Chapter Three
NOISE IMPACTS

Noise Impacts

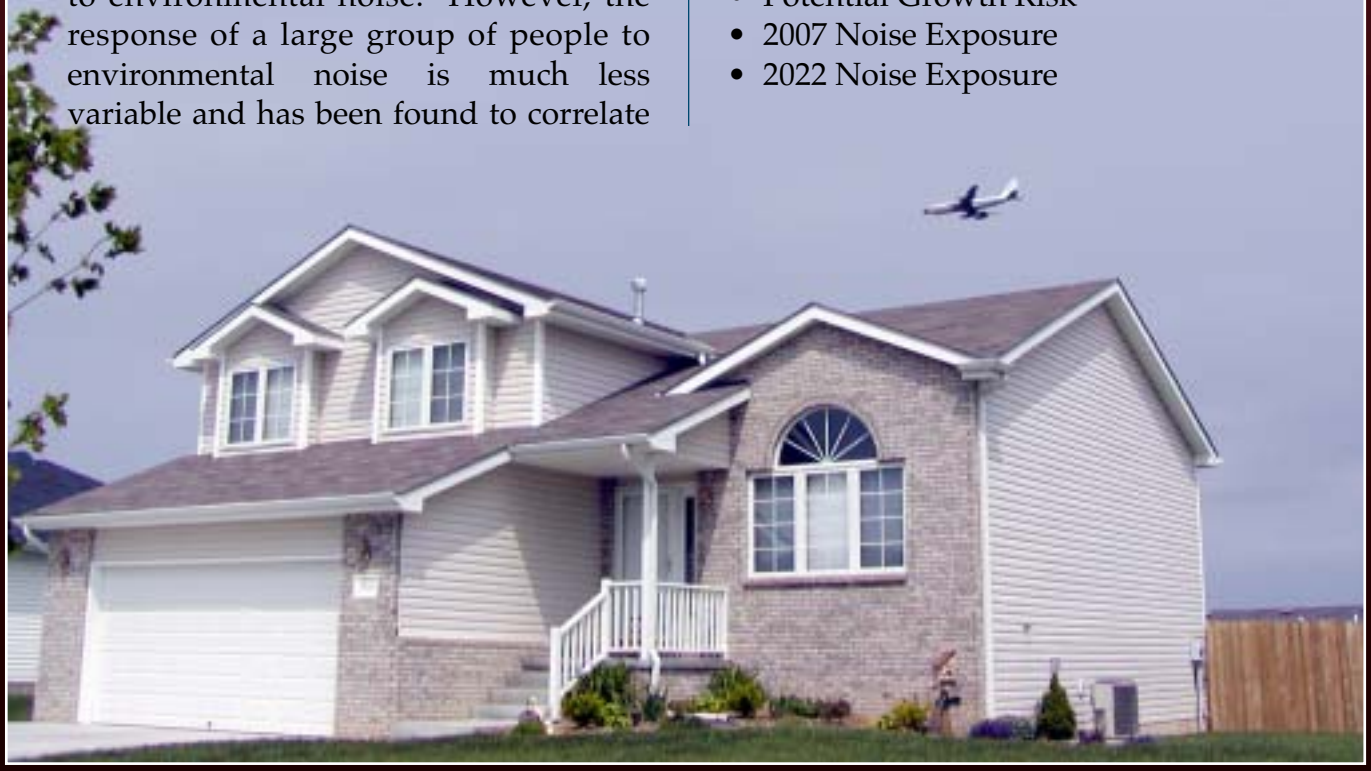
The purpose of this chapter is to examine the impacts of aircraft noise on existing and future land use and population within the study area. The effects of noise on people can include hearing loss, other ill health effects, and annoyance. While harm to physical health is generally not a problem in neighborhoods near airports, annoyance is a common problem. Annoyance can be caused by sleep disruption, interruption of conversations, interference with radio and television listening, and disturbance of quiet relaxation.

Individual responses to noise are highly variable, thus making it very difficult to predict how any person is likely to react to environmental noise. However, the response of a large group of people to environmental noise is much less variable and has been found to correlate well with cumulative noise metrics such as DNL. The development of aircraft noise impact analysis techniques has been based on this relationship between average community response and cumulative noise exposure.

For more detailed information on the effects of noise exposure, refer to the ***Technical Information Paper (T.I.P.), Effects of Noise Exposure***.

The major sections in this chapter include the following:

- Land Use Compatibility
- Noise Complaints
- Current Noise Exposure
- Potential Growth Risk
- 2007 Noise Exposure
- 2022 Noise Exposure



LAND USE COMPATIBILITY

The degree of annoyance which people suffer from aircraft noise varies depending on their activities at any given time. People rarely are as disturbed by aircraft noise when they are shopping, working, or driving as when they are at home. Transient hotel and motel residents seldom express as much concern with aircraft noise as do permanent residents of an area.

The concept of "land use compatibility" has arisen from this systematic variation in human tolerance to aircraft noise. Studies by governmental agencies and private researchers have defined the compatibility of different land uses with varying noise levels. (A review of these guidelines is presented in the ***T.I.P., Noise and Land Use Compatibility Guidelines***.) The Federal Aviation Administration (FAA) has established guidelines for defining land use compatibility for use in Federal Aviation Regulation (F.A.R.) Part 150 studies.

F.A.R. PART 150 GUIDELINES

The FAA adopted land use compatibility guidelines when it promulgated F.A.R. Part 150 in the early 1980s. (The Interim Rule was adopted on January 19, 1981; the Final Rule was adopted on December 13, 1984, was published in the Federal Register on December 18, 1985, and became effective on January 18, 1985.) These new guidelines were based on earlier studies and guidelines developed by federal agencies (Federal Interagency Committee of Urban Noise, 1980). These land use compatibility guidelines are only advisory; they are not regulations. Part 150 explicitly states that determinations of noise compatibility and regulation of land use are purely local responsibilities. (See Section A150.101(a) and (d) and explanatory note in Table 1 of F.A.R. Part 150.) **Exhibit 3A** illustrates the FAA guidelines.

The FAA uses the Part 150 guidelines as the basis for defining areas within which noise compatibility projects may be eligible for federal funding through the noise set-aside funds of the Airport Improvement Program (AIP). In general, noise compatibility projects must be within the 65 DNL contour to be eligible for federal funding. According to the AIP Handbook, "Noise compatibility projects usually must be located in areas where noise measured in day-night average sound level (DNL) is 65 (dB) or greater." (See FAA Order 5100.38A, Chapter 7, paragraph 710.b.) Funding is permitted outside the 65 DNL contour only where the airport sponsor has determined that non-compatible land uses exist at lower levels and the FAA has explicitly concurred with that determination.

The FAA guidelines outlined in **Exhibit 3A** show that residential development, including standard construction (residential construction without special acoustical treatment), mobile homes and transient lodging, are incompatible with noise above 65 DNL. Homes of standard construction and transient lodgings may be considered compatible where local communities have determined these uses are permissible;

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
COMMERCIAL USE						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally-determined land uses for those determined to be appropriate by local authorities in response to locally-determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

Lincoln Airport

Exhibit 3A
LAND USE COMPATIBILITY GUIDELINES

KEY

Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor-to-indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

1 Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2 Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

3 Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

4 Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

5 Land use compatible provided special sound reinforcement systems are installed.

6 Residential buildings require a NLR of 25.

7 Residential buildings require a NLR of 30.

8 Residential buildings not permitted.

Source: ***F.A.R. Part 150***, Appendix A, Table 1.

however, sound insulation measures are recommended. Schools and other public use facilities are also generally incompatible with noise between 65 DNL and 75 DNL, but, again, the guidelines note that, where local communities determine that these uses are permissible, sound insulation measures should be used. Other land uses considered incompatible at levels greater than 65 DNL include outdoor music shells and amphitheaters.

Land uses considered incompatible at levels above 75 DNL include hospitals, nursing homes, places of worship, auditoriums, concert halls, livestock breeding, amusement parks, resorts, and camps. Many of these incompatible land uses are considered compatible in areas subject to noise between 65 DNL and 75 DNL if prescribed levels of noise level reduction can be achieved through sound insulation. These include hospitals, nursing homes, places of worship, auditoriums, and concert halls.

Historic properties are identified in compliance with F.A.R. Part 150, Section 4(f) of the *Department of Transportation Act* (DOT Act), and the *National Historic Preservation Act of 1966*, as amended. In general, these properties are not any more sensitive to noise than are other properties of the same use; however, these federal regulations require that noise effects on these properties be considered when evaluating the effects of an action, such as a noise abatement or land use management procedure.

The strictest of these requirements is the DOT Act. Section 4(f) of the DOT Act provides that the U.S. Secretary of Transportation shall not approve any program (such as a Noise Compatibility Plan) or project which requires the use of any historic site of national, state, or local significance unless there is no feasible and prudent alternative to the use of such land. The FAA is required to consider both the direct physical taking of eligible property (such as acquisition and demolition of historic structures) and the indirect use of or adverse impact to eligible property (such as the 65 DNL noise contour). When evaluating the affects of the noise abatement and land use management alternatives later in this report, it is necessary to also identify whether the proposed action conflicts with or is compatible with the normal activity of aesthetic value of any historical properties not already significantly affected by noise. The Noise Exposure Map (NEM) contours are not evaluated under Section 4(f).

Land Use Guidelines
At Lincoln Airport

For purposes of the F.A.R. Part 150 Noise Compatibility Study at Lincoln, the FAA's land use compatibility guidelines will be used as the basis for making determinations about land use compatibility in the airport area.

While the FAA considers the 65 DNL as the threshold of significant impact on noise-sensitive uses, the noise analysis at Lincoln Airport goes down to the 60 DNL level. This is partly in response to a federal report which has recommended the need to examine

potential noise impacts below 65 DNL in environmental documents where significant increases in noise may be expected (FICON, 1992, p. 3-5) and partly in response to local experience. Local noise complaint history indicates that residents outside of the 65 DNL noise contour are annoyed by existing aircraft noise levels (noise complaint characteristics will be reviewed in the next section).

For purposes of this Part 150 Study, Lincoln Airport is considering noise between 60 and 65 DNL to have a marginal effect on the following noise-sensitive land uses.

- Residential, including mobile home parks;
- Schools;
- Hospitals and nursing homes;
- Churches, auditoriums, and concert halls;
- Outdoor music shells and amphi-theaters.

While research has shown that significantly fewer people are affected as noise decreases below 65 DNL, aircraft noise continues to be a problem for at least some people at even extremely low DNL levels. This is indicated in the two graphs illustrated on **Exhibit 3B** relating to annoyance with DNL levels. (Also see the T.I.P., Noise and Land Use Compatibility Guidelines.)

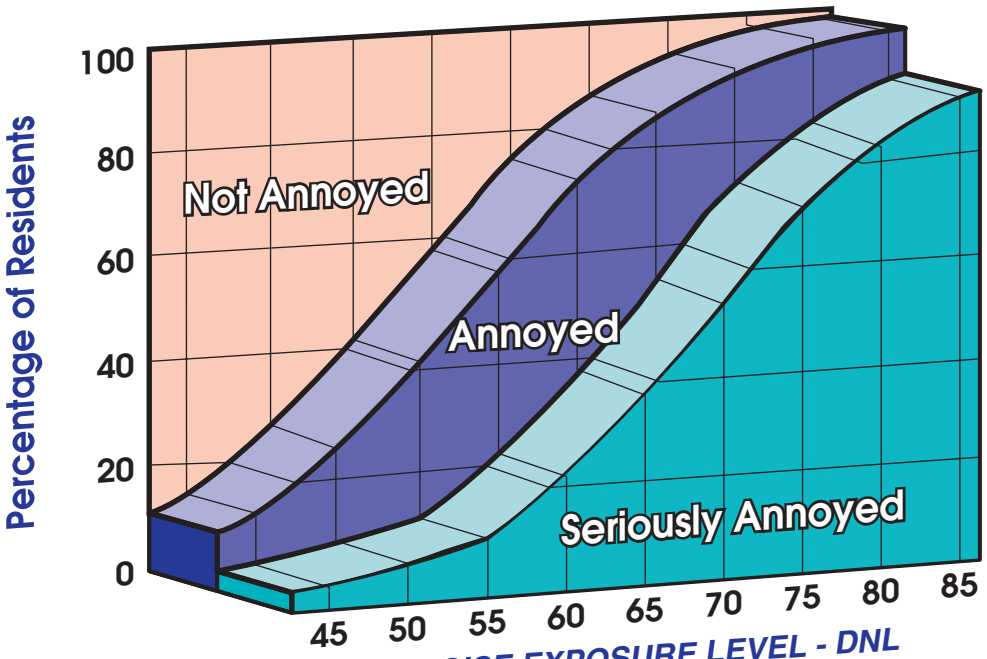
NOISE COMPLAINTS

Before assessing the exposure of local land use and population to existing aircraft noise levels, recent noise complaints and the methods for receiving complaints should be evaluated. By themselves, complaints cannot be taken as a complete assessment of a noise problem at an airport. Many unpredictable variables can influence whether a person chooses to file a noise complaint. Many people, who are annoyed, may find it inconvenient or intimidating to call and complain. Others, who decide to complain, may be unusually sensitive to noise or may be especially anxious about aircraft overflights. Unusual events, rather than a long-term situation, may also stimulate a complaint. Despite the limits of complaint information, it can aid in understanding the geographic pattern of concern about the noise created by the use of the airport.

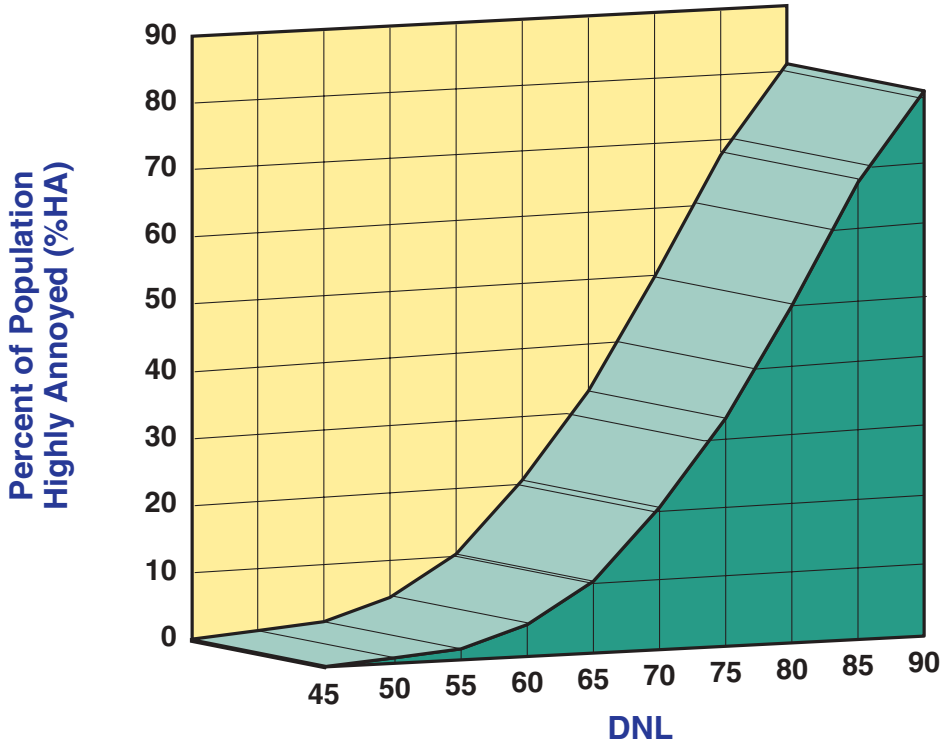
Exhibit 3C depicts the history of noise complaints received by the airport since 1995. As depicted on the exhibit, the number of complaints has decreased dramatically since 1995. The majority of noise complaints received by Lincoln Airport were the result of military aircraft utilizing the airport.

After reviewing the addresses of those individuals that lodge complaints, it was determined that most of the individuals lodging noise complaints reside outside of the 65 DNL noise contour.

In 2002, the airport began receiving a number of complaints regarding noise created by aircraft run-up activities. Run-ups are a part of aircraft maintenance and are necessary to



Source: Richards and Ollerhead 1973, p.31



Equation for Curve: $\%\ HA = \frac{100}{1 + e\ (11.13 - .14\ Ldn)}$

Source: Finegold et al. 1992 and 1994.

UPDATED SCHULTZ CURVE

Lincoln Airport

Exhibit 3B

ANNOYANCE CAUSED BY AIRCRAFT NOISE IN RESIDENTIAL AREAS

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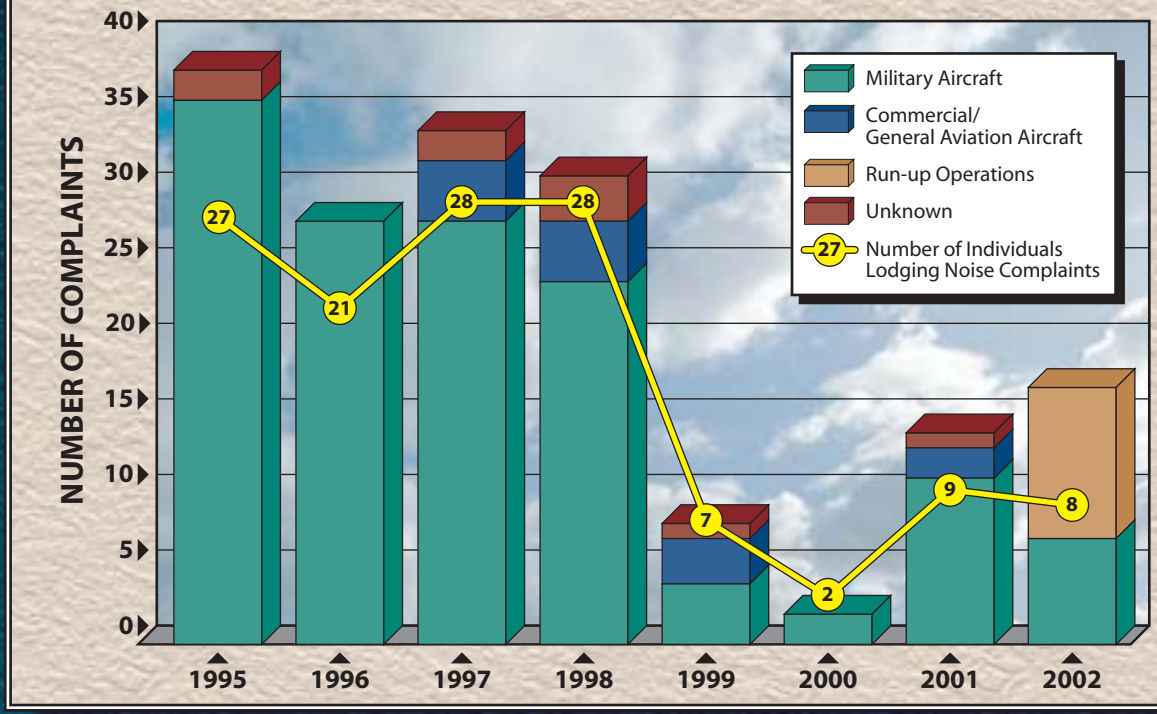
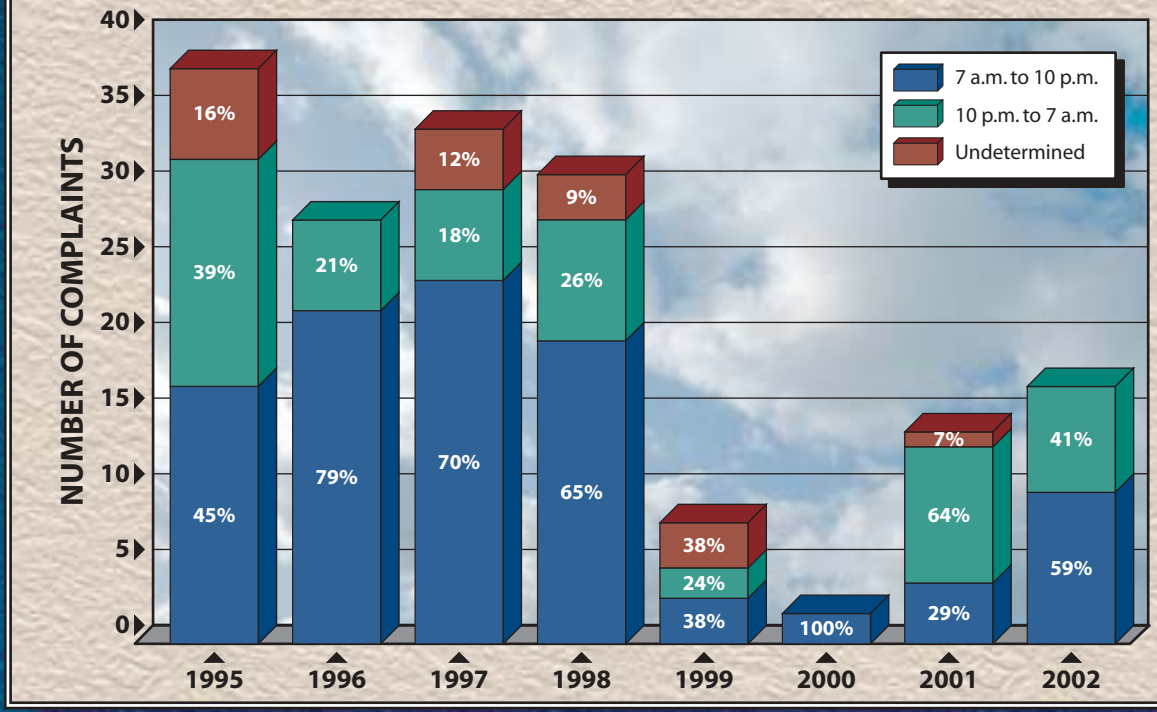
NOISE COMPLAINTS (by type)



NOISE COMPLAINTS (by time-of-day)



Lincoln Airport

Exhibit 3C
NOISE COMPLAINT HISTORY

ensure the safety of aircraft which have been modified or repaired. Prior to the spring of 2001, run-ups occurred on a run-up pad located near the west apron. Since that time, these activities have been allowed to occur on the north end of the east apron, primarily due to construction activities on crosswind Runway 14-32. This change in the location of run-up activities is most likely the cause for the increased number of noise complaints due to run-up activities.

For the filing of noise complaints, staff from Lincoln Airport are available 24 hours per day to receive complaints.

CURRENT NOISE EXPOSURE

This section describes the exposure of existing land uses and population as they relate to the 2002 noise contours. For the purposes of this study, noise in excess of 60 DNL will be discussed for the purposes of evaluating future land use planning alternatives. It must be noted that only noise-sensitive land uses within the 65 DNL contour will be eligible for federal funding assistance.

LAND USES EXPOSED TO 2002 NOISE

The location of existing noise-sensitive land uses, in relation to the 2002 noise contours at Lincoln Airport, is shown on **Exhibit 3D**. Noise-sensitive land uses shown on the exhibit are based on F.A.R. Part 150 land use compatibility guidelines and include uses considered incompatible with noise above 65 DNL and marginally incompatible with noise above 60 DNL.

Contour Descriptions

The shape and extent of the contours reflect the underlying flight track assumptions. As indicated on the exhibit, the primary runway, Runway 17R-35L, accommodates the majority of traffic at Lincoln Airport. A number of bulges within the contour set are due to training and maintenance activity at the airport. For example, the bulge east of Runway 17L-35R is due to maintenance runup activities performed by the fixed base operators at the airport. The slight bulge west of the south end of Runway 17R-35L is due to military training activities. The bulge on the east side of the south end of Runway 17L-35R is caused by aircraft turning over the lake as well as the presence of the parallel runway system.

The 60 DNL contour at its longest point extends to the north, approximately 16,000 feet from airport property, over scattered single-family residences, agricultural land, and industrial properties. The contour is "forked" due to the differentiation between traffic traveling due north versus to the northeast. To the south, the contour also extends approximately 16,000 feet over residential, commercial, and industrial property. The contour slightly extends off airport property in all other directions, primarily mirroring runway use at the airport with slight bulges due to military and maintenance activities as discussed previously.

The 65 DNL noise contour is smaller than the 60 DNL contour. The shape of the 65 DNL contour is similar to that of the 60 DNL contour, other than that the "fork" in the 60 DNL contour south of the airport is no longer as prevalent. To the north, the 65 DNL contour, at its longest point, extends approximately 7,500 feet from airport property. To the south, the contour extends approximately 8,000 feet, terminating at West A Street. The contour slightly extends off airport property in all other directions.

The 70 DNL noise contour extends approximately 1,800 feet off airport property to the north and 3,000 feet off airport property to the south. In all other directions, the contour primarily remains on airport property. The 75 DNL contour is completely contained on airport property.

2002 Land Use Impacts

The number of dwelling units within each noise contour range is determined by computer-generated counts based on an underlying housing database. (Dwelling units, for the purposes of this study, include single family homes, mobile homes, and apartment and condominium units.) This database was developed with the use of geographical information system (GIS) data provided by the Lincoln/Lancaster County Planning Department, aerial photography taken in July 2002, and field surveys conducted in May 2002. The location and number of noise-sensitive institutions were derived from the GIS data and notations made during the May 2002 field survey.

To determine the presence of historical or archaeological sites within the study area, the National Register of Historic Places was consulted. It was determined that one historic structure, located west of the airport, is present within the study area.

The 2002 land use impacts are summarized in **Table 3A** and described below.

A total of 444 dwelling units are located within the 60 DNL noise contour. The majority of these dwelling units are located within the 60 to 65 DNL contour which has a total of 433 dwelling units including five apartment buildings and 298 homes, mobile homes, and townhomes. Within the 65 to 70 DNL contour are 11 dwelling units which consist of five single-family homes and six mobile homes. No dwelling units are found within the 70 DNL contour.

The majority of the dwelling units affected by noise are found to the north, southeast, and south of the airport. To the east and west of the airport, no dwelling units are contained within the noise contours. The dwelling units contained within the 65 to 70 DNL contour are found primarily north and south of the airport along NW 27th Street as depicted on **Exhibit 3D**. No noise-sensitive institutions are contained within the various noise contours.

01SP21-3D-05/29/02

N 1st St.
NW 12th St.
W. McKelvie Rd.
NW 27th St.
NW 40th St.
NW 56th St.
NW 12th St.
W. Cornhusker Hwy
S. Folsom St.
S. Coddington Ave.
W. Vine St.
W O St
W A St.
SW 40th St.
NW 48th St.
W. Holdrege St.
W. Fletcher Ave.
W. Adams Rd.
W. VanDorn St.
SW 56th St
70
65
60
75

LEGEND

- Airport Property
- Municipal Boundaries
- Extra-territorial Jurisdiction
- Railroad Tracks
- Study Area
- 2002 Noise Exposure Contour, Marginal Effect
- 2002 Noise Exposure Contour, Significant Effect
- Low Density Residential (0-3 du/ac)
- Medium Density Residential (3.1-10 du/ac)
- High Density Residential (10.1+ du/ac)
- Floodplains
- Noise Sensitive
- School
- Planned School
- Library
- Historic Structures
- Places of Worship

Source: Base Information and Map: City of Lincoln Geographic Information System, May 2002. Coffman Associates Analysis.

NORTH

0 4000
SCALE IN FEET

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Exhibit 3D
2002 NOISE EXPOSURE CONTOUR WITH LAND USE