

Airport Land Use Compatibility

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Introduction: Objectives

- Explain why noise is a problem
- Identify methods to define the extent of the noise problem at an airport
- Identify measures to address the noise problem
 - Airport
 - Land Use

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Why Is Noise a Problem?

- Impacts on humans
 - Health
 - Annoyance
- Impacts on airports
 - Restricts use
 - Inhibits expansion

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Background on Noise

Source: Ted Woosley Landrum & Brown, 2001

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What is Noise?

- Noise is unwanted sound
- Noise is temporary
- Annoyance is subjective

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Perception of Sound

- How people perceive sound depends on several measurable physical characteristics of the sound:
 - **Intensity**
 - **Frequency Content**
 - **Changes in Sound Pressure Level**
 - **Rate of Change in Level**

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deciBels

- Decibels (dB) are the unit of measurement on the loudness scale
- The decibel scale is logarithmic, not linear
 - Smallest detectable change = 1 dB
 - 3 dB is readily detectable
 - 10 dB seems twice as loud

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Comparative Noise Levels (dB)

Saturn rocket	200
Walkman ½ volume	94
MD80 takeoff - 1,500 ft. altitude	85
dialtone	80
talking at 3 feet	65
quiet urban daytime	50
quiet urban nighttime	40
quiet rural nighttime	25

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"Rules of Thumb"

- 3 dB is noticeable to most people
- Adding two like sounds adds 3 dB increase
- Double or half the airport operations= +/- 3 dB
- 10 dB sounds twice as loud or twice as quiet
- Double or half the distance equates to 6 dB
- Using DNL, 1 night flight=10 day flights

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Noise Metrics

- Lmax - Maximum noise level
- SEL - Sound exposure Level
- Leq - Equivalent Sound Level
- DNL - Day-night average sound level

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DNL Day-Night Average Sound Level

- DNL is a 24-hour time-averaged sound exposure level with a 10 dB nighttime (10p-7a) weighting.
- $DNL = \frac{\text{Total Daytime Sound Energy} + 10 \times \text{Total Nighttime Sound Energy}}{\text{Time (in seconds)}}$
- DNL is the metric of choice in the airport world. It is used to define noise contours of equal exposure.
- All Federal agencies have adopted DNL as the metric for airport noise analysis.

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How Do You Define the Noise Problem?

- Establish noise impact area through generation of noise contours
- Identify overflight areas
- Record and plot location of noise complaints

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Integrated Noise Model (INM) and Noise Contours

- Required for calculation of aircraft noise contours in studies seeking to make noise mitigation eligible for AIP and PFC funding

Ingredients – INM

- Airport information - runways, temperature, airport altitude
- Where aircraft fly - flight tracks (definitions and usage)
- What aircraft are flown - fleet mix data
- How often they fly - operations levels – day/night (night=10dB penalty with DNL)
- What engines are used - hush kit information
- Where they fly from - runway usage
- When they fly - time-of-day characteristics
- How they are flown - climb/descent profiles
- Where they fly to - performance data
- Output includes Noise contours connecting points of equal noise exposure (typically 65, 70, 75 DNL), Tabular information, Noise levels at specific locations (grid point analysis)

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Use of Noise Monitoring

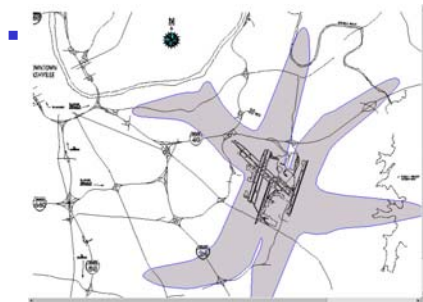
- Identifies more precisely existing noise environment
- Used to validate/calibrate noise contours

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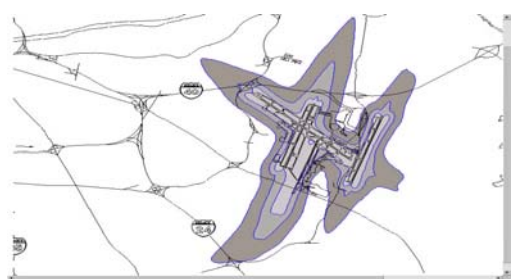
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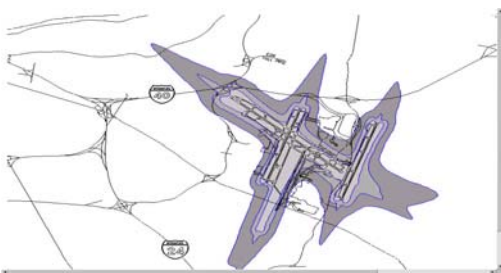
Nashville Noise Contours 1993



Nashville Noise Contours 1996



Nashville Noise Contours 2001



Palwaukee Noise Contours

[Noise Abatement Alternatives Issues and Actions \(NAAIA\)](#)

The following maps show the existing DNL noise contours and the 2005 Base Case DNL noise contours.



Issues Associated with Noise Contours

- What threshold should be used to define the problem?
 - 65 DNL
 - 60 DNL
 - 55 DNL
- What assumptions should be used to develop them
 - Use an average day over course of year
 - Use average flying day
 - Use peak flying day

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Issues Associated with Noise Contours (continued)

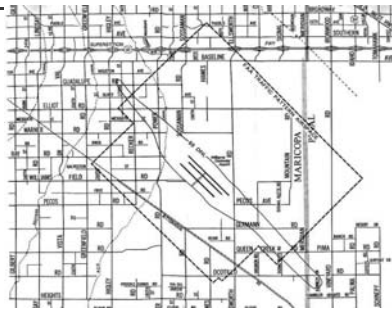
- Cumulative Noise Contours do Not Reflect Annoyance associated with single events
- Noise contours do not necessarily reflect areas subjected to overflights

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Identify Aircraft Overflight Areas



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Identify Noise Complaints

- 2000 - 2,951 by 354 people
- 2001 - 22,033 by 672 people



What Do You Do to Address the Noise Problem

- Control the aircraft noise
- Change the land use
- Some combination of the above

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Control the Noise

- Limit use of the airport
- Design airport to minimize noise problems
- Impose aircraft operational changes

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Limit Use of Airport

- Noise abatement flight routes for noisier aircraft
- Capacity restrictions
- Aircraft weight restrictions
- Prohibition of intersection departures
- Nighttime curfews
- Engine run-up restrictions
- Landing fees tied to noise

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Design Airport to Minimize Noise Problems

- Displaced thresholds
- Runway orientation
- Runway extensions
- Noise suppression equipment\
- Navigational aids
- Location of engine run-up areas

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Impose Aircraft Operational Procedure Changes

- Reduced thrust departures
- Thrust cutbacks after departure
- Maximum climb departures
- Raised pattern altitudes
- Minimum helicopter altitudes

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Control the Land Use

- Regulatory techniques
 - Zoning
 - Building code modifications
 - Subdivision regulations
 - Fair disclosure rules
- Policy Techniques
 - Comprehensive planning
 - Capital improvement programming
 - Planning commission review

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Control the Land Use (cont.)

- Expenditure and incentive techniques
 - Public acquisition of land
 - Purchasing easements
 - Soundproofing

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