14 CFR Part 150 Study

NOISE EXPOSURE MAP
and
NOISE COMPATIBILITY PROGRAM
Volume I

Prepared for:

CONNECTICUT DEPARTMENT OF TRANSPORTATION

Prepared by:

HNTB Corporation
In association with
HMMH Inc.
Elvin Strategic Writing

August 2004

CERTIFICATION

This is to certify the following:

(1) that the Noise Compatibility Program, Noise Exposure Maps, and associated documentation for Bradley International Airport submitted in this volume to the Federal Aviation Administration under 14 Code of Federal Regulations Part 150, Subpart B, Section 150.21, are true and complete under penalty of 18 U.S.C Part 1001; Part 150, Subpart B, Section 150.21, are true and complete under penalty of 18 U.S.C. Part 1001.

(2) all interested parties have been afforded opportunity to submit their views, data, and comments concerning the correctness and adequacy of the revised existing and forecast conditions noise exposure map, and of the descriptions of forecast aircraft operations; and

(3) the proposed Noise Compatibility Program elements are recommended by the Connecticut Department of Transportation and not by a consultant or other third party.

By: Louis S. Cutillo

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Title: Deputy Commissioner
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Date: 9/20/04

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14 CFR PART 150 STUDY
NOISE EXPOSURE MAP AND NOISE COMPATIBILITY PROGRAM
EXECUTIVE SUMMARY
February 2004

The 14 CFR Part 150 Study examines noise and land use around Bradley International Airport and proposes a Noise Compatibility Plan (NCP) to improve conditions for people who live and work near the airport.

ConnDOT, which operates Bradley International, began the study in 1999. The events of September 11, 2001, affected the aviation industry significantly, with resulting impacts on aircraft fleet mixes and operations at airports around the world, including Bradley International. The study was revised during 2002 and 2003 to reflect the most recent aviation industry trends and economic assumptions.

One significant post-9/11 change is the decision of many airlines to accelerate the retirement of older, noisier Stage 1 and 2 aircraft. As a result, the proportion of quieter "true" Stage 3 aircraft at Bradley has risen from 75% to 89%. This greater percentage of quieter aircraft, combined with a 20-30% decrease in operations at the airport, has improved the overall noise environment since the study began, reducing the size of the original noise contours.

Operational measures were analyzed to potentially reduce population within the 65 DNL contour. Per Technical Advisory Committee request, the Study considered, where possible, reductions within the 60 DNL contour. The Study includes minimal changes to operations.

The Study presents current and future land uses in communities around the airport and assesses the compatibility of that land use with the current and probable future noise levels. The Study uses this assessment to formulate a realistic plan for land use measures. The land use measures are combined with noise abatement measures to reduce noise and its impacts on people where possible.

The two central components of a Part 150 Study are:

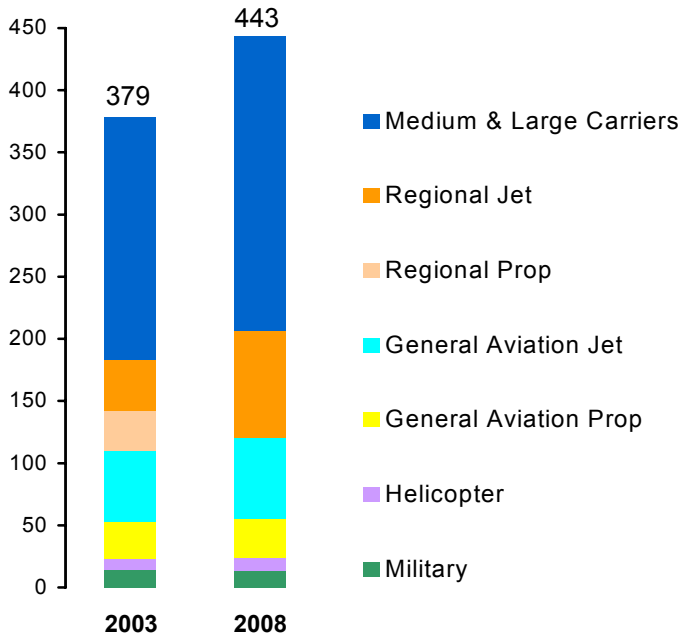
- Noise Exposure Maps (NEMs) for existing (2003) and future (2008) years.
- The recommended Noise Compatibility Plan (NCP).

There are many ways to measure "noise" (usually defined as unwanted sound); however, the federal agencies that will evaluate this study are required to use the Day-Night Average Sound Level, or DNL, as the basis of their assessments.

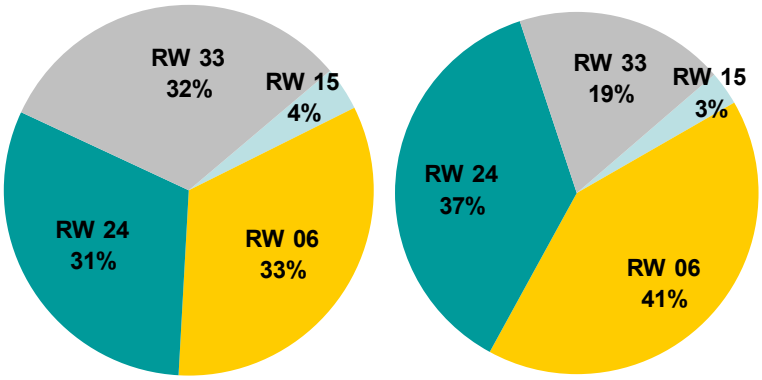
Aircraft Fleet Mix and Operations

A variety of aircraft operate regularly at Bradley. This combination of aircraft is known as the airport fleet mix. An aircraft operation is defined as a departure or arrival on any of the airport's four runways (6, 15, 24 and 33).

Bradley International Airport Fleet Mix for 2003 (actual) and 2008 (forecast)
(Annual Average Day)



BDL Average Daily Runway Use 2003 and 2008



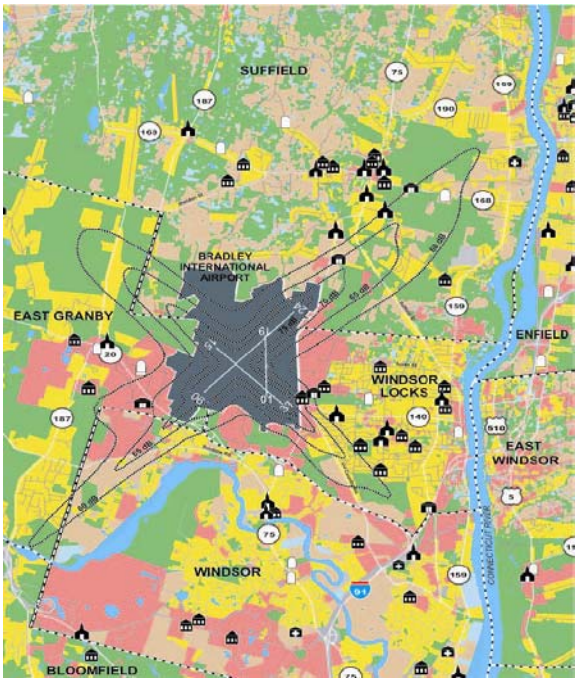
The fleet mix, operations and runway use information shown previously, as well as radar tracks and other information, are entered into the Integrated Noise Model (or INM, the model that generates the noise contours presented in the study). The INM accounts for variations in aircraft noise due to seasonable variations in weather, different models of aircraft being flown and the cumulative impacts that noise from multiple flight tracks may have over a single geographic area.

Noise Exposure

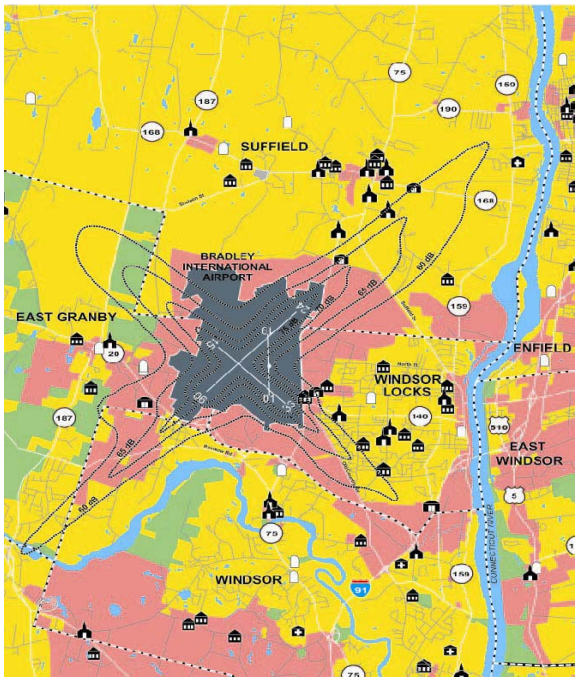
Because a person's home tends to be the place where unwanted sound has the greatest impact on quality of life, the Part 150 Study focuses on reducing and mitigating noise in residential areas. Residential areas are shown in yellow in the graphics that follow.

The INM-generated noise contours surrounding the airport are also shown on the Noise Exposure Maps (NEMs) below. It should be noted that the 2008 future land use map illustrates the allowable future land use and these land uses may not represent the conditions that will exist by 2008.

2003 Existing Land Use and Noise Contours



2008 Future Land Use and Noise Contours



Existing (confirmed May 2002)

748 people within 65 dB DNL
327 dwellings within 65 dB DNL

2,981 people within 60 dB DNL
1,207 dwellings within 60 dB DNL

5 noise-sensitive locations within 60 dB DNL
0 noise-sensitive locations within 65 dB DNL

Future (with no noise mitigation)

Up to 2,247 people within 65 dB DNL
Up to 879 dwellings within 65 dB DNL

Up to 8,217 people within 60 dB DNL
Up to 3,193 dwellings within 60 dB DNL

5 noise-sensitive locations within 60 dB DNL
0 noise-sensitive locations within 65 dB DNL

The 65 dB DNL is the federally defined threshold level at which aircraft noise begins to interfere with everyday activities, such as talking on the phone or watching TV. The yellow areas of the maps that are within the 65 dB DNL contour are the areas in which land use and noise abatement measures would likely have the most benefit. These are the areas in which elements of the Noise Compatibility Plan, such as sound

insulation, would be eligible for federal participation.

The Noise Compatibility Plan (NCP)

The proposed Noise Compatibility Plan (NCP) consists of ten measures to improve the compatibility of land use in noise-affected areas, two measures to reduce (abate) aircraft noise and five measures to provide ongoing monitoring and improvements to the noise environment.

NCP Land Use Measures

Seven of the ten recommended land use measures would help prevent residential development and land use near the airport that is not compatible with existing and future noise levels.

Preventive Land Use Measures Recommended:

- Zoning for compatible use.
- Amend state building codes to ensure interior noise reduction.
- Fair disclosure policy for residential real estate transactions.
- Purchase of Undeveloped Land.
- Purchase of Development Rights.
- Avigation Easements (release of litigation rights).
- Airport Noise Overlay Zone (combination of the preventative measures listed above). This measure is recommended for inclusion in the NCP as guidance and consideration by Capital Region Council of Governments (CRCOG) for statewide long-term planning.

The remaining three measures would help correct land use that is not compatible with existing noise levels.

Corrective Land Use Measures Recommended:

- Property Purchase Assurance Program.
- Purchase of Non-Compatible Land.
- Sound Insulation Program for residences, schools and eligible public buildings.

NCP Noise Abatement Measures

The study evaluated some 152 alternatives and existing noise abatement procedures to assess the potential noise-reduction benefits of modifying current aircraft operations. The primary evaluation criteria were the potential to reduce the number of people exposed to noise most specifically within the 65 dB DNL, as well as safety, operational feasibility, cost and the concerns of the public, airport tenants and agencies.

The alternatives evaluated included preferential runway use, rotational runway use, preferential flight tracks for departures and arrivals, noise abatement departure profiles (NADPs), arrival profiles, restrictions on excessively noisy aircraft and helicopter restrictions.

Of these, only the preferred use of different departure flight tracks on Runways 15 and 33 offered significant potential benefits for improving the noise environment. These departure tracks are recommended in the NCP and noted as “Recommended” in the table on page ES-5. For Runways 06 and 24, all of the alternatives to existing departure tracks would have increased the number of people exposed to the 90 dB SEL noise contours.

Noise Abatement: Preferred Departure Track Analysis Summary

Runway	Departure Track	Destination	Reduction in People Exposed to 90 dB SEL	Status
06	06CTR	north	*No reduction*	*No change recommended*
	06ORW	south	*No reduction*	*No change recommended*
	06PWL	west	*No reduction*	*No change recommended*
24	24CTR	north	*No reduction*	*No change recommended*
	24ORW	south	*No reduction*	*No change recommended*
	24PWL	west	*No reduction*	*No change recommended*
15	15DP4	north	-450	Recommended
	15DP6	south	-650	Recommended
	15DP5	west	-670	Recommended
33	33DP8	north	-30	Recommended
	33ORW1	south	*No reduction*	*No change recommended*
	33PWL	west	*No reduction*	*No change recommended*

NCP Continuing Program Measures

The NCP includes five continuing program measures geared to provide ongoing support and improvements to ConnDOT's aircraft noise mitigation efforts at Bradley International:

- Public information program (newsletter, website, complaint response).
- Airport Noise Committee (community, airport, and agency members).
- Operations and Noise Monitoring System (field sensors and "real time" capability).
- Periodic Evaluation of Noise Exposure levels.
- Noise Abatement Officer.

Technical Advisory Committee Feedback on the NCP

The TAC reviewed the draft NCP on September 26, 2003. Their comments are summarized on ES-6.

Public Hearing and Next Steps

The Draft Part 150 Study was distributed for public review to town halls and libraries of the towns surrounding Bradley International Airport in October of 2003. ConnDOT held a public hearing on the Draft Part 150 Study on November 20, 2003. Approximately 210 residents of the towns surrounding the airport attended the hearing.

Following the public hearing, ConnDOT reviewed and responded to comments received and prepared the Final Part 150 Study for submittal to the Federal Aviation Administration (FAA) in February of 2004. The FAA will then make a determination on the NEMs and NCP within 180-days after acceptance of the Noise Exposure Maps. ConnDOT will then begin the application process for federal support of NCP measures approved by the FAA.

Technical Advisory Committee Input on Draft NCP Measures

Land Use Measures	**Consensus**	
LU-1 Zoning for compatible use	Yes	
LU-2 Amending building codes	Yes	
LU-3 Fair disclosure policy	Yes	
LU-4 Purchase undeveloped land	Yes	
LU-5 Purchase development rights	Yes	
LU-6 Avigation easements	Yes	
LU-7 Airport noise overlay zone	Yes	
LU-8 Property purchase assurance	Yes	
LU-9 Purchase non-compatible land	Yes	
LU-10 Sound insulation program	Yes	
Noise Abatement Measures		
NA-1 Preferential departure flight tracks	Yes	*on Runways 06, 15 and 33*
NA-2 Distant NADP	Yes	
Continuing Program Measures		
CP-1 Public information program	Yes	
CP-2 BDL Airport noise committee	Yes	
CP-3 Operations and noise monitoring	Yes	
CP-4 Periodic noise evaluation	Yes	
CP-5 Noise abatement officer	Yes	

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Chapter One
INTRODUCTION

This document presents aircraft noise and land use compatibility plans for Bradley International Airport (BDL) developed in accordance with Title 14 of the Code of Federal Regulations Part 150 (14 CFR Part 150), "Airport Noise Compatibility Planning." Although the Connecticut Department of Transportation (ConnDOT) completed a Noise Abatement Plan in 1981, this study is the first Part 150 study conducted at BDL. The intent of this study is to produce a 14 CFR Part 150 noise compatibility plan to help alleviate noise impacts to the surrounding communities.

This chapter provides an introduction to 14 CFR Part 150 in Section 1.1, a summary of study goals in Section 1.2, and a summary of project roles and responsibilities in Section 1.3.

Chapter Two discusses noise and its effect on people. **Chapters Three and Four** present the existing and forecasted flight operations and land use, respectively. **Chapter Five** presents noise abatement measures evaluated during this study, while **Chapter Six** discusses land use measures. **Chapter Seven** presents the Noise Exposure Maps and recommended Noise Compatibility Program. **Chapter Eight** includes the record of consultation. As listed in the Table of Contents, **Appendices A through H** provide supporting material relevant to this document.

1.1 14 CFR PART 150

Part 150 sets forth standards for airport operators to use in documenting noise exposure in the airport environs and establishing programs to minimize noise-related land use incompatibilities. Part 150 prescribes specific standards for:

- measuring noise;
- estimating cumulative noise exposure using computer models;
- describing noise exposure (including instantaneous, single event, and cumulative levels);
- coordinating Noise Compatibility Program (NCP) development with local land use officials and other interested parties;
- documenting the analytical process and development of the compatibility program;
- submitting documentation to the Federal Aviation Administration (FAA);
- FAA and public review processes; and
- FAA approval or disapproval of the submission.

A full Part 150 submission to the FAA consists of two basic elements: a Noise Exposure Map (NEM) and a Noise Compatibility Program (NCP).

1.1.1 Noise Exposure Maps

The FAA has developed checklists for their use in review of Noise Exposure Map and Noise Compatibility Program Submittals. Appendix A provides copies of these checklists. The checklists include specific

page and section references indicating the locations where this document addresses the required items.

The NEM describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting noise/land use compatibility situation. The NEM includes graphic depictions of existing and future noise exposure resulting from aircraft operations, and of land uses in the airport environs. The NEM documentation must describe the data collection and analysis undertaken in its development.

The submission year for this Part 150 Study is 2003. This study was originally started in June 1999; however it was determined in early 2000 that adjustments to the forecast were necessary due to terminal improvements under consideration and design. Therefore the study was shelved for approximately one year during the development of the new forecast. The study was officially restarted in July of 2001 assuming that the study would be completed in late 2001 or early 2002. The study progressed with consideration of land use and noise abatement measures. However, the events of September 11, 2001 reduced operational levels across the county and at BDL. ConnDOT, in coordination with FAA, determined that the forecast levels needed to be reanalyzed to consider the impact of September 11, 2001. The revised forecast was accepted by the FAA in May 2003. As such, the submission includes a 2003 NEM that represents existing noise exposure, and a 2008 NEM that represents 5-year forecast noise exposure.

The existing conditions contours utilized the most current forecast available at the re-start of the study process, including approximately 380 modeled operations per day (based on 12 months of data from March 2002 through February 2003).

1.1.2 Noise Compatibility Program

The NCP is essentially a list of the actions the airport proprietor, airport users, local governments, and the FAA propose to undertake to minimize existing and future noise/land use incompatibilities. The NCP documentation must recount the development of the program, including a description of all measures considered, the reasons that individual measures were accepted or rejected, how measures will be implemented and funded, and the predicted effectiveness of individual measures and the overall program.

Official FAA acceptance of the Part 150 submission and approval of the NCP does not eliminate requirements for the submittal of environmental documentation of any proposed actions pursuant to requirements of the National Environmental Policy Act (NEPA). However, acceptance of the submission is a prerequisite to application for funding of implementation actions.

1.2 STUDY GOALS

A number of goals have been identified to guide the development of a 14 CFR Part 150 document for BDL. These goals include:

- Improve the overall noise environment while not shifting noise from one residential community to another;
- Develop a shared vision of land use compatibility;
- Develop an understanding of probable future noise levels; and
- Develop realistic mitigation plans within the context of Federal regulations and eligibility criteria, financial feasibility,

and fairness to aviation and non-aviation interests.

1.3 PROJECT ROLES AND RESPONSIBILITIES

Several groups had major roles in the Part 150 process, including ConnDOT, the consultant and the FAA. Chapter Eight presents a detailed description of the consultation and community involvement process.

Connecticut Department of Transportation (ConnDOT)

As the "airport operator," ConnDOT has responsibility over the entire Part 150 process, including ultimate responsibility for determining what elements will be included in the NCP when it is submitted to the FAA for review. ConnDOT is also responsible for pursuing implementation of adopted measures.

Consulting Team

ConnDOT has retained a consultant to conduct the technical work required to fulfill the Part 150 analysis and documentation requirements.

The consulting firm of HNTB Corporation (HNTB) has overall project management responsibility for the Part 150 study. Harris Miller Miller & Hanson Inc. (HMMH), and Elvin Strategic Writing (ESW), as subcontractors to HNTB, have responsibility for assisting HNTB with noise-related technical elements.

Federal Aviation Administration

The FAA has ultimate review authority over the noise compatibility program submitted under 14 CFR Part 150 Study. Their review encompasses the details of technical documentation as well as broader issues of safety and constitutionality of recommended noise abatement measures.

FAA involvement includes participation by staff from at least three levels in the agency: (1) local, (2) regional, and (3) national.

The airport's **Air Traffic Control Tower (ATCT)** provides significant input in several areas, including: operational data from their files, judgment regarding safety and capacity effects of alternative noise abatement measures, and input on implementation requirements.

On a regional level, the **FAA's New England Regional Office** also has several roles. The Air Traffic Division staff will support the ATCT role, with final review and decision authority over changes in flight procedures. When ConnDOT submits the Part 150 documentation to the FAA for review, the Regional Office will determine whether or not it satisfies all NEM and NCP requirements, and will conduct the initial FAA review of the NCP submission.

On a national level, the **FAA's Washington headquarters** is responsible for the final review of the NEM and NCP documentation for adequacy in satisfying technical and legal requirements.

Chapter Two
NOISE AND ITS EFFECT ON PEOPLE

Aircraft noise exposure in this document is primarily addressed using the Day-Night Average Sound Level (DNL) metric. This study also involves the use of supplemental noise metrics in addition to DNL to provide comprehensive analysis for quantifying a specific situation. To assist reviewers in interpreting complex noise metrics, this appendix presents an introduction to the relevant fundamentals of acoustics and noise terminology and the effects of noise on human activity.

2.1 NOISE AND ITS METRICS

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in an urban or suburban surrounding, where interstate and local roadway traffic, rail, industrial, and neighborhood sources may also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

A "metric" is defined as something "of, involving, or used in measurement." As used in environmental noise analyses, a metric refers to the unit or quantity that quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics used by individual researchers who have attempted to understand and represent the effects of noise. As a result, literature describing environmental noise or environmental noise abatement has included many different metrics.

Recently, however, various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents. Furthermore, the FAA has specified which metrics, such as DNL, should be used for federal aviation noise assessments.

This section discusses the following acoustic terms and metrics:

- Decibel, dB
- A-Weighted Decibel, dBA
- Maximum Sound Level, L_{max}
- Sound Exposure Level, SEL
- Equivalent Sound Level, L_{eq}
- Day-Night Average Sound Level, DNL
- Time-Above a Specified Level, TA

2.1.1 The Decibel, dB

All sounds come from a sound source—a musical instrument, a speaking voice, or an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in sound waves—tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sound that we

hear without pain has about one trillion times more energy than the quietest sounds we hear. As this range, on a linear scale, is unwieldy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL) and its logarithmic unit of decibel (dB).

SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). Decibels are logarithmic quantities —logarithms of the ratio of the two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs less than or equal to about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they require logarithmic math and not simple (linear) addition and subtraction. For example, if two sound sources each produce 100 dB and are operated together, they produce only 103 dB—not 200 dB as might be expected. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL (of all of the sources combined) increases another three decibels. A ten-fold increase in the number of sources makes the SPL increase by 10 dB. A hundredfold increase makes the level increase by 20 dB, and it takes a thousand equal sources to increase the level by 30 dB.

If one source is much louder than another, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produce 100 dB when operating together. The louder source "masks" the quieter one. But if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level 3 decibels above the sound level of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total.

There are two useful rules of thumb to remember when comparing SPLs: (1) most of us perceive a 6 to 10 dB increase in the SPL to be an approximate doubling of loudness, and (2) changes in SPL of less than about 3 dB are not readily detectable outside of a laboratory environment.

2.1.2 A-Weighted Decibel, dBA

Another important characteristic of sound is its frequency, or "pitch." This is the rate of repetition of the sound pressure oscillations as they reach our ear. Frequency can be expressed in units of cycles per second (cps) or Hertz (Hz). Although cps and Hz are equivalent, Hz is the preferred scientific unit and terminology.

A very good ear can hear sounds with frequencies from 16 Hz to 20,000 Hz. However, most people hear from approximately 20 Hz to approximately 10,000-15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 4,000 Hz. Acousticians have developed and applied "filters" or "weightings" to SPLs to match

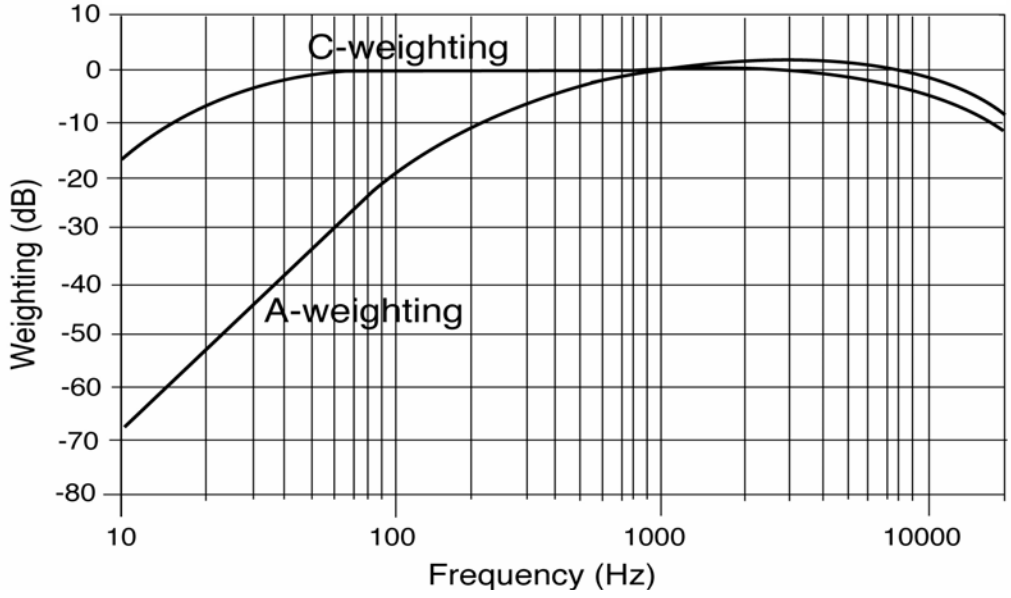
our ears' sensitivity to the pitch of sounds and to help us judge the relative loudness of sounds made up of different frequencies. Two such filters, "A" and "C," are most applicable to environmental noises.

A-weighting significantly de-emphasizes noise at low and high frequencies (below approximately 500 Hz and above approximately 10,000 Hz) where we do not hear as well. The filter has little or no effect at intervening frequencies where our hearing is most efficient. **Figure 2-1** shows a graph of the A-weighting as a function of frequency and its aforementioned characteristics. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged to be louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. Therefore, A-weighted sound levels are normally used to evaluate environmental noise. SPLs measured through this filter are referred to as A-weighted decibels (dBA).

As shown in Figure 2-1, C-weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing the low frequency noise. C-weighted levels are not used as frequently as A-weighted levels, but they may be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, perceptible vibrations, or other factors that can cause annoyance and complaints. Uses include the evaluation of blasting noise, artillery fire, sonic boom, and, in some cases, aircraft noise inside buildings. SPLs measured through this filter are referred to as C-weighted decibels (dBC).

Other weighting networks have been developed to correspond to the sensitivity and perception of other types of sounds, such as the "B" and "D" filters. However, A-weighting has been adopted as the basic measure of community environmental noise by the U.S. Environmental Protection Agency (EPA) and nearly every other agency concerned with aircraft noise throughout the United States.

Figure 2-1
Specification of Sound Level Meters



Source: ANSI S1.4-1983 "Specification of Sound Level Meters"

Figure 2-2 presents typical A-weighted sound levels of several common environmental sources. Sound levels measured (or computed) using A-weighting are most properly called "A-weighted sound levels" while sound levels measured without any frequency weighting are most properly called "sound levels." However, since this document deals only with A-weighted sound levels, the adjective "A-weighted" will be hereafter omitted, with A-weighted sound levels referred to simply as sound levels. As long as the use of A-weighting is understood, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the dB or dBA units.

An additional dimension to environmental noise is that sound levels vary with time and typically have a limited duration, as shown in **Figure 2-3.** For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (although even the background varies as birds chirp, the wind blows, or a vehicle passes by). Sounds can be classified by their duration as continuous like a waterfall, impulsive like a firecracker or sonic boom or intermittent like an aircraft overflight or vehicle passby.

2.1.3 Maximum Sound Level, L_{max}

The variation in sound level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. For the aircraft over-flight event in Figure 2-3, the L_{max} is approximately 67 dBA.

Figure 2-4 shows L_{max} values for a variety of common aircraft from the FAA's Integrated Noise Model database. These L_{max} values for each aircraft type are for aircraft performing a maximum stage (trip) length departure on a day with standard atmospheric conditions at a reference distance of 3.5 nautical miles from their brake release point. Of the dozen aircraft types listed on the figure, the Concorde has the highest L_{max} and the Saab 340 (SF340) has the lowest L_{max}.

The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical maxima may produce very different total exposures. One may be of short duration, while the other may continue for an extended period. The metric, discussed later in this appendix, corrects for this deficiency.

2.1.4 Sound Exposure Level, SEL

A frequently used metric of noise exposure for a single aircraft flyover is the Sound Exposure Level, or SEL. SEL may be considered an accumulation of the sound energy over the duration of an event. The shaded area in **Figure 2-5** illustrates that portion of the sound energy (or "dose") included in an SEL computation. The dose is then normalized (standardized) to a duration of one second. This "revised" dose is the SEL, shown as the shaded rectangular area in Figure 2-5. Mathematically, the SEL represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For events that last more than one second, SEL does not directly represent the sound level heard at any given

Figure 2-2
Sound Levels of Typical Noise Sources (dBA)

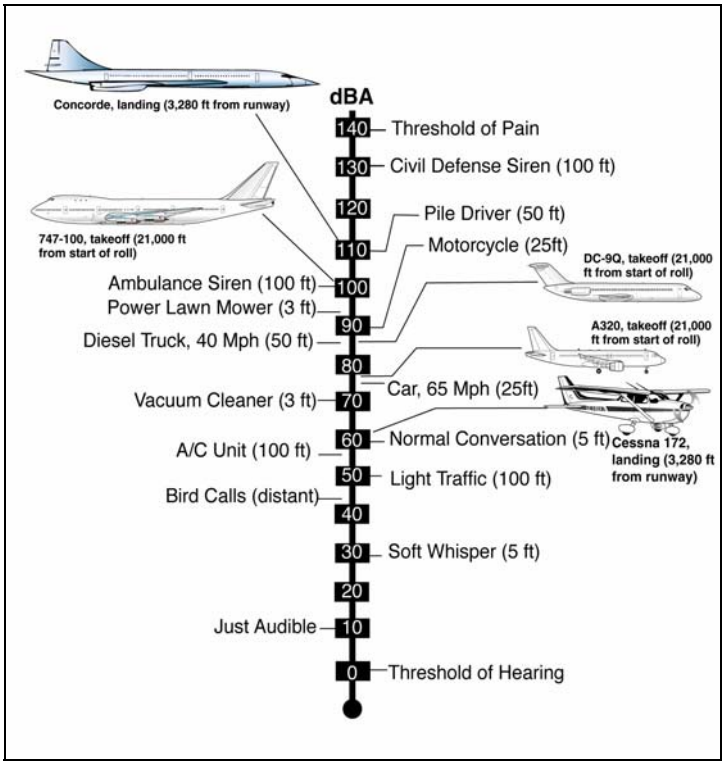
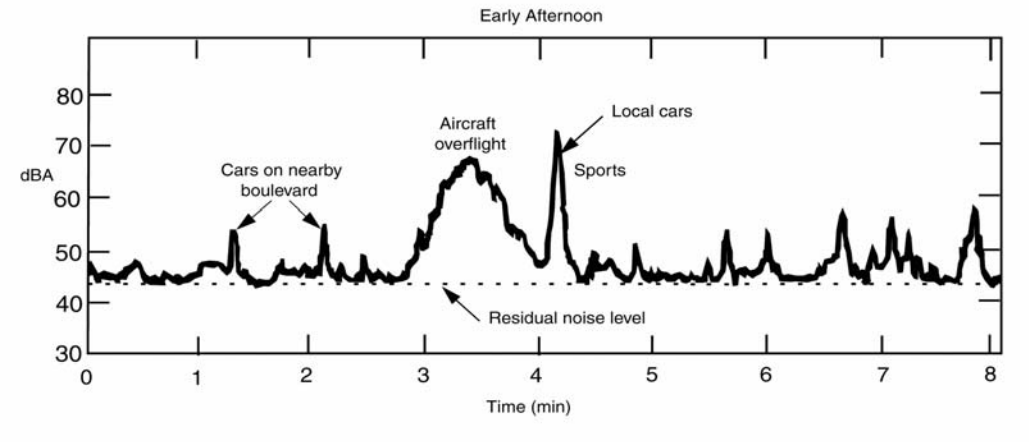


Figure 2-3
Variation of Community Noise in a Suburban Neighborhood



Source: "Community Noise," NTID 300.3 EPA, December 1971.

Figure 2-4

Common Aircraft Departure Noise Levels

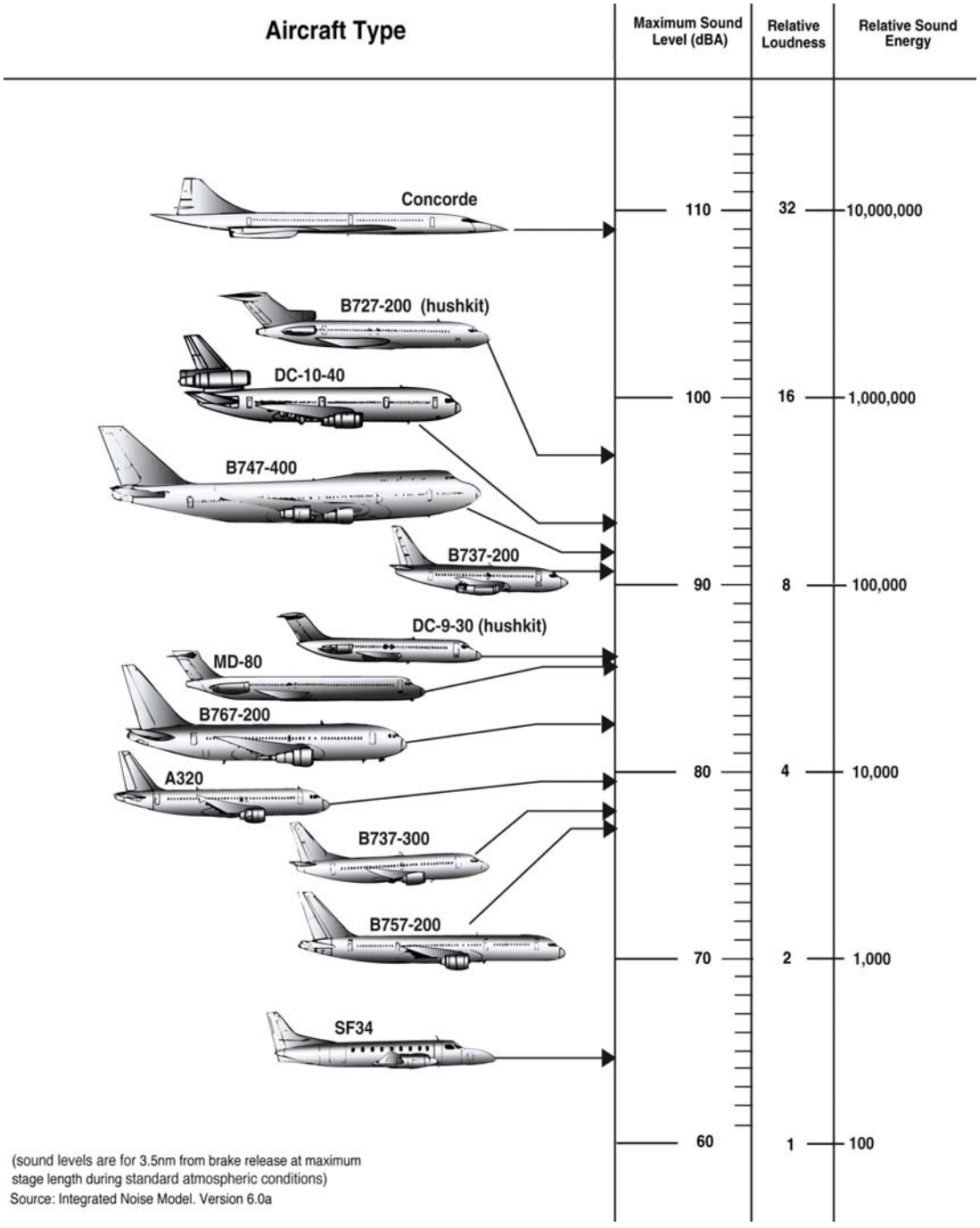
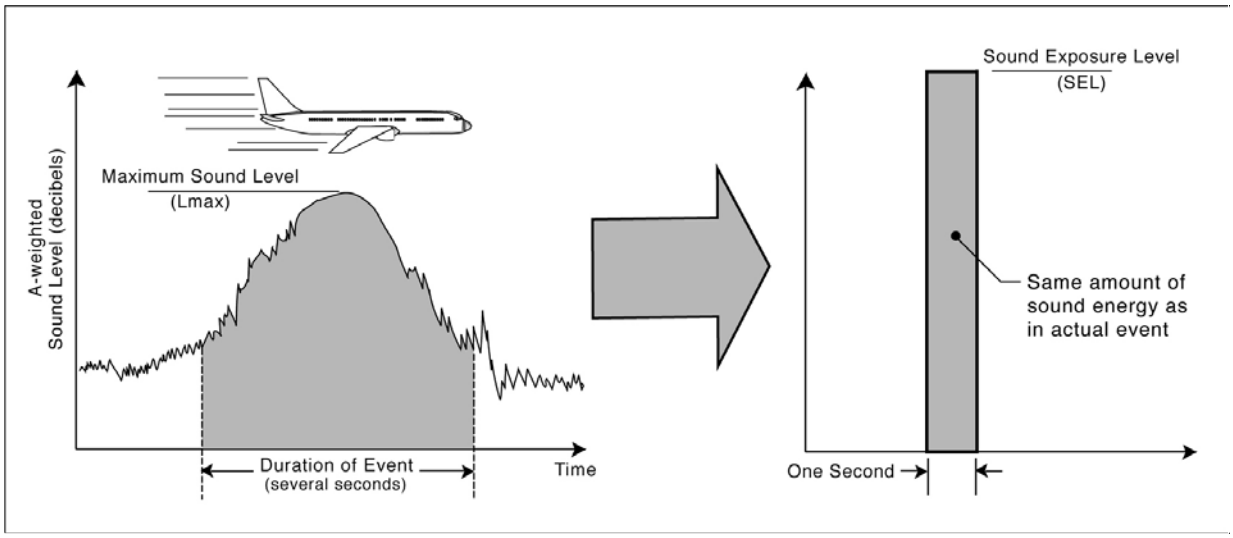


Figure 2-5

Relationship Between Single Event Noise Metrics



time, but rather provides a measure of the net impact of the entire acoustic event.

Note that, because the SEL is normalized to one second, it will always be larger in magnitude than the maximum A-weighted level for an event that lasts longer than one second. In fact, for most aircraft overflights, the SEL is on the order of 7 to 12 dBA higher than the L_{max}. The fact that it is a cumulative measure means that not only do louder flyovers have higher SELs than quieter ones (of the same duration), but longer flyovers also have greater SELs than shorter ones (of the same L_{max}).

It is the SEL's inclusion of both the intensity and duration of a sound source that makes SEL the metric of choice for comparing the single-event levels of varying duration and maximum sound level. This metric provides a comprehensive basis for modeling a noise event in determining overall noise exposure.

2.1.5 Equivalent Sound Level, L_{eq}

Maximum A-weighted level and SEL are used to measure the noise associated with individual events. The following metrics apply to longer-term cumulative noise exposure that often includes many events.

The first cumulative noise metric, the Equivalent Sound Level (abbreviated L_{eq}), is a measure of the exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an 8-hour school day, nighttime, or a full 24-hour day). However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

As for its application to aircraft noise issues, L_{eq} is often presented for consecutive 1-hour periods to illustrate how the hourly noise

dose rises and falls throughout a 24-hour period, as well as how certain hours are significantly affected by a few loud aircraft. Since the period of interest for this study is in a full 24-hour day, $L_{eq(24)}$ is the proper nomenclature.

Conceptually, L_{eq} may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level with its normal "peaks" and "valleys," as illustrated in Figure 2-3. In the context of noise from typical aircraft flight events and as noted earlier for SEL, L_{eq} does not represent the sound level heard at any particular time, but rather represents the total sound exposure for the period of interest. Also, it should be noted that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged," sound level. Thus, loud events tend to dominate the noise environment described by the L_{eq} metric.

2.1.6 Day-Night Average Sound Level

DNL is the same as L_{eq} (an energy-average noise level over a 24-hour period) except that 10 dB is added to those noise events occurring at night (between 10 p.m. and 7 a.m.). This weighting reflects the added intrusiveness of nighttime noise events attributable to the fact that community background noise levels typically decrease by about 10 dB during those nighttime hours. DNL does not represent the sound level heard at any particular time, but rather represents the total (and partially weighted) sound exposure.

Typical DNL values for a variety of noise environments are shown in **Figure 2-6** to indicate the range of noise exposure levels usually encountered.

Due to the DNL metric's excellent correlation with the degree of community annoyance from aircraft noise, DNL has been formally adopted by most federal agencies for measuring and evaluating aircraft noise for land use planning and noise impact assessment. Federal interagency committees such as the Federal Interagency Committee on Urban Noise (FICUN) and the Federal Interagency Committee on Noise (FICON) which include the EPA, FAA, Department of Defense, Department of Housing and Urban Development (HUD), and Veterans Administration, found DNL to be the best metric for land use planning. They also found no new cumulative sound descriptors or metrics of sufficient scientific standing to substitute for DNL. Other cumulative metrics could be used only to supplement, not replace DNL. Furthermore, FAA Order 1050.1D, Change 4 for environmental studies, requires that DNL be used in describing cumulative noise exposure and in identifying aircraft noise/land use compatibility issues. [1] [2] [3] [4] [5]

Measurements of DNL are practical only for obtaining values for a relatively limited number of points. Instead, many noise studies, including this document, are based on estimates of DNL using a FAA-approved computer-based noise model.

Time-Above a Specified Level

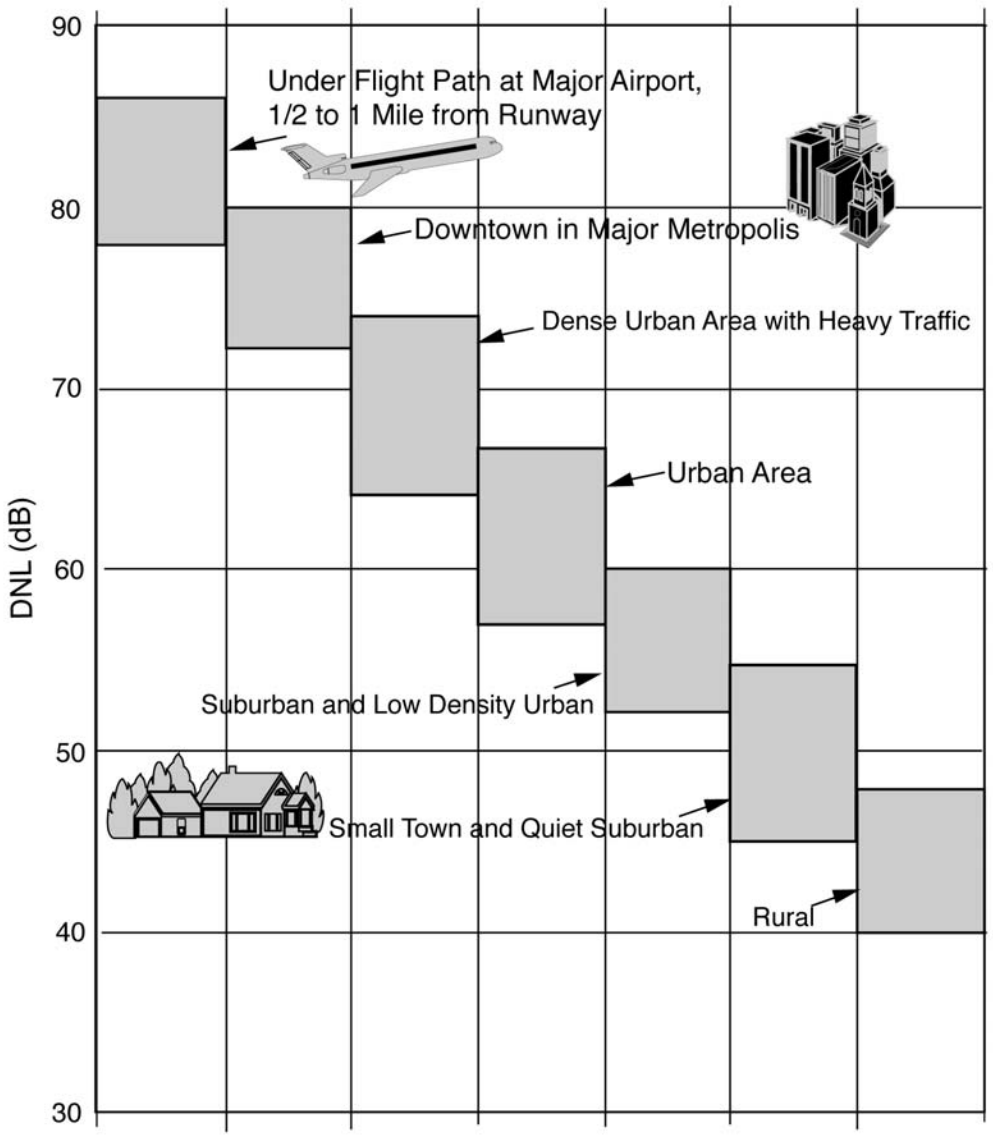
The Time-Above a Specified Level (TA) metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." Like DNL, the TA metric is typically associated with a 24-hour annual average day or only for the DNL nighttime period of 10 p.m. to 7 a.m.

When the TA calculation is expressed as a percentage of the day it is referred to as "%TA." Although the threshold chosen for the TA calculation is arbitrary, it is usually

the ambient level for the location of interest or 65 dB for comparison to a level of 65 dB DNL. For this study, the threshold is 65 dB for the full 24-hour day.

Figure 2-6

Typical Range of Outdoor Community Day-Night Average Sound Levels



Source: U.S. Department of Defense. Departments of the Air Force, the Army, and the Navy, 1978. *Planning in the Noise Environment.* AFM 19-10. TM 5-803-2, and NAVFAC P-970. Washington, D.C.: U.S. DoD.

2.2 THE EFFECTS OF AIRCRAFT NOISE ON PEOPLE

To many people, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, disrupt classroom activities in schools, and disrupt sleep. Relating these effects to specific noise metrics aids in the understanding of how and why people react to their environment. This section addresses three ways we are potentially affected by aircraft noise: annoyance, interference of speech, and disturbance of sleep.

2.2.1 Community Annoyance

The primary potential effect of aircraft noise on exposed communities is one of annoyance. The U.S. EPA defines noise annoyance as any negative subjective reaction on the part of an individual or group.[1]

Scientific studies [1] [2] [3] [6] [7] and a large number of social/attitudinal surveys[8] [9] have been conducted to appraise the U.S. and international community of annoyance due to all types of environmental noise, especially aircraft events. These studies and surveys have found the DNL to be the best measure of that annoyance.

This relation between community annoyance and time-average sound level has been confirmed, even for infrequent aircraft noise events.[10] For helicopter overflights occurring at a rate of 1 to 52 per day, the stated reactions of community individuals correlated with the daily time-average sound levels of the helicopter overflights.

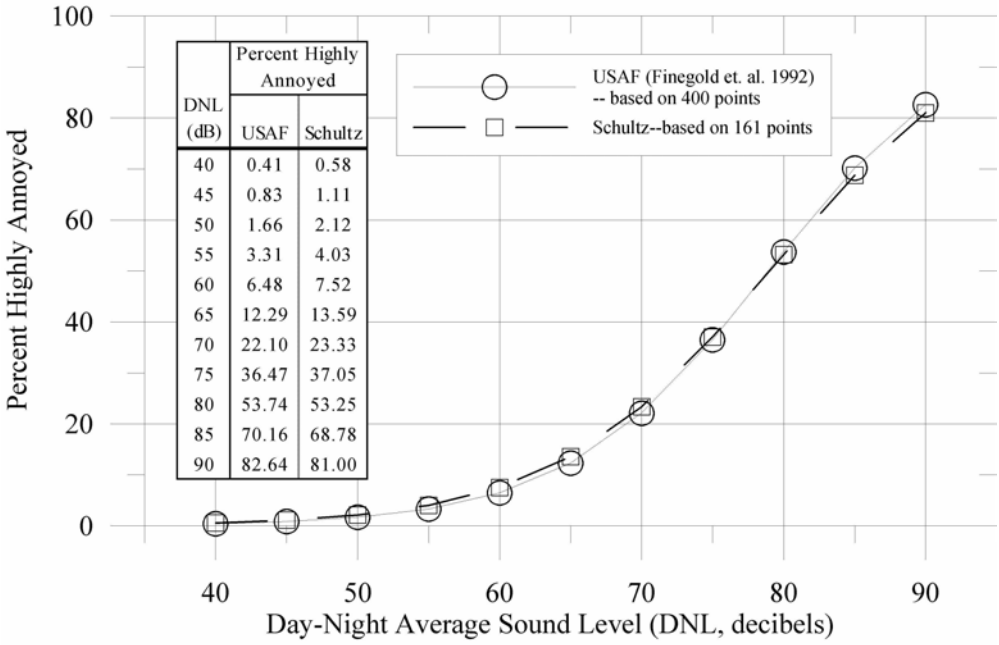
The relationship between annoyance and DNL that has been determined by the scientific community and endorsed by many federal agencies, including the FAA, is shown in **Figure 2-7**. Two lines in Figure 2-7 represent two large sets of social/ attitudinal surveys: one for a curve fit of 161 data points compiled by an individual researcher, Ted Schultz, in 1978[8] and one for a curve fit of 400 data points (which include Schultz's 161 points) compiled in 1992 by the U.S. Air Force.[9] The agreement of these two curves simply means that when one combines the more recent studies with the early landmark surveys in 1978, the results of the early surveys (i.e., the quantified effect of noise on annoyance) are confirmed.

Figure 2-7 shows the percentage of people "highly annoyed" by a given DNL. For example, the two curves in the figure yield a value of about 13 percent for the percentage of the people that would be highly annoyed by a DNL exposure of 65 dB. The figure also shows that at very low values of DNL, such as 45 dB or less, one percent or less of the exposed population would be highly annoyed. Furthermore, at very high values of DNL, such as 90 dB, more than 80 percent of the ex-posed population would be highly annoyed.

Recently, the use of DNL has been criticized as not accurately representing community annoyance and land-use compatibility with aircraft noise. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to "meaningless" time-average sound levels. In fact, a time-average noise metric, such as DNL, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

Figure 2-7

Relationship between Annoyance and Day-Night Average Sound Level



DNL (dB)	Percent Highly Annoyed	
	USAF	Schultz
40	0.41	0.58
45	0.83	1.11
50	1.66	2.12
55	3.31	4.03
60	6.48	7.52
65	12.29	13.59
70	22.10	23.33
75	36.47	37.05
80	53.74	53.25
85	70.16	68.78
90	82.64	81.00

Source: Federal Interagency Committee on Noise (FICON), "*Federal Agency Review of Selected Airport Noise Analysis Issues*", August 1992, p. 3-6, Figure 3.1

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime hours during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours 59 minutes and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.5 dB. As a second example, assume that 10 such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-average sound metric, and, specifically, the DNL.

It is often suggested that a lower DNL, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for FAA environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a DNL of 65 dB:

(1) Provides a valid basis for comparing and assessing community noise effects.

(2) Represents a noise exposure level that is normally dominated by aircraft noise and not other community or nearby highway noise sources.

(3) Reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.

(4) HUD also established a DNL standard of 65 dB for eligibility for federally guaranteed home loans.

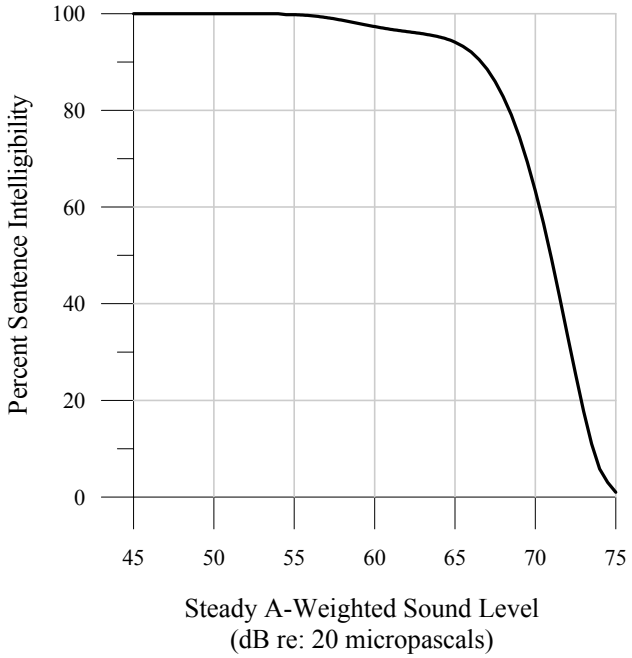
2.2.2 Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation.

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities, such as radio or television listening, telephone use, or family conversation, causes frustration and aggravation. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication."[1]

Indoor speech interference can be expressed as a percentage of sentence intelligibility among two people speaking in relaxed conversation approximately one meter apart in a typical living room or bedroom.[1] The percentage of sentence intelligibility is a non-linear function of the (steady) indoor background sound level, as shown in **Figure 2-8**. This curve was digitized and curve-fitted for the purposes of this document. Such a curve-fit yields 100 percent sentence intelligibility for background levels below 57 dB and yields less than 10 percent intelligibility for background levels above 73 dB. Note that the function is especially sensitive to changes in sound level between 65 dB and 75 dB. As an example of the sensitivity, a 1 dB increase in background sound level from 70 dB to 71 dB yields a 14 percent decrease in sentence intelligibility.

Figure 2-8
Percent Sentence Intelligibility



Source: EPA 1974

In the same document from which Figure 2-8 was taken, the EPA established an indoor criterion of 45 dB DNL as requisite to protect against speech interference indoors

2.2.3 Sleep Disturbance

Sleep disturbance is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

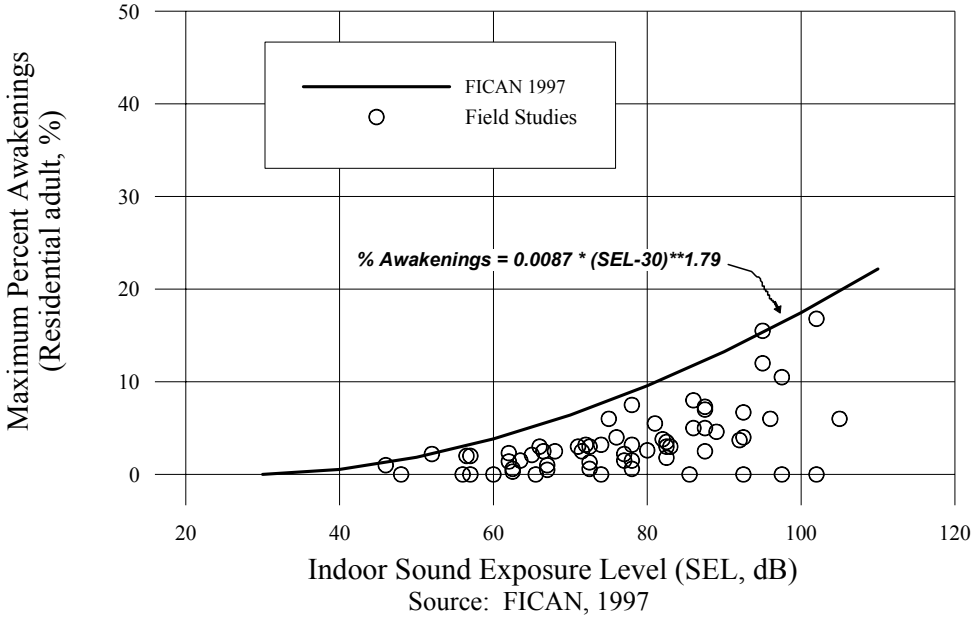
Sleep disturbance can be measured in one of two ways. "Arousal" represents awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without awakening. In general, arousal requires a higher noise level than does a change in sleep stage.

In terms of average daily noise levels, some guidance is available to judge sleep disturbance. The EPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference.[1]

In June 1997, the Federal Interagency Committee on Aviation Noise (FICAN) reviewed the sleep disturbance issue and presented a sleep disturbance dose-response prediction curve.[11] FICAN based their curve on data from field studies[12 13 14 15] and recommends the curve as the tool for analysis of potential sleep disturbance for residential areas. **Figure 2-9** shows this curve which, for an indoor SEL of 60 dB, predicts that a maximum of approximately 5 percent of the residential population exposed are expected to be behaviorally awakened. FICAN cautions that this curve should only be applied to long-term adult residents.

Figure 2-9

Sleep Disturbance Dose-Response Relationship



Source: FICAN, 1997

ENDNOTES

[1] U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety," Report 550/9-74-004, March 1974.

[2] "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise (FICUN), June 1980.

[3] "Federal Agency Review of Selected Airport Noise Analysis Issues," Federal Interagency Committee on Noise (FICON), August 1992.

[4] 14 CFR Part 150, Amendment 150-3 December 8, 1995

[5] FAA Order 1050.1D Change 4, Policies and Procedures for Considering Environmental Impacts, Department of Transportation, Federal Aviation Administration, June 14, 1999.

[6] "Sound Level Descriptors for Determination of Compatible Land Use," American National Standards Institute Standard ANSI S3.23-1980."

[7] "Quantities and Procedures for Description and Measurement of Environmental Sound, Part I," American National Standards Institute Standard ANSI S21.9-1988

[8] Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," J. Acoust. Soc. Am., 64, 377-405, August 1978.

[9] Fidell, S., Barger, D.S., Schultz, T.J., "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise." J. Acoust. Soc. Am., 89, 221-233, January 1991

[10] "Community Reactions to Helicopter Noise: Results from an Experimental Study," J. Acoust. Soc. Am., 479-492, August 1987.

[11] Federal Interagency Committee on Aviation Noise (FICAN), "Effects of Aviation Noise on Awakenings from Sleep," June 1997.

[12] Pearson, K.S., Barber, D.S., Tabachnick, B.G., "Analyses of the Predictability of Noise-Induced Sleep Disturbance," USAF Report HSD-TR-89-029, October 1989.

[13] Ollerhead, J.B., Jones, C.J., Cadous, R.E., Woodley, A., Atkinson, B.J., Horne, J.A., Pankhurst, F., Reyner, L, Hume, K.I., Van, F., Watson, A., Diamond, I.D., Egger, P., Holmes, D., McKean, J., "Report of a Field Study of Aircraft Noise and Sleep Disturbance." London Department of Safety, Environment, and Engineering, 1992.

[14] Fidell, S., Pearsons, K., Howe, R., Tabachnick, B., Silvati, L., Barber, D.S. "Noise-Induced Sleep Disturbance in Residential Settings," AL/OE-TR-1994-0131, Wright Patterson AFB, OH, Armstrong Laboratory, Occupational and Environmental Health Division, 1994.

[15] Fidell, S., Howe, R., Tabachnick, B., Pearsons, K., Sneddon, M., "Noise-Induced Sleep Disturbance in Residences Near Two Civil Airports," Langley Research Center, 1995.

Chapter Three
EXISTING AND FORECAST FLIGHT OPERATIONS

Part 150 requires the use of Day-Night Average Sound Level (DNL) contours to describe the noise environment around an airport. This chapter describes the existing and forecast operational data at BDL that is required to calculate the noise contours. Data inputs and assumptions for the following cases are discussed in this chapter:

- *Year 2003 NEM*, which models anticipated conditions during the year that the document and NEMs will be filed with the FAA.
- *Year 2008 NEM*, which models future conditions in the fifth year following the year of submission.

The FAA requires the analyses of aircraft noise exposure around airports to be accomplished using a computer program known as the Integrated Noise Model (INM), which is developed and maintained by the FAA.[1] INM version 6.0b was used for this study.

INM uses annual average daily operations to compute existing and forecast noise. Annual average daily operations are representative of all aircraft operations that occur over the course of a year. The total annual operations are divided by 365 days to determine the annual average daily operations. Runway and flight track use is also averaged over one year. The average annual runway and flight track data are meshed with forecast aircraft operations to produce the modeled noise environment for the NEMs.

Annual average daily operations consist of departures and arrivals, by daytime and nighttime. For the purposes of INM and DNL, daytime is defined as 7:00 a.m. to 10:00 p.m., and nighttime is defined as 10:00 p.m. to 7:00 a.m. Runway use, flight track location and use, and aircraft profiles define the paths that aircraft use as they fly to and from the Airport.

INM computes the annual average daily noise exposure (i.e., DNL) at points on the ground around the Airport. From the grid of points generated by the model, contours of equal daily sound level are drawn by INM for overlay onto land use maps. INM also has the capability to calculate sound levels at specific points around an airport so that noise exposure at sensitive locations can be identified.

INM allows for the projection of future, forecast noise exposure, and analyses of "before-and-after" noise impacts resulting from potential operational alternatives. INM allows noise predictions for such changes without the actual implementation and noise monitoring of those actions.

3.1 AIRPORT LOCATION AND LAYOUT

Bradley International Airport (BDL) is located in Windsor Locks, Connecticut approximately 11 miles north of Hartford, Connecticut. BDL has two operational runways. The primary runway, Runway 6/24, is 9,500 feet long, while Runway 15/33 is 6,850 feet long.

The elevation of BDL is 174 feet above Mean Sea Level (MSL). As of September 2002, the magnetic declination (the difference between magnetic north and true geographic north) of BDL is 14.6 degrees west.[2] Air Traffic Control (ATC) and pilots use magnetic headings to direct and fly aircraft.

3.1.1 Weather and Climate

Weather has a significant impact on noise exposure and propagation. Runway use and the operational characteristics of aircraft are heavily influenced by weather. The following subsections detail modeled weather conditions and related impact on aircraft operations.

Temperature

Temperature is an important factor in aircraft performance. As temperature increases, air density decreases, reducing wing lift and engine thrust, which results in increased takeoff distance and a lower climb rate. Therefore, departing aircraft are at a lower altitude, and noise exposure generally increases. Conversely, noise exposure is decreased on cold days when aircraft have improved performance capabilities. The BDL annual average temperature of 49.9 degrees Fahrenheit was used in the noise model.[3]

Humidity

Humidity does not significantly impact aircraft performance. In conjunction with temperature, however, humidity does impact the propagation of noise through the air. In general, sound travels farther in more humid conditions. Humidity is highest at night and gradually drops during the day, generally reaching its lowest point in the afternoon. The BDL annual average humidity of 66.8 percent was used in the noise model.[4]

Wind

Wind speed and direction primarily determine runway selection and operational flow. Aircraft generally takeoff and land into the wind (known as a headwind) whenever possible. Headwinds reduce an aircraft's takeoff and landing distance and increase climb rate. Aircraft can operate with considerable crosswinds (winds blowing to the side of the aircraft): up to about 20 knots for a typical air carrier aircraft. Aircraft can operate with limited tailwinds (winds blowing to the rear of the aircraft) up to 10 knots for a typical air carrier aircraft. Tailwinds increase takeoff and landing distance. Winds in excess of crosswind and tailwind limits generally force aircraft to use a different runway. The existing runways at BDL provide adequate wind coverage for typical conditions.

3.1.2 Airspace and Air Traffic Control

The airspace and ATC procedures in use at BDL direct the flow of aircraft in and out of the Airport. As a result, they are an essential component in understanding and determining noise exposure. Detailed operational procedures unique to BDL are discussed in Section 3.2.

3.2 MODELED AIRCRAFT OPERATIONS

This section describes noise model operational inputs, including flight operations, aircraft profiles, runway use, and flight track location and use. INM uses these inputs to compute noise exposure on the ground. The data in this section provide an overview of the aircraft operations incorporated in the noise model.

3.2.1 Flight Operations and Fleet Mix

The 2003 and 2008 average daily flight operations and fleet mix were developed from forecasts developed by PB Aviation, as shown in Appendix B, and supplemented by Official Airline Guide (OAG) and FAA Automated Radar Terminal System (ARTS) radar data.

OAG provides information on the use by aircraft type of passenger and cargo airlines that have scheduled commercial service at BDL. Thus, OAG data was used to define the specific aircraft and engine types incorporated in the INM fleet mix. For example, the PB Aviation forecast includes MD80 operations. OAG data indicates that American flies 83 percent of the MD80s operations at BDL, while Delta flies 17 percent. The airlines operate different variants of the MD80 series. Each airline fleet was examined using OAG data to determine the most appropriate INM aircraft type for the 2003 and 2008 fleet mixes.

Additional detail regarding specific aircraft types flown by general aviation operators were obtained from ARTS radar data. Aircraft types for general aviation jets were identified from analysis of over 1,600 operations collected from radar samples taken between January 9 through 31, 2002, and March 4 through 25, 2003.

The BDL 2003 and 2008 forecasts were approved by the FAA on May 2, 2003. Note that the flight operations forecast and fleet mix were developed after the terrorist events of September 11, 2001 and the recent worldwide downturn in aviation activity.

Table 3.1 shows year 2003 average daily flight operations by aircraft type and time of day. A total of 379 daily operations operated at BDL in 2003. Medium/large air carrier jet aircraft are forecast to conduct approximately 52 percent of total operations. Hushkitted or re-certified Stage 3 jet aircraft are forecast to conduct approximately 19 percent of medium/large air carrier jet operations and 10 percent of total aircraft operations. Approximately 14 percent of total operations are forecast to occur during the nighttime hours. Regional, General Aviation (GA), and Military operations are forecast to conduct, 19 percent, 25 percent, and four percent of total operations, respectively.

Aircraft activity is forecast to grow by approximately 65 daily flights by 2008, to a total of 443 daily operations as shown in **Table 3.2.** Like in 2003, medium/large air carrier jet aircraft are forecast to account for approximately 53 percent of total operations. Nighttime activity will remain relatively constant at 14 percent of total operations. The proportion of hushkitted Stage 3 aircraft in the fleet mix is forecast to decrease to seven percent of the medium/large air carrier jet operations and four percent of total aircraft operations. The proportion of Regional, General Aviation (GA), and Military operations is largely unchanged from 2003 with 20 percent, 23 percent, and four percent of total operations; respectively.

As shown in Tables 3.1 and 3.2, aircraft are placed into “aircraft groups” for the purpose of modeling discrete runway and flight track use, as explained in Sections 3.2.4 and 3.2.5. Aircraft groups allow the unique trends of certain airlines and aircraft types to be included in the noise model.

Table 3.1

Year 2003 Average Daily Aircraft Operations

Aircraft Group	Aircraft Name	INM Type	Arrivals		Departures		Total
			Day	Night	Day	Night	
Medium/Large Air Carrier	Airbus A300	A300	1.6	1.6	2.5	0.8	6.5
	Airbus A319	A319	8.5	2.8	9.4	1.9	22.6
	Airbus A320	A320	0.9	1.9	1.9	0.9	5.6
	Airbus A321	A321	0.0	0.9	0.9	0.0	1.8
	Boeing 727-100	727EM1	0.8	0.0	0.0	0.8	1.6
	Boeing 727-200	727EM2	1.2	0.0	1.2	0.0	2.4
	Boeing 737-200	737N17	10.4	0.9	11.3	0.0	22.6
	Boeing 737-300	737300	8.9	1.3	9.5	0.6	20.3
	Boeing 737-300	7373B2	4.4	0.6	4.7	0.3	10.0
	Boeing 737-400	737400	2.8	0.9	2.8	0.9	7.4
	Boeing 737-700	737700	7.6	1.9	8.5	0.9	18.9
	Boeing 737-800	737800	1.9	0.9	1.9	0.9	5.6
	Boeing 757-200	757PW	5.1	1.3	4.7	1.7	12.8
	Boeing 757-200	757RR	5.4	1.4	4.9	1.9	13.6
	Boeing 767-300	767300	0.9	1.7	1.7	0.9	5.2
	Boeing 767-300	767CF6	0.0	0.1	0.1	0.0	0.2
	DC8-60	DC86HK (NS)	0.4	0.0	0.0	0.4	0.8
	DC8-70	DC870	1.1	1.0	1.0	1.1	4.2
	DC9-30	DC93LW	2.7	1.6	4.3	0.0	8.6
	DC9-50	DC95HW	1.0	0.0	1.0	0.0	2.0
	MD-82	MD82	5.6	1.4	6.3	0.7	14.0
	MD-83	MD83	2.0	0.5	2.2	0.2	4.9
	MD-88	MD88	1.9	0.0	1.9	0.0	3.8
	Total		75.1	22.7	82.7	14.9	195.4
Regional Jet	Canadair CRJ-50	CL601	1.9	0.9	1.9	0.9	5.6
	Dornier 328Jet	J328 (NS)	1.9	0.0	1.9	0.0	3.8
	Embraer ERJ-135	EMB135	3.8	0.9	3.8	0.9	9.4
	Embraer ERJ-145	EMB145	1.1	0.1	1.0	0.2	2.4
	Embraer ERJ-145	EMB14L	9.3	0.8	8.4	1.7	20.2
	Total		18.0	2.7	17.0	3.7	41.4
Regional Turboprop	Beech 1900	BEC190	6.6	0.0	5.7	0.9	13.2
	Dash 8	DHC8	8.5	0.0	7.6	0.9	17.0
	Dornier 328	DO328	0.9	0.0	0.9	0.0	1.8
	Total		16.0	0.0	14.2	1.8	32.0
General Aviation Jet	Cessna Citation	CIT3	0.5	0.0	0.5	0.0	1.0
	Canadair Challenger 600	CL600	5.2	0.3	5.2	0.3	11.0
	Canadair Challenger 601	CL601	0.9	0.1	0.9	0.1	2.0
	Cessna Citation	CNA500	1.3	0.1	1.3	0.1	2.8
	Dassault 90	DA90	1.8	0.1	1.8	0.1	3.8
	Falcon 20	FAL20 (S2)	0.2	0.0	0.2	0.0	0.4
	Gulfstream 2	GIIB (S2)	0.3	0.0	0.3	0.0	0.6
	Gulfstream 4	GIV	2.3	0.2	2.3	0.2	5.0
	Astra 1125	IA1125	0.4	0.0	0.4	0.0	0.8
	Learjet 25	LEAR25 (S2)	0.7	0.1	0.7	0.1	1.6
	Learjet 35	LEAR35	8.8	1.2	8.8	1.2	20.0
	Mitsubishi 3001	MU3001	3.9	0.3	3.9	0.3	8.4
	Total		26.3	2.4	26.3	2.4	57.4
General Aviation Prop	GA Multi-Engine Piston	BEC58P	8.1	2.5	9.8	0.8	21.2
	GA Single Engine Piston	GASEPF	4.0	0.0	4.0	0.0	8.0
	Total		12.1	2.5	13.8	0.8	29.2
Helicopter	GA Helicopter	S-76	3.4	0.0	3.4	0.0	6.8
	Military Helicopter	CH47D	0.3	0.0	0.3	0.0	0.6
	Military Helicopter	S70	0.5	0.0	0.5	0.0	1.0
	Military Helicopter	B212	0.5	0.0	0.5	0.0	1.0
	Total		4.7	0.0	4.7	0.0	9.4
Military Jet	A10	A7D	6.8	0.1	6.9	0.0	13.8
	Total		6.8	0.1	6.9	0.0	13.8
Total			159.0	30.4	165.6	23.6	378.6

S2 = 14 CFR Part 36 Stage 2 Aircraft

NS= Non-Standard INM 6.0b substitutions or user-defined aircraft approved by FAA's Office of Environment and Energy (AEE-100)

Source: PB Aviation, HMMH

Table 3.2

Year 2008 Average Daily Aircraft Operations

Aircraft Group	Aircraft Name	INM Type	Arrivals		Departures		Total
			Day	Night	Day	Night	
Medium/Large Air Carrier	Airbus A300	A300	3.3	5.8	6.7	2.5	18.3
	Airbus A319	A319	14.2	2.8	15.1	1.9	34.0
	Airbus A320	A320	1.9	1.9	2.8	0.9	7.5
	Airbus A321	A321	0.0	0.9	0.9	0.0	1.8
	Boeing 727-100	727EM1	0.8	0.0	0.0	0.8	1.6
	Boeing 727-200	727EM2	0.3	0.0	0.3	0.0	0.6
	Boeing 737-200	737N17	5.7	0.9	6.6	0.0	13.2
	Boeing 737-300	737300	12.3	1.3	12.9	0.6	27.1
	Boeing 737-300	7373B2	5.7	0.6	6.0	0.3	12.6
	Boeing 737-400	737400	2.8	0.9	2.8	0.9	7.4
	Boeing 737-700	737700	11.3	2.8	13.2	0.9	28.2
	Boeing 737-800	737800	3.8	0.9	3.8	0.9	9.4
	Boeing 757-200	757PW	11.7	2.1	10.4	3.4	27.6
	Boeing 757-200	757RR	8.1	2.4	7.5	3.0	21.0
	Boeing 767-300	767300	2.8	0.8	1.7	1.9	7.2
	Boeing 767-300	767CF6	0.0	0.1	0.1	0.0	0.2
	DC8-60	DC86HK (NS)	0.4	0.0	0.0	0.4	0.8
	DC8-70	DC870	0.5	0.0	0.0	0.5	1.0
	DC9-30	DC93LW	0.0	0.0	0.0	0.0	0.0
	DC9-50	DC95HW	0.0	0.0	0.0	0.0	0.0
	MD-82	MD82	3.5	1.4	4.9	0.0	9.8
	MD-83	MD83	1.2	0.5	1.7	0.0	3.4
	MD-88	MD88	1.9	0.0	1.9	0.0	3.8
	Total		92.2	26.1	99.3	18.9	236.5
Regional Jet	Canadair CRJ-50	CL601	18.9	0.9	17.9	1.9	39.6
	Dornier 328Jet	J328 (NS)	1.9	0.0	1.9	0.0	3.8
	Embraer ERJ-135	EMB135	5.7	0.9	4.7	1.9	13.2
	Embraer ERJ-145	EMB145	0.9	0.1	0.9	0.1	2.0
	Embraer ERJ-145	EMB14L	13.2	0.9	12.3	1.8	28.2
	Total		40.6	2.8	37.7	5.7	86.8
Regional Turboprop	Beech 1900	BEC190	0.0	0.0	0.0	0.0	0.0
	Dash 8	DHC8	0.0	0.0	0.0	0.0	0.0
	Dornier 328	DO328	0.0	0.0	0.0	0.0	0.0
	Total		0.0	0.0	0.0	0.0	0.0
General Aviation Jet	Cessna Citation	CIT3	0.5	0.0	0.5	0.0	1.0
	Canadair Challenger 600	CL600	5.6	0.3	5.6	0.3	11.8
	Canadair Challenger 601	CL601	0.9	0.1	0.9	0.1	2.0
	Cessna Citation	CNA500	1.4	0.1	1.4	0.1	3.0
	Dassault 90	DA90	2.0	0.1	2.0	0.1	4.2
	Falcon 20	FAL20 (S2)	0.3	0.0	0.3	0.0	0.6
	Gulfstream 2	GIIB (S2)	0.3	0.0	0.3	0.0	0.6
	Gulfstream 4	GIV	2.4	0.2	2.4	0.2	5.2
	Astra 1125	IA1125	0.4	0.0	0.4	0.0	0.8
	Learjet 25	LEAR25 (S2)	0.9	0.2	0.9	0.2	2.2
	Learjet 35	LEAR35	10.2	2.0	10.2	2.0	24.4
	Mitsubishi 3001	MU3001	4.1	0.3	4.1	0.3	8.8
	Total		29.0	3.3	29.0	3.3	64.6
General Aviation Prop	GA Multi-Engine Piston	BEC58P	10.0	1.7	10.9	0.8	23.4
	GA Single Engine Piston	GASEPF	4.2	0.0	4.2	0.0	8.4
	Total		14.2	1.7	15.1	0.8	31.8
Helicopter	GA Helicopter	S-76	3.6	0.0	3.6	0.0	7.2
	Military Helicopter	CH47D	0.3	0.0	0.3	0.0	0.6
	Military Helicopter	S70	0.5	0.0	0.5	0.0	1.0
	Military Helicopter	B212	0.5	0.0	0.5	0.0	1.0
	Total		4.9	0.0	4.9	0.0	9.8
Military Jet	A10	A7D	6.8	0.1	6.9	0.0	13.8
	Total		6.8	0.1	6.9	0.0	13.8
Total			187.7	34.0	192.9	28.7	443.4

S2 = 14 CFR Part 36 Stage 2 Aircraft

NS= Non-Standard INM 6.0b substitutions or user-defined aircraft approved by FAA's Office of Environment and Energy (AEE-100)

Source: PB Aviation, HMMH

Federal Aviation Regulation Part 36, "Noise Standards, Aircraft Type and Airworthiness Certification", classifies civilian jet aircraft according to a set of noise standards. Aircraft not certified under Part 36 are termed "Stage 1" aircraft, aircraft meeting the original noise limits are "Stage 2", and aircraft meeting the most recent and stringent limits are "Stage 3". All turbojets and other large aircraft produced after 1974 meet at least the Stage 2 standards. Because of normal aircraft retirement and replacement, there are very few Stage 1 aircraft operating in the United States.

FAA regulations generally prohibit operations of Stage 1 and 2 aircraft with a maximum takeoff weight greater than 75,000 pounds. The Airport Noise and Capacity Act of 1990 (and subsequent FAA regulations developed to implement the Act) required that all Stage 2 aircraft weighing greater than 75,000 pounds be phased out by the end of 1999. This requirement has been met by a combination of retiring older Stage 2 aircraft and replacing them with Stage 3 aircraft, replacing engines on Stage 2 aircraft with new Stage 3 engines, and by fitting Stage 2 aircraft with hush-kits to reduce the noise produced by these engines to within the Stage 3 limits. There is, however, no schedule for phasing out Stage 1 or Stage 2 jets weighing less than 75,000 pounds. Stage 4 limitations are expected for new production aircraft, however there is no current regulatory schedule for the phase out of Stage 3 aircraft.

Stage 2 aircraft operating at BDL include the Falcon 20, Gulfstream 2, and Learjet 25 corporate jets. Hush-kitted Stage 3 aircraft operating at BDL include the Boeing 727-100/200, Boeing 737-200, DC8-60, and DC9-30/50.

3.2.2 INM Aircraft Database

INM contains noise and performance data on nearly all aircraft types that operate at BDL, including hush-kitted aircraft. Aircraft manufacturers, such as Boeing and Airbus, provide the data to the FAA. The data are used to model an aircraft's departure and arrival flight profiles and resultant noise exposure. Aircraft that are not specifically included in the database (such as those with unique engine combinations) are modeled using appropriate substitution aircraft and criteria per the FAA's pre-approved substitution list.

3.2.3 Aircraft Flight Profiles

Flight profiles define the vertical paths of aircraft during departure and arrival by specifying the altitude, speed, and engine thrust of an aircraft at any point along a flight track. INM uses this information to calculate noise exposure on the ground. Profiles are unique to each aircraft type and are based on aircraft operating weight, airfield elevation, temperature, airline operating procedures, and other factors. Detailed information on aircraft flight profiles, under varying conditions, is stored in INM's aircraft database. INM can also be used to refine standard profiles for non-standard flight conditions.

Departure Flight Profiles

The flight profiles of departing aircraft can vary considerably by aircraft type. New, modern aircraft have higher thrust engines and improved wing designs, which result in a superior climb rate. Modern jet engines are also much quieter than their predecessors, even though they can produce more thrust.

The INM aircraft database contains at least one departure profile for each aircraft type.

Most large, transport-category aircraft have multiple departure profiles that reflect several takeoff weights. However, accurate takeoff weight data by aircraft type is not normally available, especially on an average annual basis. Therefore, standard noise modeling methodology assumes that aircraft takeoff weights and resulting aircraft performance can be approximated based upon stage (or trip) length, a factor much more readily obtainable from airline schedules. Thus, the distribution of departure profiles assigned to an aircraft type is based on the distribution of stage lengths flown by that aircraft type. Longer distance (high stage length) flights are assumed to require more fuel and thus to have higher takeoff weights, which increases takeoff distance and lowers the aircraft's climb rate, as compared to lighter (short trip) flights.

Stage lengths are indexed according to the range of trip length, as shown in **Table 3.3**. For example, if an aircraft is departing for a trip of length less than 500 nautical miles (NM), it is assigned a stage length of 1; if the trip length is between 500 and 1,000 NM, it is assigned a stage length of 2, and so on.

Table 3.3

Stage Length Definition

Stage Length	Trip Distance
1	0 to 500 NM
2	500 to 1,000 NM
3	1,000 to 1,500 NM
4	1,500 to 2,500 NM
5	2,500 to 3,500 NM
6	3,500 NM to 4,500 NM
7	Over 4,500 NM

Source: INM 6.0 User's Guide

Pilots use their respective airline's operating procedures to maneuver an aircraft during takeoff. The procedures are unique to each aircraft type. Airlines develop their own procedures with aircraft manufacturer and FAA approval. As a result, operating procedures among most airlines are essentially similar. Standard INM departure profiles, which approximate Distant Noise Abatement Departure Profile (NADP)/ICAO-B profiles as published in FAA Advisory Circular (AC) 91-53A, were used in this study. NADPs are described in detail in Chapter Five.

The PB Aviation forecasts provided data on stage lengths for air carrier departures and some regional and general aviation departures. INM has only a single profile (i.e., stage length) for most regional and general aviation aircraft types. **Table 3.4** provides a summary of departure stage lengths for aircraft operating at BDL.

Arrival Flight Profiles

Profiles for arriving aircraft do not use stage lengths. They land on a descent profile determined by instrument landing aids and published visual procedures at BDL. INM has a database of standard arrival flight profiles for each modeled aircraft type. Arriving aircraft were modeled using a standard 3-degree approach path.

3.2.4 Runway Use

Runway use is determined by several factors, including safety, wind, weather, traffic demand, runway capacity, direction of flight, traffic flow at nearby airports, runway length requirements, and prescribed runway use procedures. ATC assigns an aircraft to a certain runway, and overall runway use, with consideration of all of these factors.

Table 3.4

Total (Day and Night) Departure Stage Length Distribution

Aircraft Group	Aircraft Name	INM Type	Stage Length				
			1	2	3	4	Total
Medium/Large Air Carrier	Airbus A300	A300	0%	0%	100%	0%	100%
	Airbus A319	A319	33%	42%	25%	0%	100%
	Airbus A320	A320	67%	0%	0%	33%	100%
	Airbus A321	A321	100%	0%	0%	0%	100%
	Boeing 727-100	727EM1	0%	100%	0%	0%	100%
	Boeing 727-200	727EM2	0%	100%	0%	0%	100%
	Boeing 737-200	737N17	0%	0%	100%	0%	100%
	Boeing 737-300	737300	69%	13%	18%	0%	100%
	Boeing 737-300	7373B2	69%	13%	18%	0%	100%
	Boeing 737-400	737400	75%	25%	0%	0%	100%
	Boeing 737-700	737700	80%	20%	0%	0%	100%
	Boeing 737-800	737800 (NS)	0%	67%	0%	33%	100%
	Boeing 757-200	757PW	42%	46%	0%	12%	100%
	Boeing 757-200	757RR	42%	46%	0%	12%	100%
	Boeing 767-300	767300	0%	100%	0%	0%	100%
	Boeing 767-300	767CF6	0%	100%	0%	0%	100%
	DC8-60	DC86HK (NS)	0%	100%	0%	0%	100%
	DC8-70	DC870	0%-	100%	0%	0%	100%
	DC9-30	DC93LW	0%	100%	0%	0%-	100%
	DC9-50	DC95HW	0%	100%	0%	0%	100%
	MD-82	MD82	0%	70%	30%	0%	100%
	MD-83	MD83	0%	70%	30%	0%	100%
	MD-88	MD88	0%	100%	0%	0%-	100%
Regional Jet	Canadair CRJ-50	CL601	100%	0%	0%	0%	100%
	Dornier 328Jet	J328 (NS)	0%	100%	0%	0%	100%
	Embraer ERJ-135	EMB135	40%	60%	0%	0%	100%
	Embraer ERJ-145	EMB145	67%	33%	0%	0%	100%
	Embraer ERJ145	EMB14L	67%	33%	0%	0%	100%
Regional Turboprop	Beech 1900	BEC190	71%	29%	0%	0%	100%
	Dash 8	DHC8	100%	0%	0%	0%	100%
	Dornier 328	DO328	100%	0%	0%	0%	100%
General Aviation Jet	Cessna Citation	CIT3	84%	16%	0%	0%	100%
	Canadair Challenger 600	CL600	84%	16%	0%	0%	100%
	Canadair Challenger 601	CL601	84%	16%	0%	0%	100%
	Cessna Citation	CNA500	84%	16%	0%	0%	100%
	Dassault 90	DA90	84%	16%	0%	0%	100%
	Falcon 20	FAL20 (S2)	84%	16%	0%	0%	100%
	Gulfstream 2	GIIB (S2)	84%	16%	0%	0%	100%
	Gulfstream 4	GIV	84%	16%	0%	0%	100%
	Astra 1125	IA1125	84%	16%	0%-	0%	100%
	Learjet 25	LEAR25 (S2)	76%	24%	0%	0%	100%
	Learjet 35	LEAR35	80%	20%	0%	0%	100%
	Mitsubishi 3001	MU3001	84%	16%	0%	0%	100%
General Aviation Prop	GA Multi-Engine Piston	BEC58P	45%	55%	0%	0%	100%
	GA Single Engine Piston	GASEPF	100%	0%	0%	0%	100%
Helicopter	GA Helicopter	S-76 (NS)	100%	0%	0%	0%	100%
	Military Helicopter	CH47D (NS WAITING)	100%	0%	0%	0%	100%
	Military Helicopter	S70 (NS)	100%	0%	0%	0%	100%
	Military Helicopter	B212 (NS WAITING)	100%	0%	0%	0%	100%
Military Jet	A10	A7D (NS)	100%	0%	0%	0%	100%

Note: Total stage length distributions are presented for 2003 and may differ slightly between 2003 and 2008 due to variation in daytime and nighttime operations by aircraft type.
S2 = 14 CFR Part 36 Stage 2 Aircraft
NS= Non-Standard INM 6.0b substitutions or user-defined aircraft approved by FAA's Office of Environment and Energy (AEE-100)

Source: PB Aviation, HMMH

Runway use is the proportion of aircraft that use a runway for departure or arrival, expressed as a percentage. For purposes of computing average daily noise exposure, runway use is the annual percentage of aircraft assigned to the runways, expressed separately for arrivals and departures, and daytime and nighttime hours.

Table 3.5 shows anticipated modeled average annual runway use for the 2003 and 2008 NEMs. Average annual runway use was computed from ARTS data of actual operations for the following dates: October 10, 1998 to November 12, 1998; June 12, 1999 to September 1, 1999; March 13, 2000 to April 17, 2000; and March 10, 2001 to April 4, 2001. Since runway use is primarily a function of weather, data collected for the EA was included in calculations of annual average runway use. This data set includes over 47,800 operations. The data were broadly spread over all times of day, days of the week, and seasons of the year to ensure a representative sample of actual aircraft operations.

Due to the availability of detailed operational data, the anticipated 2003 and 2008 NEM runway use is also modeled by aircraft group. Aircraft are categorized into aircraft groups by airline and aircraft type to incorporate unique operational trends into INM. For example, average runway use of air carrier operations, including passenger and cargo carriers, can differ from general aviation operations due to the different locations on the airfield from which these aircraft groups operate. General aviation and air carrier aircraft also tend to use different arrival and departure routes, and this can affect their respective runway use.

Aircraft groups allow these unique trends to be incorporated into INM, and thus improve the computation of noise exposure. For the BDL Part 150 Study, seven aircraft groups were used in the 2003 NEM: medium/large air carrier, regional jet, regional turboprop, general aviation jet, general aviation prop, helicopter, and military jet. Note that the information shown in Table 3.5 is presented as runway use by aircraft group as well as composite runway use. Composite runway use is calculated by compiling all aircraft operations regardless of aircraft group, and is useful for the analysis and discussion of overall runway use trends. The absence of projected aircraft operations on a runway does not preclude future use of that runway for such operations.

3.2.5 Flight Track Geometry and Use

Modeled flight tracks depict the approximate paths, or ground tracks, that aircraft use as they travel to and from the Airport. As with runway use, modeled flight track use reflects the percentage of annual operations that use a specific flight route, grouped by arrival/departure and day/night.

A major focus of the Part 150 Study has been to evaluate existing noise abatement procedures currently in use at BDL, including two existing noise abatement departure flight track turns that were evaluated as part of the "mini-study." The mini-study evaluated Runway 24 departure procedures, and recommended a revised flight track turn for aircraft turning to the west or north (represented by modeled tracks 24PWL and 24CTR, respectively). The tracks overfly Windsor, East Granby, and Simsbury. These procedures were found to reduce noise exposure to communities near the Airport. The "Environmental Assessment for Modification of Departure Procedures for Runway 24" was completed in July 2000.

Table 3.5

Existing Average Annual Runway Use

Aircraft Group		Day			Night			Total		
		Departures	Arrivals	Overall	Departures	Arrivals	Overall	Departures	Arrivals	Overall
Medium/Large Air Carrier	06	41%	42%	42%	39%	47%	44%	41%	43%	42%
	15	1%	1%	1%	1%	1%	1%	1%	1%	1%
	24	40%	41%	41%	30%	40%	36%	39%	41%	40%
	33	17%	15%	16%	30%	11%	19%	19%	14%	17%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%
Regional Jet	06	31%	42%	37%	39%	41%	40%	32%	42%	37%
	15	7%	3%	5%	7%	6%	6%	7%	3%	5%
	24	26%	30%	28%	23%	32%	27%	26%	30%	28%
	33	36%	25%	30%	31%	21%	27%	35%	24%	30%
	Total	100%	100%	100.	100%	100%	100%	100%	100%	100%
Regional Turboprop	06	14%	42%	29%	18%	0%	18%	15%	42%	29%
	15	4%	7%	5%	3%	0%	3%	4%	7%	5%
	24	24%	33%	29%	20%	0%	20%	24%	33%	28%
	33	58%	18%	36%	58%	0%	58%	58%	18%	38%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%
General Aviation Jet	06	22%	39%	31%	15%	45%	30%	21%	40%	31%
	15	7%	4%	5%	5%	19%	12%	7%	5%	6%
	24	25%	34%	30%	16%	24%	20%	24%	34%	29%
	33	46%	23%	34%	64%	11%	37%	48%	22%	35%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%
General Aviation Prop	06	13%	27%	20%	3%	26%	17%	12%	27%	20%
	15	6%	10%	8%	3%	23%	15%	6%	12%	9%
	24	23%	26%	25%	9%	20%	15%	22%	25%	23%
	33	58%	36%	47%	85%	32%	53%	61%	36%	48%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%
Military Jet	06	53%	27%	40%	0%	100%	100%	53%	28%	41%
	15	15%	4%	9%	0%	0%	0%	15%	4%	9%
	24	12%	37%	24%	0%	0%	0%	12%	36%	24%
	33	21%	32%	26%	0%	0%	0%	21%	32%	26%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total	06	33%	40%	36%	33%	45%	39%	33%	41%	37%
	15	4%	3%	4%	3%	5%	4%	4%	3%	4%
	24	32%	37%	34%	25%	37%	32%	31%	37%	34%
	33	31%	20%	26%	39%	14%	25%	32%	19%	26%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Notes:

Total runway use distribution may differ slightly between 2003 and 2008 due to variation in daytime and nighttime operations by aircraft type.

Percentages may not add to 100% due to rounding

Source: HMMH

The Runway 24 departure procedure has been implemented, and its use is included in the 2003 and 2008 NEMs.

INM utilizes primary (backbone) and secondary (dispersed) flight tracks to model actual arrival and departure flight tracks. Since aircraft fly through a moving air mass, a given heading will result in different paths over the ground under different wind conditions. Weather, traffic levels, pilot technique, and differing aircraft performance capabilities add to the number of dispersed flight paths that can occur along a flight route. Neither ATC nor pilots currently have the technology available to direct aircraft along a narrow highway corridor or over other specific points on the ground. The primary flight track is the mean, or average, track for a specific heading or departure procedure (DP); multiple secondary flight tracks reflect the dispersion that occurs to either side of the primary track. INM uses a normal distribution to determine the dispersion of traffic on the primary and secondary modeled flight tracks.

It is important to note that at lower exposure levels, an individual aircraft on a single flight track can significantly influence the 24-hour noise exposure, and that deviations from typical flight tracks will occur due to safety requirements, emergencies, weather, traffic demand, capacity, and aircraft performance.

Flight track geometry and use was developed from analysis of ARTS radar data collected between October 14 to 29, 2000; March 10 to April 4, 2001; and March 4 to 25, 2003.The radar data sample includes over 18,100 flight operations using only current procedures; it provides detailed information on aircraft type, runway assignment, navigational fix, and flight track geometry information. The data were broadly spread over all times of day, days of the week, and seasons of the year to ensure a representative sample actual aircraft operations. Separate flight tracks were developed for arrivals and departures for the following aircraft groups: air carrier and military aircraft, regional turboprops, corporate/regional jets, and general aviation propeller operations.

Each actual flight route was examined for the distribution and dispersion of discrete tracks over the ground and along that route, and the frequency with which the route was used. With these data, a primary and usually four additional secondary modeled flight tracks were developed for each actual route. The ARTS-derived flight track methodology created a total of 187 primary modeled tracks and an additional 648 secondary tracks, for a total of 835 unique modeled tracks in the 2003 NEMs. For the 2008 NEMs the ARTS-derived flight track methodology created a total of 152 primary modeled tracks and an additional 566 secondary tracks, for a total of 718 unique modeled tracks. The 2008 NEMs have fewer tracks due to the fact that the 2008 forecast predicts that regional turboprops will be replaced with regional jets. Therefore, the modeled tracks for the regional turboprops are not used in the 2008 NEMs.

Figures 3-1 and 3-2 show modeled arrival and departure flight tracks, respectively, for the 2003 and 2008 NEMs plotted against a small sample of the actual radar flight tracks that were utilized to develop the modeled tracks. The figures demonstrate that the modeled flight tracks are comprehensive and representative of actual operations.

Flight track geometry and use is categorized by daytime/nighttime, aircraft group, and navigational fix. Each track is assigned a six or seven character name. The first two characters describe the aircraft category for

which the track was developed (AC - air carrier; AT – regional turboprop; CJ – general aviation jet; GA - general aviation prop; H – Helicopters). The next two digits designate the runway and the fifth character describes the type of operation: "A" for arrival and "D" for departure. The last digit(s) identifies a specific track used by an aircraft group for arrival or departure to that particular runway. Helicopter tracks follow a similar convention with the exception that no runway designator is necessary since only helicopters will utilize the helipads.

A navigational fix is a geographic point whose location is defined by latitude/longitude coordinates and by a combination of ground- and satellite-based navigation facilities. The location of a fix is known to both ATC and pilots, and is identified on aeronautical charts. A flight is assigned a sequence of fixes in its flight plan; the sequence of fixes establishes the route that an aircraft will use to navigate from one airport to another. A fix is often established as part of a DP or STAR. Fixes can also mark the transition point from the terminal area airspace to en route airspace. Thus, inclusion of navigational fixes allows the modeled flight tracks to better replicate the actual routes flown by arriving and departing aircraft in the vicinity of an airport.

In INM, each modeled track is linked to a specific daytime and nighttime use that distributes aircraft operations onto specific tracks; flight track use is expressed as a percentage of total operations from a specific runway. Flight track use, as a percentage of total operations using a specific flight track from a specific runway, is expected to remain constant for 2003 and 2008.

Military aircraft were modeled on the air carrier tracks, however flight track use for military aircraft was computed separately from air carrier flight track use. Likewise, corporate and regional jets were grouped together to generate flight track geometry, but flight track use was computed separately for the two aircraft groups.

3.2.6 Run-up Operations

Run-up operations increase the engine throttle while the aircraft is on the ground. Run-ups are usually not associated with arrival or departure operations, but are used as part of maintenance and engine warm-up procedures. Discussions with airport staff, TAC members, and participants at the public informational workshops revealed that engine run-ups were not much of a concern to local residents. Therefore run-up operations are not modeled in this study.

3.3 SUMMARY OF INM INPUTS

The average daily flight operations, altitude profiles, runway use, and flight track locations and utilization are combined within INM to compute average daily noise exposure. The resulting DNL contours are discussed in Chapter 5. For example, the average daily number of aircraft modeled on any given flight track can be derived by multiplying the average daily flight operations by the runway use percentages, and then by the flight track use percentages. Note that this is representative of an average annual day only; in reality, the actual number of operations that use a specific flight track can vary significantly due to wind, runway configuration, and other operational factors.

ENDNOTES

[1] The FAA does allow modeling of DNL contours to be accomplished by a model other than INM, if that model is approved be the FAA.

[2] NOAA National Geophysical Data Center.

[3] HMMH.

[4] Ibid.

Chapter Four
LAND USE AND NOISE COMPATIBILITY

This chapter provides detail on the existing and potential future land uses relative to the BDL noise environment. Section 4.1 summarizes the Federal and local land use guidelines related to aeronautical uses. Section 4.2 describes the development of the land use and population data used as part of this Part 150 study. Section 4.3 examines existing land use and compatibility with the 2003 Noise Exposure Map (NEM) and Section 4.4 concludes with a discussion of potential future land use and compatibility relative to the 2008 NEM.

4.1 LAND USE GUIDELINES

Land use guidelines provide the primary means of preventing new non-compatible development. The following sections provide a description of federal and local land use guidelines.

4.1.1 Federal Guidelines

The degree of annoyance that people experience from aircraft noise varies depending on their activities at any given time. People are usually less disturbed by aircraft noise when they are shopping, working, or driving than 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 community reaction to noise.

In a Part 150 study, DNL values have the following two principal uses:

- Provide a basis for comparing existing noise conditions to the effects of noise abatement procedures and/or forecast changes in airport activity; and

- Provide a quantitative basis for identifying potential noise impacts.

Both of these functions require the application of objective criteria for evaluating noise impacts. Part 150 provides the FAA's recommended guidelines for noise/land use compatibility evaluation, as shown in **Table 4.1.**

The FAA's guidelines represent a compilation of the results of scientific research into noise-related activity interference and attitudinal response. However, reviewers of DNL contours should recognize the highly subjective nature of response to noise, and that special circumstance can affect individuals' tolerances. For example, a high non-aircraft background noise level can reduce the significance of aircraft noise, such as in areas constantly exposed to relatively high levels of vehicular traffic noise. Alternatively, residents of areas with unusually low background levels may find relatively low levels of aircraft noise annoying.

Expectation and experience may also affect response. People may become accustomed to a level of exposure that guidelines typically indicate may be unacceptable; conversely, minor changes in exposure may generate a response that is far greater than that which the guidelines suggest.

Table 4.1

Part 150 Noise/Land Use Compatibility Guidelines

Land Use	Yearly Day-Night Average Sound Level, DNL, in Decibels (Key and notes on following page)					
	<65	**65-70**	**70-75**	**75-80**	**80-85**	**>85**
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home park,	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
Governmental 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)	Y
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail–bulding 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

See following page for Table Key and Notes.

Key to Table 4.1

SLCUM	Standard Land Use Coding Manual.
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, or 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 for Table 4.1

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable 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 locally 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.

(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 an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.

Source: Part 150

The cumulative nature of DNL means that the same level of noise exposure can be achieved in an essentially infinite number of ways. For example, a reduction in a small number of relatively noisy operations may be counterbalanced by a much greater increase in relatively quiet flights, with no net change in DNL. Residents of the area may be highly annoyed by the increased frequency of operations, despite the apparent maintenance of the noise *status quo*.

As listed in Table 4.1, Part 150 guidelines indicate that all uses are normally compatible with aircraft noise at exposure levels below 65 dB DNL. This limit is supported in a formal way by standards adopted by the Department of Housing and Urban Development (HUD). HUD standards address whether sites are eligible for federal funding support. These standards, set forth in 24 CFR Part 51, define areas with DNL exposure not exceeding 65 dB as acceptable for funding. Areas exposed to noise levels between 65 dB and 75 dB DNL are "normally unacceptable," and require special abatement measures and review. Those areas at 75 dB DNL and above are "unacceptable" unless special approval is received[1].

4.1.2 Federal Land Use Approval and Funding Policies

FAA issued a policy on March 27, 1998, on 14 CFR Part 150, Airport Noise Compatibility Program, that limits approval of remedial mitigation measures (e.g., soundproofing, property acquisitions, and relocation). As of October 1, 1998, the FAA will approve remedial noise mitigation measures under Part 150 only for non-compatible development that existed at the time of NEM acceptance.

Non-compatible development that potentially may occur after NEM acceptance, (e.g., "in-filling") may only be addressed in Part 150 programs with preventive noise mitigation measures. In other words, approval of measures to address potential new non-compatible development after NEM approval (e.g., "in-filling"), is limited to preventive types of noise measures, such as zoning, subdivision regulation, building codes, and similar land use and/or building controls.

Approval of remedial noise mitigation measures for bypassed lots or additions to existing structures within noise-impacted neighborhoods; additions to existing noise-impacted schools or other community facilities required by demographic changes within their service areas; formerly noise-compatible uses that have been rendered non-compatible as a result of airport expansion or changes in airport operations; and other reasonable exceptions to this policy on similar grounds must be justified by airport operators in submittals to the FAA and will be considered by the FAA on a case-by-case basis.

This policy effectively limits federal funding for implementation of noise compatibility measures when Part 150 approval is a prerequisite for funding. The objective is to strongly encourage preventive actions where there are currently no non-compatible land uses and to limit remedial actions and dollars to those uses that are already noise-impacted. This policy will also affect the use of Airport Improvement Program (AIP) funds to the extent that such funding is dependent on approval under Part 150. This policy does not affect AIP funding for noise mitigation projects that do not require Part 150 approval, that can be funded with Passenger Facility Charges revenue, or that are included in FAA-approved environmental documents for airport development.

4.1.3 Local Land Use Guidelines

Land use planning for the region is identified in the *Conservation and Development and Policies Plan for Connecticut 1998-2003*. The proposed state action strategy for such areas is support for the maintenance of stable, developed neighborhoods and communities as well as intensification of development when supportive of community stability and when consistent with the capacity of available urban services.

The land surrounding BDL is a mixture of residential, commercial/industrial, open space/recreational areas, and vacant land. BDL adjoins four towns: East Granby, Suffield, Windsor Locks, and Windsor. Each town has prepared and enacted land use guidelines and regulations to preserve and enhance their rural character and to encourage economic growth and stability in accordance with *Chapter 126 §8-23 et seq*. of the State of Connecticut General Statutes.

Currently, land use guidelines and regulations for the surrounding towns do not include an aviation element. This Part 150 study will assist these towns in developing land use restrictions that will potentially minimize the affect of aircraft operations, such as noise, on people in the vicinity of BDL. During the consultation process, the TAC requested that land within the 60 dB DNL be considered during the Part 150 process.

4.2 DEVELOPMENT OF LAND USE AND POPULATION DATA

Noise impact analysis for the BDL Part 150 Study was conducted using a Geographic Information System (GIS). The GIS facilitated a detailed, comprehensive analysis of the geographical relationships and patterns emerging from the region surrounding BDL.

4.2.1 Land Use Development

The existing land use data for BDL was initially gathered and analyzed in the fall of 1999. At that time, the information received from the local town governments' went through a number of phases of analysis to insure the data obtained would provide the necessary sets of data required to perform a thorough noise impact analysis. **Table 4.2** provides a summary of the data received through December 1999. With the exception of Enfield, none of the towns included as part of the Part 150 Study had readily usable electronic existing land use or zoning data for use in the study. Much of the land use data was necessarily manually developed.

The information in Table 4.2 was used to create the initial land use file. However, the lack of proper data left much of the study area uncovered. This lack of localized land use data for the study area created the need to develop a useable land use database from generalized United States Geological Survey (USGS) information.

Generalized existing land use data was collected for northern Hartford County office of the USGS. As an alternative source, USGS, provided the most consistent and up to date data. USGS provides the National Land Cover Dataset (NLCD), which provides generalized land use categories based on aerial photography and satellite imagery taken during the mid 1990's. Data from USGS was augmented in affected areas within the 60 dB DNL noise contours by utilizing aerial orthophotos from 1995. With the use of aerial orthophotos as a backdrop, land use data was digitized to create a more detailed existing land use basemap within the affected contours.

Table 4.2

Summary of Initial Data Collection Effort

Town	Parcel Data	Zoning Maps	Land Use Maps	Other
Bloomfield	Digital Parcel Data and Building Outlines Received	Digital Zoning Maps Received	No Land Use Data Available	Paper Maps with Historic Places and Schools Received
East Granby	Paper Parcel Data Purchased and digitized by HNTB	Paper Zoning Maps Received	No Land Use Data Available	Paper Maps with Historic Places, Schools, Businesses, and Housing Statistics Received
Enfield	Digital Parcel Data Received.	Paper and Digital Zoning Maps Received	Digital Files of Existing and Future Land Use	Digital Files of Schools, Streets, Parks, and Waterlines
Granby	Digital Parcel Data Received	Paper and Electronic Zoning Maps Received	No Land Use Data Available	Paper Maps with Historic Places and Schools Received
Simsbury	Digital Parcel Data Received	Paper Zoning Maps Received	No Land Use Data Available	Paper Maps with Historic Places, Schools, and Churches Received
Suffield	Did not receive data from the Town of Suffield. Estimated cost for purchasing Parcel Data was approximately $1,000	Paper Zoning Maps Received	No Land Use Data Available	Paper Maps with Historic Places and Schools Received

Once the generalized land use data was developed, the consultant, assisted by ConnDOT, field verified the land use within the 60 dB DNL noise contour.

Once field verified, letters were sent in September 2001 with field verified land use to each of the affected towns for approval and/or comment, provide in Appendix F.

Comments and approvals were received from the towns through November 2001. Based on the data that was provided, the land use information within the 60 dB DNL noise contour, plus one mile, was deemed accurate and complete, and was approved by each of the towns. At that time, updates to the generalized land use data were made and initial noise impact analysis commenced.

However, in February 2002, many of the town planners objected to the generalized land use outside of the 60 dB DNL noise contour. More specifically, the areas under the Sound Exposure Level $(SEL)^2$ contours were found to not accurately represent the towns actual land use. A decision was made to combine the USGS generalized land use data with the electronic data previously submitted by the towns who had electronic data available. Although, the areas in question are not typically detailed in a Part 150 Study, it was requested by ConnDOT, that a meeting be conducted with each of the town's Town Planners and members of the consultant team to verify lands uses within the SEL contours. The purpose of the meeting was to have the town representatives state the changes necessary to correctly show each town's land use outside of the previously verified area. The meeting was held on March 15, 2002 at BDL and each Hartford County Town Planner or designated representative was provided one-on-one time during the meeting to make changes to the latest land use file for the study area. Changes to the land use file were made during the meeting and it was agreed that the corrected land use

files would be mailed electronically to each town planner for final approval.

Table 4.3 provides a list of the Hartford County town planners and a chronological list of the submittal and approval process for the revised land use data. **Figure 4-1** illustrates the validated existing land use for the BDL region. A meeting was held on May 16, 2002 to review the land use data with town planners in person. Minimal changes to the land use mapping was made due to input at this meeting, Appendix F provides specific changes requested. Additionally, in December 2002, the Town of Windsor requested that two active adult housing facilities be included in the existing land use analysis.

Table 4.3

Chronological List of Revised Land Use Data Submittal and Approval

Town	Town Representative	Initial Submittal Date	Final Approval Date
Bloomfield	Thomas Hooper	March 27, 2002	April 8, 2002
East Granby	Charlie Francis	April 4, 2002	April 11, 2002
Windsor	Mario Zavarella	April 12, 2002	April 24, 2002
Windsor Locks	Catherine Dorau	March 27, 2002	March 29, 2002
Simsbury	Len Tolisano	April 27, 2002	May 8, 2002
Suffield	Phillip Chester	March 28, 2002	April 5, 2002
Enfield	Jose Giner	April 2, 2002	April 11, 2002
South Windsor	Marcia Banach	April 27, 2002	May 13, 2002
Granby	Francis Armentano	March 27, 2002	March 28, 2002

4.2.2 Population Development

The population analysis component of the Part 150 Study was completed in July 2003. The analysis calculated affected population and households within multiple noise contours. These noise contours studied are:

- 2003 Existing Conditions
- 2008 Forecast Conditions
- SEL 90 Contours

Noise contours for 2003, 2008 and SEL 90 were developed. The contours were then converted from a Computer Aided Drafting (CAD) format into an ArcView shapefile, geographically referenced, and attributed with a dB level.

Data for population was then collected for northern Hartford County at the Census Block Level. This data was collected from the U.S. Census Bureau Summary File-1 (SF-1), Census 2000. The pertinent Census data used was the total population and total households, based on Census 2000 Block STFID number.

Census Block geography files for northern Hartford County was obtained from the U.S. Census Bureau, in Tiger format. These files provided a comprehensive polygon base with an underlying table structure similar to the SF-1 data. The similarity in the two file structures allows for relationships to be created and for the demographic data to be attached to the geographic files as attributes.

The population analysis component of the Part 150 Study was conducted in a step process. The step process allows for streamlining and consistency in the noise analysis.The steps used as part of the Part 150 Study consist of the following:

1. The residential land use data is spatially (geographically) intersected with the Census 2000 block data. Resultant

residential area polygons are attributed with the Census 2000 block data and this data is included in the residential land use database file.

2. The acreage of each of the resultant residential polygons is determined. Population per acre and households per acre are then calculated for each residential area polygon to create population per acre and households per acre multipliers.

3. Noise contour level data is spatially intersected with the resultant residential area/census polygons, giving each polygon the dB level value for which it falls under, and this value is also contained in the new database file. An updated calculation of acreage is performed for each of the new residential area polygons.

4. Updated acreage values for each residential polygon is then multiplied by the population per acre and households per acre multipliers to derive the total affected population and households for each noise contour interval. This analysis was also done by querying the data by town name, for each noise contour interval.

5. Potential population and household totals were calculated by utilizing the previously calculated Census 2000 existing population per acre and households per acre multipliers, which were joined to the potential residential database using the Census 2000 STFID block number as a common database field name.

A detailed discussion and examples of the step process can be found in Appendix G. The analysis was completed using ESRI's *ArcView 3.2* software.

4.3 EXISTING LAND USE AND COMPATIBILITY

The following section discusses existing land use located within the 2003 Noise Exposure Map (NEM) and the 2008 NEM and reviews the degree of noise compatibility achieved by the existing land use.

Figures 4-2 and 4-3 show the existing land use with the 2003 NEM and the 2008 NEM, respectively.

4.3.1 Existing Land Use Compatibility

Table 4.4 presents exposed land areas by land use in three DNL intervals for each NEM.

Approximately 3,584 acres of land are within the 60-64 dB DNL noise contour of the 2003 NEM, of which 21 percent is residential. Within the 65^{+} dB DNL contour of the 2003 NEM, there are approximately 3,267 acres of land, of which 13 percent are residential.

For the 2008 NEM, approximately 3,746 acres of land are within the 60-64 dB DNL noise contour, of which 20 percent is residential. Within the 65^{+} dB DNL contour of the 2008 NEM, there are approximately 3,436 acres of land, of which 15 percent are residential.

Table 4.5 contains the estimated number of people and dwellings within the DNL contour intervals for the affected towns for each NEM.

Within the 2003 NEM 60-64 dB DNL contour, there are approximately 2,233 people and 880 dwelling units. Within the 2003 NEM 65^{+} dB DNL contour, there are approximately 748 people and 327 dwelling units, all of which lie within the 65-69 dB

DNL interval; there are zero people and zero dwellings affected by DNLs of 70 dB or greater. The majority of people within the 60^{+} dB DNL noise contour are in the Town of Windsor Locks with 1,572 people and 699 dwelling units.

Within the 2008 NEM 60-64 dB DNL contour, there are approximately 2,238 people and 883 dwelling units. Within the 2008 NEM 65^{+} dB DNL noise contour, there are approximately 853 people and 369 dwelling units, including two dwellings with approximately three people affected by DNLs of 70 dB or greater. Most of the people within the 60^{+} dB DNL noise contour are in the Town of Windsor Locks with 1,613 people and 706 dwelling units.

Table 4.6 contains the number of noise-sensitive land uses within three DNL intervals for the 2003 NEM and the 2008 NEM. Table 4.6 lists six types of noise-sensitive land uses including schools, places of worship, nursing homes, historic structures, cemeteries, and pre-school/child-care facilities. It should be noted that no historic structures or nursing homes exist within the contours analyzed.

Both the 2003 and 2008 NEMs contain the same number of noise sensitive locations. Each noise-sensitive location lies within the 60-64 dB DNL interval, including one school located in the Town of Windsor Locks, two pre-school/child-care facilities located in the Towns of Suffield and East Granby, and one cemetery and one place of worship both located in the Town of Suffield. No noise-sensitive land uses exist within the 65+ dB DNL contour.

Table 4.4

Estimated Off-Airport Acreage with DNL Contours with Existing Land Use

Noise Exposure Map	Generalized Land Use	Acreage Within DNL Contour Interval (dB)				
		60-64	65-69	70-74	Within 75	Total within 60
2003 NEM	Residential	741	194	-	-	935
	Non-Residential	2,843	1,047	207	1	4,098
	TOTAL	3,584	1,241	207	1	5,033
2008 NEM	Residential	755	226	1	-	982
	Non-Residential	2,991	1,087	230	2	4,310
	TOTAL	3,746	1,313	231	2	5,292

Note: Acreage totals do not include airport property

Source: HNTB Analysis.

Table 4.5

Estimated Population and Dwelling Units with DNL Contours with the Existing Land Use

City/Town	60-64 dB DNL		65-69 dB DNL		70-74 dB DNL		Within 75 dB DNL		Total Within 60 dB DNL	
	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units
2003 NEM										
Bloomfield	-	-	-	-	-	-	-	-	**-**	**-**
Simsbury	-	-	-	-	-	-	-	-	**-**	**-**
Windsor	200	77	61	27	-	-	-	-	**261**	**104**
Windsor Locks	1,134	472	438	218	-	-	-	-	**1,572**	**690**
Suffield	676	243	243	80	-	-	-	-	**919**	**323**
East Granby	223	88	6	2	-	-	-	-	**229**	**90**
Total	**2,233**	**880**	**748**	**327**	**-**	**-**	**-**	**-**	**2,981**	**1,207**
2008 NEM										
Bloomfield	1	1	-	-	-	-	-	-	**1**	**1**
Simsbury	-	-	-	-	-	-	-	-	**-**	**-**
Windsor	204	78	68	29	1	1	-	-	**273**	**108**
Windsor Locks	1102	459	511	247	-	-	-	-	**1,613**	**706**
Suffield	677	245	261	87	2	1	-	-	**940**	**333**
East Granby	254	100	10	4	-	-	-	-	**264**	**104**
Total	**2,238**	**883**	**850**	**367**	**3**	**2**	**-**	**-**	**3,091**	**1,252**

Notes:

1. 2000 U.S. Census data was used to calculate these population statistics. Bloomfield, East Windsor, Enfield, Granby and Simsbury do not have dwellings within the 65 dB DNL contour.
2. Population data rounded to the nearest whole number, except for values less than one which are rounded up.

Source: HNTB Analysis.

Table 4.6

Estimated Noise-Sensitive Locations with DNL Contours with the Existing Land Use

Noise Sensitive Location	Number Within DNL Interval (dB)				
	60-64	65-69	70-74	Within 75	Total within 60
2003 NEM					
Schools	1	-	-	-	**1**
Places of Worship	1	-	-	-	**1**
Nursing Homes	-	-	-	-	**-**
Pre-schools	2	-	-	-	**2**
Historic	-	-	-	-	**-**
Cemetery	1	-	-	-	**1**
Total	**5**	**-**	**-**	**-**	**5**
2008 NEM					
Schools	1	-	-	-	**1**
Places of Worship	1	-	-	-	**1**
Nursing Homes	-	-	-	-	**-**
Pre-schools	2	-	-	-	**2**
Historic	-	-	-	-	**-**
Cemetery	1	-	-	-	**1**
Total	**5**	**-**	**-**	**-**	**5**

Note: Excludes BDL property.

Source: HNTB Analysis.

4.4 POTENTIAL FUTURE LAND USE AND COMPATIBILITY

This section discusses potential future land use, according to existing zoning, and reviews the degree of noise compatibility achieved by the future land use with consideration of the 2008 NEM assuming that all land zoned for residential use is developed by 2008. It should be understood that this future is unlikely by 2008. However, this analysis provides the potential non-compatible development currently allowable in the vicinity of BDL.

Figure 4-4 shows the potential future land use. The potential future land use was based on the existing land use data, with potential residential growth areas included as provided by the local town government planning officials.

Potential future land use was acquired from the Capital Region Council of Governments (CRCOG) for Hartford County in the form of a zoning map. This zoning map shows current zoning information as provided by the local townships to CRCOG and was developed by CRCOG in the year 2000. This map was used in the absence of complete future development plans within the study area. The use of this zoning map to show potential residential development was in the interest of fairness to all the townships involved in the study, and was also approved by each of the Town Planners, or acting representative thereof.

4.4.1 Future Land Use Compatibility

The DNL contours for the 2008 NEM, presented on **Figure 4-5**, are evaluated for their impact on future land use compatibility. **Table 4.7** presents the distribution of off-airport noise-exposed land areas by land use in three DNL intervals for the 2008 NEM. Fifty-eight percent of the future land use within the 60+ dB DNL noise contour of the 2008 NEM is expected to be residential, as compared to 19 percent residential for existing land use within the 2008 NEM.

Table 4.8 contains the estimated number of people and dwellings within three DNL intervals for the affected towns for the 2008 NEM. Within the 2008 NEM 60-64 dB DNL contour, there would be approximately 5,970 people and 2,314 dwelling units. Within the 65 dB DNL contour, there would be approximately 2,247 people and 879 dwelling units, including approximately 53 people and 23 dwelling units affected by DNLs of 70 dB or greater. Fifty-seven percent of the people within the 65+ dB DNL contour are in the Town of Suffield.

The number of potential noise-sensitive receptors was not projected for the future potential land use condition. The CROG zoning map, used to generate the land use in the potential future land use graphic, did not provide a list of resources that are classified as noise-sensitive.

Table 4.7

Estimated Off-Airport Acreage with DNL Contours with Potential Future Land Use

Noise Exposure Map	Generalized Land Use	Acreage Within DNL Contour Interval (dB)				
		60-64	65-70	70-74	Within 75	Total within 60
2008 NEM	Residential	2,174	573	29	-	2,776
	Non-Residential	1,572	740	202	2	2,516
	TOTAL	3,746	1,313	231	2	5,292

Note: Acreage totals do not include airport property

Source: HNTB Analysis.

Table 4.8

Estimated Population and Dwelling Units with 2008 DNL Contours with the Potential Future Land Use

City/Town	60-64 dB DNL		65-69 dB DNL		70-74 dB DNL		Within 75 dB DNL		Total within 60 dB DNL	
	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units
2008 NEM										
Bloomfield	1	1	-	-	-	-	-	-	**1**	**1**
Simsbury	-	-	-	-	-	-	-	-	**-**	**-**
Windsor	474	170	140	59	20	11	-	-	**634**	**240**
Windsor Locks	1,527	642	624	310	-	-	-	-	**2,151**	**952**
Suffield	3,263	1,224	1,414	480	32	11	-	-	**4,709**	**1,715**
East Granby	705	277	16	7	1	1	-	-	**722**	**285**
Total	**5,970**	**2,314**	**2,194**	**856**	**53**	**23**	**-**	**-**	**8,217**	**3,193**

Notes:
1. 2000 U.S. Census data was used to calculate these population statistics. Bloomfield, East Windsor, Enfield, Granby and Simsbury do not have dwellings within the 65 dB DNL contour.
2. Population data rounded to the nearest whole number, except for values less than one which are rounded up.

Source: HNTB Analysis.

ENDNOTES

[1] Per 24 CFR Part 51 Section 104, if an unacceptable area is being considered, an EIS is required prior to the approval of projects with unacceptable noise exposure. Projects in or partially in an unacceptable noise exposure area shall be submitted to the Assistant Secretary for Community Planning and Development, or the Certifying Officer for activities subject to 24 CFR part 58, for approval.

[2] A frequently used metric of noise exposure for a single aircraft flyover.

Chapter Five
NOISE ABATEMENT MEASURES

This chapter discusses existing procedures and potential alternatives for aircraft noise abatement analyzed in the Part 150 Study. The analysis of noise abatement practices and alternatives considers changes to runway use, flight track use, and other operational procedures that determine where aircraft fly in the immediate vicinity of Bradley International Airport.

Aircraft noise abatement alternatives are analyzed for their potential to reduce the noise-impacted population within the 65 dB DNL contour. The impact of an alternative on airport efficiency is an important consideration in alternative development, as proposed improvements cannot significantly reduce the airport's capacity or increase delay. In addition, alternatives considered must be operationally feasible: each must follow existing FAA regulations regarding air traffic, cannot unduly increase ATC workload, and must be usable by aircraft pilots. Above all other considerations, any alternative must maintain the safety of aircraft operations.

In this chapter, Section 5.1 discusses development of a Noise Compatibility Program (NCP). Section 5.2 reviews potential noise abatement measures; and Section 5.3 summarizes and reviews the noise abatement measures recommended for inclusion in the NCP.

5.1 GENERAL ELEMENTS OF NOISE COMPATIBILITY PROGRAMS

The development of an NCP begins with an evaluation of all reasonable feasible actions that could reduce potential land use incompatibilities identified in the NEMs. Noise compatibility measures fall into two principal categories:

- "noise abatement" measures to reduce the size or change the shape of the noise contours so as to minimize incompatibilities, and

- "land use" measures to correct current incompatibilities and to prevent future incompatibilities. NCPs may also include "continuing program measures" related to ongoing monitoring of the initial noise abatement and land use measures.

The Part 150 Study requires that an airport operator consider, at a minimum, the seven categories of noise compatibility planning measures shown in **Table 5.1**. The Part 150 Study considers NCP measures in each category, including beneficial actions proposed by the FAA, other study participants, and the public.

The development of an NCP usually focuses first on noise abatement measures, which are discussed in this chapter. These measures offer the potential to mitigate the sources of aircraft noise, and thus tend to be less expensive to implement than land use measures, which must influence a wide area to be effective. After aircraft noise abatement alternatives are developed, the NCP process then focuses on land use measures, which are discussed in Chapter 6, to address possible land use incompatibilities.

Table 5.1

Categories of Noise Compatibility Planning Measures

Category	Description	Measure Type
1	Land acquisition and interests therein	Land Use
2	Barriers, shielding, public building soundproofing	Land Use and Noise Abatement
3	Preferential runway use system	Noise Abatement
4	Flight procedures	Noise Abatement
5	Restrictions on type/class of aircraft	Noise Abatement
5a	*Restricted usage based on Federal standards*	
5b	*Capacity limits based on noisiness*	
5c	*Noise abatement procedures*	
5d	*Landing fees based on noise or time*	
5e	*Curfews*	
6	Other actions with beneficial impact	Miscellaneous, Land Use, or Noise Abatement
7	Other FAA recommendations	Miscellaneous, Land Use, or Noise Abatement

Source: 14 CFR Part 150, paragraphs B150.7 (b) (1) through (7)

The NCP process then examines continuing program measures in Chapter Seven, which may be needed to implement and evaluate the noise abatement and land use measures.

5.2 POTENTIAL NOISE ABATEMENT MEASURES

Noise abatement measures may reduce aircraft noise levels or mitigate noise in sensitive areas. The aircraft noise abatement measures for BDL in this document were developed and analyzed with input from ConnDOT, the Technical Advisory Committee (TAC), the general public, and Part 150 guidelines. **Table 5.2** presents the aircraft noise abatement measures considered in this study, organized in the five principal types of noise abatement measures required for consideration by 14 CFR Part 150.

Some measures that could be considered in a Part 150 study were not comprehensively evaluated in the BDL Part 150, due to their limited or non-existent noise benefit and input gathered during the consultation process indicating that such measures were not of major interest to local communities. Measures excluded from Summary Evaluation include revised General Aviation departure flight tracks and traffic patterns, flight training restrictions, reverse thrust restrictions, engine run-up procedures, restrictions based on landing weight, and a runway extension. Also, discussions during the study process indicate that reverse thrust upon landing is not a major concern to local residents.

Section 5.2.1 outlines the evaluation criteria for each measure. Sections 5.2.2 through 5.2.6 review each potential measure in detail.

Table 5.2

Noise Abatement Measures Considered in BDL Part 150 Study

Type of Noise Abatement Measure	Specific Measure
Runway Use Measures	• Preferential Runway Use
	• Rotational Runway Use
Preferential Flight Track Measures	• Air Carrier Departure Flight Tracks (includes reevaluation of previous recommendation of a turn as soon as possible for westbound and northbound departures off of Runway 24)
	• Helicopter Flight Corridors & Altitudes
Flight Procedure Modification Measures	• Noise Abatement Departure Profiles
	• Noise Abatement Arrival Profiles (4-Degree Approach Slope)
Airport Use Restriction Measures	• Curfews/Restrictions on Operations of Noisiest Aircraft (Restrictions on non-Stage 3 jet operations and/or hushkitted Stage 3 Air Carrier operations during Nighttime or 24 Hours)
	• Capacity Limits Based on Noisiness
	• Noise-Based Landing Fees
Airport Layout Modification Measures	• Noise Barrier
	• Displaced Thresholds

Source: HMMH

5.2.1 Evaluation Criteria

Six general criteria were used to evaluate and recommend noise abatement procedures. These are listed below, including a brief summary of the related considerations.

Safety – The primary consideration with all alternatives is safety, as determined by the FAA and ATC tower personnel.

Operational – Considerations include the potential of the procedure to meet operational requirements, implementation by FAA, ATC, and aircraft operators; flight track orientation with respect to aircraft destination; and runway length.

Reduced Population Within Sound Exposure Level (SEL) Contours - For departure flight tracks and Noise Abatement Departure Profiles (NADPs), the population is evaluated within a single-event 90 dBA Sound Exposure Level (SEL) noise contour. The Technical Advisory Committie (TAC) discussed at length the criteria for recommending a departure track or a NADP for consideration in the NCP. The TAC, ConnDOT, and consultants agreed to the following criteria. Small reductions in the exposed population of less than 10% are not used as a basis for recommending a measure, as the accuracy of land use information and the margin of error of the noise model are significant at this low level. Exposed population reductions of greater than 10% may be significant enough to warrant further evaluation. However, a percent reduction is necessarily a subjective consideration. For example, for 1,000 people impacted in an SEL contour, a reduction to 900 (10%) might be considered important. However, for 100 people

impacted in an SEL contour a reduction to 90 (10%) might not be considered important, while a reduction to 50 (50%) may be considered worthwhile. Therefore, reduced SEL populations are important to consider in the context of either criteria.

Reduced Population Within Average Day/Night Level (DNL) Contours - If applicable, a measure is evaluated with respect to its potential to reduce the exposed existing population, as shown on the 2008 65 dB DNL contour map. Although the estimated future population is shown, it is presented as a scenario for an ultimate build-out of the area around BDL and may not necessarily be an indicator of the actual future population. Any measure that reduces existing population within the 65 dB DNL contour is likely to be recommended (at least from a noise abatement perspective), as it would reduce the number of people within high noise-impact areas. Therefore, a measure that reduces the exposed 65 dB DNL population by 10% or less may be sufficient to warrant inclusion in the NCP.

Input and Recommendations from Public, Advisory Committee, Airport Staff – Input from interested parties is important in the formulation of noise abatement recommendations. Noise abatement flight tracks or a change in runway use may ultimately reduce the number of people in the DNL noise contours, but could create additional noise in other areas. Final input from airport staff, the Advisory Committee, and the general public is important to help determine the value of a candidate noise abatement procedure.

Cost – The capital and operational costs of a measure are considered to the extent practical; costs may include infrastructure improvements, equipment acquisition, and operating expenses such as labor and fuel. Cost estimates involving operational expenses use FAA cost data in year 2001 dollars.

5.2.2 Runway Use Measures

Two runway use measures are evaluated in this study: a preferential runway use system, and a rotational runway use system. Both measures are described in the following subsections.

5.2.2(a) *Potential Measure: Preferential Runway Use*[1]

The goal of a preferential runway use system (RUS) is to minimize population impacts by taking advantage of compatible land uses around the Airport, while optimizing runway use with respect to wind, weather, demand and airport layout constraints. In general, it is preferable to maximize departures over less populated areas.

The most significant factors affecting runway use are weather conditions and runway length. Weather affects runway use because aircraft must generally takeoff and land into the wind to maximize safety and aircraft performance, as well as reducing takeoff and landing distance. Runway length is an issue because some aircraft need more distance than others to become safely airborne. In addition, an aircraft's required runway length can increase with higher takeoff weights.

A preferential and practical runway use program for each runway at BDL was developed based on historic wind conditions and runway requirements of aircraft operating at BDL. The BDL Airport Layout Plan provided historic wind conditions for Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) conditions. For the purposes of this analysis, it is assumed that an aircraft in both VFR and IFR conditions could use a runway, provided that the winds

are less than four miles per hour (mph), or the crosswind component is no more than 15 mph with no tail wind component. These wind component values establish a conservative estimate of runway use requirements.[2]

Depending on factors such as aircraft performance, takeoff weight, and weather, some aircraft may not be able to use Runway 15/33 due to its shorter length of 6,850 feet, as compared to the greater length of Runway 06/24 at 9,510 feet. For the runway use analyses, the following aircraft are assumed to be unable to participate in a preferential runway use program for departures on Runway 15/33:

- All A300s, B767s, DC-8s, MD-80s, and B737-800s;
- All departing aircraft with a stage length of 3 or greater (i.e. aircraft departing for a destination more than 1,000 nautical miles from BDL); and
- All B737-400s with a stage length of 2 or greater (i.e. aircraft departing for a destination more than 500 nautical miles from BDL).
- Seven preferential RUS scenarios were developed and evaluated: four for departure use and three for arrival use. This study also examined the effect of instituting an RUS without regard for time of day (i.e. daytime or nighttime) or aircraft (jet or propeller).

The preferential departure runway analysis was performed for each of the four runway ends, while the preferential arrival runway analysis was performed for Runways 06, 24, and 33. A preferential arrival runway use analysis for Runway 15 was not examined due to the large hill under the Runway 15 approach path, and because the runway lacks an Instrument Landing System (ILS). In addition, the existing runway use patterns show that Runway 15 is rarely used for arrivals.

The 65 dB DNL contour impacts for the seven RUS scenarios are presented in **Figures 5-1 to 5-7**. The contours are based on the 2008 operations forecast[3] and only modify the runway use using the assumptions described previously.

Table 5.3 shows the future year unmitigated 2008 annual average runway use, compared to the estimated annual runway use that would result from each of the seven RUS scenarios. For example, a runway use scenario in which departures from Runway 33 were maximized would result in 54 percent of departures using that runway, as opposed to 30 percent in the unmitigated runway use. Similarly, maximizing arrivals to Runway 24 would result in 61 percent of arrivals using that runway, as opposed to 36 percent in the unmitigated runway use. The unmitigated 2008 runway use is slightly different from the existing year 2003 runway use discussed in Chapter 3 due to the fact that regional turboprops are not forecasted to operate at BDL by the year 2008.

Table 5.4 presents existing population counts for the seven runway use alternatives, as compared to the unmitigated case conditions with year 2008 operations. **Table 5.5** summarizes the evaluation of preferential runway use scenarios. In accordance with the goal of this study to "improve the overall noise environment while not shifting noise from one residential community to another," the scenarios that achieve the greatest total population reductions within the 65 dB DNL contours (preferential arrivals to Runway 24 and preferential departures from Runway 24) are not recommended for inclusion in the NCP, as population within the 60-64 dB and/or 70-74 dB DNL contours would increase

with these scenarios despite the population reduction within the 65-69 dB DNL contour. Accordingly, the existing procedures provide for optimal runway use in terms of noise abatement procedures.

Table 5.3

Annual Average Runway Use with Preferential Runway Use Alternatives

Alternative	Runway				Total
	6	15	24	33	
Year 2008 Unmitigated DNL Contours					
Arrival	41%	3%	36%	20%	100%
Departure	34%	4%	32%	30%	100%
Total	38%	3%	34%	25%	100%
Preferential Arrivals to Runway 06					
Arrival	42%	3%	36%	19%	100%
Departure	34%	4%	32%	30%	100%
Total	38%	3%	34%	24%	100%
Preferential Arrivals to Runway 24					
Arrival	25%	2%	61%	12%	100%
Departure	34%	4%	32%	30%	100%
Total	30%	3%	47%	21%	100%
Preferential Arrivals to Runway 33					
Arrival	18%	3%	16%	64%	100%
Departure	34%	4%	32%	30%	100%
Total	26%	3%	24%	47%	100%
Preferential Departures to Runway 06					
Arrival	41%	3%	36%	20%	100%
Departure	42%	4%	29%	25%	100%
Total	42%	3%	33%	22%	100%
Preferential Departures to Runway 15					
Arrival	41%	3%	36%	20%	100%
Departure	24%	35%	22%	19%	100%
Total	32%	19%	29%	19%	100%
Preferential Departures to Runway 24					
Arrival	41%	3%	36%	20%	100%
Departure	20%	4%	61%	15%	100%
Total	30%	3%	49%	18%	100%
Preferential Departures to Runway 33					
Arrival	41%	3%	36%	20%	100%
Departure	21%	4%	20%	54%	100%
Total	31%	3%	28%	37%	100%

Note: Totals may not equal 100% due to rounding.

Source: HMMH analysis.

Table 5.4

Existing and Future Population Counts of Preferential Runway Use Alternatives

Alternative	Existing Land Use					Future Land Use				
	60-64 dB DNL	65-69 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total Within 60 dB DNL**	60-64 dB DNL	65-69 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total Within 60 dB DNL**
Year 2008 Unmitigated DNL Contours										
Non-Compatible Acreage	755	226	1	-	982	2,174	573	29	-	2,776
Population	2,238	850	3	-	3,091	5,970	2,194	53	-	8,217
Housing Units	883	367	2	-	1,252	2,314	856	23	-	3,193
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Preferential Arrivals to Runway 06										
Non-Compatible Acreage	753	226	-	-	979	2,170	577	28	-	2,775
Population	2,235	846	3	-	3,084	5,973	2,198	51	-	8,222
Housing Units	882	365	1	-	1,248	2,316	857	21	-	3,194
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Preferential Arrivals to Runway 24										
Non-Compatible Acreage	740	215	5	-	960	2,116	628	25	-	2,769
Population	2,264	725	16	-	3,005	5,898	2,226	57	-	8,181
Housing Units	897	316	6	-	1,219	2,303	864	19	-	3,186
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Preferential Arrivals to Runway 33										
Non-Compatible Acreage	719	254	25	-	998	1,926	611	28	-	2,565
Population	2,097	1,164	143	-	3,404	5,361	2,355	308	-	8,024
Housing Units	815	491	71	-	1,377	2,044	909	157	-	3,110
Noise-Sensitive Locations	6	-	-	-	6	6	-	-	-	6
Preferential Departures to Runway 06										
Non-Compatible Acreage	764	221	-	-	985	2,177	550	33	-	2,760
Population	2,256	825	4	-	3,085	5,965	2,125	66	-	8,156
Housing Units	887	359	1	-	1,247	2,305	833	27	-	3,165
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Preferential Departures to Runway 24										
Non-Compatible Acreage	1,019	116	5	-	1,140	2,081	296	58	-	2,435
Population	2,724	395	15	-	3,134	5,662	1,281	84	-	7,027
Housing Units	1,095	169	9	-	1,273	2,197	496	42	-	2,735
Noise-Sensitive Locations	4	1	-	-	5	4	1	-	-	5
Preferential Departures to Runway 15										
Non-Compatible Acreage	776	283	85	-	1,144	2,128	609	63	-	2,800
Population	2,406	1,413	501	-	4,320	6,488	2,736	600	-	9,824
Housing Units	931	570	252	-	1,753	2,451	1,068	306	-	3,825
Noise-Sensitive Locations	8	1	-	-	9	8	1	-	-	9
Preferential Departures to Runway 33										
Non-Compatible Acreage	693	254	14	-	961	2,225	515	123	-	2,863
Population	2,166	723	43	-	2,932	5,194	1,648	324	-	7,166
Housing Units	848	328	15	-	1,191	2,000	680	119	-	2,799
Noise-Sensitive Locations	3	1	-	-	4	3	1	-	-	4

Note: Population and housing unit estimates rounded to nearest whole number.

Source: HMMH and HNTB analysis.

Table 5.5

Summary Evaluation of Preferential Runway Use

Description	A preferential runway use program for each runway end was developed based on the historic wind conditions and the runway requirements of aircraft operating or projected to operate at BDL. The preferential departure runway analysis was performed for each of the four runway ends while the preferential arrival runway analysis was performed for only Runways 06, 24, and 33 since Runway 15 has a large hill under the approach path and is not equipped with an ILS. Consideration was given to aircraft runway length requirements.
Net Change in Number of People Exposed to Noise	Although the 65 dB DNL contour is considered the threshold of impact for the noise abatement measures, population within the 60 dB DNL contour is considered in this analysis in the interest of meeting the study goal of "improve the overall noise environment while not shifting noise from one residential community to another." Maximizing arrivals on Runway 24 would achieve the greatest reduction in total population within the 60 dB DNL contours among the arrival scenarios, with a reduction of 86 people, or three percent, as compared to the unmitigated 2008 case (i.e., a reduction from 3,091 to 3,005).[4] However, although this scenario would decrease population within the 65-69 dB DNL contour by 125 people, it would increase population within the 60-64 dB DNL contour by 26 people and within the 70-74 dB DNL contour by 13 people. Maximizing arrivals on Runway 33 would increase population within the 60 dB DNL contour by 10 percent (from 3,091 to 3,404). Maximizing arrivals on Runway 06 would reduce the population within the 60 dB DNL contour by less than one percent (from 3,091 to 3,084 - this seven resident reduction is not large enough to be considered a reliable indication of change, relative to the accuracy of the base maps and nosie modeling). For the preferential departure scenarios, maximizing departures on Runway 24 would increase the population within the 60 dB DNL contour by 43 people (from 3,091 to 3,134) or just over one percent. Population within the 65-69 dB DNL contour would decrease by 455 people, while population within the 60-64 dB DNL contour would increase by 486 people and within the 70-74 dB DNL contour by 12 people. Maximizing departures on Runway 15 would increase population within the 60 dB DNL contour by about 40 percent (from 3,091 to 4,320), whereas maximizing Runway 33 departures could decrease the population in the 60 dB DNL contour by five percent (from 3,091 to 2,932). Maximizing Runway 06 departures would reduce the population within the 60 dB DNL contour by less than one percent (from 3,091 to 3,085 – once again, this six resident reduction is not large enough to be considered a reliable indication of change, relative to the accuracy of the base maps and nosie modeling).
Airport and ATC Operational Considerations	Implementing a preferential runway program could interfere with current aircraft operations in the airspace surrounding BDL including operations at other airports in the region. The FAA would determine any adverse airspace impacts when reviewing the NCP.
Effect on Aircraft Operators	A preferential runway use program could require that aircraft take shorter or longer taxi and/or air routes than with existing runway use procedures. Shorter routes would reduce costs and travel time; longer routes would increase costs and travel time.
Effect on Quality of Air Service	None.

Table 5.5

Summary Evaluation of Preferential Runway Use

Costs	Annual operating costs to air carriers of a preferential runway system would likely vary by as much as four percent over to two percent under current baseline costs, depending on the runway designated for preferential use. Designating Runway 24 as the preferential departure runway would result in increased annual operational costs to commercial aeronautical users of approximately $860,000. Much of this cost increase would be the increased taxi distance from the terminal to the Runway 24 end Costs are calculated based on changes to aircraft taxi and air route distance, and are derived from FAA operational costs by aircraft type in 2001 dollars.
Responsible Parties	FAA and BDL would be responsible for reviewing and implementing a preferential runway use program. Aircraft operators would be asked to comply with the program, but would be granted exceptions due to safety and pilot preference.
Implementation Factors	Based on weather history at BDL, wind conditions would limit the time or days that a preferential runway could be utilized.
Legal Implications	A formal change of FAA procedures may require environmental analysis and documentation under the provisions of the National Environmental Policy Act (NEPA) and Connecticut State laws.
Community Concerns	Implementing a preferential runway use program would increase operations for the designated runway and reduce operations for other runways. Communities under the approach and departure paths of a preferential runway would experience more noise, even though the overall number of people exposed to 65 dB DNL would be decreased.
Conclusion	No preferential runway use scenario would achieve a total reduction in population within the 65 dB DNL contour without shifting noise to either the 60-64 dB DNL contour or the 70-74 dB DNL contour. Accordingly, a preferential runway use scenario is not recommended for the NCP.

Source: HMMH and HNTB analysis

5.2.2(b) *Potential Measure: Rotational Runway Use*[5]

Rotational runway can be an effective noise abatement technique where residential areas surround the facility on all sides. In such cases, the use of runways can be rotated to disperse noise equally among all residents. However, at BDL residential areas are not equally distributed around the airport. For example, one area of dense residential land use exists off the departure end of Runway 15. Due to the fact that a program of this type is developed to distribute noise around an airport instead of minimizing noise in certain areas, a rotational runway use program would not achieve a reduction in population within the DNL contours at BDL.

Due to the dense population located off the departure end of Runway 15, it could be eliminated from a rotational runway use plan. Use of Runway 15 is currently limited due to rising terrain off the runway end, and the lack of an ILS to aid arriving aircraft executing an instrument approach. In such a scenario, it is noteworthy that the existing runway use for Runway 06, 24, and 33 (see Table 5.3) is fairly balanced: use on Runway 06 is 34 percent, Runway 24 is 32 percent, and Runway 33 is 30 percent for

departures. This balanced runway use precludes the need for a rotational runway use plan. **Table 5.6** summarizes the evaluation of the rotational runway use measure. The measure is not recommended for implementation at BDL.

Table 5.6

Summary Evaluation of Rotational Runway Use

Description	Rotational runway use "shares the burden" of aircraft noise by exposing equal numbers of residents around an airport by rotating takeoffs and landings to different runway ends when weather conditions allow.
Net Change in Community Noise	The measure would increase the number of people exposed to 65 dB DNL, as more aircraft operations would overfly populated areas around BDL. This is because residential areas at BDL are not equally distributed about the Airport, especially the dense residential area off the departure end of Runway 15.
Airport and ATC Operational Considerations	Implementing a rotational runway program may interfere with the operation of the airspace surrounding BDL. The FAA would evaluate the effect on the airspace when reviewing the program.
Effect on Aircraft Operators	A rotational runway use program may request aircraft to take shorter or longer taxi and air routes than with existing runway use procedures. Shorter routes would reduce costs and travel time, while longer routes would increase costs and travel time.
Effect on Quality of Air Service	None.
Costs	The costs of this measure would likely be comparable to the use of a preferential runway system.
Responsible Parties	FAA and ATC are responsible for reviewing and implementing the rotational runway use program. Aircraft operators would be asked to comply with the program, but would be granted exceptions due to safety and pilot preference.
Implementation Factors	Wind conditions would limit the times or days that a rotational runway system could be utilized. The shorter length of Runway 15/33 also limits the aircraft types that can use it.
Legal Implications	A formal change of FAA procedures may require environmental analysis and documentation under the provisions of the National Environmental Policy Act (NEPA) and Connecticut State laws.
Community Concerns	Implementing a rotational runway use program would increase operations for some runways and reduce operations for other runways. Communities under the approach and departure paths of runways that are currently used less, like Runway 15 for departures, would experience more noise.
Conclusion	Because of the uneven distribution of residential areas around BDL, there would be no noise reduction benefit achievable through a rotational runway system. Moreover, use of the primary departure Runways 06, 24, and 33, is already relatively balanced. Therefore, a rotational runway use is not recommended at BDL.

Source: HMMH and HNTB analysis

5.2.3 Preferential Flight Track Measures

A major focus of the Part 150 Study has been to evaluate flight track noise abatement measures currently in use at BDL, including two flight track turns that were evaluated as part of the 2000 Environmental Assessment "Mini-Study." The Mini-Study evaluated Runway 24 departure procedures, and recommended a revised flight track turn for aircraft turning to the west or north. That procedure was implemented in October 2000 and is being reevaluated in this Part 150 Study.

A modified departure procedure for aircraft departing Runway 06 was also evaluated in the Mini-Study. This flight track was not implemented due to significant noise impacts; however, it is being reevaluated in the Part 150 Study. Other flight track modifications are also evaluated in this section.

The Part 150 flight track analysis (including the modeling of existing conditions and the identification and modeling of alternatives considered) included more tracks than in the Mini-Study, to reflect the most recent post Mini-Study radar data sample and to take into account alternatives that the TAC requested for consideration.

5.2.3(a) *Potential Measure: Air Carrier Departure Flight Track Modifications*[6]

The departure flight track turn analysis involves changing the location at which departing aircraft make their initial heading turns. This type of analysis was performed for departures from Runways 06 and 24 in the July 2000 Environmental Assessment. The analysis of flight track turn locations was expanded for the Part 150 Study. Existing flight track turns were developed by examining radar data and finding the most common turn locations. These existing turn locations were used as a baseline for comparing alternative turn locations. Updated land use information was used in the analysis of all departure flight track alternatives, including the two carried forward from the 2000 Environmental Assessment.

In the development of alternative flight track turn procedures, several design constraints were considered:

1. Ultimate destination of the aircraft - At BDL, commercial aircraft typically depart to the north, west, or south, corresponding to navigation aids (NAVAIDS) at Chester (CTR), Pawling (PWL), and Norwich (ORW), respectively.

2. Turn radius of the aircraft - The average turning radius of commercial aircraft at BDL was determined to be approximately 10,000 feet, or 1.6 nautical miles, based on radar data analysis.[7] Turn radii generally became larger has the aircraft flew further from the airport and increase speed (an aircraft needs a greater turn radii at higher speeds in order to maintain the same level of comfort to passengers). The turn radius for the model tracks was determined by examining similar radar tracks. The average turn radius for model tracks was approximately 10,000 ft., however turn radii varied from 7,000 ft. to 15,000 ft.

3. Feasibility - FAA will review the procedure for safety and conflicts with air traffic routes.

4. Population reduction - The potential of the alternative to actually reduce the number of people exposed to significant noise is evaluated. Only turn procedures

that have potential of reducing the number of people exposed to noise will be forwarded to the FAA for approval.

In this evaluation, single event 90 dBA Sound Exposure Level (SEL) contours for a departing hushkitted stage 3 B737-200 aircraft were evaluated from each runway end. Although the B737-200 represents less than four percent of the total fleet projected to operate at BDL by 2008, it is one of the loudest and most common hushkitted aircraft in the 2008 forecast fleet. Accordingly, it is an appropriate aircraft to use in evaluating flight track procedures. Potential aircraft departure flight track turns were modeled and evaluated in areas where the population density was determined to be lowest, according to community approved land use base maps.

Existing residential population and other noise-sensitive locations within the 90 dBA SEL contours were tabulated for the alternative flight tracks and compared to the existing flight track(s), as shown in **Table 5.7.** Corresponding 90 dBA SEL contours are presented in **Figures 5-8 to 5-11. Tables 5.8 through 5.11** summarize the evaluation of departure flight track alternatives. This analysis shows sufficient potential in noise reduction benefits to consider changes to departure flight tracks off of Runway 15 and 33. No changes are recommended to the departure flight tracks from Runways 06 and 24.

Table 5.7

Existing Population Counts for Departure Flight Tracks

Runway	Destination (Direction)	Track Type	Track Name	Track Description	Residential Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
06	North	Existing	06CTR	Existing operations to navaid CTR	600	2
		Alternative	06DF	EA: As soon as possible left to the North	610	5
		Alternative	06DP2	Proposed as soon as possible left to CTR	630	2
		Alternative	06DP4	Proposed early left to CTR	580	3
	South	Existing	06ORW	Existing operations to navaid ORW	650	1
		Alternative	06DC	EA: 30 degree as soon as possible right then to South	1,310	0
	West	Existing	06PWL	Existing operations to navaid PWL	580	2
		Alternative	06DE	EA: As soon as possible left to the West	590	5
		Alternative	06DP1	Proposed as soon as possible left to PWL	530	3
		Alternative	06DP3	Proposed early left to PWL	580	3
24	North	Existing	24CTR	Existing operations to navaid fix CTR	300	3
		Alternative	24DP2	Proposed straight, left, until river	720	1
		Alternative	24DP5	Proposed turn to 230 degrees	1,160	0

Table 5.7

Existing Population Counts for Departure Flight Tracks

Runway	Destination (Direction)	Track Type	Track Name	Track Description	Residential Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
	South	Existing	24ORW	Existing operations to navaid ORW	810	1
		Alternative	24DE	EA: Turn to the South	750	1
		Alternative	24DP1	Proposed Late Turn to ORW	940	1
		Alternative	24DP4	Proposed straight, left, until river	720	1
		Alternative	24DP7	Proposed turn to 230 degrees	1,110	0
	West	Existing	24PWL	Existing operations to navaid PWL	310	2
		Alternative	24DA	EA: later turn to West	1,110	1
		Alternative	24DB	EA: As soon as possible turn to West	630	1
		Alternative	24DC	EA: Latest turn to West	940	1
		Alternative	24DP3	Proposed straight, left, until river	720	1
		Alternative	24DP6	Proposed turn to 230 degrees	1,120	0
15	North	Existing	15CTR	Existing operations to navaid CTR	3,360	8
		Alternative	15DP1	Proposed 15 degree right to CTR (Early)	3,880	8
		Alternative	15DP4	Proposed 15 degree right to CTR (Late)	2,910	7
	South	Existing	15ORW	Existing operations to navaid ORW	3,630	8
		Alternative	15DP3	Proposed 15 degree right to ORW (Late)	3,010	8
		Alternative	15DP6	Proposed 15 degree right to ORW (Early)	2,980	8
	West	Existing	15PWL	Existing operations to navaid PWL	3,570	8
		Alternative	15DP2	Proposed 15 degree right to PWL (Early)	3,860	8
		Alternative	15DP5	Proposed 15 degree right to PWL (Late)	2,900	7
33	North	Existing	33CTR	Existing operations to navaid CTR	280	1
		Alternative	33DP8	Proposed as soon as possible Right Turn to CTR	250	1
	South via East	Existing	33ORW2	Existing operations to navaid ORW (right)	340	1
		Alternative	33DP7	Proposed as soon as possible Right Turn to ORW	180	1
	South via West	Existing	33ORW1	Existing operations to navaid ORW (left)	290	1
		Alternative	33DP4	Proposed as soon as possible left to PWL	250	4

Table 5.7

Existing Population Counts for Departure Flight Tracks

Runway	Destination (Direction)	Track Type	Track Name	Track Description	Residential Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
	West	Existing	33PWL	Existing operations to navaid PWL	270	1
		Alternative	33DP5	Proposed as soon as possible left to CTR	440	3

Note: Population counts rounded to nearest 10.

Source: HMMH and HNTB analysis.

Table 5.8

Summary Evaluation of Runway 06 Departure Flight Track Alternatives

Description	This departure flight track alternatives analysis involves the initial turn location for aircraft departing Runway 06, as was analyzed in the 2000 "Mini Study." This analysis was expanded for the Part 150 through the consideration of additional alternative tracks. The EA turns were also re-evaluated using updated and community-verified land use information. Runway 06 departure flight tracks turn to the north (navaid CTR), south (navaid ORW), and west (navaid PWL) depending on the destination of the aircraft. The alternatives developed change the departure flight tracks with the goal of routing departing aircraft over less populated areas to reduce the overall number of people exposed to noise.
Net Change in Community Noise	The analyses of Runway 06 departure flight track turns to the north (CTR), south (ORW), and west (PWL) show no clear advantage in terms of population reduction for any of the alternatives. This is due to existing land use in the Town of Suffield and the proximity of Suffield Center to the runway end. Alternative turns to the north show a 3 percent decrease of 20 people to a 5 percent increase of 30 people. Alternative turns to the south show a 102 percent increase of 660 people. To the west, alternative flight tracks would cause a change in exposed population ranging from a 2 percent increase of 10 people to a 9 percent decrease of 50 people.
Airport and ATC Operational Considerations	None of the alternatives raise significant Airport or ATC operational concerns.
Effect on Aircraft Operators	Depending on the flight track, operators may experience minimal changes to their flight times and distances.
Effect on Quality of Air Service	No significant effects.
Costs	Each of the alternate flight tracks would provide a financial benefit to aircraft operators, due to reductions in flight time and distance. Total annual savings would very from $52,000 to $382,000 depending on the flight track. This

Table 5.8

Summary Evaluation of Runway 06 Departure Flight Track Alternatives

	represents a benefit of 2% to 12% less than the baseline operating costs. Costs are calculated based on changes to aircraft air route distance from the runway to the appropriate departure fix, and are derived from FAA operational costs by aircraft type in 2001 dollars.
Responsible Parties	BDL would request FAA and ATC to review, approve, and implement any new departure flight track procedure(s). Aircraft operators would be responsible for flying the new procedures; deviations from the flight track would be expected due to weather, aircraft performance, and available navigation technologies.
Implementation Factors	ATC would review the alternative departure flight tracks for conflicts with existing flight routes (such as arrivals to another runway or operations at other airports) and develop an appropriate procedure. Some flight tracks may require development of instrument departure procedures. Design of flight procedures would be undertaken after the Part 150 Study. Monitoring of an alternative flight track location would be conducted after implementation.
Legal Implications	A change of FAA procedures may require environmental documentation under the provisions of the National Environmental Policy Act (NEPA) and/or Connecticut State Law.
Community Concerns	The departure track alternatives are intended to route aircraft over less populated areas and reduce the overall noise exposure. However, people residing in these areas would experience increased noise.
Conclusion	None of the alternatives for Runway 06 departure flight tracks offer substantive noise benefits. Therefore, no changes are recommended for existing Runway 06 departure procedures. The use of the existing Runway 06 departure flight tracks (06CTR, 06ORW, and 06PWL) are recommended for inclusion in the NCP.

Source: HMMH and HNTB analysis

Table 5.9

Summary Evaluation of Runway 24 Departure Flight Track Alternatives

Description	This departure flight track alternatives analysis involves the initial turn location for aircraft departing from Runway 24. This analysis is a more detailed effort to evaluate similar alternatives during the 2000 "Mini-Study." Runway 24 departure flight tracks turn to the north (navaid CTR), south (navaid ORW), and west (navaid PWL) depending on the destination of the aircraft. The alternatives developed change the departure flight tracks with the goal of routing aircraft over less populated areas to reduce the overall number of people exposed to aircraft noise.
Net Change in Community Noise	The analyses of Runway 24 departure flight tracks showed that existing turns to the west (PWL) and north (CTR) on tracks 24CTR and 24PWL, respectively, still provide the greatest noise reduction for the community and expose the fewest number of people to noise. These are the flight tracks originally recommended and implemented in the "Mini-Study" that overfly Windsor, East Granby, and Simsbury. For the turn to the north (24CTR), the existing track impacts 420 to 860 fewer people than the alternative tracks. For the turn to the west (24PWL), the existing track impacts 320 to 820 fewer people than the alternative tracks. For turns to the south (ORW), alternative tracks 24DE and 24DP4 would reduce population by 60 and 90 people, respectively, which represents a decrease of seven to 11 percent. The small changes in exposed population for the south turns from Runway 24 are not sufficient to warrant a change in flight track procedures.
Airport and ATC Operational Considerations	According to ATC, the early south turn required for flight track 24DE or 24DP4 would conflict with the existing downwind arrival routes to Runway 24.
Effect on Aircraft Operators	Depending on the flight track, operators may experience minimal changes to their flight times and distances.
Effect on Quality of Air Service	No significant effect.
Costs	The annual costs differences resulting from changes in flight time and distance associated with each of the alternative flight tracks for Runway 24 departures vary from a savings of $45,000 (for track 24DP7) to an additional expense of $547,000 (for track 24DP2), as compared to baseline costs. Except for tracks 24DP2, 24DP5, and 24DP1, the cost differences are within six percent (plus or minus) of the annual baseline operating costs. Costs are calculated based on changes to aircraft air route distance from the runway to the appropriate departure fix, and are derived from FAA operational costs by aircraft type in 2001 dollars.
Responsible Parties	BDL would request FAA and ATC to review, approve, and implement the new departure flight track procedures. Aircraft operators would be responsible for flying the new procedures; deviations from the flight track would be expected due to weather, aircraft performance, and available navigation technologies.
Implementation Factors	ATC would review the alternative departure flight tracks for conflicts with other existing flight routes (such as arrivals to another runway) and develop necessary procedures. Some flight tracks may require development of instrument departure procedures. Design of flight procedures would be undertaken after the Part 150 Study. Monitoring of an alternative flight track location would be conducted after implementation.

Table 5.9

Summary Evaluation of Runway 24 Departure Flight Track Alternatives

Legal Implications	A formal change of FAA procedures may require environmental documentation under the provisions of the National Environmental Policy Act (NEPA) and/or Connecticut State Law.
Community Concerns	The departure track alternatives are intended to route aircraft over less populated areas to reduce the overall noise exposure. However, people residing in these areas would experience increased noise.
Conclusion	For westbound or northbound aircraft departures, none of the alternative flight tracks offer any reduction in exposed population, as compared to the existing procedure (24PWLB or 24CTRB). Due to airspace constraints, a change in flight procedures to use track 24DE or 24DP4 for southbound departures is not feasible. Therefore, the current Runway 24 departure flight tracks, including tracks 24CTR and 24PWL from the "Mini-Study", and track 24ORW are recommended for inclusion in the NCP.

Source: HMMH and HNTB analysis

Table 5.10

Summary Evaluation of Runway 15 Departure Flight Track Alternatives

Description	This departure flight track alternatives analysis involves the initial turn location for aircraft departing Runway 15 to route aircraft over less populated areas and thus reduce the number of people exposed to aircraft noise. Runway 15 departure flight track alternatives turn to the north (navaid CTR), south (navaid ORW), and west (navaid PWL) depending on the destination of the aircraft.
Net Change in Community Noise	Runway 15 departures overfly the densely populated areas of Windsor Locks. A right turn of 15 degrees as soon as possible after departure, followed by a subsequent turn to the appropriate departure navigation aid, would reduce the exposed population by 13 to 19 percent depending upon the direction of flight. The alternative departure flight track turns to the north (CTR) would reduce population by up to 450 people, or 13 percent, as compared to the existing flight track procedure. The alternative turn to the south (ORW) would reduce population by up to 650 people, or 18 percent, while the alternative turns to the west (PWL) would reduce population by up to 670 people, or 19 percent.
Airport and ATC Operational Considerations	According to ATC, when the airport is in a flow that is using Runways 15 and 24, the alternative Runway 15 flight tracks with right turns after departure could likely be implemented. However, when the airport is in a flow using Runways 15 and 06 aircraft making a right turn would be turning in to the face of aircraft arriving to Runway 06, which would preclude use of the alternative flight tracks.
Effect on Aircraft Operators	Depending on the flight track, operators may experience minimal changes to their flight times and distances.
Effect on Quality of Air Service	No significant effects.
Costs	The annual costs differences associated with each of the alternative flight tracks for Runway 15 departures are not significant, varying from a savings of $1,000 (3%) to an additional expense of $16,000 (5%), as compared to baseline costs. Costs are calculated based on changes to aircraft air route distance from the runway to the appropriate departure fix, and are derived from FAA operational costs by aircraft type in 2001 dollars.
Responsible Parties	BDL would request FAA and ATC to review, approve, and implement a new departure flight track procedure. Aircraft operators would be responsible for flying the new procedures; deviations from the expected flight track would be expected to occur due to weather, aircraft performance, and available navigation technologies.
Implementation Factors	ATC would review the alternatives for conflicts with other existing flight routes (such as arrivals to another runway or operations at other airports) and develop an appropriate procedure. Some flight tracks may require development of instrument departure procedures. Design of flight procedures would be undertaken after the Part 150 Study. Monitoring of an alternative flight track, if selected, would be undertaken after implementation.
Legal Implications	A formal change of FAA procedures may require environmental documentation under the provisions of the National Environmental Policy Act (NEPA and/or Connecticut State Law).

Table 5.10

Summary Evaluation of Runway 15 Departure Flight Track Alternatives

Community Concerns	The departure track alternatives are intended to route aircraft over less populated areas and reduce overall noise exposure. However, people residing in these areas would experience increased noise.
Conclusion	Tracks 15DP4, 15DP5, and 15DP6 make an initial 15-degree right turn from runway heading. These three tracks are recommended for inclusion in the NCP for Runway 15 departures in order to reduce the population exposed to high single-event noise levels. These tracks could be implemented when the airport is operating in a flow that makes use of Runway 24 and 15. .

Source: HMMH and HNTB analysis

Table 5.11

Summary Evaluation of Runway 33 Departure Flight Track Alternatives

Description	This departure flight track alternatives involves changing the initial turn location of aircraft departing Runway 33 to direct them over less populated areas and thus reduce the overall number of people exposed to aircraft noise. Runway 33 departure flight tracks turn to the north (navaid CTR), south (navaid ORW), and west (navaid PWL) depending on the destination of the aircraft.
Net Change in Community Noise	Runway 33 departures overfly East Granby, Granby, and Suffield. Analysis indicates that for departures to the west (PWL), the existing tracks expose the fewest number of people to noise. A change to this track could increase the exposed population by 170 people, or 63 percent. An alternative track for northbound departures to CTR (33DP8) with a turn as soon as possible after takeoff would provide a small reduction in exposed population of 30 people, or 11 percent. For departures to the south via a westerly course as soon as possible after takeoff, alternative track 33DP4 would provide a small reduction of 40 people, or 14 percent. For departures to the south via an easterly course as soon as possible after takeoff, a change to track 33DP7 could reduce the noise-exposed population more substantially, by 160 people or 47 percent.
Airport and ATC Operational Considerations	None of the alternatives raised significant Airport or ATC operational concerns. For departures to the south via a westerly course, alternative track 33DP4 could be flown when the airport is in a flow that uses Runways 24 and 33. For departures to the south via an easterly course, alternative track 33DP7 could be flown when the airport is in a flow that uses Runways 06 and 33.
Effect on Aircraft Operators	Depending on the flight track, operators may experience minimal changes to their flight times and distances.
Effect on Quality of Air Service	No significant effects.
Costs	Each of the flight track alternatives would provide a financial benefit to aircraft operators. Total annual savings would range from $5,000 to $36,000, depending on the flight track. This represents a savings of less than one percent to 10% over baseline operating costs. Costs are calculated based on changes to aircraft air route distance from the runway to the appropriate departure fix, and are derived from FAA operational costs by aircraft type in 2001 dollars.
Responsible Parties	BDL would request FAA and ATC to review, approve, and implement a new departure flight track procedure. Aircraft operators would be responsible for flying the new procedure; deviations from the expected flight track would be expected due to weather, aircraft performance, and available navigation technologies.
Implementation Factors	ATC would review the departure flight track alternatives for conflicts with other existing flight routes (such as arrivals to another runway or operations at other airports) and develop necessary procedures. Some flight tracks may require development of instrument departure procedures. Design of flight procedures would be undertaken at a later date. Monitoring of the alternative flight tracks would be undertaken after implementation.
Legal Implications	A formal change of FAA procedures may require environmental documentation under the provisions of the National Environmental Policy Act (NEPA) and/or

Table 5.11

Summary Evaluation of Runway 33 Departure Flight Track Alternatives

	Connecticut Sate Law.
Community Concerns	The departure track alternatives are intended to route aircraft over less populated areas and reduce overall noise exposure. However, people residing in these areas would experience an increase in noise.
Conclusion	Because of their combined ability to reduce the population exposed to high single-event noise levels, alternative tracks 33DP8, 33DP7, and 33DP4 were initially recommended for inclusion in the NCP. However, the Towns of Suffield and East Granby raised concerns over the new tracks 33DP4 and 33DP7 compared to their overall effectiveness. Therefore, the TAC recommends that these tracks not be implemented. The NCP recommends that the existing tracks 33PWL, 33ORW1, and 33ORW2 and new track 33DP8 be implemented as preferential departure flight tracks.

Source: HMMH and HNTB analysis

5.2.3(b) *Potential Measure: Helicopter Flight Corridors & Altitudes*[8]

General aviation and military helicopters operate at BDL. Locally based corporations, primarily insurance companies, account for many of the general aviation helicopters operations, and typically fly the Sikorsky S76 helicopter. The Army Air National Guard unit at BDL flies a combination of the Boeing Vertol CH47 and the Bell UH1 helicopters. The State Police and aero-medical services also account for helicopter operations at BDL. General aviation flight helicopter operations depart primarily to the southwest enroute to New York City. Other helicopter operations fly south to Hartford. There is no regularly scheduled helicopter service at BDL.

The majority of helicopter operations are conducted under VFR, and thus are only managed by the BDL ATCT when in the immediate vicinity of the Airport. Although the Army Air National Guard unit at BDL has a letter of agreement with the ATCT regarding flight routes and altitudes, general aviation helicopter operators have no such agreement.

In the past, complaints have been received from residents concerning helicopter noise. However, the complaints focused on helicopter operations at a significant distance from the airport that would generally be outside the scope of a Part 150 study. Further discussions with airport staff, TAC members, and participants at the public informational workshops indicate that helicopter operations are not much of a concern to local residents in proximity to the airport. Accordingly, although procedures could be amended at BDL to direct helicopters to fly at higher altitudes (and thus reduce noise on the ground) or over less populated areas, there is no demonstrated need to amend existing procedures.

Moreover, because of their relatively small numbers and relatively quiet noise characteristics, changes to general aviation helicopter flight procedures would have no change on the DNL noise contours and minimal affect on single event contours. Therefore, as summarized in the evaluation shown in **Table 5.12**, no changes are recommended for helicopter flight corridors and flight altitudes at BDL.

Table 5.12

Summary Evaluation of Helicopter Flight Corridors and Altitudes

Description	The alternative would amend helicopter flight corridors to permit flight at higher altitudes and/or to direct aircraft over of less populated areas in order to reduce the number of people exposed to aircraft noise.
Net Change in Community Noise	Changes to general aviation helicopter flight procedures would have no effect on the 2008 60 or 65 dB DNL noise contours and minimal effects on single event levels.
Airport and ATC Operational Considerations	ATC would determine any adverse airspace impacts when reviewing alternate helicopter flight procedures.
Effect on Aircraft Operators	Depending on the flight track, operators may experience minimal changes to their flight times and distances.
Effect on Quality of Air Service	None.
Costs	No significant cost impacts would be expected.
Responsible Parties	BDL would request FAA and ATC to review, approve, and implement any new helicopter flight track procedure. Aircraft operators would be responsible for flying the new procedures; deviations from the expected flight tracks would likely occur due to weather, helicopter performance, and available navigation technologies.
Implementation Factors	ATC would check the alternative(s) for conflicts with other existing flight routes (such as arrivals to another runway) and develop any necessary flight procedures.
Legal Implications	A formal change of FAA procedures may require environmental documentation under the provisions of the National Environmental Policy Act (NEPA) and/or Connecticut State Law.
Community Concerns	Discussions with airport staff, TAC members, and participants at the public informational workshops reveals that helicopter operations were not much of a concern to local residents near the Airport.
Conclusion	Although complaints have been received in the past from residents concerning helicopter noise, these concerns have focused on helicopter operations a significant distance from the Airport. These operations are considered outside the authority of both the airport operator to amend flight procedures under 14 CFR Part 150 and the BDL ATCT. Because helicopter noise is not a significant concern of people living near the airport, no changes regarding helicopter flight corridors and altitudes at BDL are recommended for inclusion in the NCP.

Source: HMMH and HNTB analysis

5.2.4 Flight Procedure Modification Measures

The NCP included a screening analysis of two flight procedure modification measures: noise abatement departure profiles and noise abatement arrival profiles.

5.2.4(a) *Potential Measure: Noise Abatement Departure Profiles (NADPs)*[9]

Pilots use their respective airline's aircraft operating procedures (e.g., thrust and flap settings) to maneuver an aircraft during takeoff. Communities and airports have long sought operating procedures that reduce takeoff noise. FAA Advisory

Circular (AC) 91-53A, published in 1993, establishes guidelines for Noise Abatement Departure Profiles (NADP) for civil jet aircraft with a maximum takeoff weight greater than 75,000 pounds. The AC establishes the following distinct NADPs:

- **Close-In NADPs** provides a slight reduction in noise exposure for homes in the immediate vicinity of an Airport, generally within approximately four miles of the start of takeoff (not from the end of the runway).
- **Distant NADPs** provide a slight reduction in noise for homes that are not in the immediate vicinity of an Airport, typically beyond approximately four miles from the start of takeoff.

The FAA Circular defines the NADPs generally, identifying a minimum set of operating parameters for airlines to use in developing their own aircraft-specific procedures. Because of the complexity of individual aircraft and airline operating procedures, the circular does not provide specific flight instructions, but provides guidelines for carriers to use in developing their own procedures. Airlines develop their procedures with aircraft manufacturer and FAA approval. The operating procedures are unique to each aircraft type. Through AC91-53A, the FAA has established a standardized system so that an aircraft type will use the same general operating procedure throughout the nation.

An NADP does not produce an overall reduction in the noise created by an aircraft; rather, it shifts the noise from one area to another. The Close-In NADP reduces noise for locations close in to the airport, but necessarily increases noise at locations further from the airport. The Distant NADP does the opposite. Therefore, any NADP will usually decrease noise in one area, but increase noise in another. For example, although aircraft using a Close-In NADP are at a higher altitude than aircraft using a Distant NADP during the initial climb after takeoff, they are also slower and at a higher engine thrust during certain segments of the procedure. As a result, beyond about four miles from the airport, a Close-In NADP often results in higher noise exposure than Distant NADP.

The use of a specific NADP by hushkitted aircraft such as the B737-200 or DC8-60 can result in a small benefit to noise exposure for certain areas close to or distant from an airport. However, the significantly improved climb performance of newer aircraft manufactured to Stage 3 standards (such as the A320, B737-300 through 800 series, and B757) generally eliminates differences between the Close-In and Distant NADP procedures.

Although some airports, such as John Wayne-Orange County Airport, have developed their own unique NADPs, the FAA now explicitly prohibits airports from doing so out of concern for the proliferation of nonstandard procedures and the resulting negative effects on safety. Due these safety concerns, airports are not permitted to proscribe procedures that are different from the established NADPs. Airports are permitted to select an appropriate NADP for each runway end, based upon the proximity of noise sensitive locations to the Airport. Unless otherwise instructed by the airport operator, airlines typically use a Distant NADP. Note that the Close-In NADP is functionally similar to the procedure currently in use at John Wayne-Orange County Airport.

For general aviation aircraft, the National Business Aircraft Association (NBAA) has developed recommended noise abatement operating procedures for corporate jet pilots[10]. The NBAA procedures, which are

shown in Appendix C, are generally used for jet aircraft weighing less than 75,000 pounds. Noise abatement operating procedures are not applicable to or available to propeller aircraft, as they are not a major source of noise exposure at most commercial service airports, including BDL.

Use of a Close-In NADP for BDL, compared to current use of the Distant NADP, was modeled on existing departure flight tracks for all four runway ends. The analysis was conducted using single event 90 dBA SEL contours from the Boeing 737-200 aircraft, which is forecast to make up 82 percent of the hushkitted aircraft operations in 2008. The specific Close-In NADP procedures used in this BDL Part 150 Study were derived from Delta Boeing 737-200 procedures.[11] Standard INM departure profiles were used to model existing use of the Distant NADPs.

Population counts for single-event 90 dBA contours with the current Distant NADP and potential Close-In NADP are presented in **Table 5.13**. Corresponding noise contours are shown in **Figures 5-12 through 5-15**. Although this measure would provide some relief to residents when hushkitted Stage 3 aircraft are in use, operations by these aircraft are expected to be very limited by the year 2008. The year 2008 fleet is projected to have only 6.6 daily departures of a B737-200, 1.1 daily departures of a B727-100/200, and 0.4 daily departures of a DC8-60 aircraft. With airlines rapidly phasing out these older hush-kitted aircraft, even a total of 8.1 daily operations might be high.

As a result of the limited (and declining) applicability of the Close-In NADP, it would be unrealistic to predict a reduction in DNL contours through their adoption.

There also are operational issues to consider. The Air Transport Association representative to the TAC indicated that group's opposition to the mixed use of both Close-In and Distant procedures, for safety reasons. In addition, Southwest Airlines stated its preference to use the Distant NADP for all their aircraft at BDL, for safety reasons, such as the higher airspeeds achieved using the procedure. The noise benefits, operational factors, and input from airlines on use of the Close-In NADPs are summarized in **Table 5.14**. As a result of this analysis, use of the Close-In NADP is not recommended for inclusion in the NCP.

Table 5.13

Counts of Existing Population for NADP Alternatives

Runway	Destination (Direction)	Track Name	Track Description	Distant NADP (Current Procedure)		Close-In NADP (Alternative Measures)	
				Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations	Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
06	North	Existing 06CTR	Existing operations to navaid CTR	600	2	590	0

Table 5.13

Counts of Existing Population for NADP Alternatives

Runway	Destination (Direction)	Track Name	Track Description	Distant NADP (Current Procedure)		Close-In NADP (Alternative Measures)	
				Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations	Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
		Track 06DF	EA: As soon as possible left to the North	610	5	110	1
		Track 06DP2	Possible as soon as possible left to CTR	630	2	140	0
		Track 06DP4	Possible early left to CTR	580	3	220	0
	South	Existing 06ORW	Existing operations to navaid ORW	650	1	420	2
		Track 06DC	EA: 30 degree as soon as possible right then to South	1,310	0	680	0
	West	Existing 06PWL	Existing operations to navaid PWL	580	2	610	0
		Track 06DE	EA: As soon as possible left to the West	590	5	210	2
		Track 06DP1	Possible as soon as possible left to PWL	530	3	130	0
		Track 06DP3	Possible early left to PWL	580	3	230	0
24	North	Existing 24CTRB	Existing operations to navaid CTR	300	3	120	1
		Track 24DP2	Proposed straight, left, until river	720	1	280	1
		Track 24 DP5	Proposed turn to 230 degrees	1,160	0	1,090	0
	South	Existing 24ORWB	Existing operations to navaid ORW	810	1	80	1
		Track 24DE	EA: Turn to the South	750	1	80	0
		Track 24DP1	Possible Late Turn to ORW	940	1	280	0
		Track 24DP4	Proposed straight, left, until river	720	1	140	1
		Track 24DP7	Proposed turn to 230 degrees	1,110	0	210	0
	West	Existing 24PWLB	Existing operations to navaid PWLB	310	2	20	1
		Track 24DA	EA: later turn to West	1,110	1	580	0
		Track 24DB	EA: As soon as possible turn to West	630	1	100	1

Table 5.13

Counts of Existing Population for NADP Alternatives

Runway	Destination (Direction)	Track Name	Track Description	Distant NADP (Current Procedure)		Close-In NADP (Alternative Measures)	
				Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations	Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
		Track 24DC	EA: Latest turn to West	940	1	270	0
		Track 24DP3	Proposed straight, left, until river	720	1	280	1
		Track 24DP6	Proposed turn to 230 degrees	1,120	0	1,050	0
15	North	Existing 15CTR	Existing operations to navaid CTR	3,360	8	1,890	3
		Track 15DP1	Possible 15 degree right to CTR (Early)	3,880	8	880	4
		Track 15DP4	Possible 15 degree right to CTR (Late)	2,910	7	490	3
	South	Existing 15ORW	Existing operations to navaid ORW	3,630	8	1,610	3
		Track 15DP3	Possible 15 degree right to ORW (Late)	2,870	7	1,000	5
		Track 15DP6	Possible 15 degree right to ORW (Early)	2,810	7	680	5
	West	Existing 15PWL	Existing operations to navaid PWL	3,570	8	2,340	3
		Track 15DP2	Possible 15 degree right to PWL (Early)	3,860	8	890	3
		Track 15DP5	Possible 15 degree right to PWL (Late)	2,900	7	480	3
33	North	Existing 33CTR	Existing operations to navaid CTR	280	1	360	2
		Track 33DP8	Possible as soon as possible Right Turn to CTR	250	1	50	1
	South via East	Existing 33ORW2	Existing operations to navaid ORW(right)	340	1	220	1
		Track 33DP7	Possible as soon as possible Right Turn to ORW	180	1	80	2
	South via West	Existing 33ORW1	Existing operations to navaid ORW(left)	290	1	290	1
		Track 33DP4	Possible as soon as possible left to PWL	250	4	630	1

Table 5.13

Counts of Existing Population for NADP Alternatives

Runway	Destination (Direction)	Track Name	Track Description	Distant NADP (Current Procedure)		Close-In NADP (Alternative Measures)	
				Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations	Population within 90 dB SEL	Non-Residential Noise-Sensitive Locations
	West	Existing 33PWLB	Existing operations to navaid PWL	250	1	330	1
		Track 33DP5	Possible as soon as possible left to CTR	440	3	610	1

Source: HMMH and HNTB analysis.

Table 5.14

Summary Evaluation of Noise Abatement Departure Profile Alternatives

Description	This measure would establish use of the Close-In NADP on all four runway ends for hush-kitted aircraft at BDL. The Close-In NADP would be used instead of the Distant NADP, which is the current standard NADP procedure. The Close-In NADP reduces noise for locations close in to the airport, but increases, necessarily, noise at locations further from the airport. The Distant NADP does the opposite.
Net Change in Community Noise	Use of the Close-In NADP by Stage 3 hushkitted aircraft would provide the following reductions of exposed 90 dBA SEL contour populations. • Runway 06: 5% increase to 35% decrease • Runway 15: up to 94% decrease • Runway 24: up to 83% decrease • Runway 33: 152% increase to 80% decrease
Airport and ATC Operational Considerations	ATC would monitor NADP altitudes and airspeeds to ensure safe aircraft separation. The airspeed difference between aircraft using standard operating procedures (typically the Distant NADP) and other aircraft using the Close-In NADP could create departure delays at BDL..
Effect on Aircraft Operators	Comments on use of the Close-In NADP were received from aeronautical users: • Selection and use of appropriate NADPs is strongly encouraged by the Air Line Pilots Association. • The Air Transport Association recommends use of the same NADP on all runway ends at BDL to standardize procedures and thereby maintain safety. ATA has also indicated that hushkitted aircraft should not be differentiated from manufactured

Table 5.14

Summary Evaluation of Noise Abatement Departure Profile Alternatives

	Stage 3 aircraft for noise abatement purposes. • Due to the nearly identical noise exposure produced by the Close-In and Distant NADP procedures for manufactured Stage 3 aircraft, Southwest Airlines has stated its preference to use the Distant NADP for all their aircraft at BDL, due to safety and the higher airspeeds achieved using the procedure.
Effect on Quality of Air Service	None.
Costs	Although the costs for operating the Close-In NADP are relatively equal to the standard operating procedures (e.g., Distant NADP), Southwest Airlines has stated its preference for the Distant NADP due to the higher airspeeds and lower travel times afforded by the procedure.
Responsible Parties	After FAA approval, BDL and air carriers would be responsible for coordinating and implementing the Close-In NADP for hushkitted aircraft.
Implementation Factors	Most air carriers have already developed flight deck procedures for the Close-In NADP for use at other airports. After FAA approval, each operator would be required to implement an approved procedure for hushkitted aircraft departures on Runways 06, 15, 24, and 33 at BDL. Monitoring of conformance to the new procedures would require extensive analysis of data acquired through flight track monitoring and noise measurements.
Legal Implications	None anticipated.
Community Concerns	The Close-In NADP has the potential to significantly reduce noise exposure from individual aircraft events in communities close to the Airport. However, because aircraft using the Close-In NADP are slower and at a higher engine thrust during certain segments of climb-out than aircraft using the current Distant NADP, noise exposure to communities further from the Airport would increase.
Recommendation	Although use of the Close-In NADP would reduce single event noise levels over some communities, it would increase noise over other communities. Moreover, the effect on the overall DNL contours would be extremely limited, since only hushkitted aircraft, which comprise only a small percent of the forecasted operations in 2008, would use the Close-In NADP. Moreover, for operational and safety reasons, Southwest Airlines opposes use of the Close-In NADP, and the Air Transport Association does not support mixed use of the Close-In NADP by hushkitted aircraft and use of the Distant NADP by manufactured Stage 3 aircraft. Also, the use of both procedures could result in considerable airspeed differentials between aircraft that could cause operational difficulties for ATCT. As a result of these factors, use of the Close-In NADP is not recommended for use by hushkitted aircraft at BDL. The Distant NADP is therefore recommended as the preferred NADP for inclusion in the NCP.

Source: HMMH and HNTB analysis

5.2.4(b) *Potential Measure: Noise Abatement Arrival Profiles*[12]

Alternatives to current noise abatement arrival profiles are also considered in this Part 150 Study as a means to improve the noise environment. These changes to procedures regarding the use of minimal flap settings, delayed gear deployment, and reduced power levels. Steeper approach profiles (increased glide slope) are also considered as part of this procedure.

Changes to current procedures regarding minimal settings for flaps, delaying gear deployment, and reduced power levels on approach raise significant safety concerns. Such changes could require nonstandard flight procedures and provide minimal noise reduction benefits. Therefore, it is not recommended that the Part 150 Study include the analysis of changes to existing noise abatement approach procedures.

Steeper approach profiles include raising the glide slope, which provide vertical guidance to aircraft using an ILS approach. Nationwide, the FAA has set standard instrument approaches at a 3-degree approach profile. Raising the glide slope profile at BDL was an alternative suggested by a member of the public and endorsed by certain members of the advisory committee. An analysis that evaluates raising the approach profile from 3-degrees to 4-degrees was conducted. Population counts for the changes in the glide slope profiles to all four runway ends are presented in **Table 5.15**. Corresponding single-event 90 dBA SEL contours for a Boeing 737-200 are presented in **Figure 5-16**.

For all runway approach alternatives, the population within the 90 dBA contour decreases between 74 percent for Runway 33 (770 to 200) and 100 percent for Runway 15 (30 to 0).

However, FAA policy is not to approve an increase in the glide slope angle above 3-degrees unless needed for obstruction clearance. This ensures standardization of instrument approach procedures. Additionally, airlines may not favor a steeper approach because of passenger comfort. Since it is unlikely that FAA would approve raising the glide slope to 4-degrees for noise abatement, this measure is not recommend. **Table 5.16** summarizes the evaluation of noise abatement arrival profile alternatives.

5.2.5 Airport Use Restriction Measures

As noted previously, 14 CFR Part 150 requires the consideration of the following categories of airport use restrictions:

- Restrictions based on Federal standards;
- Capacity limits based on noisiness;
- Landing fees based on noise or time; and
- Curfews.

Potential measures related to airport use restrictions include mitigation of touch-and-go traffic pattern activity (by measures such as nighttime restrictions or an overall reduction in the number of touch-and-go operations); restrictions on operations during sensitive time periods (e.g., weekends, evenings, nights); restrictions on operations of noisier aircraft; and limits on overall airport activity. These are discussed in section 5.2.5 (a) through 5.2.5 (c).

Table 5.15

Existing Population Counts of Noise Abatement Approach Profiles

Runway	Type	Track	Track Description	Existing Population within 90 dB SEL - w/Standard 3-Degree Glide Slope	Existing Population within 90 dB SEL - w/Standard 4-Degree Glide Slope
6	Existing	06A	Straight Arrival	50	10
24	Existing	24A	Straight Arrival	40	10
15	Existing	15A	Straight Arrival	30	0
33	Existing	33A	Straight Arrival	770	200

Note: Population counts rounded to nearest 10.

Source: HMMH and HNTB analysis.

Table 5.16

Summary Evaluation of Noise Abatement Arrival Profile Alternatives

Description	Noise abatement arrival profiles can include changes to flap settings, delayed landing gear deployment, reduced power levels, and steeper approach profiles.
Net Change in Community Noise	Based on the Boeing 737-200 90 dB SEL contour, replacement of the normal 3-degree approach slope with a non-standard 4-degree approach slope would reduce population by approximately 30 to 40 people for Runways 06, 15, and 24, and by approximately 570 people for Runway 33.
Airport and ATC Operational Considerations	Use of nonstandard flight procedures, such as noise abatement arrival profiles, can impair flight safety. Also, the higher airspeeds and altitudes with the procedure may not be feasible with the regional flight patterns and traffic approaching or departing other airports.
Effect on Aircraft Operators	Aircraft operators would implement the nonstandard procedures when on approach to BDL. Additional air crew training would be required.
Effect on Quality of Air Service	Passengers would experience a unusually rapid descent, which my be alarming to some and cause complaints.
Costs	Air carriers would incur increased costs for development of flight deck procedures and air crew training.
Responsible Parties	BDL would ask FAA and ATC to review, approve, and implement the new procedure in coordination with aircraft operators. The aircraft operators would be responsible to develop and train air crews on flight deck procedures.
Implementation Factors	FAA does not permit increases in glide slope unless necessary for obstruction clearance.
Legal Implications	None.

Community Concerns	Members of the public have expressed strong concerns that any noise reduction measure be safe.
Conclusion	This measure is not recommended for inclusion in the NCP because of the strong likelihood that it will not receive FAA approval, and community preferences for safe operating procedures.

Source: HMMH and HNTB analysis

There are significant procedural and regulatory requirements outside of Part 150 that define, describe, and limit the application of airport use restrictions. Major Federal legislation and regulations affecting airport use restrictions are detailed in the following paragraphs.

Airport Noise and Capacity Act of 1990

The U.S. Congress passed a pivotal piece of legislation, the Airport Noise and Capacity Act of 1990 (ANCA), which established a national aviation noise policy to be implemented through FAA regulatory actions. First, the act called for a phase out of noisier aircraft, based on their noise classification status according to Federal Aviation Regulation (14 CFR) Part 36. The FAA implemented this phase out through amendment to 14 CFR Part 91. Second, the act directed the FAA to establish a national program to review and approve local airport use restrictions. FAA implemented this program through a new regulation, 14 CFR Part 161.

14 CFR Part 36

The FAA has established limits on the allowable levels of aircraft noise emissions. These limits are presented in 14 CFR Part 36, Noise Standards, Aircraft Type and Airworthiness Certification. Part 36 sets noise standards that airplanes must meet in order for the FAA to issue "type certificates" and/or "airworthiness certificates." The permissible noise levels have become more stringent over time. Aircraft not certificated under Part 36 (aircraft receiving type/airworthiness certificates prior to the dates specified in Part 36 and for which any later tests have not demonstrated compliance) are termed "Stage 1" aircraft. Aircraft meeting the original noise limits are "Stage 2." Aircraft meeting the most recent and stringent limits are "Stage 3."

14 CFR Part 91

14 CFR Part 91 set "phase-out" schedules for aircraft operations in the U.S. based on Part 36 certification stages. These schedules only apply to aircraft with maximum gross takeoff weights over 75,000 pounds (generally air carrier aircraft). Aircraft under 75,000 pounds are exempt from this phase-out schedule (generally business jet aircraft).

Part 91 states that on and after January 1, 1985, no person may operate to or from an airport in the United States in a subsonic airplane over 75,000 pounds unless it has been shown to comply with Stage 2 or Stage 3 requirements under Part 36.

FAA amendments to Part 91 in September 1991 established a similar phase-out schedule for Stage 2 operations over 75,000 pounds, with a deadline of December 31, 1999. As of December 31 1999, 100% of the air carrier and air cargo jet operations (over 75,000 pounds) at BDL are Stage 3 aircraft. The regulations do allow a few exceptions to this rule for engines undergoing maintenance or going to a

facility to be modified to meet Stage 3 requirements.

There are no phase-out schedules or deadlines applicable to aircraft with a maximum takeoff weight less than 75,000 pounds. Also, military aircraft are exempt from the regulations.

14 CFR Part 161

As required by ANCA, 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions," establishes a program for reviewing airport noise and access restrictions on the use of Stage 2 and Stage 3 aircraft.

ANCA defines noise and access restrictions in a very comprehensive manner: "... restrictions (including but not limited to provisions of the ordinances and leases) affecting access or noise that affect the operations of Stage 2 or Stage 3 aircraft, such as limits on the noise generated on either a single-event or cumulative basis; a limit, direct or indirect, on the total number of Stage 2 or Stage 3 aircraft operations; a noise budget or noise allocation program that includes a Stage 2 or Stage 3 aircraft; a restriction imposing limits on hours of operations; a program of airport use charges that has the direct or indirect effect of controlling airport noise; and any other limit on Stage 2 or Stage 3 aircraft that has the effect of controlling airport noise. This definition does not include peak-period pricing programs where the objective is to align the number of aircraft operations with airport capacity."[13]

ANCA and Part 161 establish very different requirements for restrictions affecting Stage 2 and Stage 3 aircraft. Airports may adopt a restriction that affects only Stage 2 operations without obtaining FAA approval. However, the airport proprietor must perform certain FAA-approved analyses, publicize the proposal, and provide opportunity for public comment. In the case of Stage 3 restrictions, airports must obtain FAA approval, in addition to completing economic analyses, publicity, and comment processes.[14]

Note that ANCA and Part 161 do not address restrictions on Stage 1 aircraft, and that airport use restrictions formally proposed or implemented prior to the passage of ANCA were retained under a grandfathering agreement.

Part 161 requires that analyses of proposed use restrictions "provide separate detail" on the potential effect on aircraft weighing less than 75,000 pounds. However, these aircraft are clearly covered by the regulations.

Through its actions and statements since the passage of ANCA and Part 161, the FAA has clearly indicated that it would vigorously oppose new airport use restrictions not compliant with the standards or Part 161. In response to proposed restrictions at airports in Los Angeles, New York, and Minneapolis/St. Paul, the FAA threatened to revoke the ability of those airports to receive federal grants or to collect passenger facility charges. In each case, the airports withdrew the proposals, made them voluntary, or simply adopted the Part 91 phase-out schedule.

The FAA has also indicated that it will apply very stringent standards for the analyses required by Part 161, which would require very expensive and time-consuming studies. A mandatory use restriction must be reasonable, non-arbitrary, and non-discriminatory. Additionally, the restriction must not create an unreasonable burden on interstate or foreign commerce.

Thus, it would be extremely difficult and costly for any airport to complete the

necessary analysis and to obtain required FAA approvals to establish airport use restrictions that affect either Stage 2 or 3 operations. With the preceding information as background, the following sections discuss the range of categories of use restrictions evaluated in this Part 150 Study.

5.2.5(a) *Potential Measure: 24-Hour Restriction or Nighttime Curfew on Operations of Noisiest Aircraft*[15]

Operational curfews or other nighttime use restrictions are designed to reduce or eliminate noisy operations during late night hours, typically 10:00 p.m. to 7:00 a.m., when people may be particularly sensitive to noise. Curfews can be related to all operations, can restrict either arrivals or departures, or can be based on the noisiness of the aircraft. Such restrictions can have large noise abatement benefits relative to the number of aircraft operations affected, because of the 10 decibel penalty added to noise between 10:00 p.m. and 7:00 a.m.

The FAA noise standards to which this category refers are the Stage "1", "2", and "3" categories defined by 14 CFR Part 36. As discussed in section 5.2.5, it is likely that FAA would oppose a restriction of either Stage 2 or 3 aircraft. However, Part 161 does not limit restrictions of Stage 1 aircraft in any manner.

To evaluate a restriction on the operations of the noisiest aircraft, this study evaluated the following restrictions:

- Nighttime restriction for Stage 1 and 2 aircraft;
- 24-Hour restriction for Stage 1 and 2 aircraft;
- Nighttime restriction for Stage 1, 2, and hushkitted Stage 3 aircraft; and
- 24-Hour restriction for Stage 1, 2, and hushkitted Stage 3 aircraft.

A restriction on Stage 1 and 2 aircraft would apply to general aviation, or business jets, as there are no Stage 1 air carrier jets over 75,000 pounds operating at BDL. It could also apply to Stage 2 commercial aircraft, such as the Fokker F28 (though F28s are not forecasted to operate at BDL). However, there are presumably a few Stage 1 jets under 75,000 pounds operating at BDL, as there are less than 60 Stage 1 business jets left operating in the U.S. Business jets are projected to be approximately 15 percent of all operations at BDL by 2008, of which Stage 1 business jets would likely make up a very small fraction. Although their numbers would be minimal compared to the overall BDL fleet mix, Stage 1 and 2 business jets would be the noisiest category of aircraft operating at the airport. Reducing or eliminating their activity could result in a reduction in some of the most significant single events. To evaluate the effect of a Stage 1 and 2 business jet aircraft restriction, a detailed evaluation of the business jet fleet would have to be undertaken at BDL. Note that approximately 65 average daily business jet operations are forecast in 2008, with six of those operations expected during the late night hours. The analysis assumes that any restricted aircraft would be replaced with a similar Stage 3 aircraft.

Figures 5-17 and 5-18 present the results of the DNL noise contour analysis for a nighttime and 24-hour restriction on all Stage 1 and 2 aircraft at BDL. This restriction would apply primarily to the business jet fleet at BDL. Approximately three average daily operations (5 percent of the business jet operations, less than 1 percent of all operations) of Stage 1 and 2 business jets are forecast in 2008, including less than one such operation during the nighttime at BDL. As shown in **Table 5.17,**

the restriction would reduce population within the 65 dB DNL noise contour from 850 to 788 people with the nighttime restriction (7 percent reduction) and from 850 to 747 people with the 24-hour restriction (12 percent reduction).

A restriction on Stage 1, 2, and hushkitted Stage 3 aircraft would apply to business jets and hushkitted air carrier jets over 75,000 pounds operating at BDL. Reducing or eliminating their activity could result in a reduction in most of the intrusive single events noise levels at BDL. Approximately 20 average daily operations (4 percent of all operations) of Stage 1 and 2 business jets and hushkitted Stage 3 air carrier jets are forecast in 2008, including less than three such operations during the nighttime at BDL

Table 5.17

Existing and Future Population Counts of Aircraft Use Restriction Measures

Alternative	Existing Land Use					Future Land Use				
	60-64 dB DNL	65-69 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total within 60 dB DNL**	60-64 dB DNL	65-60 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total within 60 dB DNL**
Year 2008 Unmitigated DNL Contours										
Non-Compatible Acreage	755	226	1	-	982	2,174	573	29	-	2,776
Population	2,238	850	3	-	3,091	5,970	2,194	53	-	8,217
Housing Units	883	367	2	-	1,252	2,314	856	23	-	3,193
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Stage 1 & Stage 2 Aircraft Restriction										
Nighttime Restriction										
Non-Compatible Acreage	740	199	-	-	939	2,061	534	19	-	2,614
Population	2,205	788	1	-	2,994	5,801	2,108	23	-	7,932
Housing Units	871	342	1	-	1,214	2,248	823	11	-	3,082
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
24-Hour Restriction										
Non-Compatible Acreage	732	188	-	-	920	2,008	517	16	-	2,541
Population	2,199	747	1	-	2,947	5,715	2,051	16	-	7,782
Housing Units	868	326	-	-	1,194	2,215	802	8	-	3,025
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
Stage 1, Stage 2, & Hushkitted Hushkitted Stage 3 Aircraft Restriction										
Nighttime Restriction										
Non-Compatible Acreage	728	184	-	-	912	1,976	503	15	-	2,494
Population	2,195	742	1	-	2,938	5,652	2,024	15	-	7,691
Housing Units	865	326	-	-	1,191	2,190	794	7	-	2,991
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5
24-Hour Restriction										
Non-Compatible Acreage	707	169	-	-	876	1,885	472	13	-	2,370
Population	2,168	683	-	-	2,851	5,485	1,924	11	-	7,420
Housing Units	855	303	-	-	1,158	2,127	758	5	-	2,890
Noise-Sensitive Locations	5	-	-	-	5	5	-	-	-	5

Note: Population counts and housing units rounded to whole number.

Source: HMMH and HNTB analysis.

Figure 5-19 and 5-20 present the results of the DNL noise contour analysis for a nighttime restriction and a 24-hour restriction on all Stage 1, 2, and hush-kitted Stage 3 aircraft at BDL.

This restriction would apply to the business jet and hush-kitted air carrier fleet at BDL. Table 5.17 presents the results of the population counts. The restriction would reduce the population within the 65 dB DNL noise contour from 850 to 742 people with the nighttime restriction (an 13 percent reduction) and from 850 to 683 people with the 24-hour restriction (20 percent reduction). However, implementation of a curfew would likely be challenged by FAA and various aviation interests in court. Legal precedent suggests strongly that a curfew would be ruled illegal. Curfews have been found to be "overbroad" and to impose an "undue burden" on interstate commerce, and are often viewed as "arbitrary and capricious." A curfew would also affect Stage 3 aircraft, and thus trigger FAA approval requirements under ANCA and 14 CFR Part 161.

Restrictions on Stage 1 and 2 business jets would provide limited noise benefits. Adding hushkitted Stage 3 air carrier jets to either a nighttime or 24-hour restriction would provide a more substantial noise reduction. However, based on ConnDOT and BDL strategies to increase service at BDL, the cost and litigation of undertaking an analysis of a curfew restriction of this type under Part 161, as well as the unlikely approval of such a restriction by the FAA, and the potential for significant economic impacts, aircraft use restrictions are not recommended at BDL. **Table 5.18** summarizes the evaluation conducted in consideration of either a 24-hour restriction or nighttime curfew for the noisiest aircraft at BDL.

Table 5.18

Summary Evaluation of 24-Hour Restriction or Nighttime Curfew on Operations of Noisiest Aircraft

Description	Curfews or other use restrictions are designed to reduce or eliminate noise operations during late-night hours when people may be particularly sensitive to noise. This measure could include restrictions on Stage 1, Stage 2, and/or hushkitted hush-kitted Stage 3 aircraft operations at BDL during the nighttime hours or for the entire day. The measure would result in a reduction in some of the most intrusive single aircraft noise events.
Net Change in Community Noise	Population within the 65 dB DNL contour: *Nighttime Curfew:* • Stage 1 and 2 aircraft: 7% population reduction • Stage 1, Stage 2, and hushkitted Stage 3 aircraft: 12% population reduction *24-hour Restriction:* • Stage 1 and 2 aircraft: 13% population reduction • Stage 1, Stage 2, and hushkitted Stage 3 aircraft: 20% population reduction
Airport and ATC Operational Considerations	None significant, as ATC is not responsible for enforcement.
Effect on Aircraft	Aircraft operators with only Stage 1, Stage 2, and/or hushkitted hush-kitted Stage

Table 5.18

Summary Evaluation of 24-Hour Restriction or Nighttime Curfew on Operations of Noisiest Aircraft

Operators	3 aircraft would be excluded from operating at BDL with implementation of a 24-hour restriction. Similarly, a nighttime curfew would force aircraft operators with only Stage 1, Stage 2, and/or hush-kitted Stage 3 aircraft to cease late-night or early-morning service to BDL. Operators either could not operate at BDL or would need to buy new aircraft.
Effect on Quality of Air Service	Restricting aircraft by time or aircraft type would limit the aircraft operators as to when they can operate at BDL and/or with what equipment. This operator limitation would limit the flexibility of travel or service for their customers.
Costs	Adoption of a 24-hour restriction or nighttime curfew would have significant adverse effect on the regional economy. The measure would disproportionately affect the air cargo industry, which depends heavily on hushkitted aircraft and nighttime operations. In the year 2000, the air cargo operators at BDL supported 1,255 jobs and generated $69.6 million, or 21%, in direct economic impacts. Much, if not all, of this economic benefit would be lost with a curfew or hushkitted aircraft restriction. The loss of late night or early morning flights by general aviation and passenger airlines would also incur substantial negative economic effects.[16] Also, the Part 161 study and approval process required for implementation of the measure would likely be expensive. Airports that have conducted Part 161 studies have spent from approximately $400,000 to $2,000,000 over a period of several years.
Responsible Parties	BDL would complete a 14 CFR Part 161 Study, seeking FAA approval of the 24-hour restriction and/or nighttime curfew on nosiest aircraft. After FAA approval, BDL would be responsible for monitoring and enforcement of the curfew/restrictions. Aircraft operators would be responsible for abiding by restrictions.
Implementation Factors	The measure would likely incur a long and costly approval process involving litigation. Additional ConnDOT staff would be required to enforce a restriction and/or curfew.
Legal Implications	A Part 161 Study would be needed to implement a curfew or use restriction. The FAA has indicated it would apply stringent standards for the analyses required by Part 161. In response to proposed restrictions at other airports, the FAA has threatened to revoke the airports' abilities to receive federal grants or to collect passenger facility charges. No commercial airport has successfully completed a Part 161 study.
Community Concerns	Economic consequences; there would still be military and/or commercial operations. Noise would not go away.
Conclusion	This measure is not recommended for inclusion in the NCP due to its potential for significant economic impacts, also the strong likelihood that a curfew would be ruled illegal.

Source: HMMH and HNTB analysis

5.2.5(b) *Potential Measure: Capacity Limits Based on Noise Levels*[17]

Under this measure, a maximum cumulative limitation impact (such as the total land area within a selected DNL contour or the total amount of noise a given operator contributes to the area within the contour) is established. After establishing such a limit, the airport's operations are regulated so as not to exceed that maximum.

This measure could be implemented at airports where operations are dominated by scheduled air carrier service, because the schedules of each airline allow the airport to allocate noise shares out of a total budget. Airlines could accommodate the budget by shifting to quieter aircraft in their fleet and still accommodate growth in operations. However, this approach can be difficult to apply airports with large numbers of general aviation operations because general aviation operators do not have fleets necessary to shift to quieter types of aircraft.

Prior to the passage of ANCA and the promulgation of Part 161, this "noise budget" approach appeared to be an attractive alternative at many air carrier airports. However, the FAA would likely reject new noise budget measures under Part 161. The measure could also cause significant economic impacts, as discussed in **Table 5.19**. Accordingly, and as summarized in Table 5.19, a capacity limits measure based on noisiness is not recommended at BDL.

Table 5.19

Summary Evaluation of Capacity Limits Based on Noise

Description	A cumulative noise impact limit is established, and aircraft operations are constrained so as not to exceed that limit.
Net Change in Community Noise	This measure would tend to keep the noise at current levels or below a pre-determined maximum. This measure was not studied in detail. The maximums were not established and, therefore, a change in community noise exposure was not estimated.
Airport and ATC Operational Considerations	None.
Effect on Aircraft Operators	Some aircraft operators without quieter aircraft in their fleet would be forced to limit their operations at BDL.
Effect on Quality of Air Service	The measure could reduce air service competition at BDL by preventing equal airport access to aircraft operators.
Costs	Adoption of capacity limits based on noisiness would have significant negative effect on the regional economy. The measure would disproportionately affect the air cargo industry, since it depends heavily on hushkitted aircraft operations. In the year 2000, the air cargo operators at BDL supported 1,255 jobs and generated $69.6 million in direct economic impacts, representing nearly 21% of total direct impacts. Much of this economic benefit would be lost with capacity limits based on noisiness. Also, depending on the near-term direction of air carrier fleet replacement plans, capacity limits based could also constrain growth of the estimated $2.5 billion in total economic activity generated by aviation activity associated with BDL.[18] Also, the Part 161 study and approval process required for implementation of the measure would likely be expensive. Airports that have conducted Part 161 studies

Table 5.19

Summary Evaluation of Capacity Limits Based on Noise

	have spent from approximately $400,000 to $2,000,000 over a period of several years.
Responsible Parties	BDL would establish a maximum noise exposure level. BDL would then complete a 14 CFR Part 161 study, seeking FAA approval for limiting capacity at BDL. After FAA approval, the Airport and operators work together to determine number of operations and aircraft types permitted to operate at BDL to ensure that the impact limits are not exceeded.
Implementation Factors	The number of operations permitted at BDL by aircraft operator and airline type would be determined through coordination between the Airport and operators using a cumulative noise analysis. The capacity limits would be revised periodically to include the affects of changing fleet mixes and the entry or exit of aircraft operators.
Legal Implications	The FAA has indicated it would apply stringent standards for the analyses required by Part 161. In response to proposed restrictions at other airports, the FAA has threatened to revoke the airports' abilities to receive federal grants or to collect passenger facility charges. No commercial airport has successfully completed a Part 161 study.
Community Concerns	Economic harm, little noise benefit.
Conclusion	Due to is potential for significant economic impacts, and questionable legality under the Airport Noise and Capacity Act, this measure is not recommended for inclusion in the NCP.

Source: HMMH and HNTB analysis

5.2.5(c) *Potential Measure: Noise-Based Landing Fees*[19]

ANCA and Part 161 identify noise-based landing fees as use restrictions subject to notice, analysis, and approval provisions. Palm Beach International Airport has the only noise-based landing fee in the U.S. This rule was established prior to ANCA and Part 161, and continues under a grandfathered provision. FAA has indicated it views new noise-based landing fees in the same light as other use restrictions for Stage 2 or 3 aircraft. FAA has indicated that they would strongly oppose this type of rule at any other airports. Therefore, as summarized in **Table 5.20**, a noise-based landing fee measure is not recommended for further evaluation at BDL.

Table 5.20

Summary Evaluation of Noise-Based Landing Fees

Description	Noise-based landing fees attempt to encourage aircraft operators to use quieter aircraft at BDL in order to reduce their operating costs.
Net Change in Community Noise	Single-event noise levels and DNL would be reduced if the noise-based landing fees were successful by encouraging aircraft operators to use quieter aircraft. A detailed analysis of this measure was not undertaken. Such an analysis would require an

Table 5.20

Summary Evaluation of Noise-Based Landing Fees

	economic study to determine how many noisier aircraft would be replaced with quieter aircraft. Therefore, the potential noise exposure benefit is not known, but it would not be as significant as that resulting from a 24-hour restriction or nighttime curfew on Stage 1, Stage 2, or hushkitted Stage 3 aircraft.
Airport and ATC Operational Considerations	None.
Effect on Aircraft Operators	Some aircraft operators without quieter aircraft in their fleet would be forced to either pay higher landing fees or stop operating at BDL.
Effect on Quality of Air Service	Noise-based landing fees could deter aircraft operators with mostly noisier aircraft from serving BDL, resulting in reduced competition and service options for the region.
Costs	The noise-based landing fees would likely be structured to be revenue neutral, with surcharge applied to noisier aircraft and a discount applied to quieter aircraft. However, operators with mostly noisier aircraft would pay increased landing fees overall. Since this could deter some air carriers from serving BDL, the measure may constrain growth of the estimated $2.5 billion in total economic activity generated by aviation activity associated with BDL.[20] Also, the Part 161 study and approval process required for implementation of the measure would likely be expensive. Airports that have conducted Part 161 studies have spent from approximately $400,000 to $2,000,000 over a period of several years.
Responsible Parties	BDL would complete a 14 CFR Part 161 Study, seeking FAA approval of the noise-based landing fees. After FAA approval, BDL would be responsible for establishing and maintaining the fee structure, and colleting land fees. Aircraft operators would pay the landing fees applicable for the aircraft types used to serve BDL.
Implementation Factors	BDL would develop the landing fee structure and collect the fees with information on frequency of operations and noise levels by aircraft type.
Legal Implications	The FAA has indicated it would apply stringent standards for the analyses required by Part 161. In response to proposed restrictions at other airports, the FAA has threatened to revoke the airports' abilities to receive federal grants or to collect passenger facility charges. No commercial airport has successfully completed a Part 161 study. Additionally, implementation of a curfew would likely be challenged in court by the Federal government and by various aviation interests
Community Concerns	Regional Economics costs versus potential noise benefits.
Conclusion	Without a drastic increase in landing fees, the measure is not likely to influence the choice of aircraft types that operators use at BDL. Also, the legality of the measure under the Airport Noise and Capacity Act is questionable. Therefore, this measure is not recommended for inclusion in the NCP.

Source: HMMH and HNTB analysis

5.2.6 Airport Layout Modification Measures

5.2.6(a) *Potential Measure: Noise Barriers*[21]

Aircraft operations on the ground can be a source of noise. Relevant ground noise sources may include the noise produced during the ground roll portions of takeoffs and landings (particularly start-of-takeoff-roll and reverse-thrust noise), noise from aircraft ground movements on taxiways and aprons, engine idle noise, auxiliary or ground power units, and engine maintenance run-up noise.

INM, the noise model used to produce DNL contours, takes into account the noise produced by aircraft during takeoff ground roll and when using reverse thrust for deceleration during landing. However, INM does not take into account the noise produced by aircraft taxiing and it has limited ability to account for noise reflections off terrain, such as that provided by noise barriers. Thus, a ground noise study, and not INM, must be used to evaluate the benefits of noise barriers

However, discussions with airport staff, TAC members, and participants at the public informational workshops indicate that ground noise is not a major or significant concern to local residents. As shown in **Table 5.21**, no further consideration of noise barriers is recommended at BDL.

5.2.6(b) *Potential Measure: Displaced Arrival Thresholds*[22]

Displaced thresholds, that is advancing the target touch down point for arriving aircraft, can provide a slight noise reduction. This measure causes aircraft to be at a higher altitude when on final approach to land. Thus, the aircraft would be at a higher altitude when overflying residential areas near the runway end.

Displaced thresholds were evaluated on BDL's longest runway, Runway 06/24, as displacing the thresholds on the shorter Runway 15/33 would likely create an unacceptably short and unsafe runway length for arrivals.

Figure 5-21 presents the single-event 90 dBA SEL contours for a Boeing 737-200 the displacement of a 1,000 ft. landing threshold on both Runway 06 and 24. Population counts are presented in **Table 5.22**.

The noise benefits of a displaced threshold on Runway 06/24, is minimal. Population within the 90 dBA SEL contour drops from 50 to 40 (20 percent) for arrivals to Runway 06 and from 40 to 30 (25 percent) for arrivals to Runway 24.

As shown in **Table 5.23**, a displaced threshold would provide minimal noise benefit and would raise safety considerations. Therefore, it is not recommended for further consideration.

Table 5.21

Summary Evaluation of Noise Barriers

Measure	Noise Barriers
Description	This measure consists of the combined use of sound barrier walls and/or berms and natural landscaping to reduce aircraft ground noise for the communities in proximity to BDL.
Net Change in Community Noise	Any noise benefit provided by noise barriers would be limited to homes bordering the Airport, and would apply only to noise exposure from ground operations. Noise barriers do not mitigate noise from airborne aircraft.
Airport and ATC Operational Considerations	None.
Effect on Aircraft Operators	None.
Effect on Quality of Air Service	None.
Costs	Construction costs would be determined in a ground noise study.
Responsible Parties	BDL would be responsible for implementing any sound buffer/barriers, and FAA approval would be required for funding.
Implementation Factors	BDL would conduct a ground noise study to determine levels and potential buffer/barrier locations. Conclusions from the analysis are required to determine feasibility and benefits.
Legal Implications	None.
Community Concerns	Could benefit residences very close to airport. However, there are few, if any, homes this close to BDL runways.
Conclusion	This measure is not recommended for inclusion in the NCP due to the minimal noise benefit expected.

Source: HMMH and HNTB analysis

Table 5.22

Existing Population Counts of Displaced Arrival Thresholds - Runway 06/24

Runway	Type	Track	Track Description	Population within 90 dB SEL Contour
6	Existing	06A	Straight Arrival	50
	Alternate	06TA	Straight Arrival w/1,000-foot Displaced Threshold	40
24	Existing	24A	Straight Arrival	40
	Alternate	24TA	Straight Arrival w/1,000-foot Displaced Threshold	30

Note: Population counts rounded to nearest 10.

Source: HMMH and HNTB analysis.

Table 5.23

Summary Evaluation of Displaced Arrival Thresholds Runway 06/24

Description	Displaced thresholds can be used to move the touchdown point for arriving aircraft down the runway; this causes the aircraft to be at higher altitude when on final approach to land, thus lowering the noise level in those residential areas.
Net Change in Community Noise	The net change in community noise is minimal. Population within the 90 dB SEL contour would be reduced by 10 people with 1,000 ft. displaced thresholds on Runways 06 and 24.
Airport and ATC Operational Considerations	Reduced runway length could constrain operations of large or heavy aircraft, especially during wet conditions.
Effect on Aircraft Operators	Service by aircraft types that require the full runway length for landing would be constrained by this measure.
Effect on Quality of Air Service	Service by aircraft types that require the full runway length for landing would be constrained by this measure.
Costs	Significant costs would be incurred to move navigation equipment, including Instrument Landing System components and runway lighting.
Responsible Parties	BDL would request FAA review and approval of the displaced thresholds. After FAA approval, BDL would include the measure in its capital improvement program and request FAA funding support.
Implementation Factors	Implementation of the displaced threshold would require amendment to the Airport Layout Plan, construction to move navigation aids, and revision to airport charts.
Legal Implications	None.
Community Concerns	Minimal noise benefit in very small population.
Conclusion	This measure is not recommended for inclusion in the NCP due to the minimal noise benefit expected and the reduction of available landing distance.

Source: HMMH and HNTB analysis

5.3 SUMMARY OF RECOMMENDED NOISE ABATEMENT MEASURES

The BDL Part 150 Study considers several operational measures in accordance with the requirements of 14 CFR Part 150. Preliminary noise abatement measures and analyses were presented at Technical Advisory Committee Meetings on December 6, 2001; and January 10, March 7, and June 25, 2002; and September 25 and 26, 2003; and at Public meetings on July 16 and 17, 2002. Feedback and comments received at these meetings and various correspondences between the community and ConnDOT has been incorporated in to the development and analyses of alternative operational procedures.

Table 5.24 presents the measures evaluated in this study and a positive or negative recommendation for inclusion of each measure in the NCP. These noise abatement measures were evaluated in Section 5.2.2 through 5.2.6, with respect to the criteria described in Section 5.2.1. The only measure recommended for inclusion in the NCP is the establishment of preferential departure flight tracks, as outline in Section 5.3.1.

FAA approval of the recommended measures does not imply that these noise abatement measures can be implemented immediately. The FAA will need to conduct a separate environmental review before implementing these procedures. The environmental review process is defined in FAA Order 1051.1D and may take the form of an environmental assessment. In fact, changes in air traffic control procedures below 3,000 ft over noise sensitive areas require an environmental assessment. If an environmental assessment identifies a 1.5 dB change in DNL at a noise sensitive location within the 65 DB DNL contour, the FAA will need to prepare an environmental impact statement before implementing these procedures.

5.3.1 Recommended NA–1: Preferential Departure Flight Tracks

The evaluation discussed in Section 5.2.3(a) identified preferential departure flight tracks that are recommended for inclusion in the NCP.

For Runway 06, none of the alternative flight tracks considered would provide substantial relief as compared to the existing tracks. *Therefore, no changes to departure flight tracks procedures for Runway 06 are recommended, and the existing flight tracks (06CTR, 06OTW, and 06PWL) are recommended for continued use as preferential flight tracks and inclusion in the NCP.*

For Runway 24, the analyses found that an early turn for aircraft departing to southern destinations (moving operations from track 24ORW to track 24DE or track 24DP4) could provide some benefit to the community. However, consultation with the FAA indicates that airspace constraints prevent implementation of this procedure, as the new track would conflict with the arrival flow to Runway 24.

The analyses indicate that existing tracks 24PWL and 24CTR are the preferable tracks for aircraft departing to the west and north, respectively. *Therefore, no changes to departure flight tracks procedures for Runway 24 are recommended, and the existing flight tracks (24CTR, 24ORW, and 24PWL) are recommended for continued use*

as preferential flight tracks and inclusion in the NCP.

For Runway 15, analysis indicates that moving traffic from the existing tracks 15PWL, 15CTR, and 15ORW, to proposed tracks 15DP4, 15DP5, and 15DP6, respectively, would be beneficial. These tracks could only be used when the airport is in a flow configuration using Runway 15 and 24 and could not be use when the airport is in a flow configuration using Runways 06 and 15. Although Runway 15 is not used often for departures, Runway 15 departures overfly high density residential areas in Windsor. The proposed tracks 15DP4, 15DP5, and 15DP6 make use of some non-residential areas in Windsor and Windsor Locks. *Therefore, changes to departure flight tracks procedures for Runway 15 to proposed tracks 15DP4, 15DP5, and 15DP6, when Runway 24 is in use, are recommended for use as preferential flight tracks and inclusion in the NCP.*

For Runway 33, a right hand turn as soon as possible for departures traveling to the north to Chester (CTR) via 33DP8 would reduce noise exposure. A left turn as soon as possible for aircraft traveling south via a west route on 33DP4 and a right turn as soon as possible for aircraft traveling south via an east route on 33DP7 are not recommended due to community concerns. *Therefore, a change for Runway 33 departure procedures to proposed track 33DP8 is recommended for use as preferential flight track and inclusion in the NCP. Also, existing Runway 33 flight tracks 33PWL, 33ORW1, or 33ORW2 are recommended for continued use as preferential flight tracks and inclusion in the NCP.*

Table 5.24

Summary Analysis Results of Noise Abatement Measures Considered in BDL Part 150 Study

Type of Noise Abatement Measure	Specific Measure	Screening Result
Runway Use Measures	Preferential Runway Use	Not Recommended
	Rotational Runway Use	Not Recommended
Preferential Flight Track Measures	Air Carrier Departure Flight Tracks	Recommended – Departure flight tracks for Runway 15 & 33
	Helicopter Flight Corridors & Altitudes	Not Recommended
Flight Procedure Modification Measures	Noise Abatement Departure Profiles	Distant NADP Recommended
	Noise abatement arrival profiles	Not Recommended
Airport Use Restriction Measures	Curfews/Restrictions on Operations of Noisiest Aircraft (Nighttime and 24-Hours)	Not Recommended
	Capacity Limits Based on Noisiness	Not Recommended
	Noise-Based Landing Fees	Not Recommended
Airport Layout Modification Measures	Noise Barrier	Not Recommended
	Displaced Thresholds	Not Recommended

Source: HMMH

5.3.2 Recommended NA-2: Distant Noise Abatement Departure Profile

As discussed in detail in Section 5.2.4, the limited applicability of the Close-In NADP to certain aircraft types, the fact that it would result in a mix of increased and decreased noise levels depending on distance from the airport, and operational concerns expressed by airline representatives on the TAC, the TAC recommended continued use of the Distant procedure. *As the Close-In NADP was not found to be beneficial at BDL, the continued use of the Distant NADP is recommended as the preferred NADP for inclusion in the NCP.*

5.3.3 DNL Contours with Recommended Noise Abatement Measures

Year 2008 DNL contours and population counts that include use of the recommended NCP noise abatement measures were generated as part of the evaluation of noise abatement measures. This is the study's best estimate of the 'before' and 'after' impacts of the NCP, if the recommended departure flight track measures are implemented per measure NA-1. The current use of the Distant NADP is assumed to continue, per recommended measure NA-2. **Figure 5-22** shows the DNL contours as a result revisions to aircraft departure flight tracks on Runway 15 and 33 as described in measure NA-1.

The FAA considers the 65 dB DNL to be the principal basis for approving or disapproving measures for the NCP. However, as discussed in the preceeding sections of this Chapter, in consultation with the TAC, ConnDOT went beyond this minimum requirement, and considered cumulative exposure out to 60 dB DNL and also considered single event noise exposure (in terms of the population within the 90 dB SEL contour). As discussed in the preceding sections, the TAC evaluated each measure in the term(s) that provided it with the best perspective(s) on the effects of that specific action.

Table 5.25 summarizes the residential population, housing units, land area, and discrete sensitive receptors within the 75 dB DNL contour, and within five-decible contour intervals out to 60 dB DNL. The table also presents the totals within both the 60 and 65 dB DNL contours. The change in population is small in both cases. The total within 60 dB DNL decreases by approximately one percent, from 3,091 to 3,051. The population within the 65 dB DNL contour changes by less than one percent, from 853 to 860. This seven resident increase is not large enough to be considered a reliable indication of change, relative to the accuracy of the base maps and nosie modeling; for all intents and purposes the recommended measures cannot be considered to change the population within the 65 dB DNL contour. However, the change in population within the 60 dB DNL contour is large enough to be considered reliable and the individual measures are considered beneficial for the reasons discussed in their individual analyses. The recommendations reflect TAC consensus (and ConnDOT agreement) regarding the merit of these measures.

Table 5.25

Existing and Future Population Counts of Year 2008 DNL Noise Contours with Recommended Noise Abatement Measure

Cases	Existing Land Use						Future Land Use					
	60-64 dB DNL	65-69 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total Within 60 dB DNL**	**Total Within 65 dB DNL**	60-64 dB DNL	65-69 dB DNL	70-74 dB DNL	Within 75 dB DNL	**Total Within 60 dB DNL**	**Total Within 65 dB DNL**
Year 2008 Unmitigated DNL Contours												
Non-Compatible Acreage	755	226	1	-	982	227	2,174	573	29	-	2,776	602
Population	2,238	850	3	-	3,091	853	5,970	2,194	53	-	8,217	2,247
Housing Units	883	367	2	-	1,252	369	2,314	856	23	-	3,193	879
Noise-Sensitive Locations	5	-	-	-	5	-	5	-	-	-	5	-
Year 2008 DNL Contours with NA-1 and NA-2												
Non-Compatible Acreage	766	211	1	-	978	212	2,139	557	25	-	2,721	582
Population	2,191	858	2	-	3,051	860	5,982	2,202	42	-	8,226	2,244
Housing Units	859	376	2	-	1,237	378	2,320	860	19	-	3,199	879
Noise-Sensitive Locations	5	-	-	-	5	-	5	-	-	-	5	-

Note: Population data rounded to the nearest whole number, except for values less than one which are rounded up.

Source: HMMH and HNTB analysis.

ENDNOTES

[1] Part 150 Reference B150.7 (b)(3)

[2] Source: HMMH analysis

[3] Section 3.2.1

[4] The changes in population discussed in this table are based on “existing land use”, rather than the “future land use”.

[5] Part 150 Reference B150.7 (b)(3)

[6] Part 150 Reference B150.7 (b)(4)

[7] Source: HMMH analysis

[8] Part 150 Reference B150.7 (b)(4)

[9] Part 150 Reference B150.7 (b)(4)

[10] National Business Aircraft Association, "Noise Abatement Procedures for Turbojet Business Aircraft", January 1978.

[11] Developed by HMMH for Palm Beach County Department of Airports for use in noise study at Palm Beach International Airport (PBI).

[12] Part 150 Reference B150.7 (b)(4)

[13] 14 CFR. 161.5.

[14] No FAA approval is required for agreements between airport proprietors and aircraft operators restricting either Stage 2 or 3 operations, as long as the restrictions only apply to the operators that have signed the agreements.

[15] Part 150 Reference B150.7 (b)(5)

[16] Economic activity estimates derived from Bradley International Airport Economic Impact Study, December 2000, Wilbur Smith Associates

[17] Part 150 Reference B150.7 (b)(5)

[18] Economic activity estimates derived from Bradley International Airport Economic Impact Study, December 2000, Wilbur Smith Associates.

[19] Part 150 Reference B150.7 (b)(5)

[20] Economic activity estimates derived from Bradley International Airport Economic Impact Study, December 2000, Wilbur Smith Associates.

[21] Part 150 Reference B150.7 (b)(2)

[22] Part 150 Reference B150.7 (b)(6)

Chapter Six
POTENTIAL LAND USE COMPATIBILITY MEASURES

A Noise Compatibility Program (NCP) contains both operational noise abatement measures and land use measures. This chapter details land use measures considered by BDL. NCP components that focus on land use initiatives usually include measures associated with the following:

- **Preventive Measures**: efforts to prevent the introduction of non-compatible land uses around the Airport.
- **Corrective Measures**: efforts to correct existing non-compatible land uses around the Airport.

6.1 POTENTIAL LAND USE MEASURES

This section identifies potential land use measures to minimize airport-related noise impacts to those communities in the vicinity of BDL. There are seven preventive and three corrective land use measures being considered as part of this Part 150 study.

The seven preventive measures considered for BDL are as follows:

- Zoning for Compatible Use
- Amend Building Codes
- Fair Disclosure Policy
- Purchase of Undeveloped Land
- Purchase of Development Rights
- Avigation Easements
- Airport Noise Overlay Zone

The three corrective measures to be evaluated for BDL are as follows:

- Property Purchase Assurance Program
- Purchase of Non-Compatible Land
- Sound Insulation Program (Residential, School, and other Public Buildings)

6.1.1 Evaluation Criteria

The sections that follow describe each of the proposed land use measures in general terms. Each measure is then evaluated using the seven factors that follow:

- **Area to which measure would be applied.** This factor defines (1) the DNL contour intervals within which the measure would be applied and/or (2) the types of land uses within the applicable contour intervals that would be addressed.
- **Anticipated benefits.** This factor describes the potential benefits of the measure. Potential benefits could be of a direct nature (restricting additional residential development in areas impacted by airport noise), indirect nature (permitting informed decisions by potential buyers), or remedial nature (providing acceptable interior noise levels).
- **Responsible Agency(ies)**. This factor identifies the Federal, state and local agency(ies) responsible for the implementation of a proposed measure.
- **Costs.** This factor identifies public and private sector costs associated with

implementing the measure and potential eligibility for federal funds.

- **Effect on Property Values**. This factor considers the potential for property values to rise of fall with the proposed measure.
- **Effect on Tax Base.** This factor considers the potential for increased or decreased tax base with the proposed measure.
- **Political acceptability.** This factor describes the interests that may be adversely affected by the potential measure. Such interests could include existing landowners concerned about potential impacts on property values, neighbors concerned about the potential character change of the neighborhood, or developers opposed to limitations or conditions that might be placed on the development of land.

6.1.2 Zoning for Compatible Use

The goal of this measure is to aid in the prevention of new non-compatible development within the desired DNL contour depicted on the Mitigated 2008 NEM by amending local zoning ordinances, zoning maps, and the affected communities' *Plan for Conservation and Development*.

Currently, the land use within or intersecting the Mitigated 2008 NEM 65 dB DNL shows a mixture of residential, commercial/ industrial, forested/cultivated, and recreation/open space across four local jurisdictions (i.e., East Granby, Windsor, Windsor Locks, and Suffield) as depicted in Figure 4-4. The towns of Bloomfield, East Windsor, Enfield, Granby and Simsbury do not have areas that lie within the Mitigated 2008 NEM 65 dB DNL contours. The areas identified within the 65 dB DNL noise contour have been field verified and confirmed by local planning and zoning officials as being developed or committed for development.

The Mitigated 2008 65 dB DNL contour encompasses approximately 1,523 acres of off airport land, including 216 acres of residential use, 1,040 acres of non-residential use, and 267 acres recreation, open space or vacant land use.

Due to limited vacant land remaining within the 65 dB DNL contour, the rezoning of areas would only apply to areas of infill[1] and redevelopment rather than existing non-compatible buildings and homes. It should be noted that an airport noise overlay zone would be more vital for these areas than simply amending communities' zoning ordinances, zoning maps, and *Plan for Conservation and Development*, as evidenced by the Comprehensive Plan for Loudoun County.

To explain, in 1993, the Counties of Loudoun and Prince William (to some extent) in the Commonwealth of Virginia established an Airport Impact Overlay District. This District acknowledged the unique land use impacts of airports due to the high levels of non-compatible development and limited vacant land in areas surrounding the Washington Dulles International Airport (IAD). By instituting this Airport Impact Overlay District, land use limitations and regulations for the areas within the district were established. This Airport Impact Overlay District has helped to protect the both the Airport and the surrounding communities from developing non-compatible uses.

If accepted, the towns of East Granby, Windsor, Windsor Locks, and Suffield would limit the amount of non-compatible development in areas within the 65 dB DNL noise contour. The administrative costs associated with amending zoning

ordinances, zoning maps, and the various jurisdictions' *Plan for Conservation and Development* would be borne by the local jurisdictions.

The impact on property values would be minimal if the demand for compatible development exists. Pricing for commercially zoned property typically exceeds those for residential property. In addition, the effect on the tax base would be minimal, as regional demand for various types of land use would be unchanged allowing for the increase in compatible airport development. **Table 6.1** summarizes the evaluation of this measure.

Table 6.1

Summary Evaluation of Land Use Measure 1 – Zoning For Compatible Use (Preventive)

Description	This recommended measure is to amend the existing, *Plan of Conservation and Development*, zoning maps, and zoning guidelines for the local jurisdictions with areas within the Mitigated 2008 NEM 65^{+} dB DNL contour. The amendments would prevent new development of non-compatible residential development and other noise sensitive structures from being constructed within the Mitigated 2008 NEM 65^{+} dB DNL contour unless they comply with the Noise Level Reduction (NLR) requirements per Part 150 Guidelines. This measure could be applied with change of ownership.
Area to which measure would be applied	The measure would be applicable to jurisdictions with areas zoned for residential use that lie within the Mitigated 2008 NEM 65^{+} dB DNL contour; this includes the towns of Windsor, Windsor Locks, Suffield, and East Granby.
Anticipated Benefits	This recommended measure would aid in the prevention of new non-compatible development within the Mitigated 2008 NEM 65^{+} dB DNL contour.
Responsible Agency(ies)	The Office of Planning and Zoning for the towns of East Granby, Windsor, Windsor Locks and Suffield would be responsible for updating the existing zoning guidelines and zoning maps to designate those areas compatible with airport related activity. In addition, coordination with state legislatures must be performed to insure inclusion in updated Plans for Conservation and Development per State of Connecticut General Statutes.
Costs	The administrative costs associated with updating existing zoning guidelines and zoning maps by the Office of Planning and Zoning of East Granby, Windsor, Windsor Locks, and Suffield.
Effect on Property Values	This measure may reduce property values if converted land use has less taxable value than the existing land use.
Effect on Tax Base	Overall effect to tax base would be minimal since this measure would not change the regional demand for different types of development. The potential for tax revenue generated for both new and old residential and commercial/industrial development within the areas selected for rezoning must be considered to give surety that the rezoning will consider the highest tax base possible for the local jurisdictions.
Political Acceptability	Developers/ and or property owners may oppose the measure because of its potential to reduce areas available for residential development. However, the local jurisdictions may be in favor of this measure if commercial/industrial property generates a higher tax base than residential property in the same area.
Conclusions	While this measure may not be applied to all non-compatible land uses within the Mitigated 2008 NEM 65^{+} dB DNL contour it is recommended for application wherever possible. This measure may be modified by local jurisdictions to include land use planning within the Mitigated 2008 60^{+} dB DNL contour in future years.

6.1.3 Amend Building Codes

The goal of this measure is to amend existing state building codes, to require interior Noise Level Reduction (NLR) techniques per EPA and Part 150 guidelines. These techniques are to be used on new construction and substantially re-constructed properties in local jurisdictions within the desired DNL contour depicted on the Mitigated 2008 NEM (i.e., Town of East Granby, Town of Suffield, Town of Windsor Locks, and the Town of Windsor).

Currently, the State of Connecticut has adopted the 1996 Building Officials Code Administrators (BOCA) National Building Code and the 1995 Council of American Building Officials (CABO) One & Two Family Dwelling Code, with subsequent amendments, as the standard for building construction across the state. These building requirements comply with EPA guidelines provided in "*Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*," that states interior noise levels in residential areas should be no higher than 45 dB. This level of noise is considered to be a level that will permit spoken conversation and other activities such as sleeping, working and recreation, without causing an annoyance.

As shown in Table 4.1, Part 150 guidelines require residential properties within the 65-70 dB and 70-75 dB noise intervals to provide an interior reduction in noise levels of at least 25 dB and 30 dB, respectively to obtain the 45 dB interior noise level. Currently, there are 378 dwelling units that are within the Mitigated 2008 65 dB DNL contour.

If accepted, the towns of East Granby, Windsor, Windsor Locks, and Suffield, in coordination with ConnDOT, would petition the Codes and Standards Committee under the State Building Inspector to amend building codes relative to future noise exposure. Examples of building code language used in other areas for aviation purposes are provided in Appendix D. The administrative costs associated with petitioning for an amendment to the existing building codes would be borne by ConnDOT and the towns identified within the desired DNL contour depicted on the Mitigated 2008 NEM (i.e. 65 dB DNL), these costs would be very minimal. The administrative costs of implementing and enforcing building code revisions would be borne by the State of Connecticut – Department of Public Safety – Division of Fire, Emergency, and Building Services. Moreover, an increase in construction costs related to NLR requirements would potentially be reflected in the cost of new development.

Typically, developing appropriate standards and techniques for NLR requires research and testing to ensure the appropriate NLR is being obtained. This measure would likely have no measurable effect on property values or any changes to the existing tax base. **Table 6.2** summarizes the evaluation of this measure.

Table 6.2
Summary Evaluation of Land Use Measure 2 – Amend Building Codes (Preventive)

Description	This measure supports the revision of state building codes to ensure interior NLR techniques (e.g., Sound Insulation) per Part 150 Guidelines to areas of new construction and substantial re-construction.
Area to Which Measure Would Be Applied	All parcels located within the Mitigated 2008 NEM. In particular, those buildings constructed and proposed to be constructed in the towns of Windsor, Windsor Locks, Suffield, and East Granby that lie within the 65 dB DNL noise contour or greater.
Anticipated Benefits	The reduction of interior noise levels in newly constructed and substantially re-constructed homes and buildings.
Responsible Agency(ies)	Local jurisdiction's Office of Planning and Zoning, in coordination with ConnDOT. Proposed changes to building codes must be approved and accepted by the Connecticut Department of Public Safety – Division of Fire, Emergency and Building Services
Costs	State of Connecticut - administrative costs associated with updating the State of Connecticut building codes. Subdivision Regulations – The administrative costs associated with updating subdivision regulations to comply with the amended State of Connecticut building codes.
Effect on Property Values	Property Values may increase to incorporate the additional cost of noise attenuation of newly constructed and substantially re-constructed residential property.
Effect on Tax Base	Minimal negative effect on the tax base is anticipated.
Political Acceptability	Developers may object due to potentially higher building costs to comply with Part 150 Guidelines.
Conclusions	The measure is recommended to be included in the NCP for new construction and substantial re-construction.

6.1.4 Fair Disclosure Policy

The goal of this measure is to require the disclosure of aircraft noise levels and their meaning to potential buyers and renters prior to time of contract or title transfer for residential property. This measure would be applied to the transfer of existing residential development and new residential construction within the desired DNL contour of the Mitigated 2008 NEM (i.e. 65 DNL).

Currently, the State of Connecticut Department of Consumer Protection – Real Estate Commission does not have a requirement for disclosing aircraft generated noise levels as part of the State of Connecticut Real Estate Laws. In addition, no such disclosure of noise levels is required by the Connecticut General Statutes Section 20-327b-1, *Residential Property Condition Disclosure Report.* It should be noted however that the town of Suffield does have an existing noise disclosure policy.

This measure would not change existing zoning ordinances and/or regulations however, it would amend *Section 20-327b*, and subsequent regulations, of the Connecticut General Statutes to provide notification of noise levels for all residential dwelling units to be constructed or transferred, within the 65 dB DNL noise contour.

Notification of these noise levels would be displayed in all sales contracts, brochures, promotional documents, including the Illustrative Site Plan(s) on display within any sales related office(s), as well as in

homeowner association documents, included on all subdivision and site plans, and within all Deeds of Conveyance. Examples of disclosure policies are provided in **Appendix D**.

The implementation of this measure may result in a slight decrease in property values in those areas within the 65 dB DNL noise contour. Existing owners and developers within the 65 dB DNL may not want this measure due to the potential difficulty in selling property subjected to aircraft noise. However, by requiring the disclosure of noise levels at the time of contract, this measure would minimize future noise complaints.

The towns of East Granby, Windsor, Windsor Locks, and Suffield, in coordination with ConnDOT, would be responsible for the administrative costs associated with amending appropriate state and local laws to add regulations providing full disclosure of noise levels. **Table 6.3** summarizes the evaluation of this measure.

Table 6.3

Summary Evaluation of Land Use Measure 3 – Fair Disclosure Policy (Preventive)

Description	This measure would incorporate aircraft noise information in sales documents for existing properties placed on the market and new residential development for properties within the Mitigated 2008 NEM. In addition, this policy would require the potential buyer and/or leasee to sign a statement acknowledging that they know the property being purchased and/or leased is in an area subjected to aircraft noise of 65 dB and greater. The local jurisdictions may work together to develop additional disclosure measures such the disclosure at the time of showing the potential property, depiction of noise levels on comprehensive/zoning maps, or as part of a public information program. The jurisdictions should work to ensure that disclosure is implemented consistently across all jurisdiction affected by BDL aircraft noise levels.
Area to Which Measure Would Be Applied	Existing residential properties and new residential construction that lie within the Mitigated 2008 NEM. In particular, property owners and their agents with properties in the towns of Windsor, Windsor Locks, Suffield, and East Granby, within the 65 dB DNL noise contour or greater would be required to disclose aircraft noise levels within deeds of sale and leasing agreements.
Anticipated Benefits	Potential buyers are allowed an informed decision regarding airport-related impacts; however, disclosure of noise levels typically occurs at or near closing, after the potential buyer has committed substantial time and effort to the purchase. The benefits of disclosure may be enhanced by early disclosure.
Responsible Agency(ies)	Local jurisdiction's Office of Planning and Zoning with properties within the Mitigated 2008 NEM, and ConnDOT, must consult with the State of Connecticut Real Estate Commission to ensure legislation is updated to require an aircraft noise disclosure policy as part of the State of Connecticut Real Estate Commission laws and regulations.
Costs	The Connecticut Real Estate Commission and the local jurisdictions' Offices of Planning and Zoning, will incur administrative costs to update existing statutes, regulations and zoning maps.
Effect on Property Values	If applied to existing homes, it may reduce property values slightly by making homes harder to sell due to the aircraft noise disclosure policy.
Effect on Tax Base	Minimal.
Political Acceptability	Developers may oppose measure due to potential negative effect on marketing residential developments that are within an area subject to aircraft noise.
Conclusions	This measure is recommended for inclusion in the NCP.

6.1.5 Purchase of Undeveloped Land

The goal of this measure is to purchase selected parcels of land within the 70^{+} dB DNL of the Mitigated 2008 NEM to be maintained as vacant land, sell for development in compatible uses, or develop for compatible public use. In particular, parcels in the towns of East Granby, Suffield, Windsor Locks, and Windsor would be considered for this measure.

As part of this program, property would be acquired, with the approval of the local jurisdictions, where it has been established that the area for acquisition is vacant and not scheduled for development by the local jurisdictions. For parcels to be eligible for inclusion in this acquisition program, the parcel/s must be located in an area where incompatible development is threatening airport operation or has the likelihood to be developed with a non-compatible use.

Property considered for acquisition would be acquired by voluntary agreement with the landowner or through standard condemnation proceedings. Current Federal and local guidelines will determine the fair market value of all properties identified for acquisition. If this measure were accepted, ConnDOT would be responsible for the administrative costs and the cost of acquiring the parcel/s of land from landowners.

This measure would likely have no measurable effect on property values, as the purchase price would equal the value of land. There would be minimal effect on the local tax base due to the removal of privately-owned property from the tax base. This impact could be temporary since most of the value for the acquired property could be put back into the local tax base once it was resold with restrictions. **Table 6.4** summarizes the evaluation of this measure.

Table 6.4

Summary Evaluation of Land Use Measure 4 – Purchase of Undeveloped Land (Preventive)

Description	The goal of this measure is to acquire selected parcels of land and maintain as: • Vacant land; • Sell for development into compatible uses; or • Develop for a compatible public use.
Area to Which Measure Would Be Applied	Areas to be considered are those lands within the 70+ dB DNL noise contour of the Mitigated 2008 NEM.
Anticipated Benefits	Prevents the development of land available for non-compatible use.
Responsible Agency(ies)	ConnDOT, coordinating with local jurisdictions' will determine what undeveloped land is available for acquisition.
Costs	Current Federal and local guidelines will determine the fair market value of all properties identified for acquisition.
Effect on Property Values	No effect. Purchase price would equal the fair market appraisal price.
Effect on Tax Base	Acquired lands would be removed from the tax base. Properties resold for compatible use would be returned to the tax base.
Political Acceptability	Local jurisdictions may be against this measure, it could potentially reduce available land for development.
Conclusions	This measure is recommended for inclusion in the NCP.

6.1.6 Purchase of Development Rights

This measure would establish a program to purchase residential development rights from areas inside the Mitigated 2008 NEM. ConnDOT could seek to purchase and extinguish the development rights for selected vacant parcels with potential for non-compatible development. Typically the landowner selling the development rights would still be permitted to construct a single residential structure on their property.

The purchase of development rights has been used successfully throughout the country since the 1980. Locally, the town of Suffield has had success with the purchase of development rights.

Undeveloped parcels in the towns of Suffield and East Granby, and on a very limited basis Windsor and Windsor Locks would be considered for this measure. **Table 6.5** summarizes the evaluation of this measure.

Table 6.5

Summary Evaluation of Land Use Measure 5 – Purchase of Development Rights (Preventive)

Description	This preventive measure involves the purchase of an interest in privately owned vacant land, which permits ConnDOT to prohibit any and all uses of the land that could be adversely impacted by aircraft noise.
Area to Which Measure Would Be Applied	Jurisdictions within the Mitigated 2008 65 dB DNL contour. Vacant portions of the following communities are included within the Mitigated 2008 65 dB DNL contour. East Granby, Suffield, Windsor, and Windsor Locks. Local jurisdictions would work with ConnDOT to determine potential properties for this measure. It is recognized that the towns of Windsor and Windsor Locks have limited applicable properties.
Anticipated Benefits	Reduces future non-compatible land use within areas that have potential for non-compatible development and helps communities enhance development strategies (comprehensive planning) for compatible uses.
Responsible Agency(ies)	ConnDOT in consultation with local jurisdictions.
Costs	ConnDOT incurs the costs for acquiring interest in the property or properties and administrative costs for administering the program. Cost of development rights for residential property would essentially equal the total acquisition costs, including appraisal costs.
Effect on Property Values	Could reduce growth in property values of undeveloped properties if the new allowable developable land use, after sale of development rights, has less taxable value than non-compatible development.
Effect on Tax Base	Overall effect on existing tax base would be minimal; see evaluation of effect on property values.
Political Acceptability	Since the program would necessarily be voluntary and property owners would receive fair market value for development rights, little opposition would be anticipated. Should the program result in development of non-residential uses in residential areas, some residents could oppose the measure.
Conclusion	This measure is recommended for inclusion in the NCP.

6.1.7 Avigation Easements

The goal of this measure is to require avigation easements as a condition for issuance of building permits for new non-compatible construction within the Mitigated 2008 NEM. For property that is already zoned to permit non-compatible

development, this measure would ensure notice of the right of overflight and associated noise.

Avigation easements, which have been proven to be an effective means of ensuring compatible development around airports, should guarantee the use of the airspace for the right of flight, right to create noise, and the right to prohibit future height obstructions into the airspace. In addition, avigation easements should restrict the use of the land itself to those uses that are considered compatible to Part 150 requirements. Typical restrictions that may be addressed by avigation easements include types of buildings or structures, types of agricultural activity that may attract birds, electromagnetic interference, and light emissions.

The avigation easements may be obtained through subdivision regulation or site plan review requirements. Similarly, provisions of easements upon private land for public purposes can be required prior to local jurisdiction approval. **Table 6.6** summarizes the evaluation of this measure.

6.1.8 Airport Noise Overlay Zone

The goal of this measure is to protect the health, safety, and welfare of persons and property in the vicinity of BDL by amending zoning regulations and plans to incorporate specific land use requirements within the Mitigated 2008 NEM.

The Airport Noise Overlay Zone would supplement all other zoning regulations by which land is classified, and the appropriate sections of the Connecticut General Statutes that might impact aviation and land development, including, but not limited to, safety, fire, building, and health codes.

Three separate Aircraft Noise/Land Use Control Zones would be established as shown on **Figure 6-1**. The three noise/land use control zones would consist of:

- Zone A – 75 dB DNL and greater noise contour
- Zone B – 70 to 74 dB DNL noise contour
- Zone C – 65 to 69 dB DNL noise contour

The boundaries of the Airport Noise Overlay Zone shall be construed as the outer boundary of Zone C, and may be altered by initiation of the local planning boards whenever there is a finding that noise impacts have changed as the result of a Part 150 study.

In determining the location of the noise zone boundaries on the Airport Noise Overlay zone, the following standards would apply:

1. For platted lots less than one acre in size, where a boundary line enters or crosses said platted parcel, the land use restriction and sound level reduction standards associated with the more stringent Aircraft Noise Overlay Zone shall apply.

2. For platted and un-platted properties greater than one acre in size, where the boundary line enters or crosses the parcel, the regulations associated with more than one zone may apply. The participating local jurisdictions, in consultation with ConnDOT, shall determine the applicable line of demarcation.

Table 6.6

Summary Evaluation of Land Use Measure 6–Avigation Easements (Preventive)

Description	This measure requires the grant of avigation easements and non-suit covenants to the airport owner as a condition of building permits for specified non-compatible land uses in noise impacted areas.
Area to Which Measure Would Be Applied	Areas within the 65 dB DNL contour of the Mitigated 2008 NEM. In particular, select properties within the towns of East Granby, Windsor, Windsor Locks, and Suffield.
Anticipated Benefits	This measure provides protection for airport sponsors from litigation due to airport operation; notifies potential home builders of the noise environment before building, and alerts buyers that buildings must be built to higher standards; and would complement previously discussed preventive measure applied to in-fill development.
Responsible Agency(ies)	The building code would be amended to include an avigation easement as part of the building permit process. See Table 6.2 for information on amending the building code.
Costs	The local jurisdictions would incur the initial administrative costs to include avigation easements within the building code. Property owners would relinquish the right of filing suit. (However, avigation easements may have a minimal impact on market value of properties involved although experience with appraisal of avigation easements at other airports indicates that this effect is minimal).
Effect on Property Values	This measure would have a minimal effect on property values since the land use would not change.
Effect on Tax Base	No effect on tax base.
Political Acceptability	Developers and/or property owners may oppose this measure due to the potential for reducing marketability.
Conclusion	This measure is recommended for inclusion in the NCP as it relates to in-fill development.

If accepted, this measure shall apply to existing residential and non-residential development (e.g., commercial, industrial, and office uses and/or vacant land zoned for such use). Additionally, vacant properties zoned for residential use prior to the adoption of these proposed changes to local zoning ordinances (unless a proposed modification of the residential zoning would reduce existing noise/land use compatibility), would be included if this measure is accepted.

As part of the Airport Noise Overlay Zone, **Tables 6.7** and **6.8** summarize the proposed aircraft noise/land use controls associated with the noise overlay zone for residential and non-residential land uses.

The aircraft noise land use controls identified in Table 6.6 would apply to all residential uses including: single family, multi-family, and hotel/motel/timeshare uses.

Single family, multi-family, and mobile home uses would be prohibited in Zones A and B, except where prior approvals/agreements grant such use (e.g., military facilities). Hotel/Motel/Timeshare uses would be permitted in Zones A and B with appropriate controls as specified above. While single family and multi-family residential uses would be permitted in Zone

C, they would be discouraged. Single family, multi-family, and mobile home uses would be prohibited in Zones For single family uses in Zone C, a minimum of 25 dB NLR shall be applied. For multi-family uses in Zone C, a maximum of 25 dB NLR should be applied. Currently, there are approximately 378 dwelling units that would fall under the requirements in the Airport Noise Overlay Zone with the potential for the dwelling units to increase to 877 if all residentially zoned properties are developed.

Table 6.7

Aircraft Noise Land Use Controls for Residential Land Uses

Required Controls						
Noise/Land Use Control Zone	**Avigation Easement**	**Waiver of Claim**	**Fair Disclosure Policy**	**NLR 25 dB**	**NLR 30 dB**	**NLR 35 dB**
Zone A (On Airport)	X	X	X	-	-	X
Zone B	X	X	X	-	X	-
Zone C	X	X	X	X	-	-

Table 6.8

Aircraft Noise Land Use Controls for Non-Residential Land Uses

Required Controls					
Noise/Land Use Control Zone	**Avigation Easement**	**Waiver of Claim**	**Fair Disclosure Policy**	**NLR 25 dB**	**NLR 30 dB**
Zone A (On Airport)	X	X	X	-	-
Zone B	X	X	X	-	X
Zone C	-	X	X	X	-

The aircraft noise land use controls identified in Table 6.2 would apply to all sensitive non-residential land use types, consisting of: hospital/clinic/nursing home and school/child-care facilities. These controls would not apply to commercial, industrial and/or office areas.

Hospital/clinic/nursing homes, school/ child-care facilities would be prohibited in Zones A and B, except for aviation related training/educational facilities. Childcare facilities in Zone C would only be permitted as accessory uses. Stand-alone childcare facilities should be prohibited. Existing childcare facilities would be permitted to expand so long as new structures meet the NLR requirements listed above. Elementary, Middle and High School facilities, whether pubic or private, should be prohibited in Zone C. Other school facilities should be reviewed as a Conditional Use, in which the NLR specified above and additional land use compatibility measures may be applied. **Table 6.9** summarizes the evaluation of this measure.

Table 6.9

Summary Evaluation of Land Use Measure 7 – Airport Noise Overlay Zone (Preventive)

Description	This measure is intended to establish an airport noise overlay zone based on noise contours which add conditions to existing zoning regulations.
Area to Which Measure Would Be Applied	Local jurisdictions with land within the Mitigated 2008 NEM. In particular, the towns of East Granby, Windsor, Windsor Locks, and Suffield with properties in the 65 dB DNL noise contour, or greater, as adopted by the ConnDOT and accepted by the FAA as the NEM for BDL.
Anticipated Benefits	This recommended measure could restrict additional residential development in areas impacted by airport noise. In addition, noise reducing construction techniques (i.e., sound insulation) would be used for development in airport noise zone. **Potential Population and Dwelling Units within the Mitigated 2008 65^{+} dB DNL contour, by Town, to be included in Airport Noise Overlay Zone** **Town** — **Estimated Population and Dwelling Units** **Existing Land Use** Windsor: 69 People, 30 Dwellings Windsor Locks: 523 People, 258 Dwellings Suffield: 265 People, 89 Dwellings East Granby: 3 People, 1 Dwellings **Potential Future Land Use** Windsor: 160 People, 70 Dwellings Windsor Locks: 613 People, 309 Dwellings Suffield: 1,461 People, 495 Dwellings East Granby: 9 People, 5 Dwellings
Responsible Agency(ies)	The local jurisdictions' Offices of Planning and Zoning (East Granby, Windsor, Windsor Locks, and Suffield), in consultation with ConnDOT.
Costs	• Local jurisdictions would incur the administrative costs associated with amending local zoning guidelines and zoning map to include an airport noise overlay zone and its components (e.g., sound insulation). However, ConnDOT would work with local jurisdictions to purchase avigation easements in exchange for sound insulation. • Some costs may be eligible for 80% federal funding if part of an approved Part 150 NCP, although actual levels may be less depending upon availability of funds. • Energy savings may offset the costs of additional sound insulating construction techniques borne by developers and purchasers.
Effect on Property Values	This recommended measure would not have a measurable direct effect on property value.
Effect on Tax Base	Due to the limited amount of space available for new construction, this recommended measure might have an effect on the tax base of each local jurisdiction (East Granby, Windsor, Windsor Locks, and Suffield).
Political Acceptability	Property owners directly affected by the measure may oppose re-zoning which limits flexibility of development through re-zoning or by conditional use permits. The degree of concern should be minimal, as restrictions would be limited to areas with noise sensitive uses.
Conclusions	This measure is recommended for inclusion in the NCP as guidance. It is recognized that development of this measure will require intensive coordination between local jurisdictions that would limit implementation. It is recommended that the development of airport overlay zoning be forwarded to the CROG for state-wide consideration in long-term planning..

6.1.9 Property Purchase Assurance Program

The goal of this measure is to guarantee the purchase of existing homes within the Mitigated 2008 NEM 65 dB DNL noise contour after the seller has made a "bona fide effort" to sell the property and has been unable to do so at it's fair market value. Fair market value would be determined based on Federal and local guidelines.

Homeowners participation in this program would be voluntary and based on the how homes are prioritized by ConnDOT and local jurisdictions. The Property Purchase Assurance Program is not intended to provide the homeowner the opportunity to sell the home at its guaranteed fair market value on a "house-by-house" basis. However, each local jurisdiction would be able to determine the location and number of homes eligible for participation based on the funds available.

In order to participate, the home/s would necessarily be owner-occupied. Homeowners would be required to have resided at the property for a pre-determined length of time prior to being offered participation into the program. Once a home was deemed eligible for participation in the Property Purchase Assurance Program, a fair market value would be established for the property through a certified appraisal process that meets Federal and local guidelines. Then, a Letter-of-Intent would be signed by both the homeowner and the program administrator (ConnDOT). The Letter will be a binding contract which describes the program elements, such as:

- Predetermined length of time that property would be listed for sale before owner receives reimbursement of fair market value. (Note: This defines a "bona fide effort" and is based on the Multiple Listing Service data (MLS) for each individual neighborhood provided by each city.)

- Sound insulation package modification details and schedules.

- Granting of an avigation release to ConnDOT.

There would be two possible methods within the Property Purchase Assurance Program to transfer the ownership of a participating home. If the house does sell on the open market before a predetermined period expires, the transfer of ownership would be similar to normal open market real estate transactions. If the house does not sell on the open market before a predetermined time period, then the owner would be reimbursed the fair market value of the home and the property would be re-listed by ConnDOT on the open market until it is sold.

Each home participating in the Property Purchase Assurance Program would receive a complete sound insulation package modification based on its location within the 65 dB and 70 dB DNL noise contours and its construction. In the event the house sells before the predetermined listing period, sound insulation modifications would be done immediately after the new owner takes possession. In the event the house does not sell during the predetermined listing period, then sound insulation modifications would be done in the interim period after the original owner was reimbursed the house fair market value and before it was re-listed on the open market by the administrator (ConnDOT). It should be noted that prior to re-listing, the home would be re-appraised to determine a new fair market value that reflects the sound insulation improvements.

ConnDOT will develop an education program that realtors would be required to

attend in order to become "certified" by ConnDOT as having a working knowledge of the purchase guarantee and sound insulation programs to participate in this program. This would ensure that prospective homebuyers are aware of the location of the property within the noise contour, that the home would receive sound insulation treatment as a condition of the purchase, and of the avigation release. In addition, the homeowner would be certain that a qualified realtor is marketing the home.

Based on the Uniform Relocation and Real Property Acquisition Policies Act for voluntary programs, the Property Purchase Assurance Program would not include payment or reimbursement of moving/relocation expenses. In addition, any adjustment of the Mitigated 2008 NEM 65 dB DNL noise contour boundary to determine eligibility would be subject to FAA overall approval.

Each local jurisdiction would be responsible for determining the length of time for either acceptance or refusal of program participation, once a homeowner becomes eligible. This determined length of time may be different among participating jurisdictions, based on each jurisdiction's specific yearly implementation phasing goals. In the event of refusal, each jurisdiction would be responsible for determining how long a participant must wait before becoming eligible again for another Part 150 program. **Table 6.10** summarizes the evaluation of this measure.

Table 6.10

Summary Evaluation of Land Use Measure 8 –Property Purchase Assurance Program (Corrective)

Description	This measure would guarantee the owner-occupied property would be acquired by ConnDOT at a fair market value and would be returned to residential use with appropriate sound insulation measures, releases, and restrictions. The Property Purchase Assurance Program would not be intended nor designed to acquire all, or a substantial portion, of a designated area, but rather to provide the homeowner the opportunity to sell his/her home at a guaranteed fair market value on a house-by-house basis prior to participating in the ConnDOT sound insulation program. Property Purchase Assurance Program eligibility is limited to existing residential property within the Mitigated 2008 NEM. This program would be developed in coordination with other mitigation measures.
Area to Which Measure Would Be Applied	Alleviate noise effects in areas where neighborhood stability could be maintained and existing residential development was considered acceptable within the 65 dB DNL contour. In particular, residential properties in the towns of Windsor, Windsor Locks, Suffield, and East Granby.
Anticipated Benefits	Enable residents who desire to relocate due to noise impacts to do so, thereby reducing noise concerns. Assuming that all residential property within the Mitigated 2008 65+ dB DNL contours are eligible, approximately 377 dwelling units would be included as part of the Property Purchase Assurance Program.

Table 6.10

Summary Evaluation of Land Use Measure 8 –Property Purchase Assurance Program (Corrective)

	Sound insulation and avigation easements are typically applied to acquire properties.
Responsible Agency(ies)	ConnDOT in consultation with local jurisdictions.
Costs	ConnDOT would fund the initial cost, however the cost would be offset by resale. In addition, ConnDOT would fund the cost for administering this program. ConnDOT may be eligible for federal funding if part of an approved Part 150 NCP. Some costs may be eligible for 80% federal funding if part of an approved Part 150 NCP, although actual levels may be less depending upon availability of funds. Temporary reductions in area property taxes while properties are in state ownership.
Effect on Property Values	An increase in the cost of new construction due to the higher standards of sound insulating the properties for resale.
Effect on Tax Base	Minimal.
Political Acceptability	If other factors contribute to the inability to sell properties, the availability of this measure could lead to rapid residential turnover, causing neighborhood instability. However, this measure would provide assurance that residents could receive fair market value for their properties.
Conclusion	This measure is recommended for inclusion in the NCP.

6.1.10 Purchase Non-Compatible Land

The goal of this measure is to remove non-compatible residential areas within the 2008 Mitigated NEM 70 dB DNL noise contour and greater.

As part of this program, property would be acquired only at the initiative and with the approval of the local jurisdictions, where it has been established that there is a reasonable consensus among residents to vacate the area.

Program eligibility will be limited to homeowners residing in the 2008 Mitigated NEM 70 dB DNL noise contour. Acquisition of property would be based on the location within the noise contours. The homeowner would necessarily have lived in the home for a pre-determined period prior to the implementation of the program, unless adequate funds are made available to allow the purchase of all properties within the identified area at the same time. Property would be acquired by voluntary agreement with the homeowner or through standard condemnation proceedings. The current Federal and local guidelines will determine the fair market value of all properties identified for acquisition.

Properties to be acquired would be identified by each jurisdiction on a block-by-block basis. Once the properties were acquired, homeowners would be processed through normal appraisal and closing procedures, as with any other type of property sale. There would be no specific timeframe for completion of the transfer of property. The payment or reimbursement of moving/relocation expenses will be determined by current Federal regulations

(Uniform Relocation Assistance and Real Property Acquisition Policies Act). The property would then be cleared immediately to reduce maintenance and upkeep costs. ConnDOT will hold all acquired property. If the property was not to be converted for airport use, ConnDOT would release it for resale as a compatible land use. **Table 6.11** summarizes the evaluation of this measure.

Table 6.11

Summary Evaluation of Measure 9 – Purchase Non-Compatible Land (Corrective)

Description	This measure would be applied non-compatible land uses within the Mitigated 2008 70 dB DNL contour. The Land Acquisition Program is not intended nor designed to acquire all, or a substantial portion, of a designated area, but rather to provide the homeowner the opportunity to sell his/her home at a guaranteed fair market value if the resident desires to vacate the area. Typically eligibility is limited to existing residential property within the Mitigated 2008 70 dB DNL contour or greater. ConnDOT in coordination with local jurisdictions may decide on acquisitions below 70 dB DNL. Federal funding for such purchases may not be available. Develop this program in coordination with other mitigation measures.
Area to Which Measure Would Be Applied	Existing non-compatible parcels within the Mitigated 2008 70 dB DNL. In particular, on residential property in the towns of Windsor and one residential property within Suffield.
Anticipated Benefits	Enabling residents who desire to relocate due to noise impacts to do so, thereby reducing noise concerns.
Responsible Agency(ies)	ConnDOT in consultation with local jurisdictions.
Costs	ConnDOT would fund acquisition and administrative costs that would be offset by selling property. ConnDOT may be eligible for federal funding if part of an approved Part 150 NCP. Some costs may be eligible for 80% federal funding if part of an approved Part 150 NCP, although actual levels may be less depending upon availability of funds.
Effect on Property Values	Minimal impact on property values as only two dwellings exist within the area of application.
Effect on Tax Base	Minimal, as only two properties fall within the 2008 Mitigated 70 dB DNL contour.
Political Acceptability	Property owners may be against moving. Properties adjoining the properties to be acquired, but outside of the 70 dB DNL contour, may desire their properties to be acquired as well.
Conclusion	This measure is recommended for inclusion in the NCP.

6.1.11 Sound Insulation Program

The goal of this measure is to provide sound insulation to those properties deemed non-compatible within the 2008 Mitigated NEM 65 dB DNL noise contour, in particular those properties in the towns of East Granby, Windsor, Windsor Locks, and Suffield. Inclusion of properties within the sound insulation program will be at the discretion of the FAA as it relates to Federal funding; however, development of the program is completed in partnership with the Sponsor (ConnDOT). For BDL, ConnDOT

will work with the local jurisdiction with non-compatible parcels to determine a boundary for the sound insulation program. This boundary may include residences beyond the 65 dB DNL contour line. Other sound insulation programs across the United States have developed program boundaries that allow community cohesiveness and look for natural boundaries to define the program (i.e. roadways, subdivisions).

Currently, there are 378 dwelling units within the 65 dB DNL contour of the 2008 Mitigated NEM. The number of dwellings within the 2008 Mitigated NEM will be refined with development of the program boundary. Detailed survey analysis on a parcel level will be required for implementation of the program. To alleviate the impact of aircraft noise, this measure would involve building modifications to reduce the amount of noise entering these properties from the outside. Participation by the homeowner would be encouraged but would not be mandatory.

Residential Sound Insulation - Program eligibility would be limited to homeowners residing within the Mitigated 2008 NEM 65 dB DNL noise contour identified by each local jurisdiction. The 2008 Mitigated NEM 65 DB DNL contour would be used to determine program eligibility when approved by the FAA. A priority for insulation could be established on a house-by-house level and block level if funding will be provided on an annual basis. Each homeowner could be responsible for submitting an application to the administrator of the sound insulation program requesting participation in the program. Although a homeowner may apply to the program immediately after it is established, an application submitted at a later date might still be eligible for funding. Each jurisdiction would determine the priority of homeowners who delay participation in the program.

The criterion to be used in the program would be designed to achieve an interior level not to exceed 45 dB on an average annual basis. The NLR proposed for residences would be designed to provide an interior noise environment equal to the 45 dB standard established by BOCA National Building Code, State of Connecticut Building Code, and the EPA. Typically, this means that habitable rooms directly exposed to aircraft noise would be provided with the following additional noise level reductions provided in **Table 6.12**.

Table 6.12

Noise Level Reductions for Sound Insulation Program

DNL Noise Interval	Proposed Average	Minimum	Maximum	Projected Average Cost per Unit (in 2002 Dollars)
75	13 dB	10 dB	15 dB	$40,000
70	8 dB	5 dB	10 dB	$25,000
65	3 dB	0 dB	5 dB	$20,000

Source: HNTB Analysis

The actual amount of insulation required to achieve 5, 10, or 15 dB additional noise level reductions for any given directly-exposed room would depend on the exterior noise level, the type of construction, and the window-wall area ratio. Other habitable rooms in each home that are not directly exposed to aircraft noise would receive additional noise level reductions equal to or less than the amounts shown above. Air-conditioning and ventilation could be provided as part of the sound insulation package depending on the ultimate insulation package.

Typically, homeowners have some limited ability to select alternative modifications to some elements, i.e., windows or walls, provided that the overall sound insulation was not degraded by more than a specified amount.

ConnDOT, in association with local jurisdiction officials, would contract with an outside agency or firm that will administer the sound insulation program among the four eligible jurisdictions. This would possibly include program management, engineering, quality control, and supervising the remodeling contractors.

In some instances, homeowners may want to upgrade to a higher level of sound insulation, or make other miscellaneous improvements; the same contractor at the homeowner's expense could do additional work simultaneously as long as the proposed changes were consistent with the scope and character of the work being performed.

Construction guidelines for sound insulation, and lists of approved material suppliers, could be provided to eligible homeowners who wish to remodel their homes prior to the availability of the program in their area. In addition, homeowners living outside the Mitigated 2008 NEM 65 dB DNL noise contour who wish to add sound insulation treatments at their own expense could be provided the same sound insulation materials. The costs of this remodeling would not be reimbursable. Program participants would be required to sign an avigation easement as a condition of participating in the program.

Each jurisdiction will be responsible for determining how long a participant in the Sound Insulation Program must wait before being eligible for another Part 150 program.

Schools - Schools within the Mitigated 2008 NEM 65 dB DNL noise contour, in the local jurisdictions, may be considered for sound insulation if the sponsor determines that the schools/pre-schools are occupied on a daily basis.

Other Noise Sensitive Public Building Sound Insulation - Buildings, other than schools, containing noise sensitive uses, including libraries, nursing homes, convalescent homes, and community centers, may be considered for soundproofing after residential and school insulation has been performed.

Table 6.13 summarizes the evaluation of this measure.

Table 6.13

Summary Evaluation of Measure 10 – Sound Insulation Program (Corrective)

Description	This measure would provide for sound insulation to residential properties within the Mitigated 2008 NEM. In addition, per Part 150 Guidelines, noise sensitive uses (i.e., schools) might be included as part of the Sound Insulation Program. Those properties participating in the Sound Insulation Program would typically provide an avigation easement and a waiver of claim in exchange for the sound insulation to the property.
Area to which measure would be applied	Since 1998 changes in FAA policies make new non-compatible development ineligible for remedial noise compatibility funding. Only existing residential property within the 65 dB DNL contour and those noise sensitive locations within the 70 dB DNL noise contour are assumed to be eligible. In particular, residential properties within the 65 dB DNL noise contour, within the Towns of Windsor, Windsor Locks, Suffield, and East Granby would be included. It should be noted that there are no noise sensitive properties within the Mitigated 2008 65+ dB DNL contour.
Anticipated Benefits	• Reduce the impact of aircraft noise by providing indoor locations where normal activities can be enjoyed without interruption per EPA and Part 150 Guidelines. • Energy conservation benefits may result from sound insulation. • Treated residents may have an increase in value. **Potential Population and Dwelling Units within the Mitigated 2008 65^{+} dB Contour, by Town, to be included in Sound Insulation Program** **Town** — **Estimated Population and Dwelling Units** **Existing Land Use** Windsor — 69 People, 30 Dwellings Windsor Locks — 523 People, 258 Dwellings Suffield — 265 People, 89 Dwellings East Granby — 3 People, 1 Dwelling
Responsible Agency(ies)	ConnDOT in consultation with local jurisdictions. ConnDOT would establish a pilot program to determine program parameters, requirements, and costs.
Costs	• The costs for soundproofing residential properties within the Mitigated 2008 NEM 65^{+} dB DNL contour approximated at $7.5M. • ConnDOT would fund the soundproofing construction. This program may be eligible for 80% federal funds if part of an approved Part 150 NCP, although actual levels may be less depending upon availability of funds. • ConnDOT would fund the administration and program administration costs.
Effect on Property Values	Slight increase in property value possible due to insulation and air conditioning, but probably less than cost of improvements.
Effect on Tax Base	No measurable effect to the local tax base.
Political Acceptability	Should be no opposition expected from affected property owners or other interests.
Conclusion	This measure is recommended for inclusion in the NCP.

ENDNOTES

[1] The use of vacant land and property within a built-up area for further construction or development, especially as part of a neighborhood preservation or limited growth program.

Chapter Seven
NOISE COMPATIBILITY PROGRAM AND NOISE EXPOSURE MAPS

This chapter brings together the measures recommended for the NCP with the NEMs. Section 7.1 presents continuing program measures that could serve to enhance the recommended noise abatement and land use measures. Section 7.2 reviews the recommended NCP and implementation procedures, while Section 7.3 presents the NEMs.

7.1 CONTINUING PROGRAM MEASURES

Continuing program measures may be useful for implementing and evaluating the recommended noise abatement and land use measures. They can also serve to enhance community and airport dialogue regarding aviation noise, improve public understanding of aviation noise, and provide of ongoing evaluation of noise generated from aircraft flight operations. **Table 7.1** discusses and evaluates the continuing program measures considered at BDL. All of the continuing program measures are recommended for inclusion in the NCP.

7.2 RECOMMENDED NOISE COMPATIBILITY PROGRAM

As discussed in Section 1.4, the ConnDOT had overall responsibility for the conduct of the Part 150 update, including ultimate responsibility for the recommendation of measures for inclusion in the NCP. *All of the final NCP measures that this document proposes for implementation are recommendations of ConnDOT.*

Section 7.2.1 summarizes the noise abatement and land use measures that ConnDOT proposes for inclusion in the NCP. Section 7.2.2 summarizes NCP implementation and related requirements.

7.2.1 Recommended Measures

The noise abatement element of the NCP will provide a small reduction in non-compatible land use in the BDL environs. The land use element includes corrective measures to address currently non-compatible land uses, while the preventive measures will serve to deter future non-compatibility. The NCP for BDL includes 16 measures: 2 noise abatement measures, 9 land use measures, and 5 continuing program measures. Chapters Six and Seven present the analyses that led to the selection of the noise abatement and land use measures, respectively.

7.2.1.a Recommended Noise Abatement Measures

Noise Abatement Measure 1 - Noise Abatement Departure Flight Tracks. This measure would reduce the number of people exposed to high single event noise. Runways 06 and 24 noise abatement flight tracks are already in use. Noise abatement flight tracks for Runways 15 and 33 would be implemented.

Table 7.1

Continuing Program Measures

Measure	Description	Costs and Implementation Responsibility
1. Public Information Program	Program to increase public awareness of aircraft noise exposure issues and the NCP. The program would include a NCP website, results of any approved operations and noise monitoring system, quarterly newsletters, and public meetings as needed.	Administrative costs would be the responsibility of ConnDOT.
2. BDL Airport Noise Committee	As an extension of the public information program, regular (e.g., quarterly) meetings between airport staff and representatives of local governments, citizen groups, neighborhood associations, etc. would serve to enhance communication between the airport and neighboring communities.	Administrative costs would be the responsibility of ConnDOT.
3. Operations and Noise Monitoring System	BDL could seek acquisition of an operations and noise monitoring system. The system would be used to quantitatively track and analyze ongoing aircraft operations at the airport, including runway use and flight track geometry and use, and aircraft-induced noise exposure.	Federal funds could be used to acquire the system, with ConnDOT sharing 20% of the total costs. Operating costs would be the responsibility of ConnDOT.
4. Periodic Evaluation of Noise Exposure	Using the operations and noise monitoring system, ConnDOT would analyze operations at BDL to determine if significant changes in operations at BDL have occurred, and if the NEMs would need to be updated accordingly.	Costs for updating the NEMs would be eligible for federal funds; costs not eligible for federal funding would be the responsibility of ConnDOT.
5. Noise Abatement Officer	In order to better respond to community concerns regarding aircraft noise, ConnDOT could fund a full-time noise abatement officer position at BDL. This staff person would also be needed to manage the continuing program measures.	Staffing costs and implementation would be the responsibility of ConnDOT.

Noise Abatement Measure 2 – Distant Noise Abatement Departure Profile**.** This new measure would formalize the current use of the Distant Noise Abatement Departure Profile at BDL as the preferred profile for departure flight operations.

7.2.1.b Recommended Land Use Measures

Land Use Measure 1 - Zoning for Compatible Use **—** This measure would amend zoning maps and guidelines to

prevent new non-compatible development within the Mitigated 2008 NEM 65+ dB DNL contour unless it met the Noise Level Reduction guidelines of 14 CFR Part 150.

Land Use Measure 2 - Amend Building Codes — This measure supports the revision of state building codes to ensure interior NLR techniques per Part 150 Guidelines to areas of new construction and substantial re-construction within the Mitigated 2008 NEM 65+ dB DNL contour.

Land Use Measure 3 - Fair Disclosure Policy — This measure would incorporate aircraft noise information in sales documents for existing (if ownership changes) and new residential development, including a signed acknowledgement from the buyer, for properties within the Mitigated 2008 NEM 65+ dB DNL contour.

Land Use Measure 4 - Purchase of Undeveloped Land —Selected parcels of undeveloped land within the Mitigated 2008 NEM 70+ dB DNL contour would be acquired and maintained as vacant, sold for development into compatible uses, or developed for a compatible public use.

Land Use Measure 5 - Purchase of Development Rights — Development rights for parcels within the Mitigated 2008 NEM 65 dB DNL contour could be acquired and disposed of by BDL, thus precluding additional non-compatible development.

Land Use Measure 6 - Avigation Easement — This measure would require the grant of avigation easements and non-suit covenants to the airport owner as a condition of building permits for specified non-compatible land uses within the Mitigated 2008 NEM 65 dB DNL contour.

Land Use Measure 7 - Airport Noise Overlay Zone — An Airport Noise Overlay Zone would be established for areas within the Mitigated 2008 NEM 65 dB DNL contour, with provisions for avigation easements, fair disclosure, and noise level reduction construction techniques.

Land Use Measure 8 - Property Purchase Assurance Program — This measure would guarantee that an owner-occupied property within the Mitigated 2008 NEM 65 dB DNL contour would be acquired by ConnDOT at a fair market value and would then be returned to residential use with appropriate sound insulation measures, releases, and restrictions.

Land Use Measure 9 - Purchase of Developed Non-Compatible Land — Selected parcels of developed non-compatible land within the Mitigated 2008 NEM 70+ dB DNL contour would be acquired and converted to compatible use.

Land Use Measure 10 - Sound Insulation Program — This measure would provide for sound insulation to residential properties within the Mitigated 2008 NEM 65 dB DNL contour. Those properties participating in the Sound Insulation Program would provide an avigation easement and a waiver of claim in exchange for the sound insulation to the property.It is acknowledged that the DNL contours previously provided to the public (July 2002) were larger in size than those provided in this document. These changes are due to reduced operations both existing and forecasted for BDL. Changes in the in the forecasted contours may occur in the future as well.

7.2.1.c Continuing Program Measures

Continuing Program Measure 1 - Public Information Program. This measure would establish a program to enhance public awareness of aircraft noise issues and the NCP.

Continuing Program Measure 2 - BDL Airport Noise Committee. This measure would establish a standing committee to encourage dialogue between community representatives and BDL.

Continuing Program Measure 3 – Operations and Noise Monitoring System. An operations and noise monitoring system would be acquired to track and analyze ongoing aircraft flight operations at BDL, and aircraft induced noise exposure to nearby communities.

Continuing Program Measure 4 - Periodic Evaluation of Noise Exposure. This measure would seek to update the NEMs when needed to account for significant changes in airport operations or procedures at BDL.

Continuing Program Measure 5 - Noise Abatement Officer. An additional staff position at BDL would be created to facilitate communication with neighboring communities, and facilitate the implementation of the NCP measures.

7.2.2 NCP Implementation

Part 150 details extensive requirements related to NCP implementation, including:

- Identification of the time period covered by the program.
- Identification of parties responsible for implementation of each program element.
- Indication that responsible parties have agreed to implement the measure.
- Schedule for implementation of the program.
- Essential government actions.
- Anticipated funding sources.

Table 7.2 summarizes implementation details for each proposed element of the NCP.

Table 7.2

Implementation Summary for NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
Noise Abatement Measures			
NA-1: Preferential Departure Flight Tracks	ConnDOT would request amendment of ATCT standard operating procedures to include alternative flight procedures. FAA reviews, approves, and implements.	ConnDOT and FAA administrative costs	Runway 24 flight tracks currently in use. For Runways 15 and 33 flight tracks, process initiated following NCP approval.
NA-2: Distant NADP	ConnDOT coordinates airlines to ensure implementation of the Distant NADP.	ConnDOT administrative costs	Distant NADP already in use at BDL.
Land Use Measures			
LU-1: Zoning for Compatible Use	Local jurisdictions would be responsible for amending zoning maps and ordinances, in consultation with ConnDOT. In addition, coordination with state legislature for revision to *Plans for Conservation and Development* per State of Connecticut General Statutes.	Local jurisdiction administrative costs	Upon local and State of Connecticut approval

Table 7.2

Implementation Summary for NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
LU-2: Amend Building Codes	Local jurisdictions would propose amendments to the Connecticut Department of Public Safety. This measure could be completed statewide as it relates to airports that complete a Part 150 study. ConnDOT would support local jurisdictions.	Local jurisdiction administrative costs	Upon State of Connecticut approval
LU-3: Fair Disclosure Policy	Local jurisdiction action in consultation with the State of Connecticut Real Estate Commission; legislation needed to update Real Estate Commission laws and regulations. ConnDOT would support local jurisdictions.	Local jurisdictions administrative costs	Upon local and State of Connecticut approval
LU-4: Purchase of Undeveloped Land	ConnDOT in consultation with local jurisdictions.	FAA AIP and ConnDOT funds	Process initiated after NCP approval
LU-5: Purchase of Development Rights	ConnDOT in consultation with local jurisdictions.	FAA AIP and ConnDOT funds	Process initiated after NCP approval
LU-6: Avigation Easement	Avigation easements would be required for new development within 65^{+} dB DNL. ConnDOT would support local jurisdictions	Local jurisdiction administrative costs	Process initiated after NCP approval
LU-7: Airport Noise Overlay Zone	Local jurisdictions would be responsible for amending zoning maps and ordinances, with support from ConnDOT.	Local jurisdiction administrative costs	Process initiated after NCP approval
LU-8: Property Purchase Assurance Program	ConnDOT in consultation with local jurisdictions.	FAA AIP and ConnDOT funds	Process initiated after NCP approval
LU-9: Purchase of Developed Non-Compatible Land	ConnDOT in consultation with local jurisdictions.	FAA AIP and ConnDOT funds	Process initiated after NCP approval
LU-10: Sound Insulation Program	ConnDOT in consultation with local jurisdictions.	FAA AIP, PFCs at BDL, and ConnDOT funds	Initiate pilot program following NCP approval
Continuing program Measures			
CP-1: Public Information Program	ConnDOT would implement measure	ConnDOT administrative costs	Initiate following NCP approval
CP-2: BDL Airport Noise Committee	ConnDOT would implement measure	ConnDOT administrative costs	Initiate following NCP approval
CP-3: Operations and Noise Monitoring System	ConnDOT would seek federal funding and implement measure	FAA grant and ConnDOT funds	Initiate process following NCP approval
CP-4: Periodic Evaluation of Noise Exposure	ConnDOT would seek federal funding and implement measure	FAA grant and ConnDOT funds	Initiate process following NCP approval
CP-5: Noise Abatement Officer	ConnDOT would implement measure	ConnDOT administrative costs	Initiate following NCP approval

7.2.2.a Time Period Covered by the NCP

In the absence of unanticipated changes in forecast conditions, the NCP and NEMs cover a period of 5 years from the date of submission.

7.2.2.b Implementation Responsibility

Part 150 requires that the NCP clearly identify the agency(ies) responsible for implementing each recommended element.

According to the FAA's definition of implementation responsibility[1], the ConnDOT, as airport operator, must initiate the implementation of all noise abatement measures. Clearly, however, the FAA and ATC have key roles in the implementation of aircraft operational measures. Since the FAA is responsible for air traffic control, it must develop and provide instructions to pilots related to preferred runway use and noise abatement flight tracks. Both air carriers and pilots have supporting roles in the implementation of aircraft operational measures, as they must support and comply with noise abatement procedures, consistent with the safe operation of aircraft.

ConnDOT and local governments share responsibility for the implementation of land use measures. ConnDOT will seek assistance from local governments in the publicity and administration of land use measures. Local jurisdictions are responsible for the implementation and enforcement of land use controls. The FAA is involved in the implementation of land use measures through program approval and funding assistance.

ConnDOT has the lead responsibility for continuing program measures. The FAA may assist by providing funding and in ongoing program review. Local governments would assist in ongoing program review.

7.2.2.c Indication of Agreement to Implement

As the lead agency in the implementation of all measures, ConnDOT clearly agrees to its responsibilities. Through ConnDOT staff, the consulting team members have discussed the proposed NCP elements with the FAA and local government representatives.

7.2.2.d Further Environmental Review

Federal or local regulations may require further environmental review prior to the implementation of some NCP measures (e.g., departure track changes for Runway 15 and 33). ConnDOT will not initiate the implementation of any measure until it, the FAA, or other responsible agency has satisfied any such requirements.

In particular, the FAA may approve some noise abatement measures "subject to environmental review." The FAA will determine environmental review requirements when an official FAA "action" is contemplated. In the case of the BDL NCP, the triggering FAA action would likely be the development of air traffic procedures for altitudes less than 3,000 feet above ground level.

7.3 NOISE EXPOSURE MAPS

This section presents the BDL NEMs for 2003 and 2008, developed in accordance with the provisions of 14 CFR Part 150 Airport Noise Compatibility Planning. The certification page at the front of this document addresses Part 150 requirements regarding the accuracy of the maps and the opportunities provided for public review and input.

Figure 7-1 represents the NEM for existing conditions for the year of submission (2003), assuming the existing land use, operational procedures, airport layout, flight operations and fleet mix, and other noise modeling considerations described in Chapter 3. Figure 7-1 is referred to as the 2003 NEM. As shown in **Table 7.3**, the 60 dB DNL contour of the 2003 NEM contains 2,981 people and 1,207 dwellings. Approximately 27 percent of the dwelling units are within the 65+ dB DNL contour. As shown in Table 4.6, there are no non-residential noise sensitive locations within the 65 dB DNL contour of the 2003 NEM.

Figures 7-2 and 7-3 represent the NEMs for forecast conditions for the fifth year following the year of submission (2008), on existing and future land use respectively, assuming the existing operational procedures, airport layout, flight operations and fleet mix, and other noise modeling considerations described in Chapter 3. Figure 7-2 is referred to as the Unmitigated 2008 NEM. From the estimates in Table 7.3, the 60 dB DNL contour of the Unmitigated 2008 NEM contains 3,091 people and 1,252 dwellings, relative to the existing land use. Approximately 29 percent of the affected people and dwelling units are within the 65+ dB DNL contour. There are 45 more dwelling units within the Unmitigated 2008 NEM than in the 2003 NEM, due to the increase in forecasted flight operations discussed in Chapter 3. As shown in Table 4.6, there are no non-residential noise sensitive locations within the 65 dB DNL contour of the Unmitigated 2008 NEM.

Figures 7-4 and 7-5 represent the NEMs for forecast conditions for the fifth year following the year of submission (2008), on existing and future land use respectively, with the implementation of the NCP as described previously in this chapter. Figure 7-4 is referred to as the Mitigated 2008 NEM. From the estimates in Table 7.3, the 60 dB DNL contour of the Mitigated 2008 NEM contains 3,051 people and 1,237 dwellings, relative to the existing land use. This is similar to the population and dwelling counts for the Unmitigated 2008 NEM. Also similar to the Unmitigated 2008 NEM, there are no non-residential noise sensitive locations within the 65 dB DNL contour of the Mitigated 2008 NEM. Based upon future land use, an additional 501 dwelling units could be built within the 65 dB DNL contour of the Mitigated NEM; this potential for new non-compatible development underscores the need for effective implementation of the NCP land use and continuing program measures. Pending FAA acceptance of the NEMs and approval for the NCP, Figure 7-1 the 2003 NEM and Figure 7-4 the Mitigated 2008 NEM will represent the official noise exposure maps at BDL.

Table 7.3

Summary of Non-Compatible Land Use within Noise Exposure Maps

Noise Exposure Map	60-64 dB DNL		65-69 dB DNL		70-74 dB DNL		Within 75 dB DNL		Total Within 60 dB DNL	
	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units	Population	Dwelling Units
Existing Land Use										
2003 NEM	2,233	880	748	327	-	-	-	-	2,981	1,207
Unmitigated 2008 NEM	2,238	883	850	367	3	2	-	-	3,091	1,252
Mitigated 2008 NEM	2,191	859	858	376	2	2	-	-	3,051	1,237
Future Land Use										
Unmitigated 2008 NEM	5,970	2,314	2,194	856	53	23	-	-	8,217	3,193
Mitigated 2008 NEM	5,982	2,320	2,202	860	42	19	-	-	8,226	3,199

Note: Population data rounded to the nearest whole number, except for values less than one which are rounded up.

Source: Tables 4.5, 4.8, and 5.25

ENDNOTES

[1] As set forth in FAA Advisory Circular (AC) 150/5020-1, "Noise Control and Compatibility Planning for Airports", August 5, 1982.

Chapter Eight
PUBLIC AND AGENCY INVOLVEMENT

The BDL Part 150 Study includes a proactive and inclusive public and agency involvement program. The "public" consists of residents and officials of neighboring and noise-affected communities, as well as facility tenants and stakeholders. Agencies are represented by individuals of government agencies at the federal, state and local levels with responsibilities and interests related to the airport.

The main components of the public and agency involvement program are:

- The Technical Advisory Committee (TAC);
- Public events;
- Part 150 Study Final Public Hearing.

These components are supported by informational meeting handouts, newsletters, content provided for the Bradley Airport website, media relations and responses to specific public inquiries and correspondence. The program is designed to maximize participation and input from diverse constituency groups with interests in the airport. Outreach activities are geared to reach active participants, as well as individuals who may not wish to attend meetings or events.

8.1 THE TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee (TAC) is the principal channel for public and agency involvement. Committee members provide two-way communication with their respective constituent groups and organizations.

The TAC fulfills the role, as defined by Part 150 guidelines and federal law, as an advisory body to the airport operator (ConnDOT) on matters related to the study. The committee provides feedback on the information and measures presented by ConnDOT and the consultant during the course of the study, including the Noise Exposure Maps (NEMs), land use and noise compatibility, and the noise compatibility program (NCP). The TAC is closely involved in reviewing, critiquing and advising on these topics and information, though ConnDOT is trusted with the legal responsibility for determining the acceptance and implementation of recommended measures and policies.

8.1.1 TAC Membership

TAC members are representatives and municipal officials of the towns near the airport and outlying communities that may also be affected by noise and service considerations. In addition, the TAC includes representatives of the Federal Aviation Administration, airport tenants and service providers and the military. Current TAC members and affiliations are provided in **Table 8.1.**

Table 8.1

BDL Part 150 Study Technical Advisory Committee Members

Fran Armentano, Granby	David Kilbon, East Granby
Ann Beaudin, Windsor	Daniel Lizdas, East Granby
Frederick Boyd, Suffield	Kevin Lynch, ConnDOT
Fran Brady, West Granby	Tom Mawdsley, Windsor
Phil Chester, Suffield	Tom Maziarz, Capitol Region Council of Governments
Carol Conlon, Bloomfield	Bryan McLain, West Granby
Ron Desrosiers, Granby	Christopher Misseri, East Hartford
Robert Phillips, Windsor Locks	Lt. Col. Rick Mitchell, Military (A-10s)
Larry Edwards, Suffield	Archer Olmer, Military (Helicopters)
Paul Estefan, Bradley Commission (former)	James Parker, Windsor
Edward Ferrari, Windsor Locks	Karl Profe, Windsor
Gary Fiske, FAA ATCT	Andrea Barton Reeves, Windsor
Terry Flieger, FAA	John Romano, Simsbury
Tom Foote, United Parcel Service	Sotos Roumaniotis, Northwest Airlines
Charles Francis, East Granby	Elaine Sarsynski, Suffield
Michael Green, Simsbury	Nick Sasso, Bloomfield
Scott Godfrey, Air Transport Association	Billy Self, Southwest Airlines
Karen Goodwin, Longmeadow, MA	Scott Shanley, Enfield
Carol Hall, Enfield	Leo Smith, Suffield
Astrid Hanzalek, Bradley Commission (former)	Lt. Col. Russ Thomas, CT ANG
Thomas Hooper, Bloomfield	John Silva, FAA
Ned Hurle, ConnDOT – Policy & Planning	Tom Vincent, Simsbury
Bill Janssen, East Granby	Charles Watras, Bradley Commission (former)
Larry Jorash, Signature Flight Support Services	Mario Zavarella, Windsor
Nancy Kapral, Suffield	

8.1.2 TAC Meetings

The original scope of the Part 150 Study called for seven TAC meetings. However, to provide adequate opportunities to review information and materials, a total of nine TAC meetings have been held. All TAC meetings were open to the public. Press releases announcing the date, time and location of each meeting were provided to local news media. TAC meeting notices were also posted on the Bradley Airport website. Meeting minutes are provided.

TAC Meeting #1: July 8, 1999
1:00 to 2:30 pm
Town Hall, Windsor, CT
Attendance: 15
Agenda: (Appendix E, item 1)

TAC Meeting #2: July 12, 2001
3:00 to 5:30 pm
Town Hall, Windsor Locks, CT
Attendance: 21
Minutes: (Appendix E, item 2)

TAC Meeting #3: Dec. 6, 2001
3:00 to 5:30 pm
New England Air Museum
Windsor Locks, CT
Attendance: 21
Minutes: (Appendix E, item 3)

TAC Meeting #4: Jan. 10, 2002
3:00 to 5:30 pm
New England Air Museum
Windsor Locks, CT
Attendance: 18
Minutes: (Appendix E, item 4)

TAC Meeting #5: March 7, 2002
2:00 to 5:00 pm
East Granby Community Center
East Granby, CT
Attendance: 25
Minutes: (Appendix E, item 5)

TAC Meeting #6: June 25, 2002
2:00 to 5:15 pm
Suffield Town Hall
83 Mountain Road, Suffield, CT
Attendance: 31
Minutes: (Appendix E, item 6)

TAC Meeting #7: Sept. 12, 2002
1:00 to 3:30 pm
Bradley International Airport
Windsor Locks, CT
Attendance: 15
Minutes: (Appendix E, item 7)

TAC Meeting #8: Sept. 25, 2003
1:00 to 4:30 pm
ConnDOT Headquarters
Newington, CT
Attendance: 25
Minutes: (Appendix E, item 8)

TAC Meeting #9: Sept. 25, 2003
10:00 am to 4:00 pm
ConnDOT Headquarters
Newington, CT
Attendance: 25
Minutes: (Appendix E, item 9)

8.1.3 Summary of TAC Comments on the Proposed NCP

One of the TAC's key functions is to provide comments and feedback on the proposed Noise Compatibility Plan (NCP) in the Draft Study. During TAC meetings 8 and 9, the committee reviewed a preliminary copy of the Draft Study and proposed NCP. Table 8.2 summarizes the committee's feedback and comments on the proposed NCP to be presented in this Draft Study. Minutes of these meetings, which contain an expanded account of the committee's comments on the NCP, are included in Appendix E, items 8 and 9.

8.1.4 Community Board

As part of the public and agency involvement program, ConnDOT and the Part 150 Study consultant team provided information requested by the Bradley Airport Community Board. The Community Board is an independent body created by ConnDOT in 2001 to advise on a variety of issues related to the airport, including noise and land use.

Table 8.2
TAC Comments on Preliminary Proposed Noise Compatibility Plan

Land Use Measures	Consensus	Committee Comments for Draft Study
LU-1 Zoning for compatible use	Yes	Include information on indemnification and regulations.
LU-2 Amending building codes	Yes	Include example code language.
LU-3 Fair disclosure policy	Yes	May involve state Office of Consumer Protection; municipalities should form working group.
LU-4 Purchase undeveloped land	Yes	Identify funding source(s), agricultural preservation funds.
LU-5 Purchase development rights	Yes	Identify funding source(s).
LU-6 Avigation easements	Yes	Eligibility should be specified.
LU-7 Airport noise overlay zone	Yes	Will require municipal coordination CRCOG involvement.
LU-8 Property purchase assurance	Yes	Identify funding sources.
LU-9 Purchase non-compatible land	Yes	Would affect limited number of properties but would offer significant benefit to those occupants.
LU-10 Sound insulation program	Yes	Include recommendation that FAA consider buffer zone in 60-65 dB DNL for program eligibility.
Noise Abatement Measures		
NA-1 Preferential departure flight tracks	Yes on 3 of 4 runways	Consensus on recommended flight tracks for Runways 33, 15 and 6. More information requested on Runway 24.
NA-2 Distant NADP	Yes	Preferred by ATC and airlines for safety; little benefit due to fleet mix change to quieter planes.
Continuing Program Measures		
CP-1 Public information program	Yes	Should be genuine and integrated with other public outreach efforts.
CP-2 BDL Airport noise committee	Yes	Representatives from community, air carriers, shippers, ATC and BDL staff.
CP-3 Operations and noise monitoring	Yes	Significant benefit; should be pursued for immediate implementation to relieve FAA of on-demand requests.
CP-4 Periodic noise evaluation	Yes	More frequent and threshold-triggered evaluations should be performed.
CP-5 Noise abatement officer	Yes	Would be handle all noise-related actions, operate noise-monitoring equipment.

8.2 GENERAL PUBLIC EVENTS AND OUTREACH

The BDL Part 150 study public and agency involvement program has included a coordinated outreach effort to the general public that has included three major public events, publications, website updates and media relations. The goal of these events and activities has been to provide the general public—that is, audiences beyond the TAC—with news about the progress of the Part 150 Study and to obtain feedback on the Study's scope, objectives, progress, and results. Public events and outreach measures are described in the sections that follow.

8.2.1 Public Participation Events

The BDL Part 150 Study included four major public participation events. All four

events included open house-style presentations, during which individuals and members of the press were able to circulate and ask questions of ConnDOT and consultant staff at a series of stations focusing on major topics of the study. At the second and third events, this open house session was followed by a more formal public meeting, during which the consultant staff made a presentation and responded to inquiries and comments. To permit people with diverse work schedules to attend, these events were held at varying times of day.

Public Event #1: July 8, 1999
6:00 to 9:15 pm
Connecticut State Fire Academy
Auditorium, Windsor Locks, CT
Attendance: 68
Comments: 54 (Appendix E, item 10)

Public Event #2: July 12, 2001
6:00 to 9:15 pm
Town Hall, Windsor , CT
Attendance: 132
Comments: 54 (Appendix E, item 11)

Public Event #3: July 16, 2002
5:00 pm to 8:30 pm
East Granby Community Center
East Granby, CT
Attendance: 206
Comments: (Appendix E, item 12)

Public Event #4: July 17, 2002
2:00 to 5:00 pm
Connecticut Fire Academy Cafeteria
Windsor Locks, CT
Attendance: 60
Comments: (Appendix E, item 13)

8.2.2 Summary of Public Comments Received

Public comments were received primarily through oral and written comments and questions at the public events. Quantitative summaries and documentation of the 302 comments received at public events are provided in Appendix E, items 10 through 12. ConnDOT also received a substantial number of additional public comments and questions at TAC meetings and through telephone calls, correspondence and e-mail. Altogether, more than 350 separate comments were received through public events and other channels. It should be noted that some individuals submitted multiple comments.

The leading concerns conveyed in this substantial body of public comments (in approximate order of number received) were:

- Existing aircraft noise is very intense and diminishes the quality of life in some communities.
- Departures should be rotated over different communities to "share the pain."
- The current right turn for departures from Runway 24 should be retained because it is a fair way to share the burden of aircraft noise.
- The current right turn for departures from Runway 24 is unfair because it shifts noise from one community to another and does not reduce it.
- Departures from Runway 24 should follow a straight-out heading.
- The Part 150 Study should propose noise abatement measures that are fair to all communities.

Geographic analysis of these comments indicates that residents of the Towns of East Granby and Windsor submitted the greatest number of individual comments (more than three times the comments of residents of Suffield and Granby). A total of more than

60 individual comments were received from E. Granby residents (several individuals submitted multiple comments). A group of 40 Windsor residents submitted a petition citing excessive aircraft noise and requesting a reduction in flights over the community.

8.2.3 Handouts, Newsletters and Website Content

The Part 150 Study public participation program included the preparation and distribution of meeting handouts, newsletters and content for the Bradley Airport website.

Handouts

Handouts were provided at public events and TAC meetings. These included draft DNL contour maps for current and horizon years, departure track maps, arrival track maps, flight operations data, background information on noise and the required metrics used in the Part 150 study, typical noise "everyday" events and aircraft sound level comparisons, a glossary of terms, and other materials. These materials were also made available to individuals who requested them. Note that these materials are shown in the other chapters of this Study and are therefore not provided as appendices.

Newsletters

Three newsletters were produced and distributed to the BDL Part 150 Study mailing list and made available on the airport's website.

- **Issue 1** (Appendix E, item 14): Describes the Study goals, methodology, schedule, TAC members and participation opportunities.
- **Issue 2** (Appendix E, item 15): Describes base case conditions, land use and noise abatement measures considered, noise contours (map), and topics for analysis.
- **Issue 3 (**Appendix E, item 16**):** Describes future projections, noise exposure maps and noise compatibility program recommendations.

Website Content

During the study, information was posted on the Bradley International Airport website (www.BradleyAirport.com) and updated as the study progressed. The website proved to be an important channel of communication for reaching interested members of the public who were not able to attend public events.

During the course of the study, the following web content was provided and updated:

- TAC and public meeting notices.
- Information on noise exposure levels and metrics.
- Noise Exposure Maps for baseline and future conditions.
- Land use maps and information.
- Draft noise abatement measures and recommendations.
- Minutes of TAC and public meetings.
- Status reports.

8.2.4 Media Relations

To better communicate the Part 150 Study goals and progress to members of the public who did not wish or were not able to attend public events, the public involvement program included outreach to local media. Press releases with information about public events were provided to local television, radio and print media outlets.

ConnDOT staff was interviewed at public events and their comments reported in subsequent coverage. Coverage was

received on a variety of outlets, including *The Hartford Courant*, *The Journal Inquirer*, WTIC-TV (Channel 61), WTNH-TV (Channel 8) and WFSB-TV (Channel 3). In addition to coverage at public events, ConnDOT staff responded to periodic inquires from the media throughout the course of the study.

8.2.5 Project Mailing List

A project mailing list was created and maintained for the public and agency involvement program. In addition to TAC members, the list includes all persons attending public meetings who provided legible mailing addresses. A total of approximately 200 people and agencies currently receive mailings, including project newsletters. (The mailing list is not included to protect the privacy individuals who attended the meetings.)

8.3 FINAL PUBLIC HEARING AND COMMENTS

The public and agency involvement program included a Final Public Hearing, as specified in Part 150 regulations. This hearing was held on Thursday, November 20, 2003, from 7:00 to 9:30 PM at Suffield Middle School, 350 Mountain Road, Suffield, CT. The information presented included:

- Draft Noise Exposure Maps (NEMs).
- Draft Noise Compatibility Plan (NCP).

Notices of the Public Hearing and Open House were mailed to all individuals on the project mailing list. The meeting was also advertised in legal notices in *The Hartford Courant* and *The Journal-Inquirer* on October 17, 18 and 20, 2003 (see Appendix E, item 17). The meeting notice was also posted October 17, 2003, on the Bradley Airport website, and display newspaper ads were printed in *The Hartford Courant* and *The Journal-Inquirer* on November 14, 15 and 17, 2003. In addition, a press release was distributed to newspapers and radio and television stations in the Greater Hartford area on November 18, 2003.

In accordance with Part 150 regulations, the Draft Part 150 Study was made available to the public for review prior to the public hearing. The Draft Report was distributed to the libraries and town halls of municipalities near the airport on October 29, 2003, and was available for public review during business hours through December 1, 2003. The list of Draft Study review locations is included as Appendix E, item 18.

In addition, an Executive Summary of the Draft Study was made available in electronic format on-line at www.BradleyAirport.com. The entire Draft Report was mailed on CD-ROM or in print format to all people who requested it by e-mail through the website.

The public comment period on the Draft Study began Wednesday, October 29, 2003 and concluded Monday, December 1, 2003.

8.3.1 Public Hearing Summary

Approximately 210 residents of the towns surrounding the airport attended the hearing. ConnDOT staff and the study consultant team gave a presentation summarizing the Draft Report. A total of 47 people made oral comments; a total of 33 people submitted additional written comments (letters and e-mail) following the hearing.

8.3.2 Summary of Comments

The verbatim transcript of the Public Hearing is included as Appendix E, item 19. Written comments are included as Appendix E, item 20.

The most frequently cited comments were:

- Retain existing flight tracks for departures on Runway 24 (12 oral comments; petition signed by 540 residents of East Granby; petition signed by 68 residents of Windsor; 12 written comments).
- Change existing flight tracks for departures on Runway 24 to "straight out" and other headings (16 oral comments; 15 written comments).
- Noise conditions need to be improved in Suffield (7 oral comments; 6 written comments).
- Sound proofing should be offered in the "buffer" area of Suffield (1 oral comment; 3 written comments).
- Improve zoning and land use to limit growth of noise-affected population (1 oral comment; 5 written comments).
- Study methodology is inadequate (3 oral and 6 written comments).