5.C NOISE AND COMPATIBLE LAND USES

The discussion of the affected environment for noise and compatible land uses describes the existing noise exposure on communities surrounding Fort Lauderdale-Hollywood International Airport (FLL) and the land uses that could be affected by the development of the Airport Sponsor's Proposed Project or any of its alternatives. The noise analysis describes the noise exposure for the Environmental Impact Statement (EIS) existing conditions base year – 2005. Aircraft-related noise exposure is defined through noise contours prepared using the FAA Integrated Noise Model (INM). This noise exposure is presented using the Day-Night Average Sound Level (DNL) metric.

An explanation of the INM and the DNL metric, along with a review of the physics of noise, noise impacts on humans, social impacts of noise, and the data required to develop noise exposure contours, is summarized in Section 5.C.1, *Noise.* The noise analyses were conducted in accordance with FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures,* and Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.*

Federal Aviation Regulations (FAR) 14 Code of Federal Regulations (CFR) Part 150[1] and the 1992 Federal Interagency Committee on Noise Report (FICON)[2] were used to define and categorize compatible land uses in the Study Area. Section 5.C.2, *Land Use Compatibility,* describes the existing land use patterns, noise-sensitive public facilities, local comprehensive plans, and applicable zoning regulations for those jurisdictions within the Study Area.

Section 5.C.3 addresses the *Part 150 Noise Compatibility Study Update* currently being conducted by Broward County.

Section 5.C.4, *Interlocal Agreements and Development Orders,* discusses the interlocal agreements between Broward County and the City of Dania Beach and the City of Fort Lauderdale; and local development orders (adopted by Broward County, the cities of Hollywood and Fort Lauderdale, pursuant to Chapter 380, Florida Statutes, *Developments of Regional Impact*).

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1 *Federal Aviation Regulations Part 150 Airport Noise Compatibility Planning*, Appendix A, Table 1.

2 The Committee, composed of representatives of the Departments of Transportation (Office of the Secretary and the Federal Aviation Administration), Defense, Justice, Veterans Affairs, Housing and Urban Development; the Environmental Protection Agency; and the Council on Environmental Quality, was chartered to review specific elements of Federal agency procedures for the assessment of airport noise impacts and to make appropriate recommendations. *Federal Agency Review of Selected Airport Noise Analysis Issues*, FICON, August 1992.

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5.C.1 NOISE

5.C.1.1 Background

This section provides the methodology and disclosure of the existing noise conditions at FLL as directed by FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, dated March 20, 2006, and Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. The existing aircraft noise analysis (designated as the 2005 Baseline condition) represents the current operating conditions at the airport for the time period of April 2005 through March 2006. The existing roadway noise analysis (designated as the 2004 baseline condition for roadway noise) represents the roadway conditions on airport access roads in 2004; however, no appreciable differences would be expected between 2004 and 2005 roadway conditions. The assessment of both **aircraft noise** and **roadway noise** conditions are addressed in this section.

Aircraft noise impacts are described in terms of population, housing units, and noise-sensitive land uses determined to be incompatible with current or future noise levels. The FAR 14 CFR Part 150 land use compatibility guidelines and the 1992 FICON guidelines for defining noise impacts outside of the 65 DNL provide the criteria by which land uses are evaluated for compatibility with aircraft noise. For the disclosure of roadway noise conditions, the ambient noise level was measured at four sites using a ten-minute sampling methodology. The measurement sites were established by determining which locations were exposed to roadway noise by the arterial roadways serving the airport – U.S. Highway 1 or Griffin Road (the two roadways that may potentially be affected by the Airport Sponsor's Proposed Project or its alternatives).

5.C.1.1.1 THE PHYSICS AND MEASUREMENT OF NOISE

Noise may be defined as unwanted sound. Noise and sound are physically the same, but the difference is in the opinion of the receiver. A sound is produced by a source that has induced vibrations in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward in all directions from the source; much like ripples after a stone is thrown into a pool of water. The result of the air movement is sound waves that radiate in all directions and may be reflected and scattered.

Sound is measured by its pressure or energy in terms of decibels (dB). The dB is based on a logarithmic scale and therefore, is not directly additive as in a linear scale. For example, if a sound of 60 dB is added to another sound of 60 dB, the total is a 3 dB increase to 63 dB, not a doubling to 120 dB. The human ear can perceive a wide range of sound. At the low end of the dB scale, very faint sounds of less than 10 dB can be heard, yet at the high end of the dB scale extremely loud sounds of more than 100 dB can also be heard. The dB scale from zero to 120 covers most of the range of everyday sounds, as graphically depicted on **Exhibit 5.C.1-1, *Decibel Scale Range of Everyday Sound***. An increase of 10 dB is usually perceived as being twice as loud.

5.C.1.1.2 NOISE DESCRIPTORS

Though a particular noise may be measured in dB, the noise emanating from airport operations rises, falls, and may even cease throughout the day. Various noise descriptors or metrics have been developed to reflect how the population is affected by the time-varying noise exposure levels resulting from aircraft operations. The DNL metric is the standard noise descriptor specified by the FAA for transportation noise sources. FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, require the use of the DNL noise metric in evaluating aircraft noise exposure in environmental assessments of Federal actions. FAR 14 CFR Part 150 specifies the use of DNL in noise compatibility studies. The FICON report, referenced in Section 5.C, concluded that DNL is the recommended metric and should continue to be used as the primary metric for aircraft noise exposure. The U.S. Environmental Protection Agency (USEPA) *Guidelines for Noise Impact Analysis* (1982), recommends DNL as the primary measure of general audible noise and as the environmental noise descriptor for land use compatibility planning.

The DNL metric employs the Equivalent Sound Level (Leq), a single numerical noise rating which, over a given period of time, represents the same noise energy as the time-varying sound level. The DNL metric was derived to account for the greater annoyance caused by sound intrusion at night (10:00 p.m. to 6:59 a.m.). It augments the Leq occurring at night by 10 dB before being combined with the Leq for the daytime period (7:00 a.m. to 9:59 p.m.). The DNL provides a numerical description of the weighted 24-hour cumulative noise energy level using the A-weighted decibel (dBA) scale typically over a one-year period. The method of weighting the frequency spectrum, the A-weighted scale, was adopted by the FAA to describe environmental noise because it most closely mimics the receptivity of the human ear. (All references to dB noise levels throughout this EIS use the dBA scale.)

Roadway noise, per Federal Highway Administration (FHWA) Policy Memorandum 7-7-3, is described in terms of the Leq for the loudest hour. The FHWA has promulgated Noise Abatement Criteria to guide decisions regarding when noise abatement of highway noise must be considered.

5.C.1.1.3 NOISE IMPACTS ON HUMANS

Noise may have detrimental impacts on the human environment. To different degrees, it may interfere with activities such as face-to-face conversation, telephone use, radio and television use, and sleep. The social impact of unwanted sound is an area that has received much attention, particularly around airports.

Because human response to noise stimuli is based on human perception, it is very subjective and not easily submitted to objective testing. Consequently, noise impact assessments have been primarily in the form of social surveys at selected airports throughout the U.S., where the affected populace was asked to participate in noise impact surveys. **Table 5.C.1-1, *Typical Percentage of Persons Highly***

Disturbed by Aircraft Noise by Type of Activity, shows some typical findings from such surveys. The table lists the percentage of the population "highly disturbed" by aircraft noise by type of activity.

Annoyance is a summary measure of the general adverse reaction of population to noise that generates speech interference (including inability to use the telephone, radio, television, or recordings satisfactorily), sleep disturbance, or simply interferes with the desire for a tranquil environment. Currently, the best available measure of this response is the percentage of the area population characterized as "highly annoyed" (%HA) by long-term exposure to noise of a specified level (expressed in terms of DNL).

In general, the effects of noise on the population result from complex relationships of numerous factors. Separating the effects of these often confounding factors is impractical, if not impossible. The variability in the way individuals react to noise makes it impossible to accurately predict how any one individual will respond to a given noise. However, when the community is considered as a whole, trends emerge which relate noise to annoyance. The preponderance of case histories and social surveys indicates that the response of a community to aircraft noise is affected not only by how loud the noise is, but also by how often noise events occur (i.e., the total noise exposure in a specified time period).

In the 1970s, T.J. Schultz analyzed the findings of a number of social surveys and developed a function which relates transportation noise exposure and the prevalence of annoyance in communities.[3] Schultz developed methods for converting noise exposures measured in different units to a common set of units (DNL), and devised ways of comparing annoyance judgments measured on very different response scales. The Schultz curve provides the only widely-accepted dose-response relationship between environmental noise (in terms of DNL) and a health and welfare parameter (annoyance). DNL has been accepted as the most useful and informative metric for describing the noise exposure of a community caused by an airport, and the percent of the exposed population expected to be Highly Annoyed (%HA) as the most useful metric for characterizing or assessing noise impact on population. USEPA's *Information on Levels of Environmental Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (Levels Document) indicates DNL is used to relate noise in residential environments to chronic annoyance by activity interference. Based on the Schultz curve approximately 12 percent of the population would be "Highly Annoyed" when experiencing noise levels at or above 65 DNL. FAA land use compatibility recommendations are based upon the analysis of the relationship of %HA to DNL noise levels (*See* Appendix H, *Noise,* for a discussion of those guidelines.)

3 Shultz, T.J. (1978) *Synthesis of Social Surveys on Noise Annoyance*. Journal of Acoustical Society of America Vol. 64, 377-405.

Table 5.C.1-1
TYPICAL PERCENTAGE OF PERSONS HIGHLY DISTURBED BY AIRCRAFT NOISE BY TYPE OF ACTIVITY

ACTIVITY TYPE	PERCENT ANNOYED
TV/Radio Reception	20.6
Conversation	14.5
Telephone	13.8
Relaxing Outside	12.5
Relaxing Inside	10.7
Listening to Records/Tapes	9.1
Sleep	7.7
Reading	3.3
Eating	3.5
Other	1.3

Source: Information on *Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, United States Environmental Protection Agency: Office of Noise Abatement and Control, March 1974.

The USEPA's Levels Document identified noise levels for protection from hearing loss. The outdoor DNL of 55 dB is identified as that level which, if not exceeded, will protect the public health and welfare with an adequate margin of safety. This is based on the following factors: (1) The identified protective level indoors (to preclude speech interference) is DNL 45 dB; (2) Assuming an attenuation outdoors-to-indoors of 15 dB (which is an average amount of sound attenuation that assumes partly-open windows), the corresponding outdoor level is DNL 60 dB; and (3) A "margin of safety" of 5 dB is applied to the outdoor identified level to account for other adverse effects on activity interference and annoyance as well as for the most sensitive fraction of the population. (USEPA 1974)

Social surveys show that interference with sleep is noted as a contributor to annoyance for nearly eight percent of the population surveyed. Physiological studies show that sleep interference can exist without a person being consciously awakened. Numerous studies on sleep interference have been conducted, with varying conclusions as to the effect of noise on sleep.

One study concludes that, with adjustments for comparable measures of noise, it can be expected that approximately 30 percent of the population could be aroused or awakened if indoor levels reached 80 to 95 dB, depending on window configuration (open or closed) and quality of the residential construction.[4]

The degree to which noise interferes with indoor speech depends not only on physical factors such as noise levels, distance between the speaker and listener, and room acoustics, but also on non-physical factors such as the speaker's enunciation and the listener's interest in, and familiarity with the topic. The effects of noise interference on normally voiced speech indoors are graphically depicted on **Exhibit 5.C.1-2**, ***Impacts on Speech Communication***. The highest steady noise that allows normal conversation throughout an average room with 100 percent

[4] *Noise and Sleep*, Journal of the Acoustical Society of America, Lukas, Volume 58, Number 6, December 1975.

sentence intelligibility is 45 dBA. This steady noise level would allow for 95 to 100 percent sentence intelligibility for a normally voiced indoor conversation and the speaker and listener are no more than six to seven feet apart. Housing units located in areas receiving exterior steady noise exposure of 75 dB to 80 dB would experience interior speech intelligibility in the range of 97 percent to 99 percent (steady interior level of 55 to 60 dB), which would allow normal conversations at a comfortable voice effort at typical conversational distances.[5]

The FHWA set its noise abatement criterion for residential areas on a similar basis of annoyance with conversation. The FHWA residential criterion of 67 dB must not be "approached or exceeded." Approach is defined by the Florida Department of Transportation as 1 dB, so the effective criterion is 66 dB, very similar to the FAA's 65 DNL level. Because traffic noise has traditionally been loudest during peak travel hours, FHWA applies its criterion during the loudest hour. Typically this is at the beginning or end of the afternoon peak period when traffic is heavy, but still free-flowing. However, it can occur during the morning peak, or even at midday.

5.C.1.1.4 SOCIAL IMPACT OF NOISE

Aircraft noise may result in detrimental social impacts on humans in noise-impacted areas. Because oral communication is an intrinsic part of our society, interference with it may have adverse social effects.[6]

Exhibit 5.C.1-2 graphically depicts the comparison of different noise levels to impacts on communication and that for noise levels of up to 35 dB, communication is possible in a normal voice level, up to a distance of 32 feet.

At noise levels greater than 50 dB voice levels are consciously raised to compensate for the noise. Typically communication does not occur above a shout. Communication becomes impossible during events with levels of 70 dB with speaker separation distance of 24 feet.

5.C.1.2 2005 Baseline Condition (Aircraft)

The 2005 Baseline condition represents the current operating conditions at the airport and was based on the time period from April 2005 through March 2006. The following paragraphs provide a summary of the methodology, input data, and the resulting noise exposure levels. The noise exposure prepared for the 2005 Baseline condition provides a representation of the existing noise levels.

5.C.1.2.1 METHODOLOGY AND DATA SOURCES

The analysis of noise exposure around the airport was prepared using INM Version 6.1, the most recent version available at the initiation of this EIS analysis. The INM is a state-of-the-art computer model that is used to predict the noise exposure levels from aircraft operations. It was developed under the auspices of

[5] Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with and Adequate Margin of Safety*, March 1974.

[6] Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with and Adequate Margin of Safety*, March 1974.

the FAA and is the only model approved by the FAA for use in noise analyses at civilian airports. Inputs to the INM include the number of aircraft operations during the period evaluated, the types of aircraft flown, the time of day when they are flown, how frequently each runway is used for arriving and departing aircraft, and the routes of flight used to and from the runways. Substantial variations in any one of these factors may, when extended over a long period of time, cause marked changes to the noise exposure around the airport. The INM calculates noise exposure for the area around the airport and outputs contours of equal noise exposure. For this EIS, equal noise exposure contours for the levels of 60, 65, 70, and 75 DNL were calculated.

FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures,* indicates that supplemental noise analyses may be performed to assist the public in understanding the noise impact at an airport. The calculation of noise metrics other than DNL at specific locations or grid points is the recommended approach for conducting supplemental noise analyses. Therefore, in addition to noise exposure contours, noise levels at a variety of grid point locations, inside and outside of the 65 DNL were calculated for DNL: Sound Exposure Level (SEL), Leq, maximum noise level (Lmax), and Time Above 65 dB (TA-65) metrics. For the locations of the grid points, a definition of each metric, and the results of the analyses, *see* Appendix H, *Noise.*

As discussed previously, the INM requires a variety of data from a number of sources to calculate aircraft noise exposure contours. The input data is grouped into six categories of information – Runway Definition, Runway End Utilization, Flight Tracks and Utilization, Flight Procedures and Takeoff Profiles, Activity Levels and Fleet Mix, and Ground Run-up Noise. A summary of the input data for each category is provided below.

Runway Definition: The existing runway layout at FLL is graphically depicted on **Exhibit 5.C.1-3**, ***Existing Airfield***. There are two east/west parallel runways (9L/27R and 9R/27L) spaced approximately 4,000 feet apart. Runway 13/31, a northwest/southeast crosswind runway, is located approximately midfield and intersects with Runway 9L/27R and Runway 9R/27L. Runway 9L/27R is the longest runway on the airfield at 9,000 feet. The following provides the current runways and lengths at FLL:

Runway	Length (feet)
9L/27R	9,000
9R/27L	5,276
13/31	6,930

Runway End Utilization: Runway end utilization refers to the percent of time that a particular runway end is used for departures or arrivals. It is a principal element in the definition of the noise exposure pattern. Proportional use of a runway is based largely on conditions of wind direction and velocity, the length of the runway, and in the case of FLL, the informal runway use program.[7] Arrival and

[7] FLL 7110.65F *Standard Operating Procedures*, Chapter 2 *General Control*, Paragraph 2-14. *Fort Lauderdale ATCT Informal Runway Use Program,* b. *Runway Use Procedures*.

departure runway end utilization for FLL was determined primarily from analysis of FLL's Airport Noise and Operations Management System (ANOMS)[8] data for the period between April 2005 and March 2006.

During the daytime (7:00 a.m. to 9:59 p.m.), the airport is operated in one of two operating configurations -- east flow (78 percent of the time) or west flow (22 percent of the time). The primary flow during the 2005 Baseline period was east flow due to the prevailing east winds. When the airport operated in this configuration, aircraft arrived from the west to Runways 9L, 9R, and 13 and departures to the east occurred from Runways 9L, 9R, and 13. During west flow, aircraft arrived from the east to Runways 27R, 27L, and 31 and departures to the west occurred from Runways 27R, 27L, and 31.

Runway 9R/27L is limited to aircraft with a wingspan less than 79 feet and an approach speed less than 121 knots due to the physical limitations of the surrounding taxiways and the runway. Runway 13/31 is generally used only when winds require it, when one of the other runways is unavailable, or when the level of demand warrants its use.[9] Due to these limitations, Runway 9L/27R is the most heavily used runway during the east and west flow. For the 2005 Baseline condition the heavy jet, large jet, and all but the smallest business jets and turboprops were assigned to either Runway 9L/27R or Runway 13/31 for both arrivals and departures. Runway 9R/27L has neither the length nor the width to accept these aircraft. The small business jet and propeller aircraft used Runways 9L, 9R, and 13 for arrivals during east flow and Runways 27R, 27L, and 31 during west flow.

During the nighttime (10:00 p.m. to 6:59 a.m.), the informal runway use program guides runway utilization at the airport. The informal runway use program requests that all turbojet aircraft use Runway 9L/27R and also requests that Runway 9R/27L be closed during the nighttime, although the FLL ANOMS data does show it was occasionally used. Appendix H, *Noise,* provides the runway utilization percentages by aircraft category.

Flight Tracks and Utilization: A flight track is the path over the ground as aircraft fly to or from the airport. For this EIS, the existing flight tracks were evaluated to ensure that the flight tracks used in the modeling of aircraft noise are representative of where aircraft are flying at FLL.

The noise abatement procedures[10] for departures off Runways 9L, 9R, 27R, and 27L direct aircraft to maintain runway heading until reaching three nautical miles from the end of the runway or reaching an altitude of 3,000 feet above ground level

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8 An ANOMS system collects radar data for operations arriving, departing, and enroute through an Airport Traffic Control Tower's airspace (approximately 30 miles in all directions from an airport radar). The data collected includes runway, aircraft type, operation type, time of arrival or departure, airline, and flight track location. The Broward County Aviation Department (BCAD) owns and operates an ANOMS system with the assistance of Lochard (an airport noise monitoring and flight track management corporation).

9 FLL 7110.65F *Standard Operating Procedures*, Chapter 2 *General Control*, Paragraph 2-14. *Fort Lauderdale ATCT Informal Runway Use Program,* b. *Runway Use Procedures*.

10 FLL 7110.65F *Standard Operating Procedures*, Chapter 2 *General Control*, Paragraph 2-14. *Fort Lauderdale ATCT Informal Runway Use Program,* b. *Runway Use Procedures*.

(AGL). The Runway 31 departure procedure directs aircraft to turn left to a 270-degree heading as soon as practical, to overfly Interstate-595, and to maintain the 270-degree heading until reaching 3,000 feet AGL or three nautical miles. The noise abatement procedure for Runway 13 directs aircraft to turn left to a 90-degree heading, flying toward the Atlantic Ocean as soon as practical, until east of the shoreline or having reached 3,000 feet AGL. Arrivals to Runway 9L, 9R, 27R, and 27L direct aircraft to remain at 6,000 feet AGL until aircraft pass the airport on the downwind leg. No turns are allowed to the base leg until west of the Runway 9L or 9R final approach fix or offshore for Runway 27R or 27L. Noise abatement procedures apply to turbojet aircraft with a certified maximum gross takeoff weight of 60,000 pounds or more from 7:00 a.m. to 9:59 p.m. and to all aircraft from 10:00 p.m. to 6:59 a.m.

Radar data gathered for sample periods during April 2005 through March 2006 was analyzed to verify the location, density, and width of existing flight corridors. Departure corridors are defined by a series of individual flight tracks located across the width of the corridor. Aircraft on approach to a runway end are located within a smaller corridor due to the use of navigational instruments. **Exhibit 5.C.1-4, *2005 Baseline East Flow Jet Flight Corridors,*** and **Exhibit 5.C.1-5, *2005 Baseline East Flow Prop Flight Corridors,*** graphically depict the corridors representative of jet and propeller aircraft arriving and departing in east flow. **Exhibit 5.C.1-6, *2005 Baseline West Flow Jet Flight Corridors***, and **Exhibit 5.C.1-7, *2005 Baseline West Flow Prop Flight Corridors***, graphically depict similar information for west flow. In order to model the flight corridors in INM, consolidated flight tracks were developed from this radar data. Appendix H, *Noise,* provides the consolidated flight tracks and the utilization of each flight track.

Flight Procedures and Takeoff Profiles: The INM includes standard flight procedure data for each aircraft that represents each phase of flight to or from an airport. Information related to aircraft speed, altitude, thrust settings, flap settings, and distance are available and used by the INM to calculate noise levels on the ground. Standard aircraft departure profiles are supplied from the runway (field elevation) up to 10,000 feet above field elevation (AFE). Aircraft arrival profiles are supplied from 6,000 feet AFE down to the runway including the application of reverse thrust and rollout. The FAA requires that these standard arrival and departure profiles be used unless there is evidence that they are not applicable. Analysis prepared for this EIS using the ANOMS data and field measurements conducted in the communities surrounding the airport in October 2004, indicates that there is no significant difference between the INM standard profiles and the current flight procedures at FLL. This analysis is located in Appendix H.1, *Field Noise Measurements and Noise Complaints*. Aircraft weight during departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, the heavier an aircraft is, the slower the rate of climb and the wider the dispersion of noise along its route of flight. Where specific aircraft weights are unknown, the INM uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. The INM groups trip lengths into seven categories; these categories are:

Category	Stage Length
1	0-500 nautical miles
2	500-1000 nautical miles
3	1000-1500 nautical miles
4	1500-2500 nautical miles
5	2500-3500 nautical miles
6	3500-4500 nautical miles
7	4500+ nautical miles

The trip lengths flown from FLL are based on scheduled operations for the baseline period. **Table 5.C.1-2** indicates the proportion of the operations that fell within each of the seven trip length categories for the baseline period.

Table 5.C.1-2
DEPARTURE TRIP LENGTH DISTRIBUTION – 2005 BASELINE
Fort Lauderdale-Hollywood International Airport

STAGE LENGTH	AIR CARRIER/ CARGO	COMMUTER/ AIR TAXI	GENERAL AVIATION
1	10%	93%	100%
2	66%	7%	-
3	20%	-	-
4	4%	-	-
5	-	-	-
6	-	-	-
7	-	-	-

Source: Landrum & Brown, 2006

Activity Levels and Fleet Mix: In order to calculate DNL noise exposure levels for the 2005 Baseline condition, the average number of daily arrivals and departures by specific aircraft types was prepared for input into the INM. This data was collected for the baseline period (April 2005 through March 2006) from FLL's ANOMS,[11] FAA Air Traffic Control Tower (ATCT) counts, Official Airline Guide schedules, and other operational records maintained by FLL. During the baseline period 320,400 operations occurred at FLL.

The average daily number of aircraft arrivals and departures for the 2005 Baseline condition are calculated by taking the baseline period operations and dividing by 365 (days in a year). **Table 5.C.1-3,** ***Average Day Operations – 2005 Baseline***, provides the average operations for the three categories of users

[11] An Airport Noise and Operations Monitoring System (ANOMS) system collects radar data for operations arriving, departing, and enroute through an Airport Traffic Control Tower's (ATCT's) airspace (approximately 30 miles in all directions from an airport radar). The data collected includes runway, aircraft type, operation type, time of arrival or departure, airline, and flight track location. BCAD owns and operates an ANOMS system with the assistance of Lochard (an airport noise monitoring and flight track management corporation).

operating at the airport. The 2005 Baseline condition annual average day included 878 total operations, ten percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m.

Table 5.C.1-4, *Average Day Operations by Aircraft Type–2005 Baseline*, provides the average daily number of arrivals and departures by the individual aircraft types. The air carrier/cargo category was dominated by Boeing 737-300, Boeing 757-200, MD-88, Boeing 717-200, Boeing 767-300/400, and Airbus 320 aircraft.

The commuter/air taxi category of aircraft operating at FLL was comprised of Canadair and Embraer regional jets, and various turboprop aircraft. The most common type of propeller aircraft operating at FLL was the commuter aircraft flown by the airlines to feed their hub operations at other airports. Business jets and small propeller aircraft make up the general aviation category.

Table 5.C.1-3
AVERAGE DAY OPERATIONS - 2005 BASELINE
Fort Lauderdale-Hollywood International Airport

	Arrivals		Departures		Total	
User Group	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**
Air Carrier/Cargo	205	42	224	23	429	65
Commuter/Air Taxi	102	4	102	4	204	8
General Aviation	80	6	76	10	156	16
Total	**387**	**52**	**402**	**37**	**789**	**89**

Day: 7:00 a.m. to 9:59 p.m.

Night: 10:00 p.m. to 6:59 a.m.

Source: Landrum & Brown, 2006, FAA Tower Counts, Official Airline Guide (OAG), and Landing Fee Reports.

Table 5.C.1-4
AVERAGE DAY OPERATIONS BY AIRCRAFT TYPE - 2005 BASELINE
Fort Lauderdale-Hollywood International Airport

	Aircraft	INM	Landings		Takeoffs		Total	
	Type	Type	Day	Night	Day	Night	Day	Night
Air Carrier/Cargo								
Heavy Jet	Boeing 767-200	767CF6	1	0	1	0	2	0
	Boeing 767-200	767JT9	1	0	1	0	2	0
	Boeing 767-300	767300	4	0	3	1	7	1
	Boeing 767-400	767400	2	2	4	0	6	2
	Airbus 310	A310	1	0	1	0	2	0
	DC8-63	DC870	1	0	0	1	1	1
	DC10-10	DC1010	0	4	2	2	2	6
Large Jet	Boeing 717	717200	10	3	11	2	21	5
	Boeing 727-200 (Hushkit)	727EM2	1	1	1	1	2	2
	Boeing 737-200 (Hushkit)	737N9	1	0	1	0	2	0
	Boeing 737-200 (Hushkit)	737N17	2	0	2	0	4	0
	Boeing 737-300	737300	12	0	11	1	23	1
	Boeing 737-300	7373B2	3	0	3	0	6	0
	Boeing 737-400	737400	2	1	2	1	4	2
	Boeing 737-500	737500	0	1	1	0	1	1
	Boeing 737-700	737700	28	4	29	3	57	7
	Boeing 737-800	737800	7	5	11	1	18	6
	Boeing 757-200	757PW	17	4	20	1	37	5
	Boeing 757-200	757RR	17	3	20	0	37	3
	Boeing 757-300	757300	1	1	1	1	2	2
	Airbus 319	A319	19	1	19	1	38	2
	Airbus 320	A320	19	3	21	1	40	4
	Airbus 320	A32023	26	5	27	4	53	9
	Airbus 321	A32123	6	1	7	0	13	1
	DC9-30 (Hushkit)	DC93LW	1	1	1	1	2	2
	Embraer 170	EMB14L	1	0	1	0	2	0
	MD81	MD81	3	0	3	0	6	0
	MD82	MD82	13	2	14	1	27	3
	MD83	MD83	6	0	6	0	12	0
	Subtotal		**205**	**42**	**224**	**23**	**429**	**65**

Table 5.C.1-4, *Continued*
AVERAGE DAY OPERATIONS BY AIRCRAFT TYPE - 2005 BASELINE
Fort Lauderdale-Hollywood International Airport

	Aircraft	INM	Landings		Takeoffs		Total	
	Type	Type	Day	Night	Day	Night	Day	Night
Commuter/Air Taxi								
Commuter Jet	Canadair Regional Jet	CL601	6	0	6	0	12	0
	Embraer 135	CL600	11	0	10	1	21	1
	Embraer 145	EMB145	20	2	22	0	42	2
	Lear 25	LEAR25	0	1	1	0	1	1
	Lear 35	LEAR35	1	0	0	1	1	1
Commuter Prop	Heavy Turboprop	DHC830	3	0	3	0	6	0
	Heavy Turboprop	HS748A	6	0	6	0	12	0
	Heavy Turboprop	DHC8	13	0	13	0	26	0
	Medium Turboprop	DHC6	31	0	31	0	62	0
	Medium Turboprop	SD330	5	0	5	0	10	0
	Twin Engine Prop	BEC58P	4	0	4	0	8	0
	Single Engine Prop	GASEPF	2	1	1	2	3	3
	Subtotal		**102**	**4**	**102**	**4**	**204**	**8**
General Aviation								
General Aviation Jet	Business Jet	CIT3	2	0	1	1	3	1
	Business Jet	CL600	6	0	5	1	11	1
	Business Jet	CNA500	3	0	3	0	6	0
	Business Jet	GIIB	0	1	1	0	1	1
	Business Jet	GIV	4	0	3	1	7	1
	Business Jet	GV	1	0	1	0	2	0
	Business Jet	LEAR25	5	0	4	1	9	1
	Business Jet	LEAR35	13	2	13	2	26	4
	Business Jet	MU3001	9	0	7	2	16	2
General Aviation Prop	Heavy Turboprop	HS748A	1	1	2	0	3	1
	Medium Turboprop	DHC6	6	0	5	1	11	1
	Light Turboprop	CNA441	2	1	3	0	5	1
	Twin Engine Prop	BEC58P	19	1	20	0	39	1
	Single Engine Prop	GASEPV	6	0	5	1	11	1
	Single Engine Prop	GASEPF	3	0	3	0	6	0
	Subtotal		**80**	**6**	**76**	**10**	**156**	**16**
Average Daily Totals			**387**	**52**	**402**	**37**	**789**	**89**

Source: Landrum & Brown, 2006, FAA Tower Counts, Official Airline Guide (OAG), and Landing Fee Reports

Ground Run-up Noise: As part of the noise analysis for this EIS, data was gathered on ground run-up noise and where it was occurring. Full power engine run-ups are conducted on Runway 13/31, between Taxiways E2 and E3, between the hours of 7:00 a.m. and 11:00 p.m.[12] Small propeller aircraft also perform engine run-ups on Taxiway Q adjacent to the Very High Frequency Omnidirectional Radial (VOR) antenna.

Idle engine run-ups are conducted at various locations and times, and for various durations throughout an average day at FLL. The noise created by idle engine run-ups is generally masked by the other activity at or near the airport. Therefore, INM modeling was only performed for the full power engine run-ups. **Table 5.C.1-5** shows the number, types, and duration of engine run-ups occurring at FLL.

Table 5.C.1-5
GROUND RUN-UP OPERATIONS - 2005 BASELINE
Fort Lauderdale-Hollywood International Airport

AIRCRAFT TYPES	AVERAGE DAILY RUN-UP OPERATIONS	AVERAGE DURATION IN SECONDS	POWER (THRUST) SETTINGS
727EM2	0.05	40	80%
Lear25	0.34	40	80%
DHC6	0.17	40	80%

Source: Landrum & Brown, 2006, FLL Operations Department.

5.C.1.2.2 NOISE EXPOSURE (AIRCRAFT)

The following summarizes the noise exposure contours and the supplemental grid point analysis for the 2005 Baseline condition. A description of the land use impacts associated with the 2005 Baseline Condition is located in Section 5.C.2, *Land Use Compatibility*.

Noise Exposure Contour: The 2005 Baseline noise exposure contour for 60, 65, 70, and 75 DNL levels is graphically depicted on **Exhibit 5.C.1-8, *2005 Baseline Noise Exposure Contour***. The area within each 5 dB noise exposure contour is shown in **Table 5.C.1-6, *Area Exposed to Various Noise Levels***. Noise exposure contours do not represent the noise levels present on any specific day, but rather, represent the average of all 365 days of operation during the year. The overall size of the noise contour is a reflection of the total number of operations, the type of aircraft, and the proportion of nighttime activity. Approximately 4.9 square miles are within the 2005 Baseline condition 65+ DNL noise contour. However, 2.2 square miles of that is over either airport property or the Atlantic Ocean.

[12] Information was obtained from FLL's *Idle Power and Full Power Engine Runs* report. Broward County Aviation Department, effective November 15, 1996. Revised May 1, 2001.

The shape of the noise exposure contour extends outward from the airport off of each runway end, which is reflective of the aircraft flight tracks. The relative distance of the contours from the airport is a function of three factors: (1) the frequency of use of each runway for total arrivals and departures, (2) the type of aircraft assigned to each runway, and (3) the nighttime runway use.

The noise contours extend farther to the east and west of Runway 9L/27R than off of the other runways. This occurs because most aircraft depart and arrive on Runway 9L/27R.

Table 5.C.1-6
AREA EXPOSED TO VARIOUS NOISE LEVELS (IN SQUARE MILES) - 2005 BASELINE NOISE CONTOURS
Fort Lauderdale-Hollywood International Airport

Noise Level	Total Area within 2005 Baseline	Area Over Airport Property	Area Over Atlantic Ocean
65-70 DNL	2.8	0.6	0.3
70-75 DNL	1.3	0.6	0.0
75+ DNL	0.8	0.7	0.0
65+ DNL	4.9	1.9	0.3
60-65 DNL*	6.9	0.7	2.2

* The disclosure of the 60-65 DNL noise contour is provided for local planning purposes only.

Source: Landrum & Brown, 2006. [Contour: FLL_2005Baseline-rev2]

The general shape of the noise contour east and west of the airport is a reflection of runway use. The airport operates in one of two runway configurations -- east flow (78 percent) or west flow (22 percent). The primary flow during the baseline period was east flow due to the prevailing east winds. During east flow, aircraft arrive from the west to Runways 9L, 9R, and 13 and depart to the east from Runways 9L, 9R, and 13. This utilization results in spiked noise contours to the west of the airport, along the 9L/27R runway centerline over the City of Fort Lauderdale and crosses the Florida Turnpike into the City of Davie. The spiked shape of the contour to the west is indicative of a large number of arrival operations on Runway 9L. The noise contour is larger and more rounded to the east of the airport, extending out over John U. Lloyd Beach State Park and the Atlantic Ocean. North of the airport, the 65 DNL contour includes a portion of Snyder Park and residential areas north of Interstate-595 along SW 33rd Court. The rounded shape is indicative of a large number of departure operations.

During west flow, aircraft arrive from the east to Runways 27R, 27L, and 31 and depart to the west from Runways 27R, 27L, and 31. However, because the east flow runway configuration was the most heavily used (78 percent) during the baseline period, it dominated the shape and size of the noise contours to the east and west of the airport. The noise contours associated with Runways 13/31 and 9R/27L remain on or near the runway due to the relatively low use of these runways by small aircraft.

Grid Point Assessment: FAA Order 1050.1E states that DNL is the primary metric for describing aircraft noise exposure. However, DNL analysis may be supplemented with additional metrics to assist in the public's understanding of the noise impact from an action. Supplemental noise analysis is being prepared for this EIS, because the FAA believes it will assist with the public's understanding of the noise impacts. A grid point analysis was prepared for the 2005 Baseline condition. Regularly spaced grid points, noise monitoring locations, and specific noise-sensitive facility grid points were selected throughout the airport environs (*See* **Exhibit 5.C.1-9, Exhibit 5.C.1-10,** and **Exhibit 5.C.1-11**). The DNL, SEL, Leq, Lmax, and the amount of TA-65 were reported at each location. The DNL levels at the grid locations relate directly with the noise exposure contours for the 2005 Baseline condition within the 65 DNL. In general, the distance from the airport and from a direct path of overflight dictates the DNL noise level. For example, west of the airport in Davie, the noise levels range from 43.2 to 55.5 DNL at the column of grid points farthest from the airport (A1-A7). Those locations more closely aligned with the centerline of the east/west runways, (A3 and A5) have the highest DNL levels (50.3 DNL to 55.5 DNL), while the other locations are 4 DNL to 5 DNL lower (43.2 to 51.6 DNL). The DNL noise levels at locations closer to the airport (column B-EE) are exposed to higher overall noise levels than column A. Analysis of Lmax, SEL, and TA-65 metrics found similar patterns as those described for DNL. The output reports of the grid point analysis are provided in Appendix H, *Noise.*

Land Use Impact Assessment: The 65 DNL of the 2005 Baseline noise exposure contour encompasses 4.9 square miles of land, which includes both compatible and residential land uses. **Table 5.C.1-7,** ***Incompatible Land Uses - 2005 Baseline***, indicates the number of housing units, population, and noise-sensitive facilities located in each noise exposure contour range. Approximately 18 people and seven housing units are impacted by noise levels at or greater than 65 DNL in the 2005 Baseline condition. Of these seven residential units, four are located within the 65 DNL noise contour and three are exposed to noise levels greater than 70 DNL. There are no churches, schools, libraries, hospitals, or nursing homes located within the 65 DNL noise exposure contour.

5.C.1.3 2004 Baseline (Roadway)

Proposed changes at FLL could affect roadway traffic accessing the airport. As the number of enplanements increases, associated vehicular traffic is also likely to increase, particularly if other modal opportunities are not provided, like transit. There are no noise-sensitive receptors along the main vehicular access routes to the airport except Griffin Road west of U.S. Highway 1. A noise wall along the south side of Griffin Road already protects this area. Roadway noise can increase if the distance to the noise source is reduced, such as if a road is relocated or lanes are added. This section describes ambient noise conditions at four locations near U.S. Highway 1 and Griffin Road where residential development predominates (*See* **Exhibit 5.C.1-12**). Through the examination of aerial photography and confirmation of the extent of residential areas through field surveys, it has been determined that no other residential areas are located near roadways that could be affected by changes in airport-related vehicular traffic.

Table 5.C.1-7
INCOMPATIBLE LAND USES - 2005 BASELINE
Fort Lauderdale-Hollywood International

Type of Facility	60-65 DNL*	65-70 DNL	70-75 DNL	75+ DNL	65+ DNL
Residential					
Single Family	679	2	3	0	5
Multi Family	943	2	0	0	2
Mobile Home	1,298	0	0	0	0
Total Residential Units	**2,290**	**4**	**3**	**0**	**7**
Population					
Single Family	1,851	5	9	0	14
Multi Family	2,286	4	0	0	4
Mobile Home	3,224	0	0	0	0
Total Population	**7,361**	**9**	**9**	**0**	**18**
Churches	2	0	0	0	0
Library	0	0	0	0	0
Performing Arts Center	1	0	0	0	0
Nursing Homes	1	0	0	0	0
Schools	9	0	0	0	0

Note: Housing units and population counts are based on 2000 Traffic Analysis Zone (TAZ) data from the Broward County Metropolitan Planning Organization.

* The identified land uses between the 60-65 DNL noise contours are considered compatible by FAA in accordance with *FAR 14 CFR Part 150 Airport Noise Compatibility Planning,* Appendix A, Table 1. The disclosure of incompatible land uses between the 60-65 DNL noise contours is provided for local planning purposes only.

Source: Landrum & Brown, 2006. [Contour: FLL_2005Baseline-rev2]

Ambient noise measurements (ten-minute samples)[13] were made at four sites as graphically depicted on Exhibit 5.C.1-12. The samples were taken during November 2004, early in the initial stages of the data collection process for the FLL EIS. No appreciable differences would be expected between 2004 and 2005 roadway conditions that would contribute to significant differences in the level of roadway noise. Three sites are associated with U.S. Highway 1 and one with Griffin Road. They represent the nearest approach of residential areas to these roads. U.S. Highway 1 is lined with commercial uses and consequently the residential sites are all at least a block away. Griffin Road is separated from 10th Street in the City of Dania Beach by an existing six-foot high concrete noise wall intended to reduce noise in that community. The measurement site was on the south side of 10th Street, facing the noise wall, with Griffin Road on the far side of the wall.

[13] The ten-minute ambient noise measurement samples were taken on Tuesday, November 9, 2004, between 8:15 a.m. and 1:15 p.m. One sample was taken at each location. The samples were taken at each location during a period of free-flow traffic as to replicate a peak noise hour at that specific location.

Noise measurements were made with a Metrosonics db-3080 Noise Meter set to “slow response, A-weighting,” and an exchange rate of three. The meter was calibrated prior to use (using a Metrosonics cl-304 calibrator @ 102 dBA). At the time the noise monitoring was conducted the site conditions were a temperature in the lower 70s, humidity of about 70 percent, dry pavement, and calm winds.

Site 1: This site was located at the northwest corner of NW 3rd Terrace and NW 4th Avenue. Residential land use extends south and west of this intersection, which is a block south of Old Griffin Road and two blocks south of Griffin Road. A Florida East Coast Railroad line (FEC) is located immediately east of NW 4th Avenue. Trains’ horns are blown at the Griffin Road crossing. U.S. Highway 1 is one block east of these railroad tracks. Commercial land uses are to the north of Site 1 and the railroad and commercial land uses separate this residential area from U.S. Highway 1. Roadway noise was audible from both Griffin Road and U.S. Highway 1, but there was no dominant noise source. Traffic on Griffin Road and U.S. 1 was not visible from the measurement site, and was not counted. Aircraft takeoffs were audible from Runway 9L/27R, the north parallel runway, as well as a variety of neighborhood noises. Traffic on NW 4th Avenue was the equivalent of approximately 60 vehicles in an hour. Traffic on NW 3rd Terrace was negligible. The ambient noise level, based on a ten-minute sample during the morning peak travel period, was Leq 58 dB.

Site 2: This site was located one-half block west of U.S. Highway 1 (120 feet) and several blocks south of Griffin Road, in the northwest quadrant of NW 1st Street and U.S. Highway 1. There are housing units further west of this location along the railroad track. The South Florida First Haitian Baptist Church of Dania is at this location. Based on a ten-minute sample, the hourly equivalent volumes at Site 2 were 2,500 cars on U.S. Highway 1, together with 210 medium trucks, and 80 heavy trucks. On NW 1st Street, the hourly volumes were 192 cars, 18 medium trucks, and 18 heavy trucks. Two ten-minute samples were measured at this location because during the first sample (hourly Leq of 69) there were idling diesel trucks serving local industry. The Leq recorded in the second ten-minute interval was 66 dB.

Site 3: This site was located at the Northside Garden Park at NW 9th Avenue and NW 10th Street on the southeast corner. The location was at the setback of the homes fronting on NW 10th Street. The measurements were taken just before noon in Melaluca Gardens on the south side of Griffin Road in Dania Beach. All along this section of Griffin Road there is an existing six-foot tall concrete noise wall separating Griffin Road and NW 10th Street. A berm located on the north side of Griffin Road on airport property is planted with grass and trees that shield Griffin Road from airport property and the airport fence line. This berm breaks the line-of-sight from the point of noise measurement to the airport in all locations except where there is an access road onto airport property. The equivalent hourly traffic count on Griffin Road during the measurement period was 738 cars, 84 medium trucks, and 48 heavy trucks. The Leq recorded in the ten-minute interval was 63 dB.

Site 4: This site was located at the building setback line on the east side of NE 1st Avenue, one block east of U.S. Highway 1 and south of NE 2nd Street. At this location, the audible noise levels were mixed -- aircraft taking off from FLL, a mower operating in the distance, a passing train (blowing its horn at the Griffin Road/U.S. Highway 1 crossing), and vehicular noise of the adjacent streets, as well as U.S. Highway 1. The measured hourly Leq, based on a ten-minute sample, was 58 dB. The vehicular count from U.S. Highway 1 one block to the west was 2,500 cars, 150 medium trucks, and 42 heavy trucks.