is based on an ANNUAL AVERAGE value that includes time periods with and without aircraft overflights. Individual aircraft events may generate a higher noise value but this describes a single event and not to describe long-term noise impact.

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Section 8. Addendum (2500 feet versus 4000 feet)

The City of Monterey Park has further requested that the noise model be used to predict noise differences between overflights at 2500 feet (current altitude) and 4000 feet. The NMB staff used the model of 67 daily overflights previously done in INM for the Monterey Park study. If the number of overflights is constant at 67, raising aircraft from 2500 feet to 4000 feet has a small effect on noise.

The magnitude varies depending on two factors: (1) the proximity of the measurement point to the flight track, and (2) the elevation of the measurement point. The effect is greatest at high-elevation locations very close to the flight track. The effect is smallest at low-elevation locations distant from the flight track.

Table 8-1. Estimated Noise Value at 2500 and 4000 feet.

	2500 ft		4000 ft		
Site	**67 AC SEL**	**Lmax**	**67 AC SEL**	**201 AC SEL**	**Lmax**
GRP	**86.1**	**64.5**	**85.4 (-0.7)**	**90.2 (+4.1)**	**63.3 (-1.2)**
MHP	**91.4**	**70.1**	**89.7 (-1.7)**	**94.4 (+3.0)**	**67.3 (-2.8)**
SHS	**87.5**	**65.1**	**86.6 (-0.9)**	**91.4 (+3.9)**	**63.6 (-1.5)**
SQP	**95.0**	**75.6**	**91.0 (-4.0)**	**95.8 (+0.8)**	**69.6 (-6.0)**

The most-effected site experienced average value (HNL/CNEL) decreases of 4 dB, and Lmax decrease of 6 dB. The least-effected site experienced average value decreases of 0.7 dB, and an Lmax decrease of 1.2 dB. As general reference, a change of 3 dB is not audible and a decrease of 10 dB are perceive as a half of the noise level.

If traffic volume increases threefold (201 daily flights over Monterey Park) and if the altitude were raised to 4000 feet, the Lmax is not affected by traffic volume and there would still be the 1.2 - 6 dB decreases in Lmax. However, on average noise levels, the extra noise associated with an increase in traffic more than offsets the decrease from the raised altitudes.

The raised altitudes will not reduce overall average noise level unless it can be done without a corresponding rise in traffic. Traffic increases may be unavoidable.