Calendar Year 2005 CNEL Contours
Santa Monica Municipal Airport

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Prepared for:

The City of Santa Monica

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1.0 OUTLINE OF NOISE ANALYSIS

Year 2005 CNEL contours were developed using the calendar year 2005 operations and noise measurement data for the airport. The methodology used here is identical to that described in "Calendar Year 1999 CNEL Contours for Santa Monica Municipal Airport," April 10, 2000 by Mestre Greve Associates. The report presented here is identical to that report except that the data have been updated and the contours presented are for the year 2005.

This report contains 3 major sections including this introduction. Section 2 describes the methodology used for this study. Section 3 describes the existing noise in the environs of Santa Monica Municipal Airport including the 2005 CNEL contours. Section 4 presents historical CNEL measurement data for the airport.

2.0 METHODOLOGY

2.1 BACKGROUND

The methods used here for describing the existing noise environment in terms of CNEL rely heavily on noise measurements made by the airport's permanent noise monitoring system and computer noise modeling. The noise environment is commonly depicted in terms of lines of equal noise levels, or noise contours. These noise contours are supplemented here with specific noise data for selected points on the ground. The computer noise model used here is described in the following below.

2.2 COMPUTER MODELING

Noise contour modeling is a very key element of creating noise contours. Generating accurate noise contours is largely dependent on the use of a reliable, validated, and updated noise model. It is imperative that these contours be accurate for the meaningful analysis of airport noise.

Airport noise contours were generated using the INM Version 6.1. [1] The original INM was released in 1977. The latest version, INM Version 6.1, was released for use on March 4, 2004 and is the state-of-the-art in airport noise modeling. The INM is a large computer program developed to plot noise contours for airports. The program is provided with standard aircraft noise and performance data for over 100 civilian aircraft types that can be tailored to the characteristics of the airport in question, as well as a database of military aircraft types. Version 6.1 includes an updated data base that includes some newer aircraft, the ability to include runups in the computations, the ability to include topography in the computations, and improved computational methodologies.

One of the most important factors in generating accurate noise contours is the collection of accurate operational data. The INM program requires the input of the physical and operational

characteristics of the airport. Physical characteristics include runway coordinates, airport altitude, and temperature and optional topographical data. Operational characteristics include various types of aircraft data. This includes not only the aircraft types and flight tracks, but also departure and arrival procedures that are specific to the operations at the airport. Aircraft data needed to generate noise contours include:

- Number of aircraft operations by type
- Types of aircraft
- Day/Evening/Night time distribution by type
- Flight tracks
- Flight track utilization by type
- Flight profiles
- Typical operational procedures
- Average Meteorological Conditions

3.0 EXISTING NOISE ENVIRONMENT

3.1 EXISTING SANTA MONICA MUNICIPAL AIRPORT NOISE

3.1.1 SANTA MONCIA BACKGROUND

Santa Monica Municipal Airport serves as a general aviation airport. The use of Santa Monica Municipal Airport is heavily regulated as a result of its limited area and facilities, environmental sensitivity of the local area, and because of a long history of airport related litigation extending back at least to the 1960's. The operation of Santa Monica Municipal Airport is limited by the 1984 Settlement Agreement.

Santa Monica Municipal Airport has a long history of noise analyses and was one of the very early airports to install a permanent noise monitoring system. Extensive data from its noise monitoring system enables accurate modeling and prediction of noise levels. Both CNEL and SENEL are monitored and calculated for each day and each aircraft operated at the airport. CNEL data are collected at each of the 5 permanent noise monitoring sites. These sites are shown in Exhibit 3-1. Note that the fifth site is new and was operating for a little more than half of the year 2005.

The emphasis of the Santa Monica Municipal Airport noise control program, as agreed to in the 1984 Settlement Agreement, is on regulating and limiting single event noise. This is in response to residents concerns about high noise levels associated with some aircraft operations at the airport. Santa Monica is one of the very few airports that limit aircraft single event noise. Other airports that limit single event noise include John Wayne Airport, Long Beach Municipal Airport, Torrance Municipal Airport, and Hayward Air Terminal. Of these airports the noise limits vary and are difficult to compare because the location of the enforcement microphones at the various airports are not located in similar positions to the microphones at Santa Monica. Estimating the noise limits at all these airports using a common microphone location indicates

Exhibit 3-1
Noise Monitoring Sites
Santa Monica Municipal Airport CNEL Contour Study

that the John Wayne Airport and Long Beach Municipal Airport are much less stringent than Santa Monica (both include jet air carrier operations), Hayward Air Terminal is about 3 dB less stringent than Santa Monica and Torrance Municipal Airport noise limits are about the same as Santa Monica. No airport has limits more stringent than Santa Monica Municipal Airport.

CNEL tends to be more influenced by the noise levels associated with the most frequently flown aircraft as opposed to the noise associated with a few very loud aircraft. Historically, jet aircraft tend to produce the highest single event noise but the CNEL is dominated by the more frequently flown high performance single engine propeller aircraft as well as the jet aircraft.

3.1.2 Existing Santa Monica Municipal Airport Operations Data

Existing year 2005 aircraft operations at Santa Monica Municipal Airport totaled 133,904 of which some 17,736 are jet aircraft operations and 3,746 helicopter operations. These data were obtained from traffic counts kept the FAA Air Traffic Control Tower. Note that an operation is defined as a takeoff or a landing. Therefore, 133,904 operations translate into 66,952 takeoffs and 66,952 landings during the year. The total operations represents a decrease in operations from the year 2004 of approximately 1%. The jet operations represent an decrease of approximately 2% relative to the year 2004.

3.1.3 Existing Santa Monica Municipal Airport Fleet Mix Data

The type of aircraft using Santa Monica Municipal Airport during the year 2005 are shown in Table 1. The percentages of jet, twin piston propeller, high performance single engine, and turboprop aircraft were based on actual year 2005 counts obtained from the updated noise monitoring system known as eTamis.

Table 3-1
Santa Monica Municipal Airport Fleet Mix By Aircraft Category

Aircraft Category	Percent of Fleet
Jets	13.2*
Twin prop	4.8*
High performance single	7*
Turboprop	3 *
Light fixed prop	72**

* Based on actual Year 2004 Counts
** Equals the number of this type of aircraft stored in eTamis plus the difference between the number of aircraft stored in eTamis and tower reported number of operations for year 2004.

Table 3-2
Year 2005 Jet Operations and Percentage of the Fleet

Month	Jet Operations	Percentage Jets
January	1,303	14.1
February	1,403	14.2
March	1,444	13.4
April	1,540	12.8
May	1,703	14.4
June	1,435	11.6
July	1,475	12.9
August	1,581	12.9
September	1,432	12.2
October	1,612	15.5
November	1,485	12.9
December	1,323	12.8

3.1.4 Santa Monica Municipal Airport Runway and Flight Track Utilization

The flight tracks at Santa Monica Municipal Airport are well established to take advantage of the runway configuration and prevailing wind conditions. Runway 3/21 is approximately 5,000 feet long and is the only runway at the airport. With winds predominantly coming from the ocean, aircraft typically depart to the west and arrive from the east on Runway 21. Only during Santa Ana wind conditions or other winds that move toward the ocean does the flow reverse with departures to the east and arrivals from the west. East flow occurs approximately 5 percent of the time.

Departures to the west are grouped into 2 major tracks. Small aircraft doing visual departures follow a track that proceeds over the golf course and pilots are instructed to not turn prior to Lincoln Boulevard. Larger aircraft doing instrument departures proceed straight along the extended runway centerline. All twins, turboprops, and business jets were modeled on the straight out departure. These aircraft are generally doing an Instrument Flight Rules (IFR) departure and are instructed to fly straight out to the shoreline. Arrivals are from the east and are on a straight in track by the time they get within the airport environs. The local pattern is a left hand pattern. Flight tracks are shown on Exhibit 3-2. The tracks were refined using radar data collected from the airport's eTamis system. Sample radar tracks are attached to this report. When winds dictate flow to the east, the aircraft are assumed to operate on straight in and straight out flight tracks.

In the year 2005 the airport operated with approximately 68 percent of the operations as itinerant operations and 32 percent local operations. Local operations utilize the local traffic pattern, while

itinerant operations arrive from or depart to another airport or other location and may or may not return to Santa Monica.

The day/evening/night distribution of operations was derived from noise monitoring system data for the year 2004. The data logs show 88.5 percent of the operations during daytime hours (7 am to 7 pm), 8.7 percent during the evening hours (7 pm to 10 pm), and 2.5 percent of the operations during the night hours (10 pm to 7 am). The night operations are primarily arrivals from the east.

3.1.5 Santa Monica Municipal Airport Noise Monitoring Data

The noise monitoring locations were shown in Exhibit 3-1. The CNEL measured at each of these sites during calendar year 2004 are shown in Table 3-3.

Table 3-3
CNEL Measured During Calendar Year 2005

Site	2005 CNEL, dB
1	58.3
2	54.7
3	56.4
4	52.5
5	62.1

The daily CNEL for Site 1 is plotted in Exhibit 3-3. This exhibit is shown to provide an indication of the daily change in CNEL that occurs as a result of wind, aircraft activity, and fleet mix for a given day. The loudest day was near 76.8 dB CNEL while the quietest day was near 43.0 dB CNEL (aircraft only). From Table 3-3 it is seen that the energy average for 2005 at this site was 58.3 dB CNEL.

Exhibit 3-2
Flight Tracks Used To Generate Noise Contours
Santa Monica Municipal Airport CNEL Contour Study

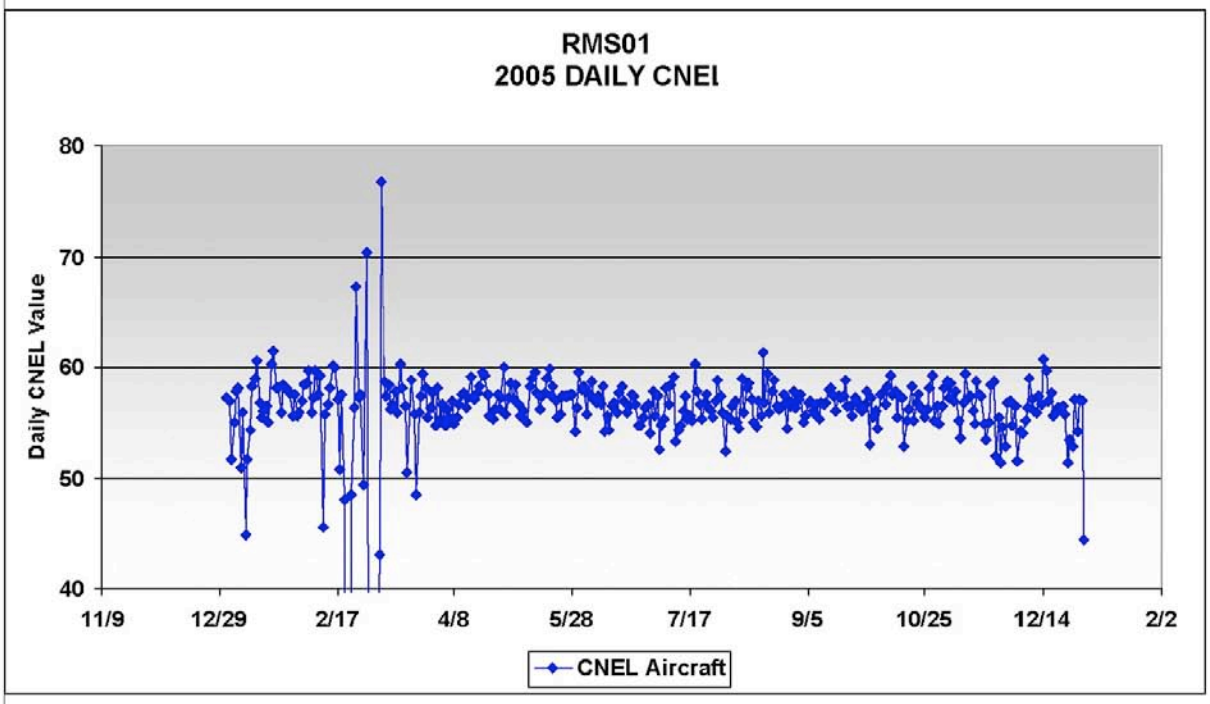


Exhibit 3-3
Year 2005 Daily CNEL Measured At Site 1

Santa Monica Municipal Airport CNEL Contour Study

3.1.6 SANTA MONICA MUNICIPAL AIRPORT YEAR 2005 CNEL CONTOURS

The CNEL contours used to depict existing noise exposure at Santa Monica Municipal Airport were developed using the INM Version 6.1. The 60 and 65 dB CNEL contours are depicted on Exhibit 3-4. Table 3-4 compares the measured CNEL with the CNEL predicted by the INM model at the 5 measurement sites.

Table 3-5
Comparison of Measured CNEL with Modeled CNEL

Site	Measured CNEL	Modeled CNEL
1	58.3	59.1
2	54.7	55.6
3	56.4	55.6
4	52.5	55.7
5	62.1	62.3

The comparison of measured versus modeled results is considered a very good correlation for all sites. Note that a noise monitoring system is expected to provide an overall end to end accuracy of at least plus or minus 1.5 dB. The measurement system, while very good, cannot match the human ear and brain for identifying sound sources. Computers, with appropriately connected microphones, can measure sound level accurately, but cannot identify the sound source precisely. Near the airport the aircraft sound can be more successfully classified than at more remote sites where ambient noise can confuse the system.

Some caution is warranted when reviewing the noise contours. The noise contours at the east end of the airport are shaped by 2 types of operations, arrivals to Runway 21 and noise aft of the aircraft generated during departure on Runway 21. The noise generated aft of the aircraft during pre-takeoff engine run and takeoff roll is modeled in the INM using a generic aircraft directional pattern that may or may not be representative of the aircraft that operate at Santa Monica Municipal Airport. Noise measurements were made in 2002 and reported in the 2002 annual report that shows the INM matches or tends to overestimate noise levels near the east end of the airport.

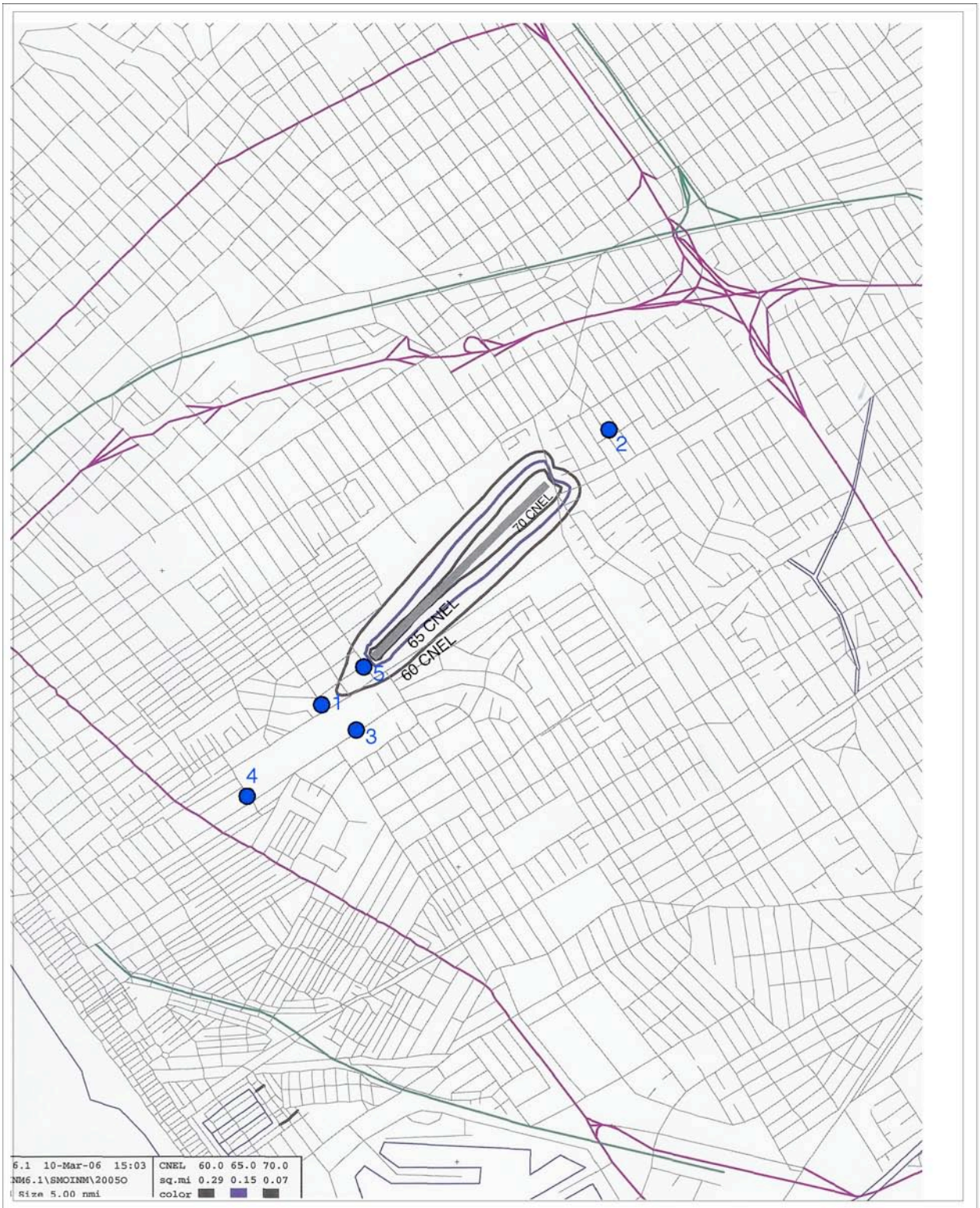


Exhibit 3-4
Year 2005 CNEL 60, 65, and 70 Contours
Santa Monica Municipal Airport CNEL Contour Study

4.0 HISTORICAL NOISE MONITORING DATA

4.1 HISTORY OF CNEL MEASUREMENT DATA, 1988 TO 2005

The original noise monitoring system was installed in the 1970's and replaced in 1988. The present noise monitoring system has been in operation since 1988 and a major system software upgrade completed last year. The CNEL data from the existing system are plotted in Exhibit 4-1.

CNEL measurements recorded prior to 1988 are available and were reported occasionally. Data for the years 1982, 1983, 1985 and 1987 were found for Site 1. These are listed in Table 4-1.

Table 4-1
Pre-1988 CNEL Measurement Data for Site 1

Year	CNEL
1982	62.1
1983	61.5
1985	58.8
1987	57.9

5.0 REFERENCES

1. U.S. Department of Transportation, Federal Aviation Administration, "Integrated Noise Model (INM) Version 6.0 User's Guide," September 1999.

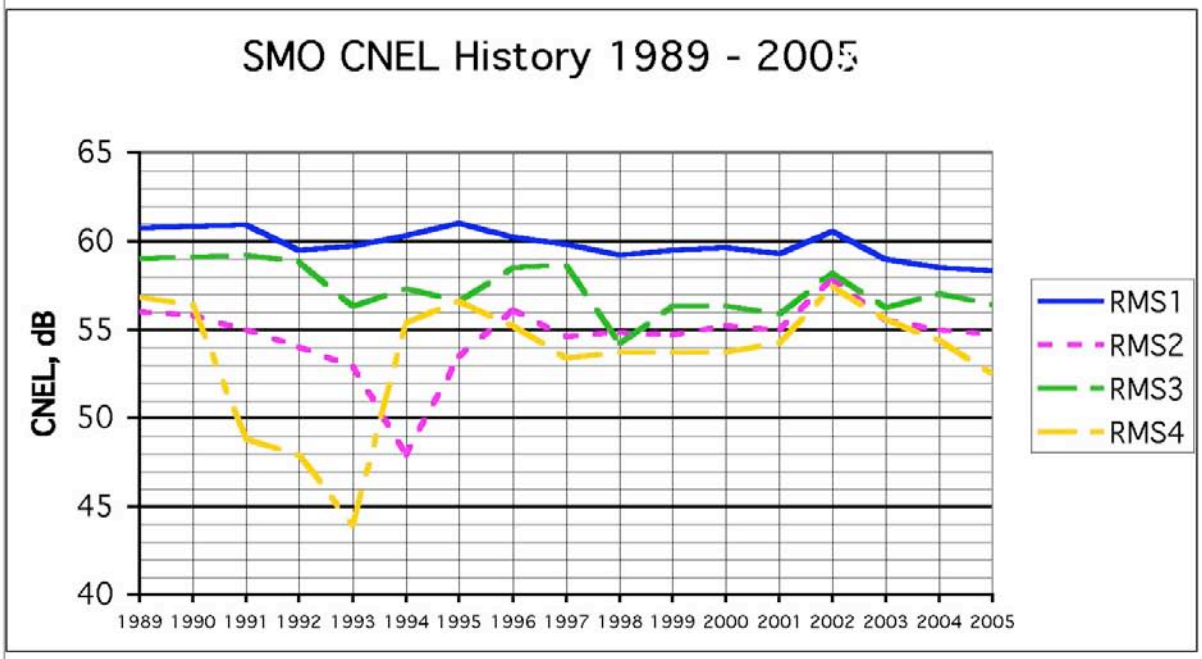
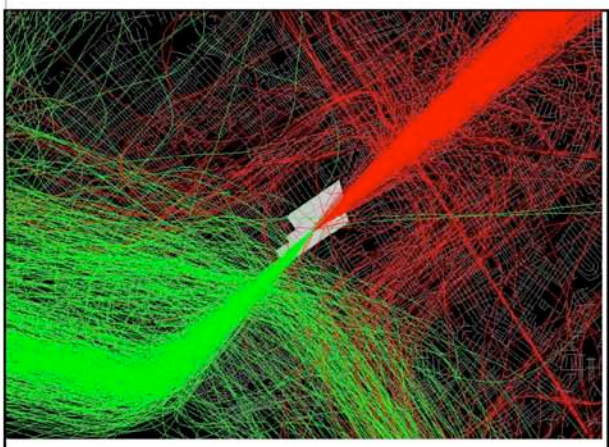


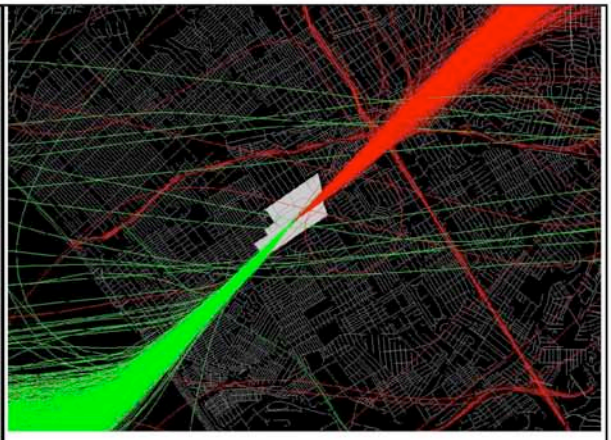
Exhibit 3-5
History of CNEL, All Sites, 1989-2005
Santa Monica Municipal Airport CNEL Contour Study

Attachment

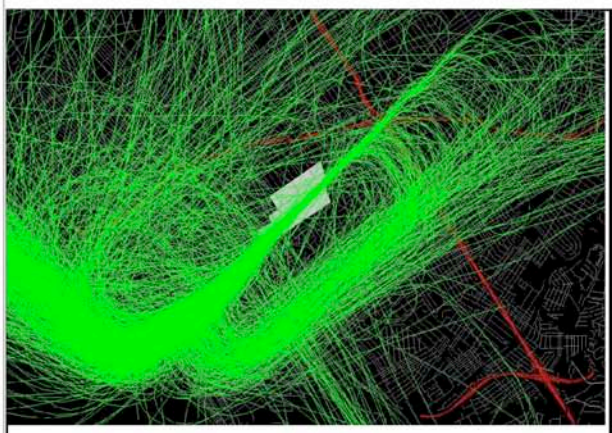
Sample Radar Tracks From eTamis



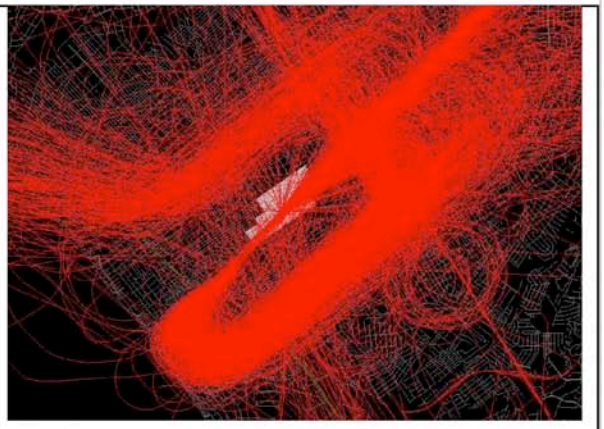
Transient Engine Propeller



Transient Jet



VFR Departures



VFR Arrivals

Sample Radar Tracks From Santa Monica Airport

Santa Monica Municipal Airport CNEL Contour Study