

Quarterly Noise Monitoring Report

October – December 2023

Metropolitan Oakland International Airport

HMMH Report No. 03-10930.000

March 2024

Prepared for:

Port of Oakland
Oakland, California



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Prepared for:

Port of Oakland, Oakland International Airport

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Executive Summary

The California Airport Noise Regulation (California Code of Regulations, Title 21, Section 5025, County Report) requires the quarterly report include use of a standard information format provided by the California Department of Transportation “Department” (form DOA 617, dated 10/89). The information below fulfills this requirement.

CALIFORNIA FORM DOA 617

**Summary of Statistical Information
For
California Department of Transportation
Oakland International Airport
Calendar Year 2023: Fourth Quarter**

1. Size of Noise Impact Area as defined in the Noise Standards (California Code of Regulations, Title 21, Chapter 2.5, Subchapter 6): 0 sq. miles
2. Estimated number of dwelling units included in the Noise Impact Area as defined by the Noise Standards: 0 dwelling units
3. Estimated number of people residing within the Noise Impact Area as defined by the Noise Standards: 0 people
4. Identification of aircraft type having highest takeoff noise level operating at this airport together with estimated number of operations by this aircraft type during the calendar quarter reporting period: Gulfstream 3; SEL: 104.5 dB; Estimated Operations: 4
5. Total number of aircraft operations during the calendar quarter: 38,981 aircraft operations
6. Number of Commercial operations during the calendar quarter (not mandatory): 27,718 Commercial Jet operations
7. Percentage of Air Carrier operations by aircraft certified under Federal Aviation Regulation (FAR) Part 36¹, Stage III (not mandatory): 100% of air carrier/air cargo operations Stage III or quieter
8. Estimated number of operations by General Aviation aircraft during the calendar quarter (not mandatory): 6,763 General Aviation aircraft operations estimated from FAA tower counts
9. Estimated number of operations by Military aircraft during the calendar quarter (not mandatory): 0 Military aircraft operations.

Per Title 21 requirements, the report must also include a map illustrating the location of the noise impact boundary, as validated by measurement, the location of the measurement points (Figure ES-1 satisfies this requirement) and the daily measured CNEL values at each of the noise monitoring sites (Tables ES-1 through ES-3 satisfy this requirement).

¹ This designation of the regulation (FAR Part 36) has been superseded by the current designation 14 CFR Part 36. The text of form DOA 617 is retained here.



Author: Michael J Hamilton; Path: \\files\vol1\Projects\310XXX\310630_Oakland_Noise_On-Call\GIS\310630_004_OAK_2023_Annual_Corridor.mxd



Oakland International Airport

Oakland, California

Annual 2023 Noise Contours

March 2024

Figure ES-1. Noise Impact Boundary: 12-Month CNEL Contours for January 2023 – December 2023

Source: Port of Oakland ANOMS™ January 1, 2023 through December 31, 2023

Table ES-1. Measured Aircraft CNEL values, October 2023

Source: ANOMS™ October 1, 2023, through December 31, 2023

October	NMT Location Number													
	1	2 ¹	3	4	5	6	7	8	9	10	11	12	13	14
	CNEL (dBA)													
1	60	N/A	41	53	57	59	60	50	59	49	49	44	35	24
2	62	N/A	40	71	71	67	62	53	56	48	49	46	33	41
3	63	N/A	46	56	60	61	61	53	57	48	48	45	36	41
4	62	N/A	45	70	72	64	60	55	60	52	46	52	37	39
5	62	N/A	48	70	81	74	69	65	63	55	63	51	46	50
6	63	N/A	48	70	65	62	61	60	60	50	55	49	44	44
7	60	N/A	43	76	74	72	69	61	59	49	55	51	46	43
8	60	N/A	54	71	81	66	61	65	63	54	59	49	45	56
9	61	N/A	38	67	74	69	63	52	57	47	48	52	31	34
10	64	N/A	47	54	58	60	60	54	57	47	49	44	36	43
11	63	N/A	41	54	59	60	60	48	56	47	49	43	34	39
12	63	N/A	48	56	58	60	60	48	56	48	48	53	35	45
13	63	N/A	48	55	58	60	63	50	56	46	48	43	40	43
14	60	N/A	45	53	56	58	64	45	57	46	48	40	N/A	33
15	57	N/A	44	59	62	59	59	48	59	49	53	44	28	30
16	62	N/A	43	63	66	64	61	51	56	49	49	42	35	37
17	63	N/A	40	55	59	59	60	53	60	48	49	44	37	38
18	63	N/A	41	57	59	59	63	51	61	46	44	45	38	39
19	62	N/A	42	58	61	60	59	48	66	49	48	46	41	42
20	64	N/A	46	53	58	59	61	50	63	51	47	43	39	39
21	61	N/A	44	52	56	58	59	46	67	47	46	45	28	36
22	60	N/A	37	52	57	58	58	44	57	47	49	45	31	N/A
23	62	N/A	42	56	58	58	58	50	56	47	48	53	41	36
24	63	N/A	44	53	57	60	59	49	54	43	46	40	40	41
25	64	N/A	50	55	58	59	60	54	57	51	49	44	42	38
26	63	N/A	49	54	57	59	62	51	56	47	49	47	45	44
27	63	N/A	47	57	59	60	60	51	57	51	49	46	43	43
28	60	N/A	42	55	57	58	58	44	59	49	50	40	37	47
29	58	N/A	49	51	53	55	55	42	54	44	44	44	36	31
30	60	N/A	40	64	66	63	59	53	56	52	50	49	39	31
31	62	N/A	45	54	56	58	57	53	54	48	45	46	41	39
Average	62	N/A	46	66	71	64	62	56	60	49	52	48	40	44
No. Day	31	0	31	31	31	31	31	31	31	31	31	31	30	30

Notes: ¹ NMT2 will be offline during the construction/redevelopment of the San Leandro Marina.
 Values reported are aircraft measured CNEL values at each monitor.
 N/A represents an error or incomplete data.

$$CNEL_{avg} = 10 \log \left(\frac{1}{N} \sum 10^{CNEL_i/10} \right)$$

Table ES-2. Measured Aircraft CNEL values, November 2023

Source: ANOMS™ October 1, 2023, through December 31, 2023

November	NMT Location Number													
	1	2 ¹	3	4	5	6	7	8	9	10	11	12	13	14
	CNEL (dBA)													
1	62	N/A	45	54	57	60	59	55	55	49	48	45	39	42
2	62	N/A	46	57	58	59	59	50	56	57	47	46	43	40
3	63	N/A	41	52	57	57	58	49	60	52	55	43	37	43
4	61	N/A	40	52	56	58	58	44	52	42	45	38	28	31
5	60	N/A	43	52	57	59	59	50	56	50	49	39	28	28
6	62	N/A	40	56	58	58	60	53	55	47	48	45	45	33
7	63	N/A	46	59	59	60	59	54	58	50	50	47	45	44
8	63	N/A	48	57	58	59	59	50	53	49	47	43	40	44
9	62	N/A	43	56	58	60	59	52	55	50	47	47	41	48
10	62	N/A	47	57	59	59	59	52	55	46	48	43	38	40
11	58	N/A	45	51	55	57	57	46	56	46	48	43	36	34
12	60	N/A	42	52	56	58	59	47	59	50	51	42	44	31
13	61	N/A	40	60	63	61	60	54	54	48	46	48	47	45
14	61	N/A	43	55	59	58	58	53	52	46	44	49	41	41
15	61	N/A	33	56	60	60	60	48	50	53	39	56	38	36
16	63	N/A	44	55	62	61	60	51	50	46	41	46	41	41
17	59	N/A	44	55	59	59	58	52	52	49	39	51	35	39
18	60	N/A	34	56	59	58	56	50	55	50	48	51	44	28
19	61	N/A	42	54	58	59	58	51	57	49	50	41	36	32
20	60	N/A	45	56	58	57	56	52	54	46	49	51	35	40
21	63	N/A	46	54	58	59	59	48	58	54	50	49	38	40
22	63	N/A	40	54	58	59	59	49	53	46	47	46	36	42
23	57	N/A	35	50	53	55	55	45	50	42	43	36	39	N/A
24	61	N/A	40	55	56	58	57	45	51	50	42	40	30	43
25	60	N/A	45	55	56	57	57	50	55	46	47	46	25	29
26	60	N/A	46	53	56	57	57	48	56	50	48	40	34	24
27	61	N/A	43	63	65	62	60	51	53	48	45	46	46	37
28	63	N/A	45	55	58	62	59	53	54	47	45	55	34	41
29	63	N/A	43	56	60	61	61	52	55	50	47	47	35	40
30	64	N/A	44	58	61	61	61	53	58	51	50	50	38	50
Average	62	N/A	44	56	59	59	59	51	55	50	48	48	41	42
No. Day	30	0	30	30	30	30	30	30	30	30	30	30	30	29

Notes: ¹ NMT2 will be offline during the construction/redevelopment of the San Leandro Marina.

Values reported are aircraft measured CNEL values at each monitor.

N/A represents an error or incomplete data.

$$CNEL_{avg} = 10 \log \left(\frac{1}{N} \sum 10^{CNEL_i/10} \right)$$

Table ES-3. Measured Aircraft CNEL values, December 2023

Source: ANOMS October 1, 2023, through December 31, 2023

December	NMT Location Number													
	1	2 ¹	3	4	5	6	7	8	9	10	11	12	13	14
	CNEL (dBA)													
1	64	N/A	49	58	63	60	60	52	57	53	50	46	41	44
2	61	N/A	43	54	58	59	59	48	56	47	49	39	28	N/A
3	60	N/A	43	53	57	58	57	47	56	51	48	39	37	23
4	61	N/A	40	66	69	66	63	53	58	46	49	45	36	31
5	64	N/A	42	55	59	60	59	50	55	45	45	46	36	39
6	64	N/A	37	55	59	60	60	50	55	47	49	45	39	40
7	64	N/A	40	54	59	60	60	52	58	53	50	47	45	43
8	63	N/A	49	55	58	59	59	52	58	52	50	45	43	46
9	59	N/A	45	56	58	58	57	49	55	50	47	44	28	39
10	59	N/A	43	55	57	58	58	47	57	49	50	36	30	31
11	61	N/A	38	56	59	58	57	57	55	49	48	45	38	38
12	63	N/A	46	53	58	58	58	54	55	44	48	53	39	41
13	63	N/A	38	54	57	58	61	48	56	57	48	46	42	42
14	63	N/A	50	57	58	59	60	54	56	50	49	51	38	44
15	63	N/A	52	56	58	59	60	53	56	62	47	45	45	42
16	60	N/A	45	53	58	57	57	46	55	48	47	42	52	30
17	57	N/A	39	57	59	58	57	50	55	48	45	42	35	N/A
18	56	N/A	38	56	60	56	54	55	56	54	50	52	45	48
19	60	N/A	44	57	60	57	56	52	57	52	49	54	48	28
20	61	N/A	44	56	62	59	56	56	55	53	47	55	56	40
21	64	N/A	54	56	61	60	60	54	57	53	50	48	42	45
22	64	N/A	49	57	60	60	60	50	57	48	52	45	44	40
23	61	N/A	45	55	58	58	59	49	55	48	49	42	38	34
24	59	N/A	47	57	57	59	59	47	54	53	43	41	38	38
25	60	N/A	41	49	57	56	57	44	54	45	46	40	34	23
26	61	N/A	42	55	61	60	59	45	57	47	49	52	40	30
27	62	N/A	37	58	64	59	55	52	56	53	51	52	47	38
28	63	N/A	48	57	61	61	61	51	53	52	47	46	35	41
29	63	N/A	41	55	63	59	59	53	54	52	49	49	45	33
30	62	N/A	38	55	59	60	62	48	53	44	46	45	N/A	35
31	60	N/A	36	53	57	58	58	47	53	47	45	42	33	26
Average	62	N/A	46	57	61	59	59	52	56	52	48	48	45	41
No. Day	31	0	31	31	31	31	31	31	31	31	31	31	30	29

Notes: ¹ NMT2 will be offline during the construction/redevelopment of the San Leandro Marina.
Values reported are aircraft measured CNEL values at each monitor.
N/A represents an error or incomplete data.

$$CNEL_{avg} = 10 \log \left(\frac{1}{N} \sum 10^{CNEL_i/10} \right)$$

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1 Introduction

This Quarterly Noise Monitoring report for the Fourth Quarter of 2023 (4Q2023) was prepared for the Port of Oakland by HMMH. This report provides the aircraft noise levels and airport operations at Metropolitan Oakland International Airport (OAK) for the three-month period from October 1, 2023, to December 31, 2023, and satisfies the California Division of Aeronautics Noise Standards², Section 5025 requirements.

According to the California Noise Standards, hereinafter referred to as “Title 21”, a county may declare an airport within its boundaries to have a noise problem and shall enforce Title 21 requirements. Alameda County has declared OAK a “noise problem” airport. As such, the County must provide quarterly reports to the California Department of Transportation containing at least the following information:

- A map illustrating the noise impact boundary; Title 21, Section 5012, Airport Noise Standard, indicates that the “noise impact area” is based on the standard of 65 dB Community Noise Equivalent Level (CNEL); see Figure ES-1 in the Executive Summary
- The annual noise impact area and the estimated number of dwelling units and people residing with the noise impact area; see Form DOA 617 in the Executive Summary
- Daily CNEL measurements, number of aircraft operations, and estimated number of operations of the highest noise level aircraft type during the calendar quarter; see Tables ES-1 through ES-3 and Form DOA 617 in the Executive Summary
- Form DOA 617; see the Executive Summary

This report meets and exceeds Title 21’s reporting requirements for 4Q2023. The following sections provide the methodology used to obtain the information reported and further details about the aircraft operations and noise exposure from those operations in the OAK environs. This report is organized as follows:

- Section 2: Aircraft Noise and Operations Measurements
- Section 3: Airport Operations
- Section 4: Preparation of Annual CNEL Contours
- Section 5: Validation of Noise Impact Area Map

² State of California Department of Transportation Division of Aeronautics, Title 21, Subchapter 6, Noise Standards, Register 90, No. 10—3-10-90.

2 Aircraft Noise and Operations Measurements

On September 14, 1990, the Port of Oakland (Port), as the airport proprietor, installed a state-of-the-art noise and operations monitoring system (NOMS)³, which automatically collects flight track and aircraft identification data for a majority of all operations at the airport and measures and reports noise levels at specific locations. In 2006 and 2011, the Port upgraded their NOMS with ANOMS8 software and Envirosuite, formerly EMS Brüel & Kjaer (B&K) 3639-E noise monitors, respectively. To maintain the most up-to-date technology, the Port upgraded to ANOMS9 software in 2016. In December 2021, the Port upgraded the EMS Brüel & Kjaer (B&K) 3639-E noise monitors to Envirosuite 3680 Environmental Monitoring Units (EMUs).

As shown in Figure ES-1, OAK's NOMS is currently configured with fourteen (14) Noise Monitoring Terminals (NMTs) dispersed in the communities surrounding OAK to assist in evaluating compliance with OAK's established flight pattern and aircraft noise abatement procedures, and to assess the noise impact in residential areas from OAK aircraft operations. ANOMS™ correlates recorded noise events at each NMT with aircraft flight track records obtained from the Federal Aviation Administration's (FAA) System Wide Information Management (SWIM) advanced technology program.

The SWIM data is used to separate aircraft and non-aircraft noise events recorded at the NMTs. ANOMS™ also excludes noise events due to aircraft overflights from other airports (such as San Francisco International) using the aircraft identification information included in the data.

The 14 NMTs located in the community are Envirosuite 3680 Environmental Monitoring Units (EMUs) fitted HBK Type 4952 outdoor microphone assemblies. The NMTs are housed in weatherproof cabinets, and the microphones are placed on booms at least 20 feet above the ground surface or at least 10 feet above neighboring rooftops, whichever is higher, and has a clear line of sight to the path of aircraft in flight. The NMTs report the maximum A-weighted sound level (L_{max}), the duration of a noise event at a pre-programmed threshold sound level, and the (A-weighted) Single Event Noise Exposure Level (SENEL) for single noise events. The NMT's pre-programmed parameters were determined from previous field observations of aircraft and background noise levels at each measurement site. ANOMS™ also reports the Hourly Noise Level (HNL) and CNEL based on both overall noise levels and individual noise events exceeding the selected measurement threshold levels.

The NMT's internal calibration system performs daily checks using an acoustic actuator. The NMTs are externally calibrated periodically, per manufacturer's recommendations, using an acoustical calibrator certified to be consistent with National Institute of Standards and Technology (NIST) reference levels. The measurement systems meet all pertinent specifications of the American National Standards Institute (ANSI) and the International Electrotechnical Commission (IEC) for Type 1 Precision sound level meters and microphones and comply with all applicable requirements of Title 21.

³ The OAK system utilizes ANOMS™, which is a product of Envirosuite.

3 Airport Operations

Title 21 requires the reporting of the total number of airport operations during the calendar quarter. Table 1 provides a summary of the monthly activity for October 1, 2023, through December 31, 2023, as captured in ANOMS™, along with the previous quarter totals. The table presents aircraft operations at OAK in the following eight categories: commercial jets, regional jets, corporate jets, turbo-propeller (turboprops), propeller, helicopters, military, and unknown. Commercial jets are primarily large jets consisting of both passenger carriers and freight operators as defined in FAA Order 7210.3. Regional jets are primarily small commercial jets while corporate jets have fewer seats and are typically flown as charter operations. The military category contains propeller, rotorcraft, and jet aircraft.

Table 1 indicates an increase in commercial and corporate jet operations of 0.6% and 5.7% respectively in the fourth quarter of 2023. Regional jet, turboprop, and propeller activity decreased by 9.3%, 0.2%, and 13.3% respectively in the fourth quarter of 2023. Helicopter operations increased by 23.7%. Military aircraft captured by ANOMS™ remained the same at zero operations in the fourth quarter 2023⁴ compared to the third quarter 2023. Unknown aircraft activity remained the same at zero operations in the fourth quarter 2023 compared to the third quarter 2023. Overall, OAK total aircraft operations, as captured in ANOMS™, decreased by 0.4% during the fourth quarter of 2023 compared to the third quarter of 2023.

Table 1. Monthly Aircraft Operational Activity – Fourth Quarter 2023

Aircraft Category	Monthly Arrivals and Departures					Percent Change
	Oct	Nov	Dec	Total	3Q2023	
Commercial Jets	9,028	9,030	9,660	27,718	27,551	0.6%
Regional Jets	818	783	885	2,486	2,740	-9.3%
Corporate Jets	1,469	1,445	1,572	4,486	4,246	5.7%
Turboprops	607	480	545	1,632	1,636	-0.2%
Propeller	1,035	731	627	2,393	2,760	-13.3%
Helicopters	71	99	96	266	215	23.7%
Military	0	0	0	0	0	0.0%
Unknown	0	0	0	0	0	0.0%
Total	13,028	12,568	13,385	38,981	39,148	-0.4%

Aircraft operations from OAK determine CNEL in the OAK environs, which by definition is a daily noise exposure. To determine the average daily noise exposure from OAK operations, additional information is required for determining aircraft fleet mix, runway use, and time of day of the operations, since CNEL weights evening (7pm to 10pm) and night (10pm to 7am) noise levels by adding approximately 5 dB and 10 dB respectively to noise levels during evening and night periods.

⁴ Majority of ANOMS military operations unavailable due to security reasons. FAA Air Traffic Activity System (ATADS) reported 176 itinerant and 25 local military operations during 4Q2023.

4 Preparation of Annual CNEL Contours

CNEL can be calculated or estimated through modeling. OAK measures CNEL at each of the aforementioned NMTs, but determination of CNEL contours requires the use of a noise model such as the FAA Aviation Environmental Design Tool (AEDT). Title 21, Section 5012, Airport Noise Standard, indicates that the “noise impact area” is based on the standard of 65 dB CNEL. AEDT incorporates a comprehensive set of computer routines for calculating airport noise exposure contours. HMMH used the most current release of AEDT, namely Version 3f, to prepare the annual contours for the 12 months ending with the fourth quarter 2023.

HMMH used the Port of Oakland’s flight track files and noise level measurement data collected by ANOMS™ as the basis for predicting and validating aircraft noise at OAK using AEDT. Data for aircraft activity, aircraft fleet mix including helicopters, and airport configuration used in the noise modeling process were obtained from ANOMS™ for the time period of January 1, 2023 through December 31, 2023. The following sections provide a summary of the data, methods and assumptions used to prepare the Annual CNEL contours.

4.1 AEDT Required Data

AEDT requires data in three principal categories: (1) aircraft noise and performance data, (2) airport layout, and (3) aircraft operational data.

4.1.1 Aircraft noise and performance data

AEDT includes a database of noise and performance data for a broad range of representative aircraft types. Noise data cover a range of distances (from 200 feet to 25,000 feet) for specific thrust levels. Performance data include thrust, speed, and altitude profiles for takeoff and landing operations. The AEDT database contains standard noise and performance data for more than 250 different aircraft types. The program automatically accesses the applicable noise and performance data for departure and approach operations by those aircraft. For aircraft not included in the database, the FAA maintains a list of acceptable “substitutes”.

Airfield elevation and average temperature have an effect on aircraft performance; these are accounted for in AEDT. For example, aircraft departing from a high-altitude airport and/or at high temperatures must use more thrust than at lower elevations and temperatures. The performance data used by AEDT define the length of the takeoff roll (based on aircraft takeoff weight), the climb rate, and speeds for each flight segment.

4.1.2 Airport layout

AEDT requires the following airfield layout related inputs:

- Runway orientations
- Runway lengths
- Runway end elevations
- Start-of-takeoff-roll points on each runway
- Landing touchdown points on each runway
- Runway threshold crossing heights
- Runway approach slopes
- Annual average temperature, pressure, relative humidity, and runway-specific headwinds

4.1.3 Aircraft operational data

AEDT requires the following aircraft operational inputs:

- Number of aircraft operations
- Aircraft fleet mix
- Day-evening-night split of operations
- Runway utilization
- Flight track geometry and utilization

For accurate determination of daily noise exposure using actual aircraft operations for modeling purposes, the ANOMS™ database provided complete and accurate information for approximately 160,692 operations on 365 days⁵.

4.2 Preparation of AEDT-input Files

As directed by the Port, HMMH prepared the AEDT input files through the use of our proprietary preprocessor which takes maximum advantage of both AEDT’s capabilities and the investment that the Port has made in operations monitoring with ANOMS™. Our preprocessor automates the process of preparing the AEDT inputs directly from the flight operations monitoring results, to permit airports to model the full diversity of activity as precisely as possible. Rather than modeling a single annual-average day, this allows the determination of noise exposure from actual OAK flight operations for a total of 365 days. It should be noted that AEDT is used for all noise calculations. The preprocessor provides an organizational structure to model individual flight tracks in AEDT. It does not modify AEDT standard noise, performance, or aircraft substitution data, but rather selects the best standard data or FAA approved non-standard data available to AEDT for each individual flight track. The following subsections summarize the noise modeling inputs for January 1, 2023 through December 31, 2023 operations at OAK.

⁵ The AEDT preprocessor, successfully processed 365 days of complete and accurate flight track data to determine the average daily noise exposure. Traditional modeling techniques determine daily noise exposure from a single day of “annual-average” activity.

4.2.1 Annual-average airport operations, aircraft fleet mix and period of day

AEDT aircraft types were assigned based on the FAA aircraft code associated with each flight, supplemented by FAA registration data. For commercial operations, selection of the specific AEDT aircraft type was accomplished by using the fleet mix of each airline. This information permits a rational and representative selection of AEDT aircraft types. In cases where multiple AEDT types are available for a single FAA code, the preprocessor chooses the AEDT type using a random process, with weightings corresponding to the number of each aircraft type operated by that particular airline.

To account for the noise level adjustments applied to evening and nighttime operations, all AEDT input must be coded as to whether it occurs in the day, evening or at night. Our preprocessor uses the time recorded in the operations data to assign each operation to the appropriate time of day based on the actual arrival or departure time at OAK. Operations between 7 a.m. and 7 p.m. are unweighted. When the time of the operation is between 7 p.m. and 10 p.m., the operation is considered to occur during the evening, and a weighting factor of 3 times the noise energy (approximately 4.7 dB) is added in the computation of CNEL by AEDT. When the time of the operation is between 10 p.m. and 7 a.m., the operation is considered to occur during the night and a weighting factor of 10 times (10 dB) is added in the computation of CNEL by AEDT.

4.2.2 Annual runway utilization

Runway use was determined from the actual flight track data acquired in ANOMS™. Table 2 summarizes the observed runway utilization rates during January 1, 2023, through December 31, 2023, collapsed into the following major aircraft type categories: (1) commercial jet, (2) regional jet, (3) corporate jet, (4) turbo-propeller (turboprops), (5) piston propeller aircraft (propeller), (6) military (7) helicopters and (8) other. AEDT modeled each aircraft operation on the individual runway and flight track found in the ANOMS™ sample, thus each aircraft type has unique runway utilization.

Table 2 summarizes the annual arrival and departure activity.

Table 2. Annual Aircraft Operational Activity – January 1, 2023 through December 31, 2023

Source: Port of Oakland ANOMS™ January 1, 2023, through December 31, 2023

Aircraft Category	South Field			North Field					Grand Total	
	RWY 30	RWY 12	South Field Total	RWY 28R/L	RWY 33	RWY 10R/L	RWY 15	PAD 1		North Field Total
Aircraft Landings										
Commercial Jets	49,708	4,319	54,027	322	0	3	0	0	325	54,352
Regional Jets	2,883	449	3,332	2,105	0	8	0	0	2,113	5,445
Corporate Jets	371	637	1,008	7,888	1	307	1	0	8,197	9,205
Turboprops	154	6	160	3,384	4	276	8	0	3,672	3,832
Propeller	1	0	1	4,883	133	79	106	0	5,201	5,202
Military	0	0	0	0	0	0	0	0	0	0
Helicopters	0	0	0	5	0	0	0	493	498	498
Other	(82)	1	(81)	(313)	(11)	(3)	(2)	(27)	(356)	(437)
Total	53,035	5,412	58,447	18,274	127	670	113	466	19,650	78,097
Aircraft Departures										
Commercial Jets	49,191	4,505	53,696	489	0	8	0	0	497	54,193
Regional Jets	4,907	434	5,341	78	0	24	0	0	102	5,443
Corporate Jets	7,098	123	7,221	986	17	826	0	0	1,829	9,050
Turboprops	26	5	31	2,363	109	309	11	0	2,792	2,823
Propeller	5	4	9	2,146	2,277	81	146	0	4,650	4,659
Military	0	0	0	0	0	0	0	0	0	0
Helicopters	3	0	3	2	0	0	0	450	452	455
Other	(16)	(4)	(20)	10	(124)	(1)	(2)	(5)	(122)	(142)
Total	61,214	5,067	66,281	6,074	2,279	1,247	155	445	10,200	76,481
Touch & Go / Circuit Operations										
Total	66	4	70	3,996	1,826	166	56	0	6,044	6,114
Total Operations	114,315	10,483	124,798	28,344	4,232	2,083	324	911	35,894	160,692
Note: "Other" aircraft category implies operations with known aircraft types, but no category associations. "(#)" denotes runways with operations that were incorrectly assigned and adjusted prior to modeling.										

4.2.3 Flight track geometry and utilization

The preprocessor uses every available flight track in the radar sample as an input to the Aviation Environmental Design Tool (AEDT). As discussed in Section 4.1.3, the OAK ANOMS database includes flight tracks with associated flight identification data for 160,692⁶ operations from a total of 365 days modeled. The preprocessor converts each available flight track into AEDT noise model inputs. AEDT is then invoked to model these operations and generate an annual CNEL contour.

4.2.4 Annual-average weather conditions

AEDT has several settings that affect aircraft performance profiles and sound propagation based on meteorological data at the airport. Meteorological settings include average temperature, sea level pressure, standard pressure, relative humidity, dew point, and headwind speed. Weather data were obtained from the National Oceanic and Atmospheric Administration’s National Climatic Data Center averaged over a 1-year period for OAK, and these values were used in AEDT for computing the annual noise exposure map.

- Temperature: 57.2 °F
- Sea Level Pressure: 1014.3 millibars
- Standard Pressure: 1017.5 millibars
- Relative humidity: 72.4%
- Dew Point: 48.3°F
- Headwind speed: 7.1 knots

4.3 Annual Noise Impact Area Map

AEDT was used to prepare the OAK 12-month CNEL noise impact area map shown in Figure ES-1 based on the aircraft noise levels and airport operational factors described in the previous sections. Our preprocessor developed AEDT inputs for each available flight track in the radar data spanning 365 total days. These inputs were imported into and run through AEDT to produce the CNEL contour results.

The contour map was used to determine the number of dwelling units included within the Noise Impact Boundary defined by the California Airport Noise Regulations. For this analysis, it was assumed that a parcel was affected if it included an incompatible land use, and if any portion of the parcel was included in the 65 dB CNEL contour. Land use was determined from the AutoCAD parcel map prepared by the Port of Oakland, which was imported into ArcView. Based upon these data and in congruence with the previous reports, no incompatible residences exist within the current Noise Impact Boundary.

⁶ There are 588 operations from ANOMS that could not be modeled due to irregular track geometry.



5 Validation of Noise Impact Area Map

AEDT modeled the 2023 CNEL values at each of the current noise monitoring sites as described in the section above. Table 3 compares the measured CNEL values for the 12 months ending December 31, 2023, to the modeled CNEL values at each NMT location for calendar year 2023.

NMT 1 is the monitoring terminal nearest to the 65 CNEL contour. The fourth quarter 2023, 12 month rolling-average CNEL at NMT 1 was 0.3 dB below the modeled CNEL. The results at NMT 4, 5, 6, 7, and 9 were reviewed to assist with the 60 CNEL contour assessment of the noise impact boundary as modeled using AEDT.

Table 3. Measured and Predicted Aircraft Annual CNEL Values

Source: Port of Oakland ANOMS™ January 1, 2023 through December 31, 2023

NMT No.	NMT Name	Measured ¹ CNEL (column A)	Modeled ² CNEL (column B)	Difference (dB) (column B minus column A)
1	Oro Loma San. Dist.	63	63	0.3
2	San Leandro Marina	53	55	2.5
3	Fernside	46	48	1.4
4	Godfrey Park	59	59	0.1
5	Garden Isle	63	61	-2.3
6	Wake Lane	60	60	0.4
7	Fire Station	60	61	1.0
8	Earhart School	53	53	0.0
9	Doolittle Drive	57	59	1.9
10	Tudor Court	50	50	0.7
11	John Muir School	50	52	2.1
12	Garfield School	50	50	-0.1
13	SLUSD Admin Office	42	45	3.2
14	Washington School	41	40	-1.1
Notes: ¹ Average, January 2023 – December 2023 ² Modeled using AEDT 3f for 4Q2023 Model.				

5.1 South Field Contour Validation

NMT 1 measured an annual CNEL 0.3 dB below the modeled CNEL at that location. Therefore, the lobe extending to the east southeast (predominant south runway arrival lobe) is accurate compared to the measured value.

Since no NMTs exist within the 65 dB CNEL contour on the opposite side of the airport (the predominant departure end of the south runway), the 60 dB contour was used to compare to measured levels at NMT 5, 6 and 7 to validate the shape and size of the predominant departure lobe. As shown in Table 3, the measured noise levels were all within 2 dB of the modeled values. Therefore, the size and shape of the 65 dB CNEL is validated for South Field.

5.2 North Field Contour Validation

Due to the relatively small noise impact boundary associated with North Field operations, NMT locations 4 and 9 were used to validate the 65 dB contour for North Field. NMT 4 is to the west of North Field and had a measured annual noise level of 59 dB, 0.1 dB less than modeled. NMT 9 is to the east of North Field and had a measured annual noise level of 57 dB, 1.9 dB less than the modeled levels. Therefore, the size and shape of the 65 dB CNEL is acceptable to report for North Field.

5.3 Single-Event Aircraft Noise Levels

ANOMS™ enables the airport to monitor the highest measured single-event noise levels for aircraft operations at all permanent noise monitors. As shown in Table 4, the highest measured A-weighted single-event aircraft noise level, i.e., SEL, during the calendar quarter from October 1, 2023 through December 31, 2023 from OAK was 104.5 dB SEL produced by a Gulfstream 3 at NMT number 5.

Table 4. Highest Takeoff Noise Levels by Aircraft Type

Source: Port of Oakland ANOMS™ October 1, 2023 through December 31, 2023

Aircraft Type	Total Operations ¹	Highest Measured SEL (dB)	Correlated NMT No.
GLF3	4	104.5	5
ASTR	2	99.6	4
LJ35	73	99.4	5

Note: ¹Information is based on Fourth Quarter 2023 ANOMS data.