Washington State

Airports and Compatible Land Use Guidebook

Draft May 2010

Washington State
Department of Transportation

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Table of Contents

CHAPTER 1: An Overview of Airport Land Use Compatibility Planning

INTRODUCTION 1-1
AIRPORTS IN WASHINGTON STATE 1-1
Economic Importance of Airports 1-2
Airport Types and Roles 1-2
State and National Aviation Systems 1-3
Washington Aviation System Plan 1-4
National Plan of Integrated Airport Systems 1-5
Who Operates Washington's Airports? 1-6
AIRPORTS' RELATIONSHIPS TO SURROUNDING LAND USES 1-6
What is Compatibility? 1-6
Types of Land Use Interactions between Airports and Communities 1-7
Encroachment of Incompatible Land Uses 1-7
What Land Use Types Pose Concerns? 1-14
ADDRESSING THE LAND USE COMPATIBILITY ISSUE 1-16
Legal Framework for Compatibility Planning 1-16
Who is Responsible for Airport Land Use Compatibility? 1-17
Washington State Department of Transportation 1-17
Federal Aviation Administration 1-19
Regional Transportation Planning Organizations 1-21
Local Government 1-22
Airports 1-23
Airport Users 1-25
Growth Management Act 1-25
Airports as Essential Public Facilities 1-25
Growth Management Hearings Boards 1-26
Taking a Proactive Approach 1-26

CHAPTER 2: Airport Land Use Compatibility Planning Step-by-Step

INTRODUCTION 2-1
What is the purpose of the compatibility planning checklist? 2-1
How should you use this checklist? 2-1
How will WSDOT use this checklist? 2-3
STEP 1: GETTING STARTED AND GATHERING DATA 2-3
What are your jurisdiction's responsibilities? 2-4
Who should be involved in airport land use compatibility planning? 2-6
What do I need to know about the airport? 2-6
Airport Context 2-7
Airport Features 2-10
Airport Activity 2-12
Where can I find this information about airports? 2-14
Documents and Databases 2-14
Interviews 2-16
What do I need to know about land uses around the airport? 2-17

Step 1 Products: 2-18
STEP 2: DELINEATE THE AIRPORT INFLUENCE AREA 2-18
What is the airport influence area? 2-19
What are the airport's impacts on surrounding land uses? 2-19
Noise Impacts 2-19
Overflight Impacts 2-20
Airspace Protection Requirements 2-21
Historical Accisdent Locations 2-22
Step 2 Products 2-24
STEP 3: IDENTIFY COMPATIBILITY CONCERNS 2-25
What is the land use character of the airport influence area? 2-25
What is the current compatibility status? 2-25
What potential compatibility conflicts are on the horizon? 2-28
What compatibility concerns need to be addressed? 2-30
Step 3 Products 2-30
STEP 4: DEVELOP COMPATIBILITY STRATEGIES AND PREPARE COMPREHENSIVE PLAN UPDATE 2-30
What does it mean to discourage development of incompatible land uses? 2-31
What compatibility policies are already in place? 2-31
What strategies can be used to respond to compatibility planning challenges? 2-33
Which approach is right for you? 2-35
What should the specific compatibility criteria be? 2-36
Things to Consider 2-36
Basic Criteria 2-37
Can the airport influence area size be adjusted? 2-38
What needs to be added or changed in the comprehensive plan? 2-40
Goals 2-40
Compatibility Criteria Identification 2-42
Land Use Map Designations 2-42
Step 4 Products 2-43
STEP 5: ADOPT THE COMPREHENSIVE PLAN UPDATE 2-43
Does WSDOT Aviation need to review the draft comprehensive plan update? 2-43
What public participation is needed for policy adoption? 2-44
How can you gain public and decision-maker support for airport land use compatibility measures? 2-44
Step 5 Products 2-45
STEP 6: IMPLEMENT THE AIRPORT LAND USE COMPATIBILITY POLICIES 2-46
What implementing regulations are needed? 2-46
What actions are necessary to ensure continued implementation of the policies? 2-47
Step 6 Products 2-48

CHAPTER 3: Airport Land Use Compatibility Implementation Toolkit

INTRODUCTION 3-1
REFLECTING COMPATIBILITY ISSUES IN THE COMPREHENSIVE PLAN 3-2
Creating a Comprehensive Plan 3-2
Policies and Goals 3-2
Comprehensive Plan Elements 3-3
Transportation Element 3-3
Land Use Element 3-4

Housing Element ... 3-4
Capital Facilities Element ... 3-4
Aviation Sub-Element ... 3-4
Sub-Area Plans ... 3-5
Urban Growth Area Issues ... 3-5
Addressing Particular Land Use Types ... 3-6
Agricultural Uses ... 3-7
Residential Uses ... 3-7
Schools and Institutional Uses ... 3-7
Parks and Recreational Facilities ... 3-7
Commercial Uses ... 3-7
Industrial Uses ... 3-8
Warehouse and Storage Facilities ... 3-8
Sports Arenas and Large Assembly Facilities ... 3-8
Utilities and Communications Facilities ... 3-8
ADDRESSING COMPATIBILITY IN THE ZONING ORDINANCE ... 3-9
Conventional Zoning ... 3-9
Airport Overlay Zoning Ordinance ... 3-9
Airspace Protection / Height Limit Overlay ... 3-10
Airport Noise and Safety Overlay ... 3-11
Other Types of Zoning Ordinances ... 3-12
Form-Based Codes ... 3-12
Wireless Communication Facilities Ordinance ... 3-12
Other Zoning Tools ... 3-13
Conditional Use Permit ... 3-13
Variances ... 3-13
Docketing Process ... 3-14
TOOLS THAT ADDRESS SPECIFIC AIRPORT LAND USE COMPATIBILITY FACTORS ... 3-14
Noise Compatibility Criteria ... 3-14
Density and Intensity Limits ... 3-14
Open Land Requirements ... 3-14
Noise Insulation ... 3-15
Notice of Proposed Construction (FAA Form 7460) ... 3-15
Other Hazards to Flight ... 3-16
Wildlife Attractants ... 3-16
Thermal Plumes ... 3-16
Visual and Electronic Interference ... 3-16
Avigation Easements ... 3-16
Buyer Awareness Tools ... 3-17
Recorded Deed Notices ... 3-18
Disclosure During Real Estate Transactions ... 3-19
OTHER TOOLS FOR ENHANCING COMPATIBILITY ... 3-19
Tools for Addressing Specific Airport Land Use Compatibility Issues ... 3-19
Clustering of Development ... 3-19
Transfer of Development Rights ... 3-19
Infill Development ... 3-20
Redevelopment ... 3-21
Mixed Use Development ... 3-21
Airport-Directed Actions ... 3-21

Airport Development Review Committee 3-21
Airport Stormwater Design Manual (ASDM): Discouraging Wildlife Attractants 3-22
Fly Friendly Procedure 3-22
SCENARIOS 3-23

APPENDICES

A The Legal Framework for Compatibility Planning
B Describing and Evaluating Airport Noise Impacts
C Describing and Evaluating Aircraft Overflight Impacts
D Describing and Evaluating Airport Airspace Protection
E Describing and Evaluating Airport Safety Concerns
F Compatibility Criteria
G Glossary of Terms

TABLES

1-1 Noise 1–8
1-2 Overflight 1-10
1-3 Airspace Protection 1-11
1-4 Safety 1-13
1-5 Compatibility Concerns Represented by Particular land Uses 1-15

2-1 Six Steps to Airport Land Use Compatibility 2-2
2-2 General Land Use Acceptability 2-26
2-3 Compatibility Challenges and Strategies 2-34
2-4 Compatibility Status 2-35
2-5 Basic Compatibility Criteria for Different Environs 2-39

Chapter 1

An Overview of Airport Land Use Compatibility Planning

Introduction

This chapter provides a high-level overview of airport land use compatibility planning and its relationship to community comprehensive planning. The intent is to give the reader a basic understanding of what is meant by "compatibility" in the context of airports and neighboring land uses. The material presented here sets the stage for the compatibility planning process outlined in Chapter 2.

In this chapter you will learn about:

- The different types of airports in Washington State.
- What types of development are incompatible with airports.
- Why and how incompatible development can affect airports
- How to deal with compatibility issues.

Incompatible land uses are one of the largest concerns affecting airports today. They cause tension between airports and their affected jurisdictions

Airports in Washington State

Airports are functionally and economically vital parts of the communities they serve. Moreover, they are integral parts of Washington's transportation system. Airports range in size from the busiest airline airports in the metropolitan areas to community airports serving business and other private aircraft to small landing strips in outlying locations. There are airports in virtually every county and in or near most cities and towns in the state. The state's airports provide a wide range of services to pilots, passengers, and the general public.

The focus of this *Guidebook* is on public-use, general aviation airports as state law is directed at protecting them from incompatible nearby land use development. However, many general aviation aircraft in the state are based at private-use airports or seaplane bases. Indeed, there are more of these types of airports than there are public-use facilities. These airports, though typically small, serve a significant supporting role to the state aviation system by cumulatively adding substantially to the system's capacity and capabilities. Their protection from incompatible land uses, though not dictated by state law, warrants careful local attention.

The 2001 economic study is in the process of being updated. Look for the newest data on the WSDOT Aviation website in 2010. http://www.wsdot.wa.gov/aviation/

Economic Importance of Airports

Airports are valuable transportation assets and economic engines. They are crucial on a local, statewide, and national level as they efficiently move people and goods, promote business and commerce and contribute to a better quality of life. Many businesses are dependent upon the fast and convenient links to places, people, and products that airports provide.

The magnitude of this impact is impressive: approximately 17 million passengers now land and take off from a Washington airport every year and more than 600,000 tons of air cargo pass through our state airports. According to a 2001 study, the aviation system contributes 170,000 jobs, $4 billion in wages, and $18.5 billion in sales output to the Washington economy each year.

At the 2006 Washington State Governor's Economic Development Conference, transportation was identified as one of several proposed future growth strategies for Washington. Transportation, including air, rail, port and highway, was also described as critical to continued economic development and success of the state in the global economy. The governor's strategic economic plan stressed the importance of long-term planning for Washington's transportation needs and the continued development of its economic future.

These conclusions were again emphasized by the Washington State Aviation Planning Council in its July 2009 report. The Council recognized that:

> "the importance of Washington's aviation system is even greater than the revenue, employment and sales data suggest. The State's aviation system is an essential function of its overall transportation system, which is the backbone of a vibrant and healthy economy."

Long-Term Air Transportation Study (LATS), Recommendations of the Washington State Aviation Planning Council, July 2009. http://www.wsdot.wa.gov/NR/rdonlyres/6CAF7B7B-37B8-44D3-B259-AB020B1AD995/0/ Council_Report_PRINT_070109_lowres.pdf

Also see the General Aviation Manufacturers Association report *General Aviation's Contribution to the U.S. Economy* (May 2006) available at http://www.nasao.org/

Military Airports

While the focus of this *Guidebook* is on civilian airports, the importance of military air bases to nearby communities should not be overlooked. These facilities often are the primary economic generators of their communities. Maintenance of compatible land uses is a factor considered when decisions are made to continue, realign, or close a military base.

Did you know?

RCW 36.70A.530 Requires jurisdictions to notify the commander of the military installation of its intent to amend its comprehensive plan or development regulations to address lands adjacent to military installations to ensure those lands are protected from incompatible development.

Airport Types and Roles

Aviation is broadly classified under three categories: airline, general aviation, and military. Airlines provide scheduled commercial service for passengers or air cargo. Flying by private aircraft, both corporate and business, is considered general aviation. Airline and general aviation activity together comprise civil aviation. The third category, military, consists of flights by aircraft operated by the various branches of the U.S. military.

Airports can be divided into the same three categories. However, just because an airport is placed in a particular category, does not mean that it exclusively serves that type of aviation. For example, airports that offer commercial service are usually called airline airports, but most also serve general aviation and may have some military flights as well. Even some military airports in the country are joint-use, although most—including all the ones in Washington—are restricted solely to military aircraft.

In Washington, all civil airports accommodate general aviation and thus are deemed general aviation airports for the purposes of state law. Even SEA-TAC has some general aviation, although most of its activity is airline. At all other airports in the state, including those that provide commercial service, the majority of the activity is general aviation.

General aviation airports serve many roles in support of a wide range of users including:

- Local companies whose aircraft are essential to their business travel.
- Local pilots who fly for personal or recreational purposes.
- Businesses that provide aviation-related services at the airport to pilots and their aircraft.
- Flight instructors and students.
- Visiting pilots and their passengers traveling to the local community for business, personal, or recreational reasons.
- Specialized aviation businesses or functions such as aerial photography, agricultural applications, and transmission line inspection.
- Sheriffs' and police departments' air patrol and support units.

Additionally, general aviation airports provide a base for a variety of emergency functions that either cannot be accomplished with other transportation modes or that may be unavailable during times of emergency or following disasters.

- Emergency air medical transportation and evacuation.
- Firefighting operations.
- Search-and-rescue operations.
- Access to communities when ground transportation is disrupted.

State and National Aviation Systems

Even though airports may appear as independent dots on a map, no airport would serve a transportation purpose if it were to function by itself. Each airport is part of a greater aviation system, just as individual roads are part of an extensive highway system. Both the state and federal governments have identified and classified the airports that have particular importance within the respective state and national aviation systems.

All airports that serve general aviation activity are considered "general aviation airports" under the Growth Management Act.

How big are general aviation aircraft?

General aviation aircraft come in all sizes and types. They range from ultralights and single engine airplanes to business jets as large as commercial airliners. Helicopters, seaplanes, sailplanes, former military aircraft, and even hot air balloons are all general aviation aircraft.

Washington Aviation System Plan

The *Washington Aviation Systems Plan* or WASP, encompasses public-use airports that have statewide significance. The 2009 WASP includes 138 airports, all of which are public-use facilities.

The WASP divides public-use airports into six classifications based upon the characteristics of the airport and geographic area it serves. The WASP classification of airports is used to help set airport improvement funding assistance consistent with the level of service provided.

The number of airports in each of the six classifications is shown in the following table.

Classification	No. of Airports	Description
Commercial Service	16	Accommodates at least 2,500 scheduled passenger enplanements per year for at least three years
Regional Service	19	Serves large or multiple communities all NPIAS Relievers; at least 40 based aircraft and 4,000-foot-long runway (some exceptions)
Community Service	23	Serves a community; at least 20 based aircraft; paved runway
Local Service	33	Serves a community; fewer than 20 based aircraft; paved runway
Recreation or Remote	38	Other land-based airports, including residential airparks
Seaplane Bases	9	Identified by FAA as a seaplane base, unless it is a commercial service airport
System Total	**138**	

Source: *Long-Term Air Transportation Study: Recommendations of the Washington State Aviation Council* (July 2009) at: http://www.wsdot.wa.gov/NR/rdonlyres/6CAF7B7B-37B8-44D3-B259-AB020B1AD995/0/Council_Report_PRINT_070109_lowres.pdf

National Plan of Integrated Airport Systems

For planning purposes, the Federal Aviation Administration (FAA) identifies more than 3,000 airports that are considered to be nationally significant. This national system of airports is known as NPIAS, the *National Plan of Integrated Airport Systems*. The NPIAS is largely used to determine an airport's eligibility to obtain federal improvement grants under the Airport Improvement Program (AIP). It also includes estimates of the amount of AIP money needed to fund infrastructure development projects that will bring the NPIAS airports up to current design standards and add capacity to congested airports. The FAA is required to provide Congress with a five-year estimate of AIP eligible development every two years.

A copy of the NPIAS can be found at: http://www.faa.gov/airports_airtraffic/airports/planning_capacity/npias/

Only civilian airports open to public use are included in the NPIAS and nearly all are publicly owned. Most airports that provide scheduled commercial airline service are listed, provided that they enplane at least 2,500 passengers per year. For a general aviation airport to be included, it normally must serve at least 10 based aircraft and be located more than 30 minutes ground travel time from another NPIAS airport. Another classification of general aviation airports in the NPIAS are reliever airports. These are high-capacity facilities in major metropolitan areas and are intended as alternatives to busy hub airports for general aviation use.

Less than half of the airports that WSDOT Aviation includes in the WASP because of their statewide significance are included in the NPIAS. Washington has 65 airports listed in the 2009-2013 NPIAS. Of these, 13 are airports that provide commercial airline service and the remainder, including five relievers, are strictly general aviation facilities. The high number of non-NPIAS airports in Washington has important funding implications because these airports are not eligible to receive federal grants for facility improvements and land use compatibility measures.

Along with on-airport improvements, FAA grants can be obtained for land acquisition. An airport's inclusion in NPIAS thus can be a significant factor with regard to an airport's ability to ensure that land uses closest to the runway ends are compatible with airport activity.

The high number of non-NPIAS airports in Washington has important funding implications because these airports are not eligible to receive federal grants for facility improvements and land use compatibility measures.

Felts Field

Located in Spokane, Felts Field has three runways – two hard surface (concrete and asphalt) and one water (on the Spokane River). Primarily a general aviation airport, Felts Field was the original site of the Washington Air National Guard. The terminal building, among others at the airport, are listed on the National Register of Historic Places.

Copalis State Airport

is located on the beach in Grays Harbor County, Washington. It is the only airport in the US that is located on an ocean beach. Landing is only available during low tide when the sand is dark and damp: the dry sand is very soft and dangerous.

State law authorizes formation of public port districts for the purpose of supporting economic development. Ports are quasi-governmental entities that may own land and often operate a variety of public infrastructure, including airports. There are 75 port districts in Washington State.

Who Operates Washington's Airports?

Of the public-use airports in Washington, almost 80 percent are publicly owned, either by municipalities, including port and airport districts, or by the state. Several airports are owned by a combination of public entities. The state-owned airports are all small facilities, mostly providing service to recreational or remote areas. Most of the privately owned, public-use airports also are recreational/remote fields or are seaplane bases.

Policy decisions involving publicly owned airports in the state are typically made by elected officials of the entity owning the airport. Day-to-day operations are generally administered by an airport manager. Larger airports usually have a full-time manager, frequently supported by other staff, while low-activity airports may have a volunteer manager, part-time contractor, or local official who serves as airport manager in addition to other roles in local government.

An airport's sponsor's acceptance of federal or state grant funds obligates the sponsor to meeting certain grant assurances as described later in this chapter.

Funding to develop, maintain, and operate airports derives from a variety of sources including user fees, revenues from land and facility leases and rents, local government funds, and federal and state grants. The proportion of funding coming from each of these sources varies from airport to airport. Larger airports are more likely to be self-supporting than the small ones with few aircraft or services. For those airports in NPIAS, a substantial proportion of development and major maintenance funding comes from the FAA grant program. State grants serve a similar function for the smaller NPIAS airports and others in the state airport system.

Type of Ownership	No. of Airports
City or Town	43
County	9
Port or Airport District	31
Multi-Agency	8
State	17
Private	30
Total	138

Airports' Relationships to Surrounding Land Uses

What is Compatibility?

Airports unavoidably create negative impacts on their environs and almost every land use can potentially cause direct or indirect impacts on the way airports develop and operate.

com·pat·i·ble

Capable of existing or performing in an harmonious, agreeable, or congenial combination with another or others.

This two-way character of airport land use compatibility is important to emphasize. Most people are familiar with the negatives associated with proximity to an airport: particularly such things as noise, vibration, odors, and accident risks. Fewer people understand the effect that adjacent land uses can have on airport activities. Development around an airport can have the direct consequences of creating obstructions to the airspace needed for aircraft to safely approach and depart the runway and reducing property available for operations and safety areas. Indirectly, incompatible development can lead to objections to the airports impacts and demands for limitations on the airport activity. Ultimately, incompatible development reduces transportation access, reduces the value of public investment in airport infrastructure, reduces opportuni-

ty for economic development, and reduces quality of life for people living in communities near airports.

Communities can address airport land use compatibility in a variety of ways based on the specific characteristics of an individual airport facility as well as numerous other factors that are unique to their area. Approaches that may work well in outlying communities may be impossible to achieve in urban locations. To determine the best approach for any particular airport and community, the types of land use interactions between the two must first be understood.

Types of Land Use Interactions between Airports and Communities

Airports and nearby communities interact in a variety of ways, both physical and economic. Economically, airports can be important attractors of business and income to a community as briefly noted at the beginning of this section. The physical interactions are the focus here, though, and particularly the interactions that occur between all types of airports and communities:

- *Noise* addresses the areas of concentrated impacts that are most disruptive to land use activities;
- *Overflight* is concerned with lesser noise levels that some people living near airports can nonetheless find to be annoying;
- *Airspace protection* deals with aspects of land uses that can cause or contribute to aircraft accidents; and
- *Safety* is concerned with the consequences of accidents when they occur.

The four tables on the following pages further describe and illustrate each of these four compatibility concerns.

Encroachment of Incompatible Land Uses

Encroachment of incompatible land uses is a key factor contributing to constraints on expansion and restrictions on operations of airports in the U.S. It can even lead to the closure of airports.

Why is encroachment occurring? There are numerous explanations:

- The population of Washington State has doubled in the last 30 years.
- Urban areas are expanding and communities are pursuing denser development.
- Local land use authorities are not aware of the requirements of Washington's Growth Management Act or perhaps are ignoring them.

Evergreen Field
Vancouver, Washington

These photos show the spread of urban development around Evergreen Field in Vancouver, Washington. The airport closed in summer 2006 to make way for a mixed-use development including retail, office, and residential units after the original owner passed away and his heirs sold the land to developers.

Table 1-1. Noise

How Airport Noise Affects Land Use

In simplest terms, noise can be defined as unwanted sound. As such, noise is perhaps the most basic airport land use compatibility concern. Certainly, it is the most noticeable form of airport impact, especially when aircraft noise is disruptive to human activities. Noise affects land uses because it can be disruptive in several ways:

- **Speech Interference.** Prolonged loud noises, such as can be created by an aircraft flying by, can overwhelm a normal voice level and make conversation difficult or impossible.
- **Children's Learning.** Research suggests that aviation noise can adversely affect the ability of children's learning abilities, including reading, speech, memory, and motivation. Speech interference is a likely underlying cause.
- **Sleep Interference.** Loud noise can cause people to shift to a lighter stage of sleep or even to awaken. Sensitivity can vary not only from person to person, but also is dependent on the nature of the noise (a baby crying might awaken a parent, while an equally loud automobile driving by might not). Near busy airports with night activity, aircraft noise can interfere with the sleep patterns of some people.
- **Hearing Loss.** Exposure to frequent, high-decibel, noise events can cause people to suffer permanent loss of some of their hearing ability. At airports, this outcome could occur to people who work around the aircraft if they do not wear hearing protection. As for people living or working nearby, aircraft noise is very unlikely to cause hearing loss.
- **Other Health Effects.** Some not fully conclusive evidence suggests that extremely high noise levels can effect health in ways other than hearing loss. The effects may be physical or mental. Except maybe at the very busiest airports, aviation noise appears unlikely to have these health consequences.

Measuring the Impact

Noise can be measured in many different ways. The basic measure is the decibel (dB), usually adjusted for human hearing sensitivity and abbreviated dBA. The adjacent chart shows some common sound levels from a variety of sources. For sounds representing distinct single events, the chart indicates the typical maximum sound level reached during the event.

For compatibility planning purposes—particularly for setting compatibility policies to guide land use development—noise is usually measured in terms of cumulative noise level metrics. The metric used in most states, including Washington, is the Day-Night Average Sound Level, abbreviated as DNL. For airports, DNL describes the average aircraft-related sound level in decibels to which any point near an airport is exposed over the course of an average day of the year. DNL values are typically depicted on a map as contours lines representing points of equal noise exposure. Because of people's heightened sensitivity to noise at night (defined at 10:00 p.m. to 7:00 a.m.), DNL counts each nighttime noise event as if it is 10 dB louder than it actually is.

A notable shortcoming of cumulative noise metrics such as DNL is that they are not easy to comprehend. While they take into account the maximum noise levels produced by individual events, they also consider the number of events. In effect, DNL is an average noise level. Even though both cumulative and single-event aviation noise levels are measured in decibels, the decibel value for cumulative noise will always be lower than the single-event levels at any given location.

Think of cumulative noise metrics as being like the climate while single-event metrics are like the weather.

Table 1-1, continued

Many factors affect the apparent loudness of aircraft noise:

- **Aircraft Type.** The most obvious variable is the type of aircraft producing the noise. Not only does the loudness vary among different aircraft, so do the qualities of the noise.
  - *Jet Aircraft.* Newer designs produce lower sound magnitudes and frequencies. Although improved, jets are still perceived as top noise-producers.
  - *Propeller-Driven Aircraft (turbine or piston).* Much of the noise is generated from the propeller itself. This sound is variable and depends upon the number of engines, rotation speed of the propellers, the number of blades for each propeller, and the type of engine.
  - *Helicopters.* Most notable for the modulating, impulsive sound sometimes called "blade slap" caused by the relatively slow-turning main rotor. This sound is most evident on low-speed descents and high-speed cruise, particularly as the helicopter is approaching the listener. It is also known to create vibration or rattle in structures.

For more on helicopter noise, see the Helicopter Association International's *Fly Neighborly Guide* at http://www.rotor.com/portals/12/Fly%202009.pdf

- **Pilot Techniques.** One aircraft type can generate differing noise levels depending upon power settings, the propeller pitch (for aircraft with variable pitch) especially at high power settings, the angle of climb while on takeoff, and flap settings on the wings. Pilot familiarity with the airport and its surroundings also can affect noise impacts to the extent that overflight of noise-sensitive land uses can be avoided.
- **Topography, Structures, Vegetation.** Sound waves may bounce off nearby structures and steep terrain, thus making the noise louder. Conversely, these features can block the noise from aircraft while they are on the ground. Dense vegetation also can absorb sound as it travels along the ground.
- **Weather Conditions.** Low cloud cover may reflect sound back toward the ground and increase noise levels.
- **Ambient Noise Levels.** High background noise levels tend to mask or reduce the intrusiveness of individual noise events. The higher the ambient noise level, the less noticeable any individual noise will be.

What to Avoid

- Residential uses
- Schools and noise-sensitive outdoor uses
- Noise-sensitive indoor uses unless constructed with special features to reduce the noise to an acceptable level

Why Compatibility Measures are Important

Airport noise compatibility measures are important primarily to minimize the exposure of people to the adverse effects of the noise. Indirectly, though, the reaction of people to airport noise can have negative consequences for airports. Among all airport impacts, noise is the most likely to cause people to seek constraints on the airport to reduce the impact. These desired constraints can be in the form of limits to where and when aircraft fly or opposition to airport expansion. Demands for airport closure can even result.

Table 1-2. Overflight

How Aircraft Overflights Affect Land Use

Experience at many airports has shown that noise-related concerns do not stop at the boundary of the mapped noise contours. As noted in the preceding discussion of noise impacts, individual noise events can be disruptive even where the cumulative noise levels are relatively low. Additionally, many people are sensitive to the frequent or random, but unusual presence of aircraft overhead even when the events are not loud enough to be highly disruptive. The latter reactions are often described as annoyance.

Measuring the Impact

No methodology exists with which to precisely define the extent of the area of overflight impacts at an airport. For general aviation airports, though, the boundary can usually be drawn by taking into account where aircraft normally fly as they approach and depart the airport or engage in closed-circuit flight training activity. Vertically, the focus is typically on where aircraft are flying roughly at the traffic pattern altitude or lower.

Single-event noise is an important component of overflight impacts. Unlike the routine noise events that usually determine the noise impact area defined by DNL contours, it is often random, unusual noise events that generate the annoyance associated with overflight impacts. Occasional noise events that people believe to be unusual may be significant overflight impacts yet not be apparent in the noise impacts measured by DNL contours. Rapid changes in power settings, abnormally low-altitude flights, and actual or apparent aerobatic maneuvers, all can contribute to annoyance and cause complaints. Sudden high use of a normally little-used runway—as may occur because of wind conditions or repair work on another runway—also may be factors.

What to Avoid

- New residential subdivisions, particularly if situated in otherwise quiet environments

Why Compatibility Measures are Important

Even though the direct effects of aircraft overflights on people living and working near airports are less than in highly noise-impacted locations, the repercussions airports can be even greater. People may believe the overflights to be unnecessary and thus demand that airports take action to prevent similar occurrences in the future.

Houses around airport

Houses at runway end

Table 1-3. Airspace Protection

How Airspace Protection Requirements Affect Land Use

The goal of airspace protection requirements is to prevent creation of land use features that can cause or contribute to an aircraft accident. Airspace protection does not affect land use directly in the manner that noise and overflight impacts can be evident with each aircraft flight. Rather, the effect is an indirect one: restrictions on land uses are needed because, without them, adverse consequences for the airport and the aircraft that use it can occur. The primary restrictions are limits on the heights of structures, but other restrictions to prevent hazards to flight are also important.

Measuring the Impact

The navigable airspace around an airport is delineated in accordance with standards set forth in Federal Aviation Regulations (FAR), Part 77. The regulations define a set of imaginary surfaces in the air around an airport. Any object—including structures, trees, movable objects, and even the ground itself—that penetrates one of the airspace surfaces is considered to be an obstruction. The chief function of FAR Part 77 is as a device for notifying the FAA about proposed construction near an airport so that the agency can assess whether the object would be a hazard to flight (see discussion in Chapter 1).

For airports having instrument approach procedures, another set of airspace protection surfaces are defined by the U.S. Standard for Terminal Instrument Procedures, known as TERPS. These surfaces are used by the FAA to design instrument procedures. In most cases, TERPS surfaces are higher than those of FAR Part 77 and thus less restrictive on the heights of objects. However, TERPS surfaces may be critical in some locations, particularly if the approach course is not aligned with the runway centerline. The FAA publishes (and regularly updates) charts showing the approved instrument approach and departure procedures. These define where aircraft must fly in order to remain clear of obstructions in the vicinity of the airport. From a land use compatibility standpoint, the important thing to remember about TERPS is that any new object that penetrates one of the surfaces will require a modification to the instrument approach procedure, generally to increase the minimum cloud ceiling under which the procedure can be used.

Among other physical hazards to flight, bird strikes represent the most widespread concern. The FAA recommends that uses known to attract birds—sanitary landfills and certain types of crops being primary examples—be kept at least 5,000 feet from runway used only by piston-powered aircraft. For runways used by turbine-powered aircraft the distance increases to 10,000 feet.

An additional, little recognized, physical hazard to aircraft flight are thermal plumes generated by power plants. Invisible unless the heated air turns to steam, the plumes from large facilities can create unstable air at the altitude that airplanes or helicopters fly when near airports.

Criteria defining land use characteristics that can cause visual or electronic hazards to flight are more qualitative in nature—the FAA has not set any precise standards. In general, visual hazards to flight include sources of dust, steam, smoke, or glare that can impair pilot visibility, as well as distracting lights that can be confused for airport lights. Electronic hazards are ones that can cause interference with aircraft communications or navigation.

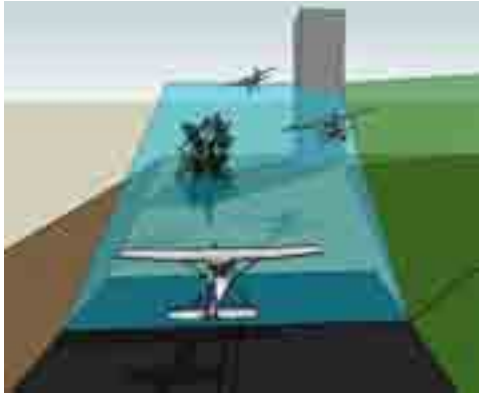


Table 1-3, continued

What to Avoid

- Tall buildings, antennas, cell phone towers, wind farms, trees, and other tall objects, particularly if located along the extended runway centerline or on high terrain
- Uses that attract birds
- Power plants and other facilities that generate steam or thermal plumes
- Uses that create smoke, dust, or glare
- Lighting that can be confused with airport lights
- Uses that can generate electronic interference with aircraft communications or navigation

Why Compatibility Measures are Important

The importance of airspace protection measures is clear: they serve to prevent creation of land use features that can cause aircraft accidents. They also are important because, when airspace obstructions and other land-use-related hazards to flight exist, changes to the way an airport operates may be necessary. A particular consequence may be modifications to airport instrument approach procedures that reduce the usefulness of the procedures when weather and visibility conditions are poor.

Table 1-4. Safety

How Aircraft Accident Risks Affect Land Use

In the context of airport land use compatibility planning, safety is concerned with the potential for damage to property and injury to people on the ground in the event of an aircraft accident beyond the runway. Also to be considered, at least for general aviation, are land use characteristics that can affect the chances of survival of the aircraft occupants. Land uses are affected because of the need to keep people and critical facilities out of harm's way where the risks warrant these actions.

Measuring the Impact

Clearly, locations in the vicinity of an airport are exposed to a greater risk of being the site of an aircraft accident than is the case for more distant places. The difficulty lies in measuring the magnitude of the risk and then in determining an appropriate response. Further compounding the difficulty is that perception plays as much of a role as measurement in determining the response to the risk.

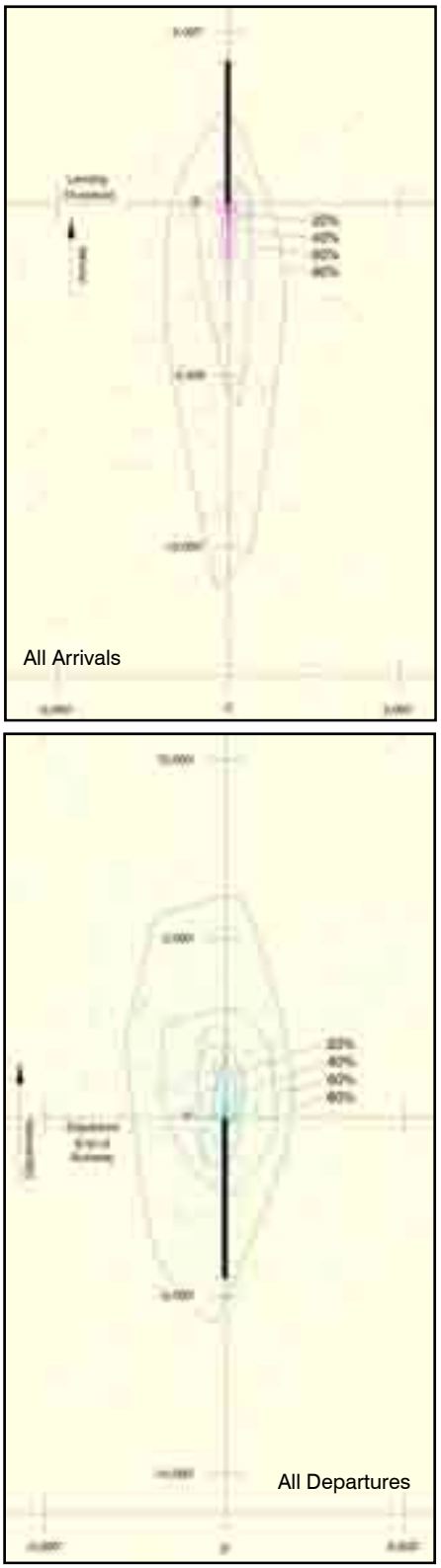
For land use compatibility planning purposes, the most important piece of information regarding aircraft accidents near airports is their spatial distribution. Where do accidents take place relative to the runway used or intended to be used? For this type of analysis to be meaningful, a large data set is essential. However, because aircraft accidents are infrequent occurrences, the number of events at any given airport is too small to be statistically meaningful. Data gathered from many airports is needed. The adjacent diagrams show a large sampling of where general aviation aircraft accidents have historically occurred near airports in the U.S. While repeat occurrence of an accident in the same location cannot be assumed, it is reasonable to predict that the broad cluster areas where accidents have occurred in the past reflect the same areas where accidents will likely occur in the future.

What to Avoid

- Uses where there will be large numbers of people in a concentrated area
- Hospitals, schools, and other uses involving people having limited effective mobility
- Critical community infrastructure including power plants and emergency communications facilities
- Elimination of all level, open land areas that could be used for an emergency landing by a small aircraft

Why Compatibility Measures are Important

While the risk of injury to people on the ground as a result of an aircraft accident are relatively small, they are not inconsequential in locations close to airport runways. Moreover, allowing development that puts more people in harm's way can only increase the risks. As with noise impacts, aircraft accidents can lead to public demands to restrict or close an airport.



General Aviation Accident Distribution Contours

Source: California Airport Land Use Planning Handbook (2002)

- Communities underestimate the adverse impacts of incompatible land use development on airport operations.
- Many airports are currently surrounded by flat, undeveloped land that is attractive for development because, particularly when the land is served by utilities and other infrastructure.

High intensity development

Consequences of Incompatible Land Uses Near Airports

Consequences to the aviation system and its users:

- Delays and constraints to airport development, leading to limitations on system capacity
- Restrictions on aircraft operations, leading to system delays and travel time penalties
- Constraints to runway approach protection, leading to runway capacity constraints and safety risks
- Litigation and related costs
- Increased development costs
- Lost value of public investment
- Increased risk of aviation accidents caused by the presence of tall structures, visual obstructions, and wildlife attractants

Consequences to people who live near airports:

- Exposure to noise
- Exposure to emissions
- Exposure to aviation accident risk
- Decline in transportation access
- Consequences to concerned local and regional jurisdictions:
- Unrealized local and regional economic impacts due to constraints on airport growth
- Irresolvable political disputes

What Land Use Types Pose Concerns?

Some types of compatibility conflicts between airports and land uses are obvious: houses and schools, for example, are generally incompatible near airports for reasons of both noise and safety. Others are not as readily recognized or understood: uses that concentrate people in locations where aircraft accident risks are greatest; tall structures that impinge upon airport airspace; or features that attract birds to areas where aircraft fly. Some examples of the obvious and not-so-obvious compatibility conflicts are listed in the table on the following page.

Table 1-5. Compatibility Concerns Represented by Particular Land Uses

Land Use Type	Compatibility Concerns
Single-Family Residential	▪ Noise can be disruptive in outdoor areas as well as indoors with open windows ▪ Aircraft overflight can be annoying, especially where ambient noise levels are low
Multi-Family Residential	▪ Noise can be disruptive in outdoor areas as well as indoors with open windows, although less sensitive than for single-family residential ▪ High density presents concern for safety of residents in areas exposed to significant risk of aircraft accidents
Children's Schools	▪ Noise can disrupt the learning environment ▪ Special concerns for safety of children in areas exposed to significant risk of aircraft accidents
Hospitals / Nursing Homes	▪ Special concerns for safety of patients in areas exposed to significant risk of aircraft accidents
Retail Centers	▪ Large numbers of people could be at risk from aircraft accidents ▪ Noise can be disruptive in outdoor spaces
Business Parks	▪ Safety concerns for places with high-intensity uses ▪ Tall buildings can be airspace obstructions
Assembly Facilities	▪ Large numbers of people could be at risk from aircraft accidents; outdoor stadiums have greatest exposure
Industrial Uses	▪ Smoke, steam, and thermal plumes can be hazards to flight ▪ Tall structures can be airspace obstructions ▪ Possible release of hazardous materials if damaged during an accident
Agricultural Uses	▪ Potential wildlife attractants as well as a source of dust and smoke
Water / Natural Areas	▪ Potential wildlife attractants
Power Plants	▪ Smoke, steam, and thermal plumes can be hazards to flight ▪ Tall structures can be airspace obstructions ▪ Potential disruption of service if damaged during an accident
Critical Community Infrastructure (emergency services and communications)	▪ Potential disruption of service if damaged during an accident

In general, to avoid compatibility conflicts, land uses closest to the ends of runways should ideally consist of open or agricultural land with relatively few buildings or people. In more urban areas where such uses are impractical, the best choices are commercial or industrial uses that are low-intensity (few people). Warehouses and storage facilities are preferable, but many light industrial uses and single-story offices can also be compatible. Farther away from the runway ends, higher-intensity uses including some types of retail become more acceptable.

Because of noise and overflight impacts, single-family residential uses are best kept away from anywhere that aircraft are regularly flying to reach or leave the airport. Often, multi-family residential can be a better option than single-family in locations where aircraft accident risks are low, but noise impacts are present.

Addressing the Land Use Compatibility Issue

How should land use compatibility issues be addressed? First, it is important to recognize that the responsibility for airport land use compatibility does not rest just with WSDOT Aviation or any other single party. Many participants have a role to play in the process and a stake in its outcome. The process can be thought of as puzzle with each participant as having a part of a puzzle—the planning effort is not complete without every piece.

Legal Framework for Compatibility Planning

The legal tools needed to address airport land use compatibility issues are provided by a variety of state and federal laws, regulations, and legal decisions. Some of this framework sets mandatory requirements for airports or local land use entities; other pieces merely enable airport or local action, but are not mandatory.

Within Washington, three laws are particularly important to defining the relationship between airports and surrounding jurisdictions. These are:

- **Airport Zoning Act (RCW 14.12).** This act establishes definitions and criteria, and allows local jurisdictions to adopt zoning controls to protect critical airspace from buildings, structures, or other airspace obstructions. The law provides direction and guidance to cities and counties on how to manage airport hazards.
- **Planning Enabling Act (RCW Chapter 36.70).** Specifically, the section entitled "General Aviation Airports" (RCW 36.70.547) mandates that:

> "Every county, city, and town in which there is located a general aviation airport that is operated for the benefit of the general public, whether publicly owned or privately owned public use, shall, through its comprehensive plan and development regulations, discourage the siting of incompatible uses adjacent to such general aviation airport."

Plans may only be adopted following formal consultation with aviation stakeholders, including WSDOT Aviation. WSDOT Aviation is tasked with providing technical assistance to local agencies preparing plans and regulations consistent with this section.

- **Growth Management Act (RCW 36.70A).** Among other things, the act requires counties, cities, and towns to plan for essential public facilities within their jurisdictions (RCW 36.70A.200). These facilities are ones that are typically difficult to site. Airports are explicitly identified as an example. Others include: state education facilities, state or regional transportation facilities, state and local correctional facilities, solid waste handling facilities, and inpatient facilities including substance abuse facilities, mental health facilities, group homes, and secure community transition facilities. Counties and cities planning under GMA must have a process for identifying and siting essential public facilities. No local comprehensive plan or development regulation may preclude the siting of essential public facilities.

An extended listing of the laws and regulations, both federal and state, that apply to airport land use compatibility planning can be found in Appendix A of this *Guidebook*. Also included in the appendix is a summary of relevant Growth Management Hearings Board findings.

Who is Responsible for Airport Land Use Compatibility?

The responsibilities for preserving and enhancing airport land use compatibility rest at all levels of government as well as with the private sector. Each entity has its own distinct role to play. While the respective responsibilities—and the limitations on authority—are largely defined by law local planning depends on participation from a diverse range of interests and stakeholders to define community needs and identify solutions. Participation is critically important for influencing outcomes; it is the nature of the planning process that interests that are not represented are often not addressed. Airport advocates wishing to preserve aviation facilities should ensure their place at the table so they can work cooperatively with other citizens and local leaders to educate them about the importance of air transportation for their community.

Washington State Department of Transportation

The State of Washington has a lead role in promoting land use compatibility around the airports in the state. This role derives from the state's broad interest in all modes of transportation in recognition of the benefits that transportation brings the state and its citizens. The specific responsibility as the primary steward and advocate of the state's aviation interests is assigned to the Aviation Division of the Washington State Department of Transportation (WSDOT Aviation). The WSDOT Aviation role extends to advocating for promotion of safe air

transportation, preservation of aviation facilities, provision of airport capacity to meet demand, and mitigation of environment impacts.

State law addressing airport hazards dates back to the mid 1940s. RCW 14.12 focuses on obstructions to airport airspace and gives counties and cities the power to adopt and enforce airport hazard zoning.

"It is hereby found that an airport hazard endangers the lives and property of users of the airport and of occupants of land in its vicinity, and also, if of the obstruction type, in effect reduces the size of the area available for the landing, taking-off and maneuvering of aircraft thus tending to destroy or impair the utility of the airport and the public investment therein."

WSDOT Aviation's responsibilities under the Growth Management Act are narrowly limited to airport compatibility concerns. The state agency having overall responsibility for overseeing implementation of the act is Growth Management Services (GMS), a unit of the Department of Commerce Local Government Division. GMS provides technical and financial resources to help local governments to undertake planning and other work essential to their compliance with provisions of the act. The Department of Commerce was created in 2009 from what had been the Department of Community, Trade and Economic Development (CTED).

While not exclusively directed at airports or airport land use compatibility, broader legislative attention to land use planning matters took place with enactment of the Growth Management Act (RCW 36.70A) in 1990. The basic purposes of the act are to ensure a high quality of life by residents of the state through comprehensive planning in metropolitan areas and other areas experiencing growth and coordination among all levels of government. The act designates airports as one of several types of "Essential Public Facilities" and establishes a planning process required to be implemented by state and local agencies.

Legislation adopted in 1996 was aimed more specifically at airport land use compatibility. RCW 36.70.547 and other sections that refer to it (including 35.63.250, 35A.63.270, and 36.70A.510) requires towns, cities, and counties to "discourage the siting of incompatible uses" adjacent to general aviation airports through adoption of comprehensive plan policies and development regulations. *Note that, in the context of this statute, all airports that serve general aviation, meaning all public-use airports in the state, are considered to be general aviation airports.* Formal consultation with WSDOT Aviation, together with airport owners and other stakeholders, is required before such plans and regulations may be adopted or amended. WSDOT Aviation is tasked with providing technical assistance to the communities to help them meet the requirements of the law. [See Appendix __ for more details on the consultation process.]

In conclusion to the *Long-Term Air Transportation Study (LATS)* in July 2009, the Washington State Aviation Planning Council recommended policies that clarify Washington's position and responsibility in relation to its local, regional, and federal aviation partners as the primary steward and advocate for protecting Washington State's aviation system interests.

"The challenge of meeting Washington's aviation capacity is shared between many entities including the FAA, local and regional agencies, airlines, and publicly and privately owned airports. The Council believes that the State needs to exercise a leadership role as the primary steward for a healthy and viability aviation system. In this role, it will provide the FAA with support to help it better manage the national aviation system and clarity about its funding priorities. The State will also provide policy direction and support local and regional agencies in fulfilling their distinct aviation roles."

The technical assistance includes establishing airport land use compatibility guidelines. WSDOT Aviation does not have regulatory authority over land use decisions and cannot mandate local adherence to the guidelines. Nevertheless, cases decided by the state's Growth Management Hearing Boards direct local government to "give substantial

weight to WSDOT Aviation Division's comments and concerns related to matters affecting safety at general aviation airports." [See ***Stephen Pruitt and Steven Van Cleve vs. Town of Eatonville***, heard by the Central Puget Sound Growth Management Hearings Board (CPSGMHB; Case No. 06-3-0016)]

More information about WSDOT Aviation is available at:
www.wsdot.wa.gov/aviation/

Federal Aviation Administration

The FAA plays a very focused role in airport land use compatibility planning. Its involvement stems from its primary areas of responsibility: the safe and efficient operation of airports and the national aviation system. In these matters, the FAA role is preeminent. Federal law preempts local regulations in the area of aircraft safety, navigable airspace, flight operations, and noise control.

It is important to note that, the FAA relies on local jurisdictions with land use authority to protect critical airspace. The FAA has no direct land use authority and must rely on local decision makers.

Even in these fields, though, the FAA's authority is directed primarily at the operators of airports and aircraft. The FAA has little ability to prevent the development of incompatible land uses near airports. The U.S. Constitution reserves to the states the authority over local land use matters. Thus, the FAA cannot dictate the decisions made by airports and local land use entities, it can only influence them—albeit sometimes very strongly. The two mechanisms by which the FAA most strongly influences local land use decisions are: through regulations designed to protect airport and en route airspace; and via its grant program.

Grant Program

As authorized under the Airport and Airway Improvement Act of 1982, the FAA's grant program—the Airport Improvement Program (AIP)—provides the majority of funding for facility improvements and land acquisition for airports within the NPIAS. In exchange for receipt of grant funding, however, airports must promise to take steps, to the extent possible, to prevent creation of airspace hazards and incompatible land uses. The FAA can withhold funds from a grantee or require repayment of funds if the grant assurances are not met. The grant assurance language is quite general, but two particular assurances address the actions that the FAA expects the airport sponsor to take. The grant assurances say that the airport sponsor must agree that:

- **20**. **Hazard Removal and Mitigation**. It will take appropriate action to assure that such terminal airspace as is required to protect instrument and visual operations to the airport (including established minimum flight altitudes) will be adequately cleared and protected by removing, lowering, relocating, marking, or lighting, or otherwise mitigating existing airport hazards and by preventing the establishment or creation of future airport hazards.

- **21. Compatible Land Use**. It will take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft. In addition, if the project is for noise compatibility program implementation, it will not cause or permit any change in land use, within its jurisdiction, that will reduce its compatibility, with respect to the airport, of the noise compatibility program measures upon which Federal funds have been expended.

See Appendix D for additional description of the FAA Aeronautical Study process.

The full set of FAA grant assurances can be read online at: http://www.faa.gov/airports/aip/grant_assurances/

Airspace Protection

The other way in which the FAA gets involved in local land use actions is with regard to protection of airport and en route airspace. However, beyond the obligation that the FAA puts on airports when they accept grant funds, the agency does not have the authority to prevent airspace hazards from being created. This is a local responsibility and is not mandatory. The FAA's function is to set the standards used to determine whether tall structures would adversely affect the airspace and, additionally, to evaluate individual proposals relative to these standards. The standards and the review process are both defined in Part 77 of the Federal Aviation Regulations (14 CFR Part 77).

The one facet of the federal regulations that does create a mandatory local responsibility is the notification process. Part 77 requires that notification be submitted to the FAA before any tall structure is constructed erected that could penetrate the airspace surfaces defined in the regulations. Certain other land use features or activities are also subject to the notification process (for example, uses involving electro-magnetic radiation or laser lights). The notification responsibility rests with the project proponent, not the local government agency that has approval authority. Substantial fines can be levied for failure to comply with the notification requirements.

See U.S. Code Title 49, Sections 44718, Structures Interfering with Air Commerce and 46301(a), Civil Penalties

Upon receipt of the notification the FAA conducts an "Aeronautical Study" to assess whether the objects could be hazards to air navigation. Two aspects of Aeronautical Studies are important to emphasize. One is that they only address what might cause an accident; land uses and features that might put people on the ground at risk should an accident occur are not study topics. Second, is that local land use jurisdictions are not obligated to adhere to the FAA's findings. The local jurisdiction could allow a structure to be created despite the FAA's objections, though presumably it would take on a high degree of liability in doing so. Oppositely, the local jurisdiction could, based on its assessment of

the myriad of other factors—both aeronautical and nonaeronautical—that affect local decision-making, deny a proposal even though the FAA said that it would not be a hazard to airspace.

Regional Transportation Planning Organizations

Regional Transportation Planning Organizations (RTPOs) occupy a special niche in the overall spectrum of agencies having responsibilities for airport land use compatibility planning in Washington. As enabled by state law, RTPOs are voluntary associations of local governments within a county or contiguous counties. They were authorized as part of the 1990 Growth Management Act to ensure local and regional coordination of transportation plans. RTPO members include cities, counties, WSDOT, tribes, ports, transportation service providers, private employers and others. Among the duties taken on by these organizations is review of local countywide planning policies and the transportation-related provisions in local comprehensive plans.

The level of involvement of RTPOs in airport land use compatibility planning varies from one organization to another. As the RTPO for the state's most populated area, the Puget Sound Regional Council (PSRC) specifically reviews airport compatible land use policies as part of its comprehensive plan review and certification process. The process requires cities and counties to report on actions taken to discourage the siting of incompatible land uses near airports. PSRC also offers technical assistance to local planners to assist them in identifying key airport land use compatibility issues and to help in developing policies and planning provisions to address those issues.

More information about Washington's Metropolitan Planning Organizations (MPOs) and RTPOs, including information about the review and certification process, is available at: www.wsdot.wa.gov/planning/Regional/

Local Government

To a great extent, the ultimate responsibility for airport land use compatibility rests with local government bodies: towns, cities, and counties. Although local plans, policies, and regulations must be consistent with state law and countywide planning policies, local government has discretion to determine how development occurs within the community. Also, the federal preemption doctrine does not affect the local government's ability to use its police powers, particularly land use controls, to anticipate, abate, mitigate and otherwise respond to other land use concerns provided they are reasonable and do not restrict airport operations.

The local government level is where day-to-day decisions are made on whether development proposals are compatible with airport activity. Airport compatibility issues may be addressed in a variety of local planning documents.

- **Countywide Planning Policies.** Counties develop these policies in cooperation with their cities. The policies provide a common framework for local planning efforts within each county. Countywide planning policies address numerous issues, including: siting major public capital facilities; defining transportation strategies and facility needs; and facilitating joint planning. Basic airport land use compatibility goals and intergovernmental coordination mechanisms should be addressed.

- **Comprehensive Plans.** Comprehensive plans guide land use development within towns, cities, and counties. They determine where development is or is not desirable and set the tone for the development size and intensity. The plans are the centerpiece of local planning and the starting point for the planning of individual projects. Development regulations—zoning, subdivision, and other controls—must be consistent with comprehensive plans. State agencies are required to comply with comprehensive plans and development regulations of jurisdictions planning under the GMA. Establishment of land use patterns to avoid compatibility conflicts with airports must be a consideration in preparation of these plans.
- **Sub-Area Plans.** These planning documents address a portion of a municipality. They address a smaller geographic area than the comprehensive plan, but often influence airports depending on their scope and approach. Limits on development in areas subject to airport impacts should be described.

- **Development Regulations/Zoning.** These regulations are set by local jurisdictions to implement the comprehensive plan. They specify the types of activities that may take place in a given location and establish limits on the physical size and shape of the development. Specific limitations on the number of occupants, the heights and overall sizes of structures, and requirements for sound attenuation are appropriate elements of local zoning.
- **Environmental Review.** This is a formal process for soliciting public comment on the effects of a particular development proposal or planning effort. The procedural and analysis requirements are set forth in the State Environmental Policy Act (SEPA). The SEPA process provides a way to identify possible environmental impacts that may result from governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies or plans. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified. As part of a SEPA document regarding development near airports, the compatibility of the proposed development with airport activities should be addressed.

Under the National Environmental Policy Act (NEPA), similar environmental review requirements are established at the federal level. NEPA comes into play with regard to actions by federal agencies including the provision of grants for airport improvements. Local land use actions are not subject to NEPA.

For additional information regarding SEPA and its process visit:
http://www.ecy.wa.gov/programs/sea/sepa/e-review.html

Information about the NEPA process can be found at:
http://www.epa.gov/compliance/basics/nepa.html

For more information about the planning process in Washington State, see the Department of Commerce Short Course on Local Land Use Planning at:
http://www.commerce.wa.gov/site/395/default.aspx

Airports

Airports are the only participant in the airport land use compatibility process that have the ability, although limited in many ways, to address the issue from two perspectives: through their long-range planning of future airport development and with actions affecting day-to-day operation of the airport.

What is a Comprehensive Plan?

The comprehensive plan expresses a community's vision about itself and what it would like to become. The plan forms the policy framework from which all future community planning actions will be judged, and it is the starting point for any discussion regarding local land use. It enables the community to compare how it looks now with what it wants to look like in 20 years.

The comprehensive plan is developed cooperatively by elected officials, the planning commission, planning staff, and the public. Consultants are often engaged for all or part of the work effort. Elected public officials adopt the plan following a series of public hearings. The time range for the comprehensive plan is generally 20 years. Periodic updates every 5 to 7 years are usually required. Comprehensive plans generally cover the following topic areas, or "elements":

- Land Use
- Housing
- Capital Facilities
- Utilities
- Transportation
- Economic Development
- Parks and Recreation
- Rural (county comprehensive plans only)
- Natural Resources

Adapted from *What is a Comprehensive Plan?* by David Martineau, Planning Director, City of Colville. Presented at the Spring 2006 meeting of the Washington State Community Airports Association (CAA). Wenatchee, WA.

Chief among actions in the first category are decisions regarding the configuration of the airport. Airports can decide whether to build or extend a runway, for example. They also can purchase property either to eliminate highly incompatible land uses or to prevent future incompatible development. Funding is typically the major limitation, however. Acquisition of property within runway protection zones is eligible for FAA grants.

An airport master plan is the primary mechanism by which airports determine the future direction of airport development. These development actions can have direct implications on the airport's impacts on nearby land uses. The master planning process also can affect airport impacts more indirectly by not seeking to attract types of aircraft that generate the greatest impacts. Airports, though, cannot exclude aircraft based on noise or safety and ultimately it is the pilot's decision as to whether the aircraft can safely operate at the airport.

Airport Master Plan and Airport Layout Plans

Two distinct, yet interrelated, types of plans used to guide airport development are the airport master plan (AMP) and airport layout plan (ALP).

An AMP is a comprehensive document intended to guide development on an airport. The planning period is normally 20 years. A typical AMP will contain most of the aviation-related information needed to prepare a land use compatibility plan. Almost all AMPs will contain:

- An inventory of airport facilities.
- Data on current and forecast activity levels.
- Assessment of future development needs and alternatives for meeting the needs.
- Text and drawings describing proposed improvements.

The AMP itself or an accompanying environmental document also will usually contain depictions of current and projected noise contours.

An ALP is a conceptual map depicting current and proposed airport features including runways, taxiways, navigational aids, buildings, aircraft parking areas, and other infrastructure. Airport property boundaries and the limits of required clear areas such as runway protection zones and runway object free areas are shown as well. Data tables (sometimes on a separate sheet) provide additional information about the airport runways, approaches, and other features, as well as the critical aircraft that the airport is designed to accommodate.

Additional drawing sheets typically will illustrate the airport airspace (FAR Part 77 surfaces), the runway approach surfaces and any obstructions to them, and details of the airport terminal or building area.

Even airports that do not have a current AMP may have a current ALP. ALPs are typically updated more regularly than AMPs. In addition to being listed in the NPIAS, to be eligible for FAA grant funds an airport must have a current ALP approved by the FAA. Completion of an ALP is also an eligibility requirement for WSDOT Aviation's grant program.

See FAA Advisory Circular 150/5070-6B, *Airport Master Plans*, to learn how the master plan process works, including how your airport can apply for federal funds when/if eligible.

In terms of day-to-day operations, airports can seek the cooperation of local pilots to identify noise sensitive areas and to help spread the word to avoid overflying these locations to the extent practical and safe. Airports also can work with the FAA to modify manner in which aircraft are flown at the airport. There are significant limitations as to what types of modifications are acceptable to the FAA, but changes to such things as traffic pattern locations, instrument approach procedures, and preferential runway designation may be open to consideration.

Airport Users

Airport users, especially pilots, have an informal but important role is airport land use compatibility matters. Foremost, when operating their aircraft, they should do so safely and in a manner that minimizes noise impacts on the land uses below. Individual pilots should encourage other pilots to do the same. Beyond these actions, airport users need to be engaged in planning for their airport and the surrounding community. Participating in public meetings and speaking out regarding compatibility concerns is essential.

Growth Management Act

Perhaps the most powerful airport land use compatibility planning tool available in Washington to airports, local government agencies, and other participants is provided by two sections of state law. The first, originally enacted in 1990, is the Growth Management Act (GMA). Among other things, GMA defines planning requirements for "essential public facilities" and designates airports as facilities of this type. Second, a 1996 law made land use compatibility a mandatory consideration in local planning. These statutory requirements are spelled out under Revised Code of Washington (RCW) Sections 36.7A.200 and 36.70.547, respectively.

Airports as Essential Public Facilities

The GMA recognizes that while certain public facilities are needed by society, they often have real or perceived negative impacts on the surrounding communities. These real or perceived negative impacts often make them undesirable neighbors and thus increase the complexity and difficulty of siting new facilities or expanding existing ones. The GMA requires a process for identifying and siting these essential public facilities to be included in all local comprehensive plans. Additionally, the GMA prohibits local comprehensive plans or development regulations from explicitly precluding the siting of essential public facilities, although reasonable conditions and mitigation measures can required.

By establishing the requirement for airport land use compatibility planning, the legislature implicitly recognized not only the societal benefits provided by air transportation, but also that merely providing for the siting of airports as essential public facilities was insufficient to the goal of protecting these facilities. Incompatible land uses in the airport environs have the potential to directly or indirectly impair the operation of airports.

Several Growth Management Hearing Boards decisions are directly relevant to airport land use compatibility planning issues. A summary of these decisions is included in Appendix A.

Note: State legislation under consideration in early 2010 may consolidate the three hearings boards into one.

Growth Management Hearings Boards

Another feature of the GMA is establishment of three Growth Management Hearings Boards: one for the eastern part of the state, one for the western part excluding the Puget Sound area, and the third for Puget Sound area counties. The GMA itself provides only basic guidance regarding comprehensive planning and the siting of essential public facilities. The hearings boards serve to render decisions on petitions that allege that either (1) a state agency, county, or city planning under comprehensive planning provisions of the Growth Management Act is not in compliance with the act, or (2) the official state population projections need adjustment.

Taking a Proactive Approach

The most effective strategy for promoting airport land use compatibility is a proactive approach. Moreover, effectiveness depends upon the participation of all the preceding stakeholders in the process.

A focus on individual development projects proposed in areas adjacent to aviation facilities is a time-consuming approach that does not provide assurance of airport protection. Once a project gets to this phase, and meets all pre-determined development requirements, it is generally too late to significantly affect the outcome because policy decisions about the types of development that will be permitted have already been made. It may be possible to influence specific features of the development, but generally the question of whether or not a proposed use should be established at a particular site has already been decided.

Early consideration of airport land use compatibility therefore is critically important, especially given the dwindling land supply in metropolitan areas that contributes to development pressures. This is the point where airport advocates can be most effective in influencing development patterns near airports.

Being proactive provides multiple benefits.

- **Provides a base of support for the airport.** If the importance of its airport is not apparent to the community, then decisions involving compatibility are not likely to favor the airport. A proactive approach establishes a support base for the airport that can quickly be activated if airport compatibility is threatened.

- **Avoids problems before they start.** Once specific development is proposed, stopping or modifying it is much more difficult than if local plans clearly indicate what uses are acceptable near the airport.
- **Provides predictability for the community.** By knowing the ground rules as to what uses are compatible with the airport operations, the community's energies and development interests can be directed toward uses suited to the airport environs. Ad hoc decisions made on a case-by-case basis can be avoided.

Relationship of Airport Master Plans to Comprehensive Plans

Ideally, an airport master plan would be developed concurrently with the comprehensive planning process for that community. This would maximize the ability to integrate the two plans and increases the likelihood of effective implementation. For a variety of reasons, however, a combined planning effort almost never happens. Often, the airport and surrounding land uses are not controlled by the same jurisdiction. Also, even when both are under the same entity, the two types of plans have different funding sources and require different specialized knowledge, thus dictating that they proceed independently.

Regardless of these circumstances, coordination between airport master plans and comprehensive plans is important. The airport master planning process should explicitly include a land use compatibility component, including identification of noise and other land use impacts. Conversely, when a comprehensive plan is being updated, and the affected airport master plan is old, a focused update of the plan can be included as part of the comprehensive plan. Re-examination of projected activity levels may be appropriate. Most important, though, is to incorporate land use compatibility measures into the planning of long-range development patterns in the community.

- **Make informed decisions.** Often incompatible land uses are allowed to occur near airports simply because of a lack of awareness of the issues on the part of planners and decision makers. The process of establishing and implementing compatibility guidelines will at least ensure that consideration is given to the potential consequences of incompatibility.
- **Address on-going challenges cooperatively.** Putting in place a mechanism for addressing compatibility matters on an on-going basis should enable better cooperation among the various stakeholders and potentially lead to consensus decisions. This mechanism might include, for example, the formation of a special committee to examine all aspects of potentially incompatible development proposals and report their findings to decision makers.

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Chapter 2

Airport Land Use Compatibility Planning Step-by-Step

Introduction

This chapter will take you step by step through the process of identifying and evaluating airport land use compatibility issues that affect your community and then incorporating the results into the update of your comprehensive plan. You will learn about:

- The types of airport and land use data important to your analysis
- Specific types of airport land use compatibility concerns about which you should be aware
- Land use strategies available for addressing these concerns as part of the comprehensive plan update process
- The importance of coordination with WSDOT Aviation and the aviation stakeholders in your community

What is the purpose of the compatibility planning checklist?

WSDOT Aviation has provided this step-by-step checklist to make airport land use compatibility resources easier to use and understand. The guide communicates state guidelines and best management practices, and directs users to more detailed reference materials.

How should you use this checklist?

This chapter outlines a five-step process for airport land use compatibility planning. The steps take you through research and analysis that will help your jurisdiction make informed decisions about airport land use compatibility. The products you develop as you move through the process provide background materials that will help the jurisdiction "show their work" by demonstrating how they arrived at their decisions. This type of transparency supports public outreach programs and is useful for supporting local decision-making when brought before the Growth Management Hearings Boards. These steps will help you craft defensible, objective policies and zoning regulations.

Tips

- A checklist template is provided in the appendices to this *Guidebook.*
- Include a completed checklist in your submittal package to review agencies, including WSDOT Aviation, Department of Commerce Growth Management Services, and your MPO/RTPO for plan certification.

Table 2-1: Six Steps to Airport Land Use Compatibility

	Step 1: Getting Started and Gathering Data	Step 2: Delineate the Airport Influence Area	Step 3: Identify Compatibility Concerns	Step 4: Develop Compatibility Strategies and Criteria	Step 5: Adopt the Comprehensive Plan Update	Step 6: Implement the ALUC Policies
Description:	Conduct preliminary work needed to initiate the compatibility planning process.	Define the area you need to consider for land use planning.	Examine the level of compatibility in your community.	Examine the various policy and regulatory strategies available to pursue airport land use compatibility	Incorporate criteria into the Comprehensive Plan	Put the plan to use
You Know You've Been Successful When:	You have identified applicable state laws A process is in place to help stakeholders work together You can describe the airport's role, features, and activity You know what land uses exist around the airport and what land use plans are in place	You can define the noise, overflight, airspace protection, and safety impacts of the airport and know what areas in the airport environs are affected You have designated an airport influence area	You have determined the compatibility status of existing land uses in airport influence area You have identified the particular compatibility concerns that will require further review in the next step	You have weighed the comparative advantages and disadvantages of available planning strategies You have identified preferred planning strategies You have drafted specific compatibility criteria You have fully considered airport land use compatibility measures in your comprehensive planning process and incorporated compatibility policies into draft comprehensive plan where appropriate You are ready to circulate proposed comprehensive plan for review and adoption	Airport stakeholders feel that their concerns regarding compatibility matters have been understood and appropriately considered in the comprehensive plan update You have gained public acceptance of the importance of airport land use compatibility planning WSDOT Aviation provides comments supporting the compatibility measures you propose to take in your comprehensive plan update Your community's decision-makers have adopted a comprehensive plan update that contains appropriate measures to protect the airport from encroachment by incompatible land use	You have proposed revised development regulations to implement the policies You have begun to put the policies to use
Products:	Creation of a compatibility planning working group Findings that outline your airport land use compatibility planning responsibilities under state law Understanding of the airport's context within the community, state, and nation Inventory of airport facilities, activities, and services for use in subsequent land use compatibility planning steps and in transportation element of the comprehensive plan Summary of data regarding land uses around the airport	Noise contours, both current and 20-year projection Map of areas affected by overflight of approaching and departing aircraft Airport airspace map showing FAR Part 77 imaginary surfaces and elevations Map of compatibility zones applicable to each runway end Overall boundary of the airport influence area	List of current community policies affecting land use development airport influence area Evaluation of current compatibility status Identification of potential future compatibility conflicts List of specific compatibility issues to be addressed by new policies	List of current policies affecting airport land use compatibility in your community whether positively or negatively Assessment of adequacy of current policies Evaluation of alternative compatibility strategies Draft of specific compatibility criteria Adjustment of airport influence area boundary if necessary Draft comprehensive plan policies Draft comprehensive plan land use map	A strategy to gain public and decision-maker support of the compatibility measures Information materials describing the importance of the airport and airport land use compatibility An adopted comprehensive plan incorporating airport land use compatibility measures	Draft and adopted implementing regulations such as an airport overlay zoning ordinance that contains the specific compatibility criteria to be met Identification of continuing actions and specific points in the development review process where airport land use compatibility concerns will be addressed

This book is not just for beginners! The step-by-step method described in these pages is a cyclical process that can be used to review and update goals, policies and regulations as needed. Such review is appropriate during comprehensive plan updates as well following completion of significant airport planning efforts, such as the master plan or airport layout plan.

How will WSDOT use this checklist?

WSDOT's interest is to preserve the airport as part of the state transportation system. Our role is to provide technical assistance recognizing the uniqueness of every individual community and airport. We will focus on reviewing the community's airport land use compatibility goals, policies, and regulations proposed for adoption. We use our technical expertise to assist communities in making fully informed decisions. If we think you've missed something, or we recognize a shortcoming with the preferred policies and regulations that may result in negative impacts on airport land use compatibility, we'll address them in our comments.

WSDOT's comments to a local jurisdiction may:

- Express support for strong elements in the community's goals, policies and regulations.
- Point out advantages and disadvantages of the community's preferred approach.
- Clarify technical elements that have been misinterpreted.
- Raise issues that might not have been addressed.
- Suggest that additional information be provided to explain and support decision-making.

Step 1: Getting Started and Gathering Data

In this step you will begin your work on airport land use compatibility planning by setting a foundation for your process. Answering the questions listed here will enable you to define and understand the objectives of the process and who should be involved. Your other major task in this step will be to gather the airport and land use data that will enable you to address airport land use compatibility issues.

☑ *You will know you've been successful when:*

- *You have identified applicable state laws*
- *A process is in place to help stakeholders work together*
- *You can describe the airport's role, features, and activity*
- *You know what land uses exist around the airport and what land use plans are in place*

Which airports must be protected?

To find out which airports should be addressed in your jurisdiction's planning efforts, use WSDOT's Airport Information System to generate a list of airports by region or county.

What are your jurisdiction's responsibilities?

Washington state law (RCW 36.70.547) requires all towns, cities, and counties in the state to discourage development of incompatible land uses near general aviation airports through adoption of comprehensive plan policies and development regulations. The lead role in compatibility planning for any particular airport thus belongs to the town, city, or unincorporated county jurisdictions that control the land uses around the airport. A primary purpose of this *Guidebook* is to help the entities satisfy the statutory requirement. However, the manner in which compatibility planning objectives are achieved will not be the same from one jurisdiction to another. Characteristics of the community and its natural environment, as well as those of the airport, will dictate different approaches.

To begin the planning process, local planners should answer these questions:

- **Which particular state laws affect your jurisdiction's planning responsibilities related to airports?** Many of the laws apply to all jurisdictions, while others are relevant only to certain types. Appendix A briefly describes the most significant statutes and provides links to the full text. Use Worksheet 1A to note your observations and questions as to how the state laws apply to your jurisdiction.

Worksheet 1A: State Laws Applicable to Airport Land Use Compatibility in Your Community

- **Beyond the basic requirements of state law, what are the primary purposes and objectives to be achieved in compatibility planning for the airports in your jurisdiction?** Are there specific issues to be addressed that are arising either because of changes at the airport or development pressures nearby? List the top three objectives in Worksheet 1B.

Worksheet 1B: Objectives of Airport Land Use Compatibility Planning
1:
2:
3:

- **What particular challenges do you expect to face during the compatibility planning effort?** Has the airport been controversial and generated community opposition? Is data about the airport readily available or will special effort be needed to get information? In Worksheet 1C, identify three top challenges.

WSDOT Aviation is in the process of drafting guidance on what "formal consultation" means.

Worksheet 1C: Challenges of Airport Land Use Compatibility Planning
1:
2:
3:

- **How do you intend to accomplish the compatibility planning study?** The outcome of the study ultimately must be reflected in the comprehensive plan and development regulations, but will the study be done as part of the comprehensive plan update or is a separate effort needed? In most cases, the analysis of compatibility issues can be done as a task within the overall comprehensive plan update process. However, if the compatibility planning issues involved are complex, a separate study may be warranted. Any such separate study would need to be completed, or largely so, in advance of the comprehensive plan update so that its recommendations can be incorporated.
- **Can the work be done by the jurisdiction's staff or comprehensive planning consultant or is a specialized consultant needed?** With the help of this *Guidebook* and WSDOT Aviation, planning staff should be able to address compatibility planning matters themselves. More complex airports, though, may necessitate using a consultant that specializes in airport land use compatibility planning.

WSDOT Aviation is in the process of drafting guidance on what "formal consultation" means.

See the discussion in Chapter 1 regarding the various stakeholders in the compatibility planning process.

Who should be involved in airport land use compatibility planning?

State law requires that comprehensive planning be early, continuous and collaborative. In addition, RCW 36.70.547 explicitly requires "formal consultation with" aviation interests prior to adoption of a comprehensive plan or development regulations dealing with airport land use compatibility. Several stakeholders—airport owners and managers, private airport operators, general aviation pilots, ports and the aviation division of the department of transportation—are specifically identified in state law. Other interests whose input may be helpful include the airport's aviation service providers (fixed base operators), airline and air taxi operators, public and private emergency response providers, local business owners, regional agencies (RTPO and/or MPO), the State Department of Commerce, the FAA, and community representatives.

Tips

- Obtaining input from a wide range of interests is important at this stage of the process. However, keeping advisory groups to a manageable size is also important; otherwise than can become unproductive. Consider splitting a group into separate technical and policy committees to keep the discussion focused.
- Consider using a professional facilitator and/or media relations consultant for particularly controversial planning efforts.

An aviation working group or advisory committee can be a helpful tool for jurisdictions planning for airport land use compatibility. Not only does this type of group provide a method for meeting public involvement and consultation requirements, it is also a way to form long-lasting relationships that extend beyond airport land use compatibility planning. The group can be used to give input on relative advantages and disadvantages of various approaches and communicate with stakeholder groups about progress of work.

Other resources on citizen participation in the planning process are provided by Department of Commerce Growth Management Services at: www.commerce.wa.gov/site/420/default.aspx

Use the checklist in Worksheet 1D to make sure you have answered all the questions.

What do I need to know about the airport?

Once you have determined what needs to be accomplished and who should be involved in the compatibility planning process, you next need to collect essential data about the airport. This data falls into three general categories:

- *Context*. Who owns the airport? What roles does it play within the state and national aviation systems and within the local community? Who uses it?
- *Features*. What physical components of the airport are significant to land use compatibility? What are the locations and sizes of these facilities?
- *Activity*. What types of aircraft use the airport and what is the level of activity? Where do aircraft normally fly as they approach and depart the airport?

Planners need this information in order to develop compatibility criteria for the airport. Also, decision makers need this information to understand the role of the airport in the community for transportation and economic development. Collecting and communicating these airport facts is an essential part of the compatibility planning process.

Another use for the data you gather about the airport is in completing the transportation inventory element of the community comprehensive plan and the regional transportation plan. The transportation inventory should catalog air transportation facilities and describe their role as part of the multi-modal transportation system. Future plans for the facilities should also be identified.

Identification of future airport improvement needs is particularly necessary for towns, cities, and counties that own or operate an airport. State law requires that these entities include a list of planned airport improvements within their capital facilities plan.

Check out the state's Airport Information System database on the WSDOT Aviation web site. It contains information about facilities and services available at each airport in the state system, as well as economic impact data about the airport. www.wsdot.wa.gov/aviation/AllStateAirports/default.htm

For specific statutory requirements see:

- RCW 36.70A.070 Comprehensive plans – mandatory elements
- WAC 365-195-325 Transportation element
- RCW 36.70.330 Comprehensive plan – required elements
- RCW 47.80.030 Regional transportation plan – contents, review, use.

For a sample transportation inventory see Chapter 3, Planning Toolkit, in this *Guidebook*

Airport Context

The first thing you should learn about the airport is how it relates in a functional sense to other airports and to the community where it resides—in other words, what is its context. Some of the questions listed here will not necessarily help you in developing compatibility policies, at least not in a direct sense. However, what the answers will tell you is something about the importance of the airport both within the state and national airport systems and within the overall fabric and economy of your community. This information, in turn, will aid in obtaining public support for the compatibility policies as discussed in Step 5.

- **Who owns or "sponsors" the airport? Who runs it?** This is an indicator of your primary partner in airport land use compatibility planning. Even before starting work on your study, you should contact the airport manager to get input on the work scope and issues that should be addressed.
- **What previous planning studies have been done for the airport?** Gathering this information at the outset of your work is essential. Earlier studies will help you answer many of these airport inventory questions. An airport master plan, airport layout plan drawings, FAR Part 150 study, environmental studies for a master plan or individual projects, and other planning studies, to the extent that they have been done, should contain valuable information needed for compatibility planning around the airport. Any economic studies concerning the airport also may be useful. Obtain copies of each of these.

Worksheet 1D: Airport Data Inventory Checklist	☑
Airport Context	
▪ Who owns or "sponsors" the airport? Who runs it?	
▪ What previous planning studies have been done for the airport?	
▪ What is the state classification of the airport?	
▪ What is the federal classification of the airport?	
▪ Who uses the airport?	
▪ What is the airport's role in the community?	
▪ Does the airport connect with other transportation modes?	
▪ What is the airport's economic contribution to the community?	
Airport Features *(see Appendix ?? for a form on which you can enter specific data)(To be added)*	
▪ What are the characteristics of the landing surface?	
▪ What types of approach capabilities does each runway end have?	
▪ Which design standards apply to the airport and does the airport meet these standards?	
▪ What types of nonaviation facilities are located at the airport?	
▪ What is the plan for future development at the airport?	
Airport Activity *(see Appendix ?? for a form on which you can enter specific data))(To be added)*	
▪ What is the composition of aircraft operations?	
▪ What types of aircraft use the airport and how often?	
▪ How many passengers does the airport serve?	
▪ What is the distribution of aircraft operations by time and runway?	
▪ What routes do aircraft fly as they approach and depart the airport?	
▪ What deviations from the normal traffic pattern are typical at the airport?	
▪ Does the airport receive noise complaints?	

- **What is the state classification of the airport?** WSDOT Aviation categorized airports into state classifications in the Long-Term Air Transportation Study (LATS). This classification is an indicator of the role the airport plays in the state system and the types of facilities and services needed to serve that role. It also includes facility, service, and operational performance objectives that were developed for each airport classification level as a basis for prioritizing state funding to airports.
- **What is the federal classification of the airport?** The FAA categorizes airports into classifications in its National Plan of Integrated Airport Systems (NPIAS). This classification is an indicator of the role the airport plays in the national aviation system and the types of facilities and services needed to serve that role. It also indicates the eligibility and typical level of federal funding provided to the airport.
- **Who uses the airport?** Obtain information about the users of the airport. Many communities are surprised by the number of businesses located on the airport or that require proximity to it to support their activity. The airport's importance to emergency response services such as police, fire, aeromedical, and search-and-rescue also may not be widely recognized. Airport users and businesses have a vested interest in having compatible land uses around the airport. They will be supporters of strong land use compatibility measures.
- **What is the airport's role in the community?** How does the airport fit into the goals of the community and the region? Has your community adopted specific policies regarding the role of the airport? How is the airport perceived by the general public? Have compatibility problems or other issues become major controversies? Knowing this status will help you understand the challenges you may face in establishing compatibility policies for the airport. Information can be obtained from airport staff, community groups, newspaper articles, meeting minutes, and other such sources.
- **Does the airport connect with other transportation modes?** As with the airport role, this question again examines a facet of the airport's relationship to the community and region. Is the airport an integral part of a multi-modal transportation system within your community and region or is it disassociated with the transportation network? What links does the airport have with public transportation and freight movement systems? What are the opportunities for better inter-modal connections?

See Chapter 1 for more about the LATS and NPIAS.

- **What is the airport's economic contribution to the community?** Only the busiest airports typically pay their own way solely from aviation-related revenues. This is why many airports have established industrial parks on parts of their property not needed for aviation uses. This revenue can be significant to the airport and to the community. Equally, if not more, significant than these direct revenues are the indirect economic benefits that airports contribute to the local economy. As with the contributions of other modes of transportation, most airports provide services that are essential to the economic vitality of their communities. If an economic study has been done of your airport, review its findings and use the data in support of the need for protecting the airport from encroachment. If this data is not available, other means of showing the airport's contribution to the local economy include:
  - Document the number of public and private employees on the airport through interviews with agencies and businesses based there. If you can ensure confidentially, it may also be possible to document the gross payroll of those employed on the airport.
  - If your community has a branch of a regional or national business, staff from the main office may be flown to your community on a regular basis in company or chartered aircraft. This is particularly likely if your community does not have scheduled passenger service.
  - If there are local manufacturers or distributors that ship their products via one of the small-package shippers at the airport (e.g., UPS), you should be able to document this through interviews with the shipper or manufacturer.
  - Outside of metropolitan areas, medical specialists are sometimes flown in on a regular basis. Discussions with the commercial aviation-service providers (fixed base operators) at the airport or staff at the local hospital can help you determine whether this exists in your community.

Jurisdictions can utilize WSDOT's online economic data to examine generalized economic impacts for the local airport. Three types of economic effects are identified: direct, indirect, and induced. Combined, the three impact types yield the total economic impacts of an airport.
www.wsdot.wa.gov/aviation/EconImpacts/default.htm

Airport Features

In order to accurately identify and map the airport's impacts on nearby land uses, you need to know the airport's physical configuration.

- **What are the characteristics of the landing surface?** Indicate the length, width, and surface type for each runway at the airport and whether the runway is lighted for nighttime use. These features determine what types of aircraft can operate at the airport. For paved runways, data on the pavement strength also can be useful to know

in that pavement strength limits the aircraft that can use the airport. Ascertain the length of any displacement of the landing thresholds from the runway ends. Find the official latitude and longitude coordinates of the runway ends and displaced thresholds. This data is essential to mapping of runways and associated airport impacts relative to surrounding geographic features. Entering the data into a GIS database is desirable.

- **What types of approach capabilities does each runway end have?** Runway approaches are either visual or instrument. Visual approaches require good visibility conditions. When visibility is poor or cloud ceilings low, use of an instrument approach procedure is necessary. These procedures are established by the FAA and often require special facilities (navigational aids) at the airport. Also, aircraft must be properly equipped and pilots must be certified for instrument flight. Different types of instrument approach procedures provide varying capabilities in terms of the minimum weather conditions in which the procedures are usable. Instrument approach capabilities are particularly important to scheduled airline service and corporate aircraft operators. These users depend upon being able to land even when clouds lie over the airport.

  Information on existing instrument approach procedures is available on-line. A good source is: www.airnav.com/airports/

- **Which design standards apply to the airport and does the airport meet these standards?** The FAA defines design standards for runways in accordance with the "airport reference code" (ARC) applicable to that facility. The ARC reflects characteristics (size and approach speed) of the critical aircraft expected to use the facility and the type approach capability available. The design standards determine not only the runway dimensions, but also the sizes of critical clear areas surrounding the runway. These areas are important for the safety of aircraft occupants in case the aircraft lands short of the runway, overruns the far end, or deviates off to the side. It is equally important that these areas be kept clear of people and buildings because of the risks involved. Other FAA standards determine the heights that structures, trees, and other objects near the airport can reach without becoming obstructions to the airport airspace. Design deficiencies and existing airspace obstructions should be identified during this inventory process.

  Look first at the Airport Layout Plan for this information. Useful data also is compiled in the WSDOT Airport Information System database: (www.wsdot.wa.gov/aviation/AllStateAirports/default.htm). To read more about the specific standards, refer to FAA Advisory Circular 150-5300-13 and Federal Aviation Regulations (FAR) Part 77.

A displaced threshold moves the spot at which aircraft land down the runway from the end of pavement. Tall objects within the runway approach are the most common reason for a displaced threshold. Even though the affected portion of the runway is still usable for aircraft to begin their takeoff roll, a displaced threshold reduces the usability and safety of the runway. This is one reason why avoiding obstructions to runway approaches is so important.

One of the performance objectives specified in LATS is that airports classified as Commercial, Regional, or Community should have instrument approach capabilities.

Tips

- Also check the airport master plan or airport layout plan for any new or upgraded instrument approach capabilities planned for the airport.

Tips

- Many airport design standards have little significance off of the airport. Probably most important are the runway protection zones (RPZs) and object free areas (OFAs). Also look for building restriction lines (BRLs) shown on the airport layout plan as they indicate how close buildings can be to a runway. These areas generally should be on airport property. However, if they aren't, then your compatibility policies and regulations should limit development to ensure that it is consistent with the Airport Master Plan and FAA guidelines.
- For protection of runway approaches, it is particularly important to know the slope of the approach surface that limits the height of objects. These slopes are defined by FAR Part 77 (see Appendix A for more information).

Tips

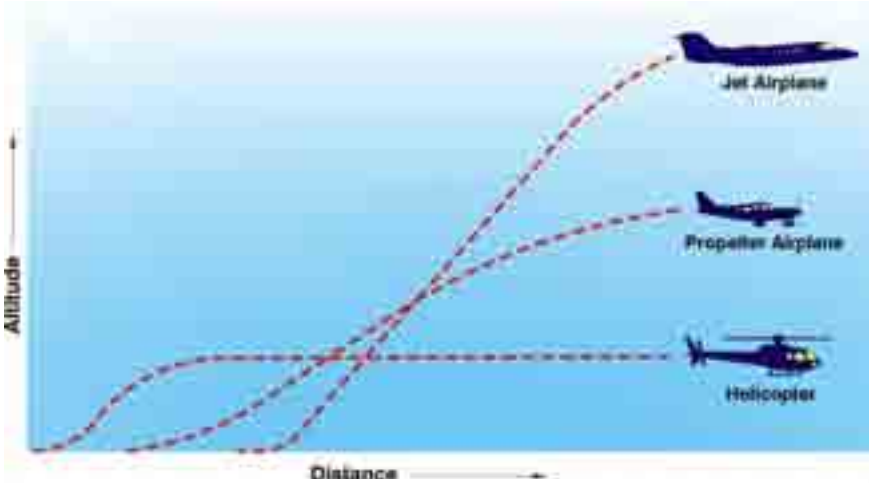
- Remember that you will need data not just for current activity, but also for the activity projected to occur in the future. The recommended time horizon for airport land use compatibility planning purposes is at least 20 years.
- While the types of data noted here can be used to produce new noise contours for the airport, you generally should not need to do so. For busy airports, noise contours should be available from an airport master plan or other documents. At lower-activity airports for which noise contours have not been calculated, simply knowing the characteristics of noise-generating activity may be sufficient for the purposes of establishing land use compatibility criteria. See additional discussion in Appendix B.

- **What is the plan for future development at the airport?** Airports that receive funding from WSDOT Aviation and the FAA must complete 20-year plans that forecast future activity and catalog future development needs. If an airport master plan has been adopted for the airport, descriptions of the planned improvements and a detailed capital improvement program listing each project typically would be included. Also in an airport master plan should be an airport layout plan and other drawings showing where the improvements are proposed. Planned changes to runways or instrument approaches can have implications that should be considered in land use compatibility planning.

Airport Activity

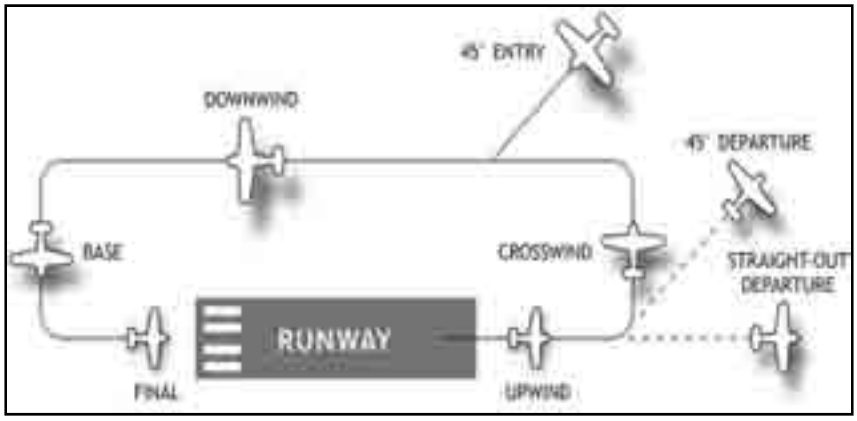
For the most part, an airport's effects on surrounding land uses are created not by the airport itself, but by the activity that takes place there. The questions below will serve as a checklist of the types of airport activity data you will need. See the following section for suggestions on where to find this information:

- **What is the composition of aircraft operations?** Is the airport used strictly by general aviation aircraft or are there also scheduled airline flights or operations by military aircraft?
- **What types of aircraft use the airport and how often?** Obtain information on the mix of aircraft types that are based at the airport as well as those that regularly visit (transient aircraft). As discussed in Step 2, different aircraft types (business jets, propeller airplanes, helicopters) have different flight characteristics and create different noise and safety issues for surrounding lands. Gather information on the number of takeoffs and landings made by each type. For the critical aircraft, identify the specific models (e.g., which specific business jets use the airport). Also consider what types of aircraft are expected to use the airport in the future.



Typical Takeoff Profiles

- **How many passengers does the airport serve?** If the airport has airline service, get data on the number of passengers who board there (passenger enplanements). If applicable, also obtain data on cargo tonnage shipped.
- **What is the distribution of aircraft operations by time and runway?** Get data or estimates of how much each runway is used at night (defined as 10:00 p.m. to 7:00 a.m.) versus during the day (7:00 a.m. to 10:00 p.m.). Find out how often each runway is used and in which direction. Determine if there are significant seasonal variations in these numbers. Ask if anything is expected to cause these percentages to change in the future.
- **What routes do aircraft fly as they approach and depart the airport?** Federal regulations define the basic shape of the traffic patterns used by general aviation aircraft as they approach and depart most airports, but the specific size, altitude, and other characteristics may vary to meet local needs. Map the typical routes aircraft fly and consider that different aircraft (especially helicopters) may follow different routes. Seek information from the airport manager and pilot community on how often each route is followed.



A standard traffic pattern will look something like this.

- **What deviations from the normal traffic pattern are typical at the airport?** While certain primary traffic corridors are defined, deviations occur. Some of these variations are permanent ones dictated by the airport's proximity to other airports, high terrain, or noise-sensitive land uses. These usually are indicated in pilots' guides or are posted at the airport. Others are individual instances resulting from pilot techniques, other aircraft in the pattern, wind conditions, and other such factors.

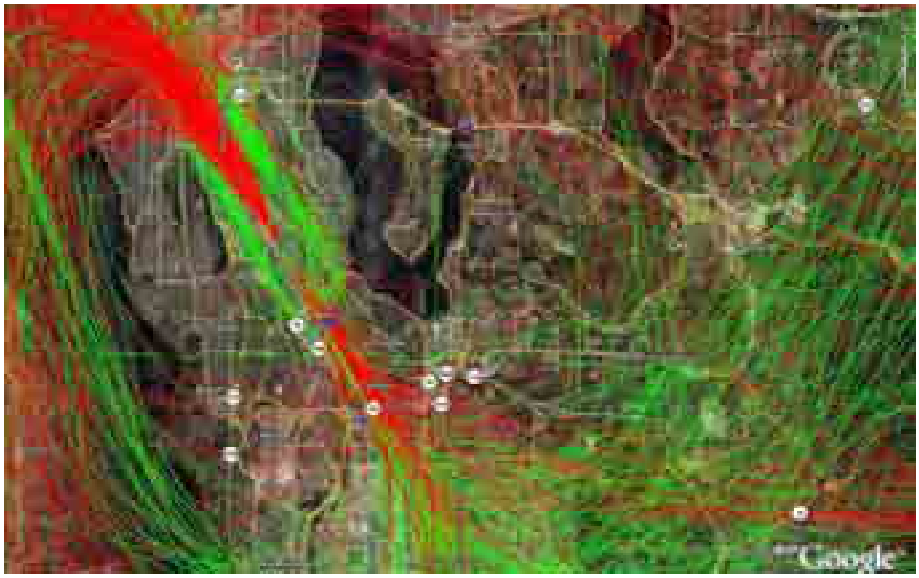
The "critical aircraft" is the aircraft type that regularly uses the airport and is most demanding on the facilities in terms of runway length needed for takeoff and landing, pavement strength and wingtip clearance. Usually, the same aircraft type is the most critical in all these respects, but sometimes there can be more than one critical aircraft type. "Regular use" means at least 250 takeoffs and landings annually.

Tips

- It is important to coordinate with the airport operator to determine expectations for long-term airport development. Keep in mind that a current airport layout plan may be available even if the airport master plan is outdated. State and federal planning documents may also provide information about the future direction of the airport.
- When no plans have been prepared and the airport operator has not identified any future development, then you generally can assume that the airport will remain essentially as is throughout your planning time frame.

As this radar data map of flight tracks shows, the actual paths flown by aircraft will vary from one flight to another even though the basic shape of the traffic pattern remains constant.

Radar tracks: This diagram shows aircraft flight tracks captured by radar. The image illustrates the variability of typical flight routes.



- **Are there frequent aircraft maintenance operations at the airport?** Maintenance testing of aircraft requires use of high power settings with an accompanying increase of noise levels.
- **Does the airport receive noise complaints?** Most airports probably get at least a few complaints. Busy airports may get enough that they record and map them in a formal manner. Knowing the geographic source of complaints can be useful when drafting compatibility policies for the airport. Most airports receive the majority of noise complaints not from locations overflown on a regular basis, but from places where overflights are more random events.

Getting precise data isn't necessary if you are not trying to produce noise contours. However, knowing approximately how much each runway is used and whether it has nighttime activity is important in describing the airport's impacts.

Where can I find this information about airports?

The sources outlined here should provide the bulk of the airport information you will need for airport land use compatibility planning. However, don't expect to find all the data in a single place. Be prepared to spend some time seeking out the information. Documents and databases are the first places to turn, but interviews with airport management and other people familiar with the airport and its operations are usually also necessary.

Documents and Databases

These printed documents and on-line databases contain extensive amounts of data, not all of which will be directly relevant to the compatibility planning task. Nevertheless, it is important to check out each source to glean important information about the airport in your community.

- **WSDOT Airport Information System.** This is a comprehensive database of descriptive information about airports in the state. Data included in the Airport Information System is provided by airports and updated on an annual basis. The database contains a wide range of information on each airport in the Washington Aviation System including airport runway, facility, and service data, number and type of based aircraft, and capital development projects.

  www.wsdot.wa.gov/aviation/AllStateAirports/default.htm

- **Airport Master Plan.** An airport master plan (AMP) is a comprehensive document intended to guide development on an airport. The planning period is normally 20 years. A typical airport master plan will contain most of the aviation-related information needed to prepare a land use compatibility plan. Normally, an AMP is formally adopted by the airport sponsor—the entity that owns or operates the airport. It also may be adopted by reference in the comprehensive plan.
- **Airport Layout Plan.** An airport layout plan (ALP) is a set of drawings showing the existing and planned configuration of airport facilities and the airspace around the airport. An ALP set is often accompanied by a short narrative report describing key features of the plan set. Airport layout plans are typically updated more regularly than airport master plans and even airports that do not have a current airport master plan may have a current ALP. A current ALP is prerequisite to obtaining airport improvement funding from the FAA or WSDOT.

- **FAA Airport Master Record.** The most up-to-date source of information regarding existing physical dimensions of airport runways, instrument approach procedures, and other airport features usually is the FAA's on-line airport master record (FAA Form 5010) and other websites that derive their information from the FAA database. These sites regularly update their data as it is received from the airports.

  Check out these on-line sources:
  www.wsdot.wa.gov/aviation/AllStateAirports/default.htm
  www.wsdot.wa.gov/aviation/PilotsGuide
  naco.faa.gov/index.asp?xml=naco/online/d_afdwww.gcr1.com/5010Web/
  www.airnav.com/airports/

- **Statewide Aviation System Plan – Long-Term Air Transportation Study.** The purpose of LATS is to understand what capacity currently exists in aviation facilities and what will be needed to meet future demand for air transportation. There are 138 public use airports within the system. Approximately 65 of these airports are also recognized in the national air transportation system. The Aviation Planning Council report, Aviation System Plan, and

Tips

Looking for more information about airport planning? The following FAA Advisory Circulars provide guidance on implementing airport planning projects:

- 150/5070-6B, *Airport Master Plans*
- 150/5300-13, *Airport Design*

supporting technical documents includes an existing airport capacity/facility assessment, 25-year demand/market analysis, airport forecasts to 2030, statewide aviation policies and implementation recommendations.

You can find the LATS at: www.wsdot.wa.gov/aviation/lats/default.htm

- **Washington Transportation Plan.** The Washington Transportation Plan (WTP) is a comprehensive and balanced statewide transportation plan that establishes a 20-year vision for the development of the statewide transportation system, from state highways and ferries to sidewalks and bike paths, county roads, city streets, public transit, air and rail.

  The WTP is available on-line at: www.wstc.wa.gov/WTP_New/default.htm

- **National Plan of Integrated Airport Systems.** The National Plan of Integrated Airport Systems (NPIAS) identifies more than 3,300 airports that are significant to national air transportation and thus eligible to receive Federal grants under the Airport Improvement Program (AIP). It also includes estimates of the amount of AIP money needed to fund infrastructure development projects that will bring these airports up to current design standards and add capacity to congested airports. FAA is required to provide Congress with a 5-year estimate of AIP eligible development every 2 years.

  See: www.faa.gov/airports_airtraffic/airports/planning_capacity/npias/

- **Comprehensive Plan (town, city, county, port district).** The comprehensive plan is the starting point for any planning process and the centerpiece of local planning. Development regulations (zoning, subdivision, and other controls) must be consistent with comprehensive plans. State agencies are required to comply with comprehensive plans and development regulations of jurisdictions planning under the GMA.

  For a slide show overview of planning under the Growth Management Act, see www.commerce.wa.gov/_CTED/documents/ID_878_Publications.pdf. Also see links on WSDOT Aviation web site.

Interviews

Sometimes the best way to collect information is to reach out to people who have personal knowledge about the airport. This is particularly true with respect to some of the airport activity data—even though this data may not be recorded, these people may be able to provide usable estimates.

- **Airport Manager.** The airport manager is usually the best overall source of data on airport activity and for supplemental information on airport facilities.

- **Other Airport Staff.** At larger airports, other staff are likely to have more detailed knowledge of particular information such as activity data or noise issues.
- **Fixed Base Operators.** Particularly at smaller airports, the day-to-day operation of the airport may be delegated to a fixed base operator (FBO) who has a business at the airport.
- **Air Traffic Control Personnel.** If the airport has a control tower, interviewing the personnel will often yield excellent information on aircraft operations, runway usage, and traffic patterns. Tower personnel sometimes will even have recorded data on aspects of airport activity that are not included among the compiled data available on the FAA or state website.
- **Flight Instructors and Other Pilots.** Pilots, and particularly flight instructors, who regularly fly at the airport often have the best sense of where traffic patterns are located, the types of aircraft that use the airport, the distribution of activity among runways, and other operational characteristics of the airport.
- **Passenger Airline and Air Cargo Operators.** If the airport manager does not have data on passenger and cargo activity, direct contact with these users may be necessary at airports where this use is present.
- **Specialized Users.** Where special functions such as aerial firefighting, search and rescue, disaster management, aeromedical transport, or crop dusting take place at the airport, contact with the users will provide information on their activities and possibly additional insight into airport operations as a whole. Talking to military personnel also may be warranted if military activity is a significant component of the airport use.

What do I need to know about land uses around the airport?

The other side of the airport land use compatibility planning coin is the land use side. To be able to identify where compatibility conflicts already exist and to develop policies to avoid new problems, you need to gather information about existing and planned land uses in the airport influence area. If you are working through the compatibility planning process in this *Guidebook* as part of a comprehensive plan update, you presumably have the necessary information readily at hand.

With the copious amounts of land use documents, policies, databases, maps, and other information available for most communities, the challenge is to focus on the information that is most pertinent to airport land use compatibility issues. Here are some of the items you should assemble. The information will be used when you get to Step 4.

Tips

- Most of the land use map data you will need should have been collected during your comprehensive plan updates or rezone activities. This information may also be available in your local or regional geographic information system.
- What is the ambient noise level? It is the background noise level absent identifiable individual sounds. Knowing this level is important because noise is usually experienced differently in a quiet, rural setting than in a bustling commercial center or noisy industrial area.

- Map showing individual parcels
- Topography map
- Map of existing land uses
- Adopted comprehensive plan policies
- Map showing comprehensive plan land use designations
- Environmental sensitive area maps
- Zoning ordinance and map, including any airport overlay zone.

Step 1 Products:

- *Creation of a compatibility planning working group*
- *Findings that outline your airport land use compatibility planning responsibilities under state law*
- *Understanding of the airport's context within the community, state, and nation*
- *Inventory of airport facilities, activities, and services for use in subsequent land use compatibility planning steps and in the transportation element of the comprehensive plan as well as the capital facilities element, when applicable*
- *Summary of data regarding compatible and incompatible land uses around the airport*

Tips

- Does the airport influence area extend beyond your jurisdictional boundaries? The best approach in this situation is to pursue airport land use compatibility as a joint planning process. Another option is for a single community to conduct planning for the entire airport influence area, and forward recommendations to neighboring jurisdictions. It is not recommended that communities plan for only a portion of the influence area in isolation of their neighbors.
- At this point in your analysis, it is best to delineate the airport influence area based directly on your assessment of the four types of aeronautical impacts discussed next. Later, in Step 4, you will examine the implications of the resulting airport impact area boundary and may need to come back to this step to reconsider the assumptions underlying the impacts you have identified.

Step 2: Delineate the Airport Influence Area

Now that you've learned about the airport and its setting and have created a framework for your planning process, the next step is to define the area you need to consider for land use compatibility planning. This is the airport influence area. How do you determine the size of the influence area? The boundaries different for each airport based on its unique characteristics. The key is to think about all areas where existing or future aircraft operations at the airport may interfere with the development and use of the land, as well as where land uses can impair the development and use of the airport. The most significant effects are direct physical impacts such as those brought about by noise or tall structures. However, it is also important to recognize certain indirect effects, particularly those that result when incompatible land uses produce demands by the airport's neighbors to limit aircraft operations, change flight patterns, or prevent expansion of facilities.

☑ *You will know you've been successful when:*

- *You can define the noise, overflight, airspace protection, and safety impacts of the airport and know what areas in the airport environs are affected*
- *You have designated an airport influence area.*

What is the airport influence area?

An airport's influence area is the area within which the airport's impacts may adversely affect the use of land or the land uses may adversely affect development and use of the airport. To avoid airport land use compatibility conflicts, various degrees of restriction on land use development are necessary within the airport influence area. Also, to the extent that airport expansion or changes in the character of its use cause new impacts on surrounding land uses, then the airport may need to take steps to mitigate these impacts.

Although airports and surrounding land uses each have effects on the other, the delineation of an airport influence area is driven by aeronautical factors, not by land uses. That is, except sometimes at the margins, an airport influence area should not be drawn to deliberately include or exclude a particular land use. It should be drawn based on where the airport's impacts occur.

As indicated in Chapter 1, four types of impacts are of concern in airport land use compatibility planning: noise, overflight, airspace protection, and safety. To determine the size and shape of the airport influence area, the geographic extent of each of these impacts must first be determined. A typical influence area for a general aviation airport will extend approximately two miles in all directions from the airport runways, but can be larger or smaller. Busy airports and ones that have instrument approach capabilities will usually have a larger airport influence area.

What are the airport's impacts on surrounding land uses?

Noise Impacts

When we talk about airport noise impacts—as opposed to the overflight impacts discussed in the next section—we are referring to noise levels that are sufficiently loud and frequent that they can significantly disrupt the normal activities of people and sometimes animals as well. As indicated in Chapter 1, for most airport land use compatibility planning purposes we measure these impacts in terms of DNL contours. DNL is a cumulative measure of noise that takes into account both the loudness of noise events and how often they occur.

The lowest DNL at which impacts to noise-sensitive land uses, particularly residential uses, become significant depends upon airport characteristics, ambient noise levels in the surrounding community, and other factors. As a general rule, these are the significance thresholds to consider when establishing noise compatibility criteria for new development near your airport:

- **DNL 60 or 65 dB.** For busy airline and general aviation airports in urban areas.

For all but the busiest airports, the overflight (traffic pattern) or airspace protection areas will control the overall airport influence area at least for planning purposes. However, after analyzing all of the impact factors, local jurisdictions may find that impacts are minimal in certain areas and choose to reduce the airport influence area accordingly.

Remember to consider not just the current noise impacts, but also those that will take place in the future. A time horizon of at least 20 years is essential to airport land use compatibility planning.

Tips

- You generally should not need to produce noise contours for compatibility planning purposes. Busy airports should have an airport master plan that contains noise contours you can use. With the downturn in activity that has occurred in recent years, old forecasts and noise contours are likely to be usable simply by applying them to a later point in time. For low-activity airports, you can rely upon the generalized noise contours illustrated in Appendix together with the overflight impact areas identified next.
- To calculate noise contours, the first step is to update the activity forecasts. For land use compatibility planning, it is best to use a forecast that is near the high end of the likely range of future scenarios. Use of a low forecast and associated smaller noise contours can result in allowing incompatible development close to the airport that cannot be undone if the future noise impacts prove to be greater than expected.
- For new noise contours, the tool used most is the FAA's Integrated Noise Model (INM) computer program. Although the user interface of the current program is greatly simplified from early versions, INM is a sophisticated program that requires some understanding of aviation and noise. In most cases, you will want to consider hiring an aviation or noise consulting firm to run the program for you.

The most common traffic pattern altitude for general aviation airports is approximately 1,000 feet above the airport elevation for small airplanes. Business jets often fly higher.

Tips

- Knowing the topography with the airport environs is important as high terrain can significantly affect arrival and departure flight routes. High terrain also can increase the overflight impacts as aircraft will be closer to the ground when they fly over these points.
- When drawing the overflight area boundary, don't attempt to encompass every flight track, just the major ones—aim for about 80%. If you are defining the boundary based on information from pilots and others, you won't have 100% coverage in any case. However, even with radar data, you can omit the stray tracks that don't follow the typical routes. Some of these may just be aircraft passing through the area without landing.
- *Remember to include a buffer beyond where the tracks are drawn*. Overflight impacts are not limited to just directly below the aircraft. Rather, they extend outward to encompass a corridor of land within which the aircraft can be heard and seen as they fly by (a good rule might be to extend the flight corridor laterally a distance equal to the altitude of the aircraft—that is, anything within a 45° angle downward from the aircraft).
- When considering complaints or lack of them as one of the determinants of overflight impacts, take into account the existing land uses. If the traffic patterns are over area with few residences, then there will probably be few complaints. This status could dramatically change, however, if a new subdivision is built in the area. Also take consider the distribution of complaints. It is sometimes the case that one individual is responsible for the majority of complaints.

- **DNL 50, 55, or 60 dB.** For most general aviation airports, including ones with limited airline activity.

In each of these scenarios, there may be instances in which the respective noise contours barely reach beyond the airport boundaries. *These circumstances should not be taken as a sign that the airport has no noise-related impacts.* Single-event noise impacts—which are an important component of overflight impacts as addressed next—will still occur and be disruptive over a wider area. Especially in quiet communities, overflight impacts should be given substantial weight in land use planning around airports.

Overflight Impacts

As examined in Chapter 1, noise is the primary ingredient of overflight impacts, though other factors such as vibration, fumes, and even fear may also come into play. In any case, the key to assessing overflight impacts is knowing where aircraft fly as they use the airport. However, because aircraft do not all fly in exactly the same places or at the same altitude, obtaining this information can prove challenging as you may have learned in Step 1. Airport managers and pilots, particularly flight instructors, will usually be your best sources for flight track and overflight area information. If your airport is located near a large airport that has a control tower, you might be able to get actual flight track data from its radar facility. "Near" can be 50 miles away or more, provided that no high terrain is situated between the two airports.

Once you have mapped the flight routes, your next challenge is to decide what overflights are significant. For a typical general aviation airport, the overflight impact area should at a minimum include the normal traffic pattern and adjacent locations regularly overflown as aircraft enter and leave the pattern. If the airport has instrument approach procedures, a more extended area may be affected by aircraft flying at altitudes below that of the normal traffic pattern. Also, faster airplanes—primarily turbo-props and business jets—tend to fly wider and longer patterns than slower, single-engine propeller planes.

The noise levels produced by individual aircraft overflights also may be a useful determinant of the overflight area boundary. The difficult issue, though, will be to decide what noise level is significant. Aircraft, particularly jets, can generate peak outdoor noise levels high enough to interfere with speech communication a surprising distance from the airport—potentially many miles.

Another factor to consider when determining the extent of the overflight impact area is the geographic distribution of noise complaints. Although only the busiest airports usually maintain complaint logs, most airport managers will be able to describe hot spots for noise complaints. It is interesting to note that complaints do not usually come from the most impacted areas, as people in those locations expect to be affected.

Rather, the annoyance that underlies complaints usually result from unusual activity as described in Chapter 1. Concentrations of complaints from certain areas may suggest that something happening there is causing an identifiable impact. On the other hand, scattered complaints from locations beyond where aircraft normally fly are probably just random events that need not be considered in delineating the overflight impact area.

Noise Complaint History – Scottsdale Airport, Arizona

Year	Annual Operations	Number of Noise Complaints
1967	10,000	Not measured
1985	170,000	834
1998	210,000	570
2003	190,000	8,719

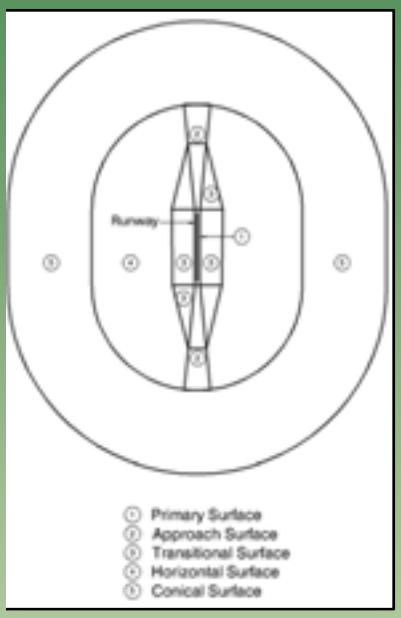
This data from Scottsdale Airport, Arizona, illustrates the point that noise complaints are usually more closely related to development patterns than to the volume of aircraft operations. As residential development encroached on the airport, the number of complaint increased more than ten-fold. Meanwhile, the airport had taken major steps to limit noise impacts and make submitting complaints easier.

Airspace Protection Requirements

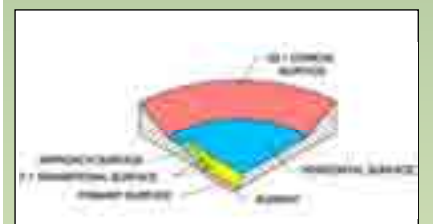
As noted in Chapter 1, airspace protection requirements address land use features that can cause or contribute to aircraft accidents. Most critical among such hazards are tall objects that penetrate the navigable airspace around an airport. However, other physical, visual, and electronic land use features can also create airspace hazards. FAA standards dictate the boundary of the area required for airport airspace protection.

With respect to tall objects that may affect the airport navigable airspace, the requirements are defined in Federal Aviation Regulations (FAR), Part 77, *Objects Affecting Navigable Airspace*. A map showing the airport's airspace "imaginary surfaces" is usually prepared as part of the airport master plan or included with the set of airport layout plan drawings. If this map is not available, then one will need to be created.

The TERPS surfaces used in the design of instrument approach procedures (see Chapter 1) also may be critical at some airports. TERPS surfaces are highly complex, however, and take special expertise to draw. Moreover, any changes to an instrument approach procedure—whether because of new technology or a new obstruction—likely will result in changes to the surfaces. Generally, you can rely on the FAR Part 77 surfaces for compatibility planning, but make sure that the project applicant submits Form 7460 to the FAA as required by federal law (see Step 6) for any proposed object near the airport that meets the notification requirements, particularly if the object will be taller than its surroundings.



The figure above shows an example of an airspace protection map depicting FAR Part 77 imaginary surfaces



Typical FAR Part 77 Surfaces

The FAA also has criteria defining how close landfills and other uses known to attract birds should be allowed near airports. For visual hazards such as smoke or glare and electronic hazards that can disrupt aircraft communication or navigation, the criteria are less precise. These types of conflicts can be site specific and often are only addressed after they arise.

See these FAA documents for more information:

Federal Aviation Regulations Part 77 (14 CFR Part 77), *Objects Affecting Navigable Airspace* http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=cef54e5ded0ce244bbfe6ec32f6a63e8&tpl=/ecfrbrowse/Title14/14cfr77_main_02.tpl

Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports* www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentNumber/150_5200-33B

Historical Accident Locations

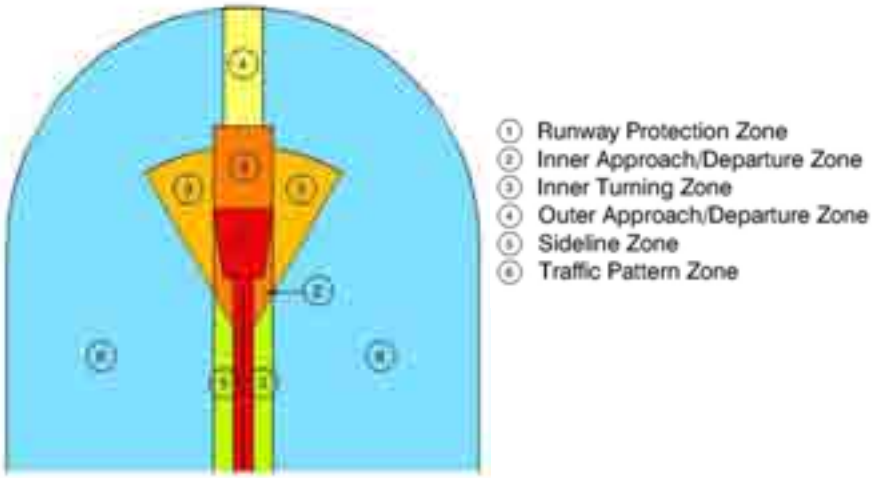
Under this heading, we are concerned with the historical pattern of aircraft accidents and the consequences that result when something causes an aircraft flight to end at a location other than on a runway. Our concern is primarily for the people and property on the ground near airports, but potential consequences for the occupants of aircraft are important as well. The consequences can range from fatal accidents to successful emergency landings where no one is hurt and little or no damage occurs—and the outcome often depends upon land use characteristics at the point where the aircraft lands.

Safety is a difficult compatibility impact to measure. Unlike noise impacts which occur to some degree with every aircraft flight, safety deals with events that happened only occasionally and with much less predictability than noise. To get a handle on what might happen if an accident occurs, we look at what has happened in the past. In particular, we are interested in *where* accidents have occurred relative to the airport runway. Locations where accidents have historically been most concentrated represent the places where land use compatibility measures to reduce the potential consequences are most essential.

Tips

- Remember to take into account not just the existing runway configuration, but also any planned new runways, extensions or shortening of existing runways, and planned upgrading of instrument approach capabilities. Each of these changes would affect the FAR Part 77 surfaces and the allowable heights of objects.
- Check with the airport manager to find out if there are locations around the airport where TERPS surfaces are known to be critical. The FAA also may be able to assist. If necessary an airport consultant can investigate for you.
- For tips on implementation of airspace protection criteria, see Step 6.

To date, the most comprehensive examination of the topic of accident locations is contained in the 2002 edition of the *California Airport Land Use Planning Handbook* published by the California Department of Transportation Division of Aeronautics. The California *Handbook* uses



Sample Safety Zones

the general aviation accident scatter diagrams described in Appendix E of this *Guidebook* to identify sets of up to six safety zones. The sizes and shapes of the safety zones reflect varying degrees of aircraft accident concentrations and also take into account the manner in which aircraft fly as they land and takeoff (where they fly and turn and the altitude at which they normally would be). Different safety zone sizes and shapes are suggested depending upon the runway length and type of aircraft presumed to use the runway.

Most critical among the safety zones is Zone 1 which encompasses the runway protection zone (RPZ) and land along the edges of the runway. RPZs are where the highest concentrations of off-runway accidents take place. FAA standards define the dimensions of RPZs and the criteria for land uses within them. The function of RPZs is "to enhance the protection of people and property on the ground." The FAA encourages airports to control the land uses in RPZs, preferably though acquisition of the property though easements or zoning may suffice. When owned by the airport, the center portion of the RPZ must be clear of all objects (except certain navigational facilities) and only very-low-intensity uses such as automobile parking are acceptable elsewhere. These standards are strongly recommended even when the RPZ is not fully on the airport.

The adjacent diagram is just one of the ones included in the California Handbook. See Appendix E of this Guidebook for additional examples and suggested dimensions. The appendix also contains additional details regarding historical accident pattern data.

In making adjustments to safety zones to fit local conditions, it is essential to understand that where aircraft fly under normal circumstances may not be where they will fly in an emergency or where they might crash. Thus, ignoring certain areas because "aircraft never fly there" can unduly expose people on the ground to aircraft accident risks.

For questions on acceptable land uses in each zone, see Appendix (to be added).

Tips

- The number of aircraft accidents at any particular airport is not great enough to provide a statistically meaningful prediction of where future accidents are most likely to occur. A much larger database, such as the one in the California *Handbook* is necessary. At best, airport-specific data can help to identify possible variations from the greater trends.
- Knowing where aircraft normally fly as they approach and depart an airport can also be useful in adjusting the suggested generic safety zones to better fit local conditions.

While Safety Zone 1 contains the highest concentration of historical accident points, data from the California *Handbook* indicates that only about 20% of off-runway, near airport accidents occur in this area. Significant accident potential thus exists in other parts of the airport environs, it is just more dispersed. Of the other zones, Safety Zone 2 is most important as it encompasses the second highest concentration of accident points. The concentrations in the other zones diminish from there. Land use compatibility criteria for each safety zone should be set in accordance with these relative concentrations of accidents—the greatest restrictions should apply within Safety Zone 1 and reduced limitations farther from the runway ends.

FAA Advisory Circular 150/5300-13 is available on-line at www.faa.gov/airports/resources/advisory_circulars/

If you wish to find data on historical accidents at your airport, much can be found on the National Transportation Safety Board website: http://www.ntsb.gov/ntsb/
Enter the name of the city associated with the airport.

Seaplane Bases

What should be considered when determining the airport influence area for seaplane bases?

- Location and alignment of the area used for takeoffs and landings
- Any areas along the standard arrival and departure routes where aircraft will be below 1,000 feet AGL
- Estimates of how often different routes are used
- FAR Part 77 Imaginary Surfaces
- Land-based services areas

The primary difference between sea and land airports is in defining the takeoff and landing area: it is much less clearly defined for seaplane facilities. Once defined, however, the same compatibility planning factors apply as for land airports.

✈ *Step 2 Products:*

- Noise contours, both current and 20-year projection
- Map of areas affected by overflight of approaching and departing aircraft
- Airport airspace map showing FAR Part 77 imaginary surfaces and elevations
- Map of compatibility zones applicable to each runway end
- Overall boundary of the airport influence area

Step 3: Identify Compatibility Concerns

You've set a foundation that described key information about your airport and community. You've also identified the airport influence area that is relevant. Now it's time to examine the level of compatibility in your community. This step will help you understand the various issues involved in determining compatibility.

☑ *You will know you've been successful when:*

- *You have determined the compatibility status of existing land uses in the airport influence area*
- *You have identified potential compatibility conflicts that could arise from future development*
- *You have identified the particular compatibility concerns that will require further review in the next step*

What is the land use character of the airport influence area?

Once you've identified the influence area, the next step is to understand the land use conditions within that area. What are current land uses? What types of development are allowed under existing development regulations? The following factors should be taken into account when assessing existing conditions in the airport influence area:

- **Existing Land Uses.** Describe the function, condition and height of existing structures within the airport influence area. Note typical types of uses and age of uses where possible. Also describe the residential density and nonresidential development intensity. Identify and describe vested development proposals where possible.
- **Infrastructure.** Review existing and planned infrastructure in the airport area—particularly water, sewer, major roadways—to assess what type of future development it will support.
- **Allowed Land Uses.** Describe what land uses might be allowed under a maximum build-out scenario based on current comprehensive plan policies and development regulations. Also take note of where there are large parcels that can be subdivided under current policies and regulations. Note potential density and intensity where possible.
- **Topography/Geography.** Provide a general description of land features within the airport influence area. Of particular interest are features that constrain future development: steep terrain, lakes, flood zones, environmentally sensitive habitats, etc.

What is the current compatibility status?

Although the focus of this compatibility planning process is on preventing new incompatible land uses from being created, knowing the airport's compatibility status relative to existing land uses can be helpful.

As used for airport land use compatibility purposes, "density" refers to residential development and is measured in dwelling units per acre. "Intensity" applies to nonresidential uses and is measured in people per acre.

Tips

- Communities can use design visualization to illustrate a full build-out scenario. This technique helps stakeholders appreciate the potential for future compatibility conflicts and gauge the severity.
- Create a series of maps to support your inventory of the influence area. Pay special attention to vacant or agricultural lands planned for development. Also identify areas where redevelopment could result in greater residential densities or nonresidential intensities.

Sometimes it is essential to make sure that existing problems don't become worse; in other instances, infill development similar in character to the existing uses may be reasonable. Also, knowing the current compatibility status will help you to look for opportunities where incompatible uses could be converted to more compatible ones if encouraged by local policies.

The following table is a general guide to the compatibility of various uses that may be found around the airport. You will be able to make a more detailed assessment of the land use compatibility status once you have drafted specific compatibility criteria in Step 4.

Table 2-2: General Land Use Acceptability

Typical Land Use Types	*Airport Proximity:*	*In and Around RPZs*	*Within Runway Approaches*	*Beneath Traffic Patterns*
	In General…	Only low heights and few or no people	Limited building height and number of people; no noise-sensitive uses	No very-high-intensity or highly noise sensitive uses
	Agricultural	Compatible if not bird attractant or produces airspace obstructions	Compatible if not bird attractant	Compatible if not bird attractant
	Power Plants / Transmission Lines / Roads	Generally incompatible	Compatible if does not produce airspace obstructions	Compatible
	Parks / Recreation	Incompatible	Compatible if low intensity	Compatible
	Stadiums	Incompatible	Incompatible	Generally incompatible
	Industrial	Compatible if low-activity, warehousing, mini-storage, etc.	Compatible if does not produce airspace obstructions or have bulk amounts of hazardous materials	Compatible if does not produce airspace obstructions
	Retail / Service Uses	Incompatible	Compatible only if low intensity	Compatible
	Dining / Entertainment	Incompatible	High-intensity and outdoor areas incompatible	Outdoor areas generally incompatible
	Offices / Industrial Parks	Incompatible	Compatible if low intensity	Compatible
	Places of Worship	Incompatible	Incompatible	Compatible if low intensity
	Residential	Incompatible	Incompatible	Generally incompatible
	Children's Schools / Daycare Centers	Incompatible	Incompatible	Incompatible
	Hospitals / Nursing Homes	Incompatible	Incompatible	Incompatible

Mixed-use development may be appropriate depending where it is located and what type of uses are involved. A good mixed-use development might include offices, retail, and multi-family residential.

Now inventory the uses that exist within the airport influence area. Are these uses clearly compatible or incompatible with the airport? Flag the uses that could potentially be incompatible or that you are uncertain about. Use Worksheet 3A to summarize your information.

To the extent that land uses are compatible with the airport, you will want to ensure that policies are in place to continue that status.

This is especially true in locations on the edge of urban areas where pressures are greatest for conversion of agricultural lands to urban uses. Airport compatibility must be considered when drawing or modifying urban growth area boundaries.

As for existing incompatibilities, there may not be a lot that can be done to remedy them, but some actions may be possible. For example:

- Are there areas of transitional or mixed uses near the airport where industrial or other compatible uses can be encouraged and residential uses phased out?
- Are their prospects that the airport could obtain FAA or state funds to buy the most highly impacted lands close to the runway ends and convert the areas to compatible uses?
- Can the airport obtain funds to install sound attenuation in noise-impacted residences and schools in locations where conversion to other uses is impractical? This option would be available only to the busiest airports with considerable jet traffic.

Worksheet 3A: Compatibility Status of Existing Land Uses

Land Uses	To what degree does this use exist today?	Is the use compatible or incompatible? Why?
Agricultural		
Power Plants / Transmission Lines / Roads		
Parks / Recreation		
Stadiums		
Industrial		
Retail / Service Uses		
Dining / Entertainment		
Offices / Industrial Parks		
Places of Worship		
Residential – Low-Density		
Residential – Medium-Density		
Residential – High-Density		
Children's Schools / Daycare Centers		
Hospitals / Nursing Homes		
Wildlife Attractants		
Airspace Hazards (tall structures, dust, smoke, glare, electronic transmissions)		
Vacant or undeveloped land		

What potential compatibility conflicts are on the horizon?

Here is where your efforts stand to reap the greatest benefits in terms of enhancing airport land use compatibility. Questions you should ask include:

- Where could uses allowed by current plans and zoning be developed, yet be potentially be incompatible with the airport?
- Are there plans to extend utilities, roads, and other infrastructure into an area to support development that would be incompatible with the airport?
- Are there locations within the airport influence area where redevelopment is planned? Will the redevelopment result in uses that would be incompatible because of density/intensity, noise, height, or other factors? Can the redevelopment be directed toward uses that are compatible with the airport.
- Are there vacant or underdeveloped sites that have infill development potential within these areas? Would such development be too incompatible with the airport to consider or could it be acceptable given the character of the surrounding land uses?
- To what extent can reuse of existing buildings result in more intense occupancy? Can a vacant building shell be used in a manner that might be incompatible with the airport? For example, can an office or religious institution go into a building originally planned as industrial or warehouse space?
- What controls do you have over the heights of cell towers, antennas, and other such structures that could be airspace obstructions?

Use Worksheet 3B to understand how the jurisdiction's plan for future development in the airport influence area will affect compatibility concerns: increase? decrease? remain the same? Identify issues that have the potential to become conflicts in the future.

Tips

- Much of this exercise relies upon a review of the designations indicated in your comprehensive plan land use map. However, other maps in the comprehensive plan also may indicate proposals such as new roads that could lead to new incompatible uses.

Worksheet 3B: Potential New Incompatible Uses

Land Uses	Based on current policy, what new development might exist in the future?	Is the use compatible or incompatible? Why?
Agricultural		
Power Plants / Transmission Lines / Roads		
Parks / Recreation		
Stadiums		
Industrial		
Retail / Service Uses		
Dining / Entertainment		
Offices / Industrial Parks		
Places of Worship		
Residential – Low-Density		
Residential – Medium-Density		
Residential – High-Density		
Children's Schools / Daycare Centers		
Hospitals / Nursing Homes		
Wildlife Attractants		
Airspace Hazards (tall structures, dust, smoke, glare, electronic transmissions)		
Airspace Hazards (tall structures, dust, smoke, glare, electronic transmissions)		

What compatibility concerns need to be addressed?

Now, list in Worksheet 3C the specific issues that must be addressed to ensure that development of incompatible land uses is avoided in the airport influence area. You will use this list in Step 4.

Worksheet 3C: Compatibility Concerns

✈ *Step 3 Products:*

- List of current community policies affecting land use development in the airport influence area
- Evaluation of current compatibility status
- Identification of potential future compatibility conflicts
- List of specific compatibility issues to be addressed by new policies

Step 4: Develop Compatibility Strategies and Prepare Comprehensive Plan Update

Steps 1 through 3 led you through the research and analysis needed to describe and assess the interactions between airports and surrounding land uses. You now know what constitutes compatible land uses around your airport and have identified key challenges to prevention of more incompatible uses. What are your options for addressing those challenges? This step will help you think through the various compatibility strategies available, then evaluate and incorporate the best strategies into the draft update of your comprehensive plan.

☑ *You will know you've been successful when:*

- *You have weighed the comparative advantages and disadvantages of available planning strategies*
- *You have identified preferred planning strategies*
- *You have decided upon specific compatibility criteria*
- *You have fully considered airport land use compatibility measures in your comprehensive planning process and incorporated compatibility policies into the draft comprehensive plan where appropriate*
- *You are ready to circulate the proposed comprehensive plan for review and adoption*

What does it mean to discourage development of incompatible land uses?

State law requires towns, cities and counties to "adopt comprehensive plan policies and regulations to discourage development of incompatible land uses adjacent to public use airports." What does that mean to you? It means that your jurisdiction must take actions necessary to preserve investment in transportation infrastructure and protect the airport as an essential public facility.

Communities can address airport land use compatibility in a variety of ways based on the characteristics of the individual airport facility as well as numerous other factors that are unique to each location. The following two principles—developed based on WSDOT's experience and expertise with airport land use compatibility—guide our technical assistance program:

- To "discourage" encroachment, communities must take proactive steps to prevent the proliferation of incompatible land uses in adjacent to public-use airports. Existing conditions should be maintained or improved to prevent future incompatible development.
- To adopt effective goals, policies and regulations, communities must conduct thorough analyses to understand available research and apply it appropriately to the unique characteristics of a particular airport and its environs.

As you begin drafting compatibility criteria for the airport and melding those criteria into the comprehensive plan for your community, you must look first at the impacts generated by the airport as identified in Step 2. Your task does not stop there, however. Compatibility planning seldom takes place in a vacuum where existing land uses and future development expectations around the airport can be ignored. Criteria that may be appropriate for a rural airport surrounded by farmlands are likely to be unacceptable in an urban environment. The analyses you've done in Step 3 thus will significantly affect how you proceed with Step 4.

What compatibility policies are already in place?

If the airport you are addressing is owned by your jurisdiction or physically located within its boundaries, chances are that your current comprehensive plan acknowledges it in some manner. If only portions of the airport influence area overlap your community's territory, then the comprehensive plan may make little or no mention of the airport's impacts. The absence of explicit compatibility policies may implicitly be a policy that allows or even promotes incompatible development.

The number one goal of airport land use compatibility planning is to support continuation of existing compatible land uses around airports and prevent encroachment by new incompatible uses. Beyond that, any feasible actions that can be taken to reduce or eliminate existing conflicts are desirable as well.

Review the land use planning documents gathered during Step 1. In Worksheet 4A, list the existing goals, policies, and development regulations affecting the airport influence area. Also note any implicit policies that may affect future land use compatibility.

Worksheet 4A: Current Land Use Policies

Next, assess the effectiveness of these policies.

- Do the current policies help prevent incompatible land use development in the airport influence area or do they tend to promote this development?
- To what extent have policies intended to prevent incompatible development been inadequate to the task? Why? Are their loopholes in the policies that allow compatibility goals to be circumvented?
- Are the policies clearly defined or are they open to a wide degree of interpretation?
- Do the current policies provide a good starting point for more detailed and thorough policies or do you need to start from nothing?

In Worksheet 4B, write statements of fact that document your findings. These statements provide evidence of your work on airport land use compatibility and may be used to support adoption of policies and regulations, and may also be referenced in any proceedings of the Growth Management Hearings Board.

Worksheet 4B: Compatibility Policy Findings

What strategies can be used to respond to compatibility planning challenges?

Every community faces certain challenges in planning for airport land use compatibility. In almost every case, communities must decide how to balance a range of competing interests in order to protect the airport, preserve quality of life, and meet the requirements of state law.

Avoid, minimize, and mitigate is a principle used in planning to address adverse impacts of development. This principle is a hierarchical approach; the idea is to first avoid negative impacts when possible. When it is not possible to avoid adverse effects, the second part of the strategy is to minimize the effects to the greatest degree possible. The third step, used in cases where the adverse impacts are truly unavoidable, is to mitigate the negative effects by offsetting the impacts in some way. This approach can be used in airport land use compatibility planning as well. This *Guidebook* provides tools to empower local jurisdictions to prevent development of incompatible land uses adjacent to airports. However, where it is not possible to prevent such development, the tools may also be used to minimize and mitigate the effects.

The table on the next page lists a series of challenges you may encounter as you prepare compatibility policies and incorporate them into your comprehensive plan. For each of these challenges, the table identifies one or more basic strategies that can be used to address these challenges. Most jurisdictions will utilize a combination of techniques to implement their compatibility programs. Note, though, that some strategies may be appropriate for your community, while others will not be. Also, different strategies are applicable to different circumstances. Specifically, some strategies are "preventative," meaning that they are designed to avoid new incompatible development. Other strategies are "mitigation techniques," meaning that they are used to minimize the negative effects of incompatible development when such development already exists or is unavoidable.

These strategies are not intended to represent specific policies or criteria. Think of them more as tools. Indeed most are discussed in Chapter 3, *Airport Land Use Compatibility Toolkit*.

Table 2-3: Compatibility Challenges and Strategies

Challenge	Strategy															
	Encourage Airport to Buy Property	Prohibit the Use	Limit Residential Density	Limit Usage Intensity (people per acre)	Avoid Highly-Risk Sensitive Uses	Avoid Noise-Sensitive Uses	Encourage Development Clustering	Encourage Transfer of Development Rights	Consider limited criteria exceptions	Require Preservation of Open Land	Restrict Heights of Structures	Prohibit Bird & Wildlife Attractants	Require Avigation Easement Dedication	Require Recorded Deed or Plat Notice	Recommend Disclosure During Real Estate Transactions	Establish Coordination Mechanism
Expansion of GMA to encompass all or part of the airport influence area is proposed							X	X		X	X			X	X	X
The airport influence area encompasses all of a town or city					X				X		X	X				X
The airport influence area encompasses multiple jurisdictions								X								X
The airport area is in a GMA and extensive new development is unavoidable			X	X	X	X	X	X						X	X	
Airport influence area is almost completely developed and there is a demand for infill			X	X	X	X	X	X					X	X	X	
Redevelopment is planned for part of airport influence area					X	X					X					
Nearby property is more valuable than airport							X	X								
Land near the airport is needed for residential development		X	X				X	X		X			X	X	X	
There are existing residential areas near the airport and a new school is needed		X		X												
The community's commercial core area is within runway approach zone				X	X						X		X			
Some of runway protection zone is private property	X			X					X	X	X	X	X			
Planned new high-intensity development near runway approaches would put people at risk			X	X												
Little open land remains near the airport							X			X						
High terrain exceeding FAR Part 77 standards exists near the airport									X	X	X		X			
Property is so close to runway that FAR Part 77 height criteria doesn't allow buildings	X	X					X		X				X			
Tall buildings could be located near the airport		X						X			X		X			
Cell towers and antennas are not restricted in the airport environs		X									X		X			
Existing uses in the airport area attract birds or other wildlife												X				X
Airport compatibility conflicts with siting requirements for other essential public facilities located nearby					X											X

Which approach is right for you?

There is no single right way to approach these issues—although there are some wrong ones—and WSDOT does not endorse a particular approach for every community. Rather, what is most critical is that every community evaluate the options that are available and make informed decisions about the right course of action that will meet its stated goals and policies and uphold the requirements of the Growth Management Act.

As you consider the various options for addressing compatibility challenges, think about the advantages and disadvantages for your airport and your community. How would use of each technique influence the efficacy of your airport land use compatibility program? How would the approach work in your community?

Using the table below, rate the level of compatibility in the airport influence area based on the chart below. This will help you set expectations for the kinds of amendments that may be needed to achieve airport land use compatibility in your community.

Table 2-4: Compatibility Status

	Green	Yellow	Red
Airport Influence Area Land Use Characteristics	Few opportunities for incompatible development given existing policies and regulations.	Some incompatible development already exists; some opportunity for new incompatible development based on existing policy and regulations.	Significant amount of existing and potential future incompatible development.
Strategy	Keep a good thing going.	Proceed with caution.	Change direction.
Action	Perform a review of existing land use map, policies, and regulations for key elements of compatibility. Amend comprehensive plan and development regulations as necessary for continued success.	Consider course corrections to prevent new incompatible development. Consider downzoning or rezoning to a more compatible use to achieve airport land use compatibility objectives.	Planning as usual will not discourage incompatible land use. A new direction is needed to protect the airport.

The next worksheet takes you through the process of evaluating various strategies available and settling on the best approaches. It is important as you evaluate each approach to remember the principles that guide airport land use compatibility planning: How does each approach serve (or detract) from these planning principles?

Worksheet 4C: Alternatives Analysis

Compatibility Problem	***Potential Planning Strategies***	***Preferred Strategy***
List compatibility issues identified in Step 3 that need to be addressed	List options for addressing the problem and describe the advantages and disadvantages of each	Write a finding that explains why the selected approaches is best for your community

Tips

- Use this worksheet in your project documentation. Cut and paste the completed table into your staff report, environmental checklist, etc.; include it in your review package for WSDOT, Department of Commerce, RTPO, etc.

What should the specific compatibility criteria be?

Things to Consider

You have decided upon the compatibility strategies that will work best for your community. Next you will need to prepare specific compatibility criteria. How detailed you choose to make the criteria will depend upon the complexity of the issues you are facing. In outlying areas where little development is expected, providing general development parameters (such as height limits or maximum number of people per acre) may be sufficient. Where much development will be occurring, a detailed list of acceptable and unacceptable land uses and conditions to be met if the use is marginal may be necessary.

Another major decision to be made at this point is how restrictive your compatibility criteria should be. Again, the choice may depend upon the existing character of the airport environs. For example, it may be a simple decision to have policies precluding high-intensity development in outlying rural areas because such development is unlikely to occur anyway. In developed or developing locations, the point at which the line is drawn for acceptability with regard to airport impacts can be controversial. Questions you should consider in making this choice include:

- Is the development not likely to occur for reasons other than airport compatibility restrictions?
- What is the community's current image of the airport? Is it seen as a good neighbor?
- Are existing uses that might seem to be incompatible felt to be acceptable in your community given the community characteristics, relationship with the airport, and other factors?
- What are the community's expectations for and acceptance of growth in airport activity and the additional impacts that might result?

- What assurances can be given to protect the viability of the airport if relatively relaxed compatibility criteria are established?
- What realistic and economically viable uses of the land would remain with the compatibility restrictions in place?
- Could highly restrictive criteria cause some private property to be unusable and thus raise concerns that the policies could be deemed a taking?
- Would restrictive criteria render large areas of existing development as nonconforming to the compatibility criteria? What implications would this have?
- Should infill areas be treated differently than larger sites and ones on the edges of urbanized areas?
- Are different parts of the airport environs sufficiently different in land use character that different compatibility criteria should be applied?

For more about takings, review this advisory Washington Department of Commerce publication:
qa.cted.wa.gov/_CTED/documents/ID_1068_Publications.pdf

Tips

- To avoid takings issues, you usually will want to allow a single-family dwelling to be built on a legal residential lot of record.

Basic Criteria

Table 2-5 is intended as a starting point for your preparation of specific compatibility criteria. It provides basic, qualitative criteria for different types of airport environs from outlying to developed. Your criteria will most likely need to be more detailed and quantitative.

With regard to the four primary compatibility factors, some key points to remember are:

- **Noise.** No new noise-sensitive uses should be permitted within the high-noise-impact areas defined by noise contours. This especially includes residential uses, but other uses with outdoor activities are also incompatible. Remember that noise impacts extend beyond the runway approach and departure areas into the areas affected by the overflight factor.
- **Overflight.** Not just the noise of individual aircraft operations, but vibration, fumes, and an element of fear from low-flying aircraft all contribute to annoyance and other impacts associated with aircraft overflight. Avoid residential uses except in urban areas where background noise levels are high. Where residential uses are to be accommodated, multi-family residential is preferable to single-family because of the typically greater background noise, fewer outside walls through which outside noise can intrude, and less amount of outdoor living space. Consider establishing some form of buyer awareness program to alert prospective new residents to the occurrence of overflights.

See Chapter 3 for further information and some specific examples that you can adopt or use as a starting point for your policies.

- **Airspace Protection.** You can generally use FAR Part 77 standards as the guide for determining allowable heights for new structures, but be sure to take into account any plans for runway extensions or new types of instrument approach procedures. Work with the airport and the FAA to determine acceptable heights in places where the ground itself exceeds the standards. Also be sure to address other hazards to flight. Uses that attract birds into the airport airspace or wildlife onto the runways are a particular concern. Other hazards include land uses that generate steam or smoke, produce glare, or otherwise interfere with the view of pilots and ones that could generate electrical interference with aircraft navigation or communication signals.
- **Safety.** Uses that attract concentrations of people into small areas near airports are not wise planning, especially in locations close to the ends of runways. New children's schools, hospitals, and other uses in which the occupants are young or infirm should not be allowed. Uses involving quantities of hazardous materials also don't belong near airports. Seek to cluster development in a manner that leaves some flat, open land where small aircraft could make an emergency landing if necessary.

Can the airport influence area size be adjusted?

Most of the time, the airport influence area will consist of a combination of the areas affected by each of the four preceding compatibility factors. In some instances, though, there are reasons for making adjustments. This should be done by going back to the four individual factors and reconsidering the underlying assumptions. Simply expanding the influence area boundary when no impacts occur and no compatibility criteria would apply within part of the area would serve little purpose. Oppositely, to omit locations where identified impacts warrant some form of compatibility policies would be contrary to the purpose of compatibility planning.

Table 2-5: Basic Compatibility Criteria for Different Environs

Characteristics of Existing Influence Area Environs:	***Rural*** *Existing land use is agricultural or remote; few buildings; new development not anticipated*	***Limited Development*** *Existing development is scattered or low-intensity with little new development anticipated*	***Developing*** *Extensive vacant or underutilized land with urban development potential*	***Developed*** *Fully or mostly developed; potential redevelopment*
In and Around Runway Protection Zone	Airport should control land consistent with design standards Height restrictions Avoid new buildings	Airport should control land consistent with design standards Height restrictions Avoid new buildings Avoid new roads	Airport should control land consistent with design standards Height restrictions Avoid new buildings Avoid new roads	Airport should control land consistent with design standards Height restrictions Infill uses if low intensity
Lateral to Runway	Aviation-related development preferred No new residential tracts Low intensity non-residential uses acceptable No new schools, day care centers, nursing homes, etc. Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage keeping land agricultural, undeveloped, or in airport-related uses*	Aviation-related development preferred No new residential tracts Low intensity non-residential uses acceptable Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage keeping land agricultural, undeveloped, or in airport-related uses*	Aviation-related development preferred Low/moderate intensity non-residential uses acceptable No new residential tracts No new schools, day care centers, nursing homes, etc. No new shopping centers or places of public assembly* Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage light industrial and other low-intensity uses or airport-related uses*	Aviation-related development preferred Low/moderate intensity non-residential uses acceptable No new residential tracts No new schools, day care centers, nursing homes, etc. No new shopping centers or places of public assembly* Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage light industrial and other low-intensity uses or airport-related uses*
Approaches / Extended Runway Centerline	Low-intensity non-residential uses acceptable (consider a one-story limit to ensure acceptable intensity) No new residential tracts No new schools, day care centers, nursing homes, hospitals, etc. Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage continuation of agricultural and related uses*	Low-intensity non-residential uses acceptable (consider a one-story limit to ensure acceptable intensity) No new residential tracts No new schools, day care centers, nursing homes, hospitals, etc. Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage continuation of agricultural and related uses*	Low/moderate-intensity non-residential uses acceptable (consider a two-story limit to ensure acceptable intensity) No new residential tracts; infill discouraged No new schools, day care centers, nursing homes, hospitals, etc. No new shopping centers, industrial uses with high concentrations of people, places of public assembly* Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage light industrial, office, and other low-intensity uses*	Low/moderate-intensity non-residential uses acceptable (consider a two-story limit to ensure acceptable intensity) Residential as infill acceptable No new schools, day care centers, nursing homes, hospitals, etc. No new shopping centers, industrial uses with high concentrations of people, places of public assembly* Tall structures restricted to protect airspace Caution regarding land uses that attract birds *Encourage light industrial, office, and other low-intensity uses*
Traffic Pattern	*Maintain existing minimal development conditions to maximum extent practical*	Limit residential tracts *Encourage continued agricultural and agriculture-related commercial or other low-intensity commercial uses*	*Encourage nonresidential uses except for ones with very high intensities (such as sports arenas)* *Favor high-density or clustered residential over low-density if residential is necessary*	*Encourage nonresidential uses except for ones with very high intensities (such as sports arenas)* *Favor high-density residential as infill or redevelopment*

* Places of worship, auditoriums, outdoor sports arenas, etc.

Tips

- Because the initial delineation of compatibility zones was based solely upon aeronautical factors, any adjustment of the zones must remain consistent with the basic aeronautical concepts. Look at any adjustments to be more like fine tuning than fundamental revisions.
- To the extent possible, consider making adjustments to the compatibility criteria rather than the zone boundaries. Also, it may be better to allow more relaxed criteria for infill development or other small exception areas than for the entire airport influence area.
- *If you make adjustments to the zone boundaries, it is important to demonstrate and document in the record the reasons for doing so.*

Preparation and adoption of draft airport compatibility policies generally will be done as part of the overall comprehensive plan update process. While specific attention should be given to compatibility topics, they should not be addressed in isolation from other planning issues.

What needs to be added or changed in the comprehensive plan?

The comprehensive plan establishes the policy foundation that guides the physical development of a community. Towns, cities, and counties in the state each must adopt a comprehensive plan. Policies directed toward ensuring airport land use compatibility in the community must be an integral part of the plan. These policies should be evident in:

- The goals that the community seeks to achieve with regard to future development and the manner in which the airport and provisions for land use compatibility around it fit into these goals.
- Description of the types of airport land use compatibility standards that future development will need to meet
- Comprehensive plan map designation of lands near the airport for types of development that will be compatible with the airport.
- Identification of the specific tools that will be used to ensure implementation of the compatibility standards.

Goals

It is critically important that a community's goals for air transportation facilities and adjacent land uses be expressed in the comprehensive plan. Values and strategies included in the comprehensive plan filter down through all other planning decisions, from zoning to issuing building permits. The land use, transportation, public facilities, and economic sections are all appropriate places to discuss airports and land use compatibility.

The goals should cover a range of issues that express the value of the airport to the community, as well as the community's commitment to preserving the airport consistent with its value. At a minimum, the goals should:

- Recognize the multiple roles of the airport in the community, its contribution to the community's economy, and the services it provides to the community's businesses, residents, and visitors.
- Recognize the airport as an essential public facility.
- Recognize the airport as part of the multi-modal transportation system.
- Signal the community's intent to discourage development of incompatible land uses adjacent to the airport.
- Signal the community's intent to protect the airport's airspace.

Worksheet 4D: Airport Influence Area Adjustments

Circumstances Warranting Possible Impact Area Adjustment	*What are the conditions at your airport?*	*Do these conditions warrant adjusting the Airport Influence Area boundary? In what manner?*
All ▪ Have any planned runway configuration changes been accounted for? ▪ Is the traffic pattern only on one side of the runway?		
Noise ▪ Have future changes in airport role and aircraft usage been considered? ▪ Does airport activity have a significant seasonal variation warranting consideration of peak season activity		
Overflight ▪ Do aircraft frequently follow a "nonstandard" approach or departure pattern? ▪ Are there locations that should be encompassed in the overflight area because the area has particularly noise-sensitive uses or is the source of complaints from many different people? ▪ Is the area initially drawn so large that its significance is diluted?		
Airspace Protection ▪ Does the airport have instrument approach procedures that are not aligned with extended runway centerline? ▪ Do any of the runways have a displaced threshold? ▪ Are there existing obstructions such as high terrain that affect where aircraft fly?		
Safety ▪ Do aircraft frequently follow a "nonstandard" approach or departure pattern? ▪ Does the airport's historical accident pattern reveal conditions that create greater or lower than normal risks in certain locations?		

Note that sample goals and policies are provided in Chapter 3.

Tips

- Adopt language in the comprehensive plan that expresses the importance of retaining land use compatibility for the airport. This will help create institutional memory about the role existing policy and regulations serve in preserving airport land use compatibility.

Note that, even if you have avoided designating land for future development that would be incompatible with the airport, your map may still show incompatible uses. This will occur where incompatible uses already exist and the map is merely reflecting a continuation of this status. While converting these uses to ones that are more compatible is preferable, that option is not always possible.

Compatibility Criteria Identification

The basic objectives of the compatibility criteria for each of the four compatibility concerns should be identified in the comprehensive plan. Indicate which of the strategies you selected earlier in Step 4. Also, the airport influence area boundary that you have defined should be presented in the comprehensive plan together with a discussion of the factors on which it is based.

At least a basic level of compatibility criteria should be included in the comprehensive plan to ensure that they are not overlooked during reviews of individual development proposals. Highly detailed criteria may be better suited to inclusion in a separate policy document or within an airport compatibility overlay component to the community zoning ordinance. If the complete criteria will appear in the comprehensive plan rather than in other policy documents, then maps of the impact areas for the four individual compatibility factors would need to be included as well.

Land Use Map Designations

Designating land uses that will be compatible with the airport impacts in a particular location is key to the success of the whole compatibility planning process.

- **Agricultural Uses and Related Uses.** How much of these types of undeveloped or minimally developed uses can be continued? Especially outside of urban growth boundaries, this should be a high-priority choice.
- **Residential Uses.** Residential land uses are a particular concern. Is new residential development, especially any new subdivisions, proposed for locations where it would be incompatible with the airport? If so, are other more compatible uses possible?
- **Noise- and Risk-Sensitive Uses.** Where are schools, hospitals, and other sensitive uses planned to be located? If these uses already exist, can expansion be limited? Are there any critical community infrastructure uses—such as power plants and communication facilities—planned in the airport influence area that could be built elsewhere instead?
- **Other Nonresidential Uses.** Take a close look at commercial and other nonresidential uses that potentially have high concentrations of people. Are any such uses proposed within the compatibility zones close to the runway? If so, what can be done to limit the intensity? Also make certain the building heights allowed for these uses would not result in airspace obstructions.

✈ Step 4 Products:

- List of current policies affecting airport land use compatibility in your community whether positively or negatively (Worksheet 4A)
- Assessment of the adequacy of current policies (Worksheet 4B)
- Evaluation of alternative compatibility strategies (Worksheet 4C)
- Draft of specific compatibility criteria
- Adjustment of airport influence area boundary if necessary (Worksheet 4D)
- Draft comprehensive plan policies
- Draft comprehensive plan land use map

Step 5: Adopt the Comprehensive Plan Update

This short step takes the comprehensive plan update you prepared in Step 4 through the adoption process. Particular emphasis is given to gaining support for the airport land use compatibility measures you have incorporated into the draft plan.

☑ *You will know you've been successful when:*

- Airport stakeholders feel that their concerns regarding compatibility matters have been understood and appropriately considered in the comprehensive plan update.
- You have gained public acceptance of the importance of airport land use compatibility planning.
- WSDOT Aviation provides comments supporting the compatibility measures you propose to take in your comprehensive plan update.
- Your community's decision-makers have adopted a comprehensive plan update that contains appropriate measures to protect the airport from encroachment by incompatible land uses.

Does WSDOT Aviation need to review the draft comprehensive plan update?

Under RCW 36.70.547, "all proposed and adopted plans and regulations shall be filed with the aviation division of the department of transportation within a reasonable time after release for public consideration and comment." Beyond this requirement, as you begin work on preparing your draft comprehensive plan, it is important that you coordinate with WSDOT Aviation. We can provide technical assistance and help you identify and understand the airport land use compatibility issues you will need to consider during your comprehensive plan update process.

What public participation is needed for policy adoption?

By the time you reach this step, you should have thoroughly examined airport land use compatibility issues and incorporated appropriate measures into the draft comprehensive plan update. Airport land use compatibility planning now becomes one of many issues that the public and decision-makers will evaluate during the process leading to the adoption of the comprehensive plan update. Thus, the formal public participation process for compatibility planning should be the same as for the comprehensive plan and implementing regulations.

Airport land use compatibility planning has its own unique group of stakeholders, however, and these stakeholders may not always be active participants in the comprehensive planning process. Chapter 1 described the stakeholders in compatibility planning and the importance of involving them in the process. Now, at the adoption phase, is where special effort to engage these stakeholders is particularly important.

How can you gain public and decision-maker support for airport land use compatibility measures?

For people closely involved with aviation, the importance of airport land use compatibility planning is probably obvious. To other people, it may not be as evident or they may view it as less of a priority than other community planning objectives. For the airport land use compatibility measures you have developed by following this five-step process to be successful, the people who have the authority to make decisions or the ability to sway those decisions must be convinced.

One way of doing this is to demonstrate why compatibility is important not just to the airport, but also to the community's residents and businesses. This topic was covered in Chapter 1. Simply put, development that unnecessarily puts people where they will be exposed to significant noise or risk is poor planning.

Another approach is to focus on the economic importance of the airport to the community. This topic has already touched upon several times in this *Guidebook*. From a statewide perspective, some additional points to consider are these:

- Airports, aviation, and industries related to aviation in Washington have an impact on the economic well-being of communities throughout the state. Airports and aviation-related industries create thousands of jobs and provide millions of dollars in income and sales each year.
- According to a WSDOT study conducted in 2001, airport operations, aviation-related businesses, air travel visitor spending, and special aviation events in Washington generate an estimated $19.6 billion annually in total economic activity, support over 176,900 full- and part-time employees statewide; and produce $14 billion each year in employee wages and benefits for state residents.
- Capital spending by local airports also contributes to the economic well-being of local and regional economies. While not generally an annual expenditure, spending on capital improvements in the year 2000 generated an additional $137.9 million in output, supported over 1,400 jobs and produced $42 million in employee wages and benefits for state residents.

For more on the WSDOT Aviation economic impact study, see www.wsdot.wa.gov/aviation/EconImpacts.

To bring these points home at a local level, preparation of an airport economic analysis focusing on your airport may be worth considering. Such studies can document several types of economic benefits:

- They measure the new economic benefits that accrue to the region due to the airport that would not have otherwise occurred.
- They provide a metric for comparison to other public projects in terms of rate of return on investment.
- They show how dollars flowing into the local economy from outside of the community because of the airport is a net benefit.

✈ *Step 5 Products:*

- A strategy to gain public and decision-maker support of the compatibility measures
- Information materials describing the importance of the airport and airport land use compatibility
- An adopted comprehensive plan incorporating airport land use compatibility measures

Tips

- Information collected for the transportation inventory can be expanded as public outreach materials to educate community members about the airport. For example, a brief fact sheet or flyer describing activities supported by the airport and future activity anticipated at the airport can be a great resource for raising awareness about the role of the airport in the local, regional and state transportation system.

Step 6: Implement the Airport Land Use Compatibility Policies

Congratulations! You have shepherded airport land use compatibility matters through the research and analysis process to successful reflection of the concerns in your draft comprehensive plan update which has now been adopted by your community's decision-makers. But, you can't stop there. The one final step involves preparing implementing regulations, getting them adopted, and then using them on a day-to-day basis to ensure that compatibility concerns continue to be recognized and avoidable conflicts do not occur.

☑ *You will know you've been successful when:*

- You have proposed revised development regulations to implement the policies
- You have begun to put the policies to use

What implementing regulations are needed?

Most likely, unless the compatibility issues you face are simple, your comprehensive plan will not contain all the tools necessary for implementation of the compatibility criteria. The details will need to be included in separate implementing regulations. Primary among these is your zoning ordinance, but subdivision and environmental impact regulations, and other implementing regulations also may need to be reviewed and revised to reflect the comprehensive plan policies on airport land use compatibility.

With regard to zoning, there are at least a couple of ways to proceed. One is to modify your community-wide ordinance in a manner that will prevent land use conflicts with airport operations. This approach may be sufficient where the airport controls a substantial amount of land around the runway. For example, if airport airspace protection would not restrict any off-airport locations to heights of less than 35 feet and the height limit under community-wide zoning is 35 feet, then airport-specific restrictions might not be needed (although regulations on the height of antennas, poles, and trees might still be necessary). Similarly, if surrounding lands are all zoned for agriculture or other generally compatible uses, then minor additions to the established zoning to address height limits and other miscellaneous compatibility issues may be adequate.

A different option to consider, especially for airports where adjoining land uses are closer and more varied, is to adopt an airport overlay zoning ordinance. Overlay zones supplement the community-wide land use zoning. These zones may modify the underlying zoning or add other conditions. Flood hazard overlay zoning is a common example.

An airport overlay zone ordinance can serve as a convenient means of bringing various airport compatibility criteria into one place. The airport-related height-limit zoning that many jurisdictions have adopted as a means of protecting airport airspace is a form of overlay zoning. Compatibility criteria addressing noise/overflight and safety factors can be included as well. Other than where direct conflicts need to be eliminated from the comprehensive plan text and maps, implementation of compatibility policies could be accomplished almost entirely through the airport overlay zoning ordinance.

An outline of topics which could be addressed in an airport overlay or combining zone is included in Chapter 3.

Tips

- Development regulations put policy into action. It is important that the regulations implement the policy, not start a new direction. Make sure to provide adequate detail in the regulations to help the development community understand what is required.
- Use Worksheet 6A to confirm that you have addressed all the compatibility criteria in your implementing regulations.

Worksheet 6A: Implementation Check

List Relevant Planning Policies	*Describe How Regulations Support Implementation*

What actions are necessary to ensure continued implementation of the policies?

To conclude this five-step process, a final point to remember is that your work does not end with adoption of a comprehensive plan and implementing regulations that incorporate airport land use compatibility planning measures. The criteria must continue to be applied on an on-going basis.

Among the continuing actions to do are these:

- Make sure that compatibility criteria are not buried in the planning policies and implementing regulations in a manner that planners who are conducting reviews of development proposals might overlook them. Flagging parcels affected by airport compatibility criteria with an airport overlay zoning designation is a way of helping ensure that the criteria are noticed. Consider incorporating the compatibility criteria into a geographic information system (GIS) to make the criteria quickly evident.

Tips

- Local jurisdictions are strongly encouraged to conduct a preliminary analysis to determine if the project meets local height regulations and FAR Part 77 standards. This preliminary analysis should be done prior to when the project applicant submits Form 7460 to the FAA. If the project would be penetrate an FAR Part 77 surface and thus be an airspace obstruction, jurisdictions should require the applicant to propose alterations to the proposal. If the applicant still chooses to pursue the project, then an early submittal of Form 7460 is advised. Receiving an early determination from the FAA as to whether the project would be deemed a hazard to flight will save the applicant time and money. The results of the FAA aeronautical study also will help the local jurisdiction to decide whether it should grant a height variance for the project.
- Remind project applicants that filing of FAA Form 7460 is a federal requirement and the responsibility rests with them not with the local jurisdiction. Also, they should be made aware that failure to do so when required is subject to federal penalties.

- Pay attention not just to the finished height of structures, but also to any add-on features such as antennas that would increase the overall height. Also consider construction cranes or other temporary objects that could be airspace obstruction if near the airport. The height of trees could be another concern. Be certain that project proponents submit proper notification (Form 7460) to the FAA for an Aeronautical Study in accordance with FAR Part 77 requirements.
- Don't overlook proposed changes of use of existing buildings. A proposal to change a low-intensity or vacant building to one with many occupants or to a use that is noise sensitive could be contrary to the compatibility criteria.

✈ *Step 6 Products:*

- Draft and adopted implementing regulations such as an airport overlay zoning ordinance that contains the specific compatibility criteria to be met
- Identification of continuing actions and specific points in the development review process where airport land use compatibility concerns will be addressed

Chapter 3

Airport Land Use Compatibility Implementation Toolkit

Introduction

This chapter describes a collection of tools that you can use to implement the airport land use compatibility strategies you selected as you worked through the steps outlined in Chapter 2. Some of these are tools you use on a daily basis: comprehensive plans and zoning ordinances. But, how do you specifically use these tools for addressing airport land use compatibility issues? The first two sections of the chapter will provide you some guidance. Then, in the latter part of the chapter, you will find various tools that can be applied to more individualized compatibility problems or during the approval process of specific projects. A final section *[to be added]* outlines several planning scenarios that put the various tools to use. Also, take a look at the *Guidebook* appendices for additional discussion and specific examples of implementation tools you can use *[some included … more to be added]*

In this chapter you will learn about:

- **Comprehensive Plan**. Where compatibility issues can or should be addressed; what land uses should be planned for near airport and what ones should be avoided
- **Zoning Ordinances.** Aspects of airport land use compatibility planning that should be addressed in a traditional zoning ordinance; airport overlay zones and other types of zoning that can be employed to address compatibility concerns
- **Tools for Addressing Specific Compatibility Factors.** Guidance on specific criteria to use with regard to noise, overflight, safety, and airspace protection
- **Other Tools.** These include some special tools that planners and airport managers can employ to promote compatibility
- **Scenarios.** Some examples of how tools might be applied in particular situations

Do you know when your comprehensive plan is being updated?

The Department of Commerce does!

Reflecting Compatibility Issues in the Comprehensive Plan

Creating a Comprehensive Plan

As discussed in Chapter 1, a comprehensive plan presents a community's vision about itself and what it would like to become. The comprehensive plan is the policy framework on which all future community planning actions will be based and it is the starting point for any discussion regarding local land use. Therefore, when an airport's influence area extends into a community's territory, the comprehensive plan is where airport land use compatibility issues must fundamentally be addressed.

Depending upon the nature of the relationship between the airport and the community—where the airport is located relative to the community boundaries, whether the community owns the airport or it belongs to another entity, the airport's economic importance to the community, etc.—airport land use compatibility topics could be addressed in various places within the comprehensive plan. Take a particularly close look at these standard comprehensive components and make sure that they discuss the airport and compatibility issues:

- Introduction and description
- Goals
- Policies
- Elements
- Urban Growth Boundary (UGB)
- Land Use Map

Additionally, when there is an airport in your community—or even when the airport is outside your boundaries, but its impacts extend inside—the following items should be included somewhere in the comprehensive plan:

- Map of the airport influence area
- Map of the FAR Part 77 Airspace Protection Surfaces
- An inventory of compatible and incompatible land uses

Policies and Goals

Comprehensive plan goals and policies provide decision makers with a foundation for making strategic, long-term land-use decisions. Community planning commissions and city councils use these policies and goals to determine appropriate steps to take when planning for airport land use compatibility. Goals and policies guide regulations and development decisions within the airport's influence area, so it is critical to include policies that address incompatible development.

Policies should acknowledge the airport's role as an essential public facility, its economic contribution to the community and its role in the overall aviation system.

Comprehensive Plan Elements

The issue of airport land use compatibility is relevant to many of the elements of a comprehensive plan including

- Transportation
- Land Use
- Housing
- Capital Facilities
- Utilities
- Economic Development (optional)
- Parks and Recreation (optional)
- Rural (county comprehensive plans only)
- Natural Resources

WSDOT Aviation recommends that airport land use compatibility and other airport-related topics particularly be addressed in these four elements.

Transportation Element

The transportation element should:

- Inventory transportation assets, including all public-use airports within in the jurisdiction (required by law).
- Recognize the unique access airports provide.
- Recognize the role aviation facilities play in emergency management.
- Identify the role that the community's airport or airports play in the Washington State Aviation System Plan (WASP).
- Identify, reference, and coordinate with the current Airport Master Plan or Airport Layout Plan.
- Provide an inventory of airport operations and facilities, both existing and planned.
- Identify the siting and expansion process of general aviation airports. (required by law).
- Promote inter-jurisdictional planning that encourages regional transportation linkages and multimodal connections to and from aviation facilities and employment centers.

Tips

Be sure to remember:

- Comprehensive plans are amended no more than once a year. Jurisdictions are required to formally consult with aviation stakeholders and WSDOT Aviation during the development of these policies and plans.
- Jurisdictions are also required by Washington state law (RCW 36.70A.040) to coordinate policies on related regional issues, such as airports. Jurisdictions within an airport influence area should have policies that are consistent with those of the other jurisdictions, though they don't need to be identical.

Land Use Element

The land use element should:

- Discourage incompatible residential development by establishing criteria, standards and compatible land-use designations within the airport influence area.
- Identify the best available science used to develop residential compatibility criteria.
- Include criteria and standards addressing noise, overflight, safety, and airspace protection.
- A map of the Federal Aviation Regulations Part 77 airspace protection surfaces indicating the acceptable heights of objects in and near the runway approach zones.

Housing Element

The housing element should:

- Recognize the airport as an industrial use.
- Include a map that identifies the airport influence area.
- Inventory compatible and incompatible land uses within the airport influence area.
- Discourage development of incompatible uses by establishing criteria, standards and compatible land-use designations for the airport influence area.
- Encourage alternatives to residential development within the airport influence area.

Capital Facilities Element

The capital facilities element should:

- Provide an inventory of airport facilities. Jurisdictions planning under the Growth Management Act and owning an airport are required to inventory the airport facilities as a part of this element.

Use an aviation sub-element to document the methods, data, analysis and results of the jurisdiction's land-use compatibility process. This sub-element preserves information as a part of the public record and establishes an easy-to-use tool to gauge compatibility efforts.

Aviation Sub-Element

Jurisdictions with airports in their midst should consider developing an aviation sub-element within the transportation element of their comprehensive plan. An aviation sub-element can be particularly useful for jurisdictions that both own the airport and control the land uses around it. In this way, all of the key information about planned airport improvements and projected activity can be brought together with the planning for future roads, infrastructure, and land use development in the airport environs. Competing objectives should become more readily apparent and policies can be set in place to help ensure long-term airport land use compatibility.

WSDOT Aviation highly recommends the addition of an aviation sub-element because it establishes a defendable public record of the process and analysis the jurisdiction used to achieve its land-use compatibility goals. Recommended components of this sub-element include:

- Introduction and description
- Goals
- Policies
- Compatibility criteria
- References to aviation planning documents: Airport Master Plan or Airport Layout Plan
- Map of the airport influence area
- Map of surrounding land uses
- An inventory of compatible and incompatible land use
- FAR Part 77 Airspace Protection Surfaces map
- Airport compatibility overlay map
- Formal consultation process with WSDOT Aviation
- Public participation process

Sub-Area Plans

Another way of focusing airport and airport land use compatibility topics in one component of the comprehensive plan is via a sub-area plan. Many jurisdictions, particularly counties, cover wide geographic areas. While the comprehensive plan addresses issues that are common to all or many parts of the jurisdiction, individual locations may have planning issues that are unique to that area and warrant closer investigation. In these instances, a set of sub-area plans may be prepared to address these issues.

The environs of airports often pose planning challenges that make these areas distinct from elsewhere in the jurisdiction. In these instances, creating an airport sub-area is worth considering. The airport's role within the community and the importance of airport land use compatibility would be a major focus. Goals and policies should address these topics. Implementation actions to be taken to pursue airport land use compatibility should be described in detail.

Urban Growth Area Issues

Jurisdictions are required by the GMA to comprehensively plan for future development and make informed land-use decisions. A part of this planning effort is the urban growth boundary (UGB). It represents the community's projected land use needs for the next 20 years. Land within a jurisdiction's UGB should be capable of accommodating the community's urban growth needs, including residential, commercial, industrial, institutional, and other uses.

Critical Concept!

It is extremely important to understand that lands within the UGB will be developed to an urban level of intensity and use. If the property is zoned for single-family residential development, it will be developed to an urban density that is incompatible with an aviation environment. In much of the airport influence area, multi-family residential is preferable to single-family because it is less susceptible to noise intrusion.

The basic concept of the UGB is to focus growth in appropriate areas where infrastructure, such as sewer, water and power, already exists. This discourages leap-frog developments and costly sprawl which, over time, diminishes the quality of life for Washington residents. Jurisdictions are required to review UGBs, at least every seven to ten years and make changes if needed. Many jurisdictions revisit their plans and update them every year.

Click here for more information: www.commerce.wa.gov/site/402/default.aspx

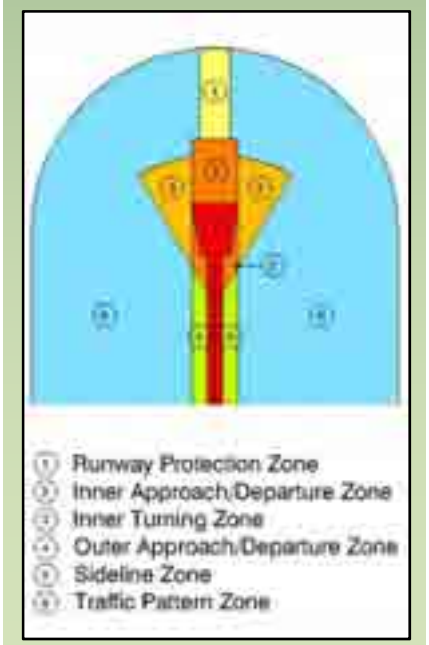
How can the *Urban Growth Boundary* be used to promote airport land use compatibility?

- **Inside the UGB.** An urban growth boundary (UGB) allows property adjacent to an airport to be developed for complementary commercial and industrial use. Having an airport inside the UGB boundary allows a community to unlock its economic potential as a transportation asset. When surrounding property is zoned appropriately, it can be developed to its fullest potential and yet be compatible with the airport.
- **Outside the UGB.** If a community contains enough land to accommodate foreseeable growth over the next 20 years, lands within the airport influence area should preferably remain outside the UGB. Because many types of development that would be incompatible with the airport are not allowed outside the UGB, protecting the airport from encroachment can be easier to accomplish than when the airport is inside the UGB.

Addressing Particular Land Use Types

A central component of all comprehensive plans is the land use map. Here is where the future geographic pattern of land uses in the community are depicted. For most communities, the majority of the land will show designations that simply represent what already exists on the ground indicating that no changes in the uses are contemplated. Where this is the case, there is little that your airport land use compatibility efforts can accomplish other than to maybe encourage land uses that are incompatible with airport activities be redeveloped and converted to more compatible uses.

The greatest opportunities for promoting airport land use compatibility are within the portions of the airport influence area where new development is planned and flexibility remains as to what types of land uses to locate where. Expanding upon the basic compatibility criteria noted in Table 2–4 of Chapter 2, listed below are brief assessments of the positive and negative compatibility aspects of basic land use categories. More detailed evaluations are included in Appendix *[to be added]*.



Generic Compatibility Zones

Agricultural Uses

- Most agricultural uses are compatible with airports
- Orchards may be incompatible near runway approaches because of the height of trees
- Crops that attract waterfowl or flocks of birds should be avoided
- Packing facilities and similar high-intensity agricultural-related functions should not be situated in runway approach zones.

Residential Uses

- It is best to minimize new residential development in the airport influence area because of noise, overflight, safety impacts
- No new dwellings should be allowed inside any runway protection zone
- Outside the urban growth boundary, scattered, large-lot, agricultural-related residences are acceptable, but not subdivisions.
- Inside the urban growth boundary, new residential development should not be planned for high-noise areas or any of the approach compatibility zones (Zones 1 through 5); in the traffic pattern area (Compatibility Zone 6), multi-family residential is preferable to single-family uses because safety concerns are low and multi-family residences are less susceptible to noise intrusion.

Schools and Institutional Uses

- Give children's schools the highest degree of compatibility protection; don't allow new schools or expansion in high-noise areas or the approach compatibility zones; the same applies to large day-care facilities
- Libraries should generally be treated the same as schools
- Hospitals, nursing homes, and other medical facilities where patients remain overnight should not be situated in approach compatibility zones

Parks and Recreational Facilities

- Parks and recreational facilities intended primarily for children should follow the same criteria as for schools
- Other facilities that don't have spectator seating can be located anywhere in the airport influence area other than the runway protection zones

Commercial Uses

- The airport compatibility of commercial uses depends largely upon their intensity—the number of people concentrated on the site—and proximity to the runway approaches
- Office-type uses, particularly those having only one or two floors, are generally acceptable throughout the airport influence area except in and near the runway protection zone (Compatibility

Zones 1 and 2); taller buildings may present airspace obstruction issues as well as be too intense (too many people) for good safety

- Retail spaces are generally acceptable beyond Compatibility Zones 1 and 2, but major shopping centers and big-box stores should not be located in any of the compatibility zones; low-intensity retail uses such as furniture stores are preferable
- The high concentration of people in many dining establishments makes them vulnerable to aircraft accident risks and should be avoided in the approach compatibility zones, particularly Zone 2
- Lodging facilities are generally compatible with airport—and often located nearby—but should not be situated within the runway approaches (Zones 1 through 5) because of noise and safety impacts

Industrial Uses

- Most light-industrial uses are low intensity and low height, making them preferred choices for close to the airport
- The compatibility of heavy industry depends on the facility—tall smokestacks or other features, generation of steam or electromagnetic interference, and storage or use of large amounts of hazardous materials are all features that are incompatible within the runway approach zones

Warehouse and Storage Facilities

- These types of facilities are generally ideal near airports because they have few occupants
- Efforts should be made to avoid placing large buildings directly on the extended runway centerline; for safety, keep this area open or use it for automobile parking lots

Sports Arenas and Large Assembly Facilities

- The high concentrations of people in sports arenas, convention centers, multiplex theaters, large places of worship, and other assembly facilities (500 or more people) makes them incompatible within any of the compatibility zones, including the traffic pattern zone (Zone 6)
- Outdoor arenas and amphitheaters can be particularly incompatible because no structure provides protection from a light aircraft accident; noise intrusion can also be an issue

Utilities and Communications Facilities

- Critical facilities that could be made inoperable if struck by an aircraft should not be situated in the approach compatibility zones

Addressing Compatibility in the Zoning Ordinance

Beyond the comprehensive plan itself, the zoning ordinance is the most fundamental tool available for addressing airport land use compatibility issues. Various types of development regulations can be structured as zoning ordinances. The two forms of zoning most clearly applicable to compatibility planning are traditional, community-wide zoning and overlay zoning.

Critical Concept!

To be successful in implementing both an airport overlay and traditional zoning, the two strategies must have and maintain a give-and-take relationship. This means you cannot change the underlying zoning without due process or cause, such as a change in circumstance or operations. Jurisdictions should establish a clear record of their methodology and goals regarding efforts to achieve a more compatible environment though the use of both tools.

Conventional Zoning

Conventional zoning ordinances typically involve two components: text and a map. The text defines the categories, uses and standards of development permitted within a particular land use designation. The map demonstrates the spatial distribution of the zoning classifications.

Historically, zoning has been used as a land-use control technique to segregate incompatible land uses and establish standards for the type and intensity of use. Zoning ordinances typically categorize land uses into several different classifications. Usually included are: residential, commercial, industrial, institutional/governmental, parks/open space, and agricultural. The exact classifications will vary from jurisdiction to jurisdiction. Zoning is also used to regulate the manner in which structures can be placed on the site—setback distances, lot coverage, and allowable height. Parking and landscaping requirement for each land use classification are typically specified in the zoning ordinance as well.

Click here to review your jurisdiction's development regulations:
www.mrsc.org/codes.aspx

How can *Conventional Zoning* be used to promote airport land use compatibility?

To discourage the encroachment of incompatible land uses within the airport influence area, jurisdictions can implement zoning that limits residential development and promotes compatible commercial, agricultural, light industrial and mixed use development. Parcels within the airport influence area should, at a minimum, be maintained at their current level of compatibility or rezoned for a more compatible use. Parcels should not be rezoned to allow a more incompatible use. Remember, jurisdictions are required to discourage incompatible development, not encourage its proliferation through passive zoning regulations.

Airport Overlay Zoning Ordinance

Overlay zoning is used to modify the standards set in the conventional zoning ordinance. While the land use classifications established in conventional zoning are applicable wherever that land use occurs within the jurisdiction, overlay zones are usually created to be applied only within smaller geographic areas. Overlay zones either modify or supplement the criteria and restrictions of the underlying zoning classification.

Airport Overlay

Critical Concept!

While the airspace protection (FAR Part 77) component of an airport overlay zoning ordinance is certainly important, it is not enough to stop there. As emphasized throughout this *Guidebook*, there are other facets to airport land use compatibility besides height limits. Noise, overflight, and safety compatibility criteria need to be established as well. These criteria can be identified in a separate ordinance or included with the height limit zoning into one airport overlay zoning ordinance, but they need to be addressed somewhere.

Overlay zoning is a highly useful and efficient tool by which land use compatibility measures for an airport influence area can be applied. By creating an airport overlay zone, the underlying zoning criteria for property within the airport influence area can be modified to ensure compatibility with the airport, yet be applied without modification elsewhere in the community. In this way, the need to create an "airport industrial," "airport commercial," or other such classifications specific to the airport influence area can be avoided.

As an example, commercial and industrial uses are generally compatible with airports, but some of these uses may include features that would be incompatible. The use might involve high numbers of people, be too tall, be highly noise sensitive, or generate smoke, all of which would be unsuitable for the airport environs. An airport overlay zone can prevent new development that would contain these features.

Height limits established to implement FAR Part 77 airspace protection standards (see below) are a prime example of airport overlay zoning. However, an airport overlay zoning ordinance that fully addresses airport land use compatibility matters must contain more than aviation-related height limits. It also needs to ensure that land use development is compatible with the noise and safety impacts of airport activity.

How can an *Airport Overlay Zoning Ordinance* be used to promote airport land use compatibility?

Use the airport overlay to prohibit or restrict land use features and activities within underlying zoning districts where those features or activities would be incompatible with the airport or create unsafe operating conditions Use the overlay to address issues such as:

- Tall structures and development that would penetrate critical airspace surfaces within airport influence area.
- Stormwater or other facilities (such as stormwater or agricultural operations) that may attract hazardous wildlife. The overlay may direct staff to use a specific standard such as the Washington Aviation Stormwater Manual.
- Special function uses, such as facilities that produce interference with air navigation (i.e. smoke, electromagnetic interference).
- High-intensity land uses, such as schools, places of worship, and sporting arenas.
- Above-ground bulk storage of fuel, explosive, or hazardous chemicals within the airport approach or other sensitive areas.
- Noise-sensitive uses.
- Reflective building materials. The overlay may suggest reducing light and glare by limiting the type of materials or requiring special conditions such as downward shaded lighting equipment.
- Promoting compatible uses such as mixed use.

Airspace Protection / Height Limit Overlay

The Federal Aviation Administration's Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, establishes standards for determining obstructions to the airspace necessary for safe aircraft operations. To do this, the regulations define a set of airspace protection surfaces referred to as "imaginary surfaces." The sizes and shapes of the surfaces are determined by the airport's runway configuration, the weight of the aircraft each runway can accommodate, and the type of approach procedure (visual, non-precision, or precision) at each runway end. There are five types of surfaces:

- **Primary Surface.** It is longitudinally centered on a runway and, if the runway is paved, extends 200 feet beyond the runway ends.
- **Approach Surfaces.** These surfaces begin at the end of the primary surface and extend from 5,000 feet to as much as 50,000 feet if the runway has a precision approach. The surface slopes upward at a horizontal-to-vertical ratio of 20:1, 34:1, or 50:1.
- **Transitional Surfaces.** These surfaces are situated along the edges of the primary and approach surfaces. They have a slope of 7:1 running at right angles to the runway centerline.
- **Horizontal Surface.** As the name suggests, this surface is a horizontal plane. Its elevation is 150 feet above the highest point on the airport runway(s) and it extends either 5,000 or 10,000 feet from the runway.
- **Conical Surface.** Extending outward and upward from the periphery of the horizontal surface, the conical surface has a slope of 20:1 for a horizontal distance of 4,000 feet.

Objects that are too tall may constitute airspace hazards. By holding objects to heights that remain below the FAR Part 77, land use jurisdictions can ensure that constraints are not placed on the length of the runway usable for aircraft takeoffs and landings or on the runway's instrument approach procedures.

See Appendix D for a diagram of FAR Part 77 imaginary surface and a chart of the surfaces' dimensions.

Did You Know?

The FAA relies on local jurisdictions with land use authority to keep critical airspace clear of obstructions. If jurisdictions permit tall structures within the approach of their community airport ,it may limit the airport's ability to develop a more sophisticated instrument approach in the future.

Tips

- Remember that FAR Part 77 standards apply not just to proposed man-made objects and objects of natural growth, but also to movable or temporary objects such as vehicles and construction cranes.

How can an *Airspace Protection* / *Height Limit Overlay* be used to promote airport land use compatibility?

Use the airspace definitions provided in federal law to identify Part 77 surfaces for your airport, and include in the development regulations language that prohibits penetration of these surfaces. Provide a map and instructions to assist community members, airport managers, and planning staff with implementing the regulations.

Click here for the airspace assessment worksheet. (To be added)

Airport Noise and Safety Overlay

This component of an airport overlay zoning ordinance can cover a wide range of compatibility criteria. For example, the standard zoning designation for a property could be modified to enhance airport compatibility by:

- Requiring extra sound insulation if the building is in a high-noise location
- Restricting the amount of outdoor living space for residential uses
- Prohibiting dining or assembly spaces in facilities situated where accident risks are high
- Limiting the number of occupants in a building

- Limiting the building footprints on large sites to encourage open land
- Requiring that the building have sprinklers or other features to enhance safety in the event of an aircraft accident
- Prohibiting storage of large quantities of hazardous materials

Also see Noise and Safety Tools later in this chapter.

Other Types of Zoning Ordinances

Form-Based Codes

Form-based zoning codes differ from traditional zoning in that they focus on the size and shape of buildings rather than on the way the land is used. The codes often include drawings illustrating how buildings should relate to the public spaces around them. While not highly widespread in application, form-based codes are becoming more common particularly for the more highly developed, core areas of cities and where redevelopment to more intensive uses is desired.

How can *Form-Based Codes* be used to promote airport land use compatibility?

Form-base codes have pluses and minuses in terms of their relationship to the objectives of airport land use compatibility planning. They might be beneficial in setting height limits, defining building types that offer better protection in the event of an aircraft accident, and in setting criteria for open land areas where an emergency landing could be made. On the other hand, they typically do not address occupancy types that are at the heart of conventional zoning and compatibility planning. Nevertheless, by incorporating provisions addressing usage intensities and noise sensitivity, form-based codes could be an ideal mechanism for promoting airport land use compatibility in urban communities.

Wireless Communication Facilities Ordinance

In the last decade, Washington State has seen an unprecedented growth in wireless communication facilities. Unfortunately, most jurisdictions lack development regulations governing the siting of wireless communication facilities communication towers and other tall structures that can be hazards to aviation. Wireless communications antennas—because of their height and relative inconspicuousness from a fast-moving aircraft—can adversely affect airport airspace. The frequent location of these facilities on ridge lines and other high terrain can pose conflicts with aviation airspace even when situated well away from an airport. The potential for electronic interference with aircraft communications also should be examined in the siting of the antennas.

How can a *Wireless Communications Facilities Ordinance* be used to promote airport land use compatibility?

Jurisdictions can craft ordinances to address the siting of wireless communication facilities. Ordinances can be designed to minimize obstruction of critical airspace by allowing their construction in safe and appropriate areas, and thus discourage their placement adjacent to aviation facilities.

Jurisdictions should:

- Work with stakeholders to identify pre-approved areas for cell towers
- Expedite the process for cell tower companies

A wireless communications ordinance should include:

- A definition of wireless communication towers
- Prohibit penetration of the FAA's FAR Part 77 "Imaginary Surfaces"
- Require co-location of communication facilities/structures to accommodate multiple communication antennas—new towers should not be built until it is demonstrated that no existing towers or structures (such as rooftops, water towers) can accommodate the equipment
- Designate approved and prohibited locations
- Designate:
  - maximum allowable height in geographic locations
  - setbacks
  - compliance with various standards such as the Uniform Building Code, National Electric Code

Other Zoning Tools

Conditional Use Permit

Conditional use permits are another way in which the criteria of underlying zoning designations can be modified. Many uses are appropriate for a particular zoning district, but may require special consideration to integrate them into the community. Conditional uses are permitted only where certain conditions exist. For example, residential uses may be permitted in nonresidential zoning districts when they meet these criteria.

Variances

A variance is nothing more than a waiver of one or more specific physical (rather than use) standards, such as bulk, yard, site coverage or height, contained in an ordinance. Variances should be used only in extreme circumstances. The Planning Enabling Act details several prerequisites which **must** be met before a variance may be granted. These include:

- Special circumstance of the subject property (including size and shape or surroundings). Strict application of the zoning ordinance would deprive the property owner of rights or privileges enjoyed by other owners of properties in the vicinity and under identical zone classifications.
- That the granting of the variance will not be materially detrimental to the public welfare or injurious to the property or improvements in the vicinity and zone in which the subject property is located.

Docketing Process

How to recommend changes to your jurisdiction's comprehensive plan and development regulations?

Docketing is a process by which parties recommend changes to comprehensive plans and development regulations. Jurisdictions compile and maintain a list of suggested changes and consider them on an annual basis. The docket process allows parties to note deficiencies and recommend changes. These suggested changes are reviewed by the jurisdictions and made available for review by the public. There is no fee for submitting the docket form in some jurisdictions. This process allows for public input on policy affect land use compatibility.

Tools that Address Specific Airport Land Use Compatibility Factors

Noise and Compatibility Criteria

Density and Intensity Limits

Establishment of criteria limiting the maximum number of dwellings or people in areas close to the airport is the most direct method of reducing the potential severity of an aircraft accident. In setting these criteria, consideration must be given to the two different forms of aircraft accidents: those in which the aircraft is descending, but is flying and under directional control of the pilot; and those in which the aircraft is out of control as it falls (also see later discussion of Clustering).

Limits on usage intensity—the number of people per acre—must take into account both types of potential aircraft accidents. To the extent that accidents and incidents are of the controlled variety, then allowing high concentrations of people in a small area would be sensible, as long as intervening areas are little populated. However, concentrated populations present a greater risk for severe consequences in the event of an uncontrolled accident at that location. Limiting the average usage intensity over a site reduces the risks associated with either type of accident. In most types of land use development, though, people are not spread equally throughout the site. To minimize the risks from an uncontrolled accident, the criteria should also limit the extent to which people can be concentrated and development can be clustered in any small area.

Open Land Requirements

Creation of requirements for open land near an airport addresses the objective of enhancing safety for the occupants of an aircraft forced to make an emergency landing away from a runway. If sufficiently large and clear of obstacles, open land areas can be valuable for light aircraft anywhere near an airport.

For large and high-performance aircraft, however, open land has little value for emergency landing purposes and is useful primarily where it is an extension of the clear areas immediately adjoining a runway.

Noise Insulation

[to be added]

Notice of Proposed Construction (FAA Form 7460)

The principal mechanism by which the Federal Aviation Administration monitors obstructions to airport and en route airspace under FAR Part 77 is through the requirement that Notice of Proposed Construction be submitted to the agency. The form used to submit this information is known as FAA Form 7460. The notification requirements are specified in Subpart B of the Part 77 regulations. Specifically, notification is required, with certain exceptions, for any proposed object that would have a height exceeding an imaginary surface extending outward and upward from a runway at a slope of:

- More than 50:1 for a horizontal distance of 10,000 feet at airports where no runway is longer than 3,200 feet; or
- More than 100:1 for a horizontal distance of 20,000 feet at airports having a runway longer than 3,200 feet.

Additionally, any object taller than 200 feet requires FAA notification, regardless of the object's proximity to any airport.

Note that these notification slopes are shallower than those of Subpart B which are used to identify obstructions. Exceptions to the notification requirements are made for objects in developed communities where the proposed object would be shielded by existing structures or terrain of equal or greater height. Antennas less than 20 feet in height are also exempt unless added to existing antennas.

Also important to understand is that Federal law places the burden for FAA notification of development near airports on the proponents of such development, not on the local land use jurisdiction. The role of local jurisdictions is to alert project proponents of the notification requirements.

Noise insulation

Tips

- Local jurisdictions also should include an explicit step in their approval process for projects in an airport influence area to check that the project proponent has submitted Form 7460 to the FAA and has received a response documenting the results of the FAA's aeronautical study of the proposal.

Other Hazards to Flight

Wildlife Attractants

Among other physical hazards to flight, bird strikes represent the most widespread concern. Measures based upon FAA guidance should be established to prevent creation of known types of conflicts and to enable mitigation of unanticipated problems. Particular attention should be paid to any proposed use that could create an increased attraction for birds and other wildlife. These uses include landfills and certain recreational or agricultural uses that attract large flocks of birds and may pose bird strike hazards to aircraft in flight.

Waterfowl, gulls, and raptors represent 77% of reported bird strikes causing damage to aircraft in the US.

The FAA recommends that uses known to attract birds—sanitary landfills and certain types of crops being primary examples—be kept at least 5,000 feet from runway used only by piston-powered aircraft. For runways used by turbine-powered aircraft, the distance increases to 10,000 feet.

FAA rules and regulations concerning these hazards are found in FAA Order 5200.5A, *Waste Disposal Sites on or Near Airports*, and Advisory Circular 150/5200-33, *Hazardous Wildlife Attractants On or Near Airports*.

Thermal Plumes

An additional, little recognized, physical hazard to aircraft flight are thermal plumes generated by power plants. Invisible unless the heated air turns to steam, the plumes from large facilities can create unstable air at the altitude that airplanes or helicopters fly when near airports. Power plants and other facilities that generate large thermal plumes should be avoided within airport traffic pattern areas.

Visual and Electronic Interference

Criteria defining land use characteristics that can cause visual or electronic hazards to flight are more qualitative in nature—the FAA has not set any precise standards. In general, visual hazards to flight include sources of dust, steam, smoke, or glare that can impair pilot visibility, as well as distracting lights that can be confused for airport lights. Electronic hazards are ones that can cause interference with aircraft communications or navigation. While it is not always possible to prevent these types of hazards to flight from occurring, awareness of the potential can often enable reduction or mitigation of the most serious problems.

Avigation Easements

An easement that includes noise-related provisions, but not height limits, is often called a *noise easement*.

As with any type of easement, an avigation easement is a conveyance of specified property rights from the owner of the property to another party. Avigation easements are recorded with the title to the underlying properties and run with the land—that is, they remain in effect even

with sale of the property. In most cases, avigation easements are owned by the entity owning the airport. The airport may obtain the easements either through purchase or via dedication.

An avigation easement typically gives the easement owner the right to fly aircraft over the property at a low altitude and to cause noise, vibrations, exhaust particle emissions, and other impacts associated with normal flight. Limits on the heights of structures, trees, and other objects are also usually established by avigation easements. To enforce these limits, an avigation easement may give the easement owner the right to enter the property to remove or reduce the height of objects that exceed the height limits.

In addition to the specific rights that avigation easements convey, another function they serve is as a form of buyer awareness that carries with it a degree of legal protection for the airport. By having an avigation easement on their property, property owners cannot easily argue politically or through litigation that the airport generates unacceptable noise levels or creates other impacts. While useful in this way, avigation easements do nothing to change the fundamental incompatibility of residential and other inappropriate land uses—they do not address the quality of life people experience.

Another important limitation of avigation easements is that they normally do not restrict the underlying use of the property. Thus, the property could still be used for residential or other type of land use that would be incompatible with airport activity in ways other than height. Where airports wish to prohibit specific land uses—or, conversely, only allow specified uses—they sometimes acquire a type of easement sometimes called an *approach protection easement*. In practice, though, approach protection easements are only occasionally used because their cost is usually not much less than for fee title acquisition.

How can *Avigation Easements* be used to promote airport land use compatibility?

Short of fee title property acquisition, airport ownership of an avigation easement is the most certain means of ensuring protection of the runway approaches from too tall objects. For property located close to runway approaches where common structures, trees, and other objects could penetrate the airport airspace, a common practice is to require that the property owner dedicate an avigation easement to the airport as a condition for local approval of property development.

An additional benefit to avigation easements is that they serve as a form of buyer awareness tool as described in the next section. Caution should be exercised, however, in attempting to require avigation easement dedication in locations where buyer awareness is their only purpose. Their most appropriate use is for locations where height limits are substantial or where significant constraints on the development or use of the property are necessary for noise or safety reasons.

Buyer Awareness Tools

Chapter 1 of this *Guidebook* described aircraft overflight as one of the four types of impacts needing to be addressed by airport land use compatibility tools. The preferred strategy to avoid overflight impacts is to promote types of land uses that tend to mask or reduce the intrusiveness of aircraft noise.

To the extent that residential land uses must be located in aircraft overflight areas, multi-family residences—because they tend to have comparatively little outdoor living areas, fewer external walls through which aircraft noise can intrude, and relatively high noise levels of their own—are preferable to single-family dwellings. Particularly undesirable are "ranchette" style residential areas consisting of large (about an acre on average) lots. Such developments are dense enough to expose many people to overflight noise, yet sufficiently rural in character that background noise levels are likely to be low.

Where this strategy is impractical, then a second option is to help people with above-average sensitivity to aircraft overflights to avoid living in locations where frequent overflights occur. This strategy involves making people more aware of an airport's proximity and its current and potential aircraft noise impacts on the community before they move to the area. This can be accomplished through buyer awareness tools such as recorded deed notices and/or real estate disclosure statements.

Recorded Deed Notices

This type of device goes by various names including deed notice and overflight acknowledgement. The key point is that the information about airport proximity is recorded on the property deed, but a conveyance of property rights is not involved. County assessors sometimes have concerns over recording of information that does not involve the property description or property rights, but this is usually less of an issue when the notice is applied as a condition for new development approval rather than to existing development.

Disclosure During Real Estate Transactions

Some states have established statutory guidance with regard to disclosure of external impacts on a property such as noise, odors, natural hazards, and proximity to undesirable land uses. Airport proximity and the presence of frequent aircraft overflights may be one of the conditions to be disclosed during the sale or lease of residential property.

Disclosure is an obligation between private parties and normally not something that state or local governments can dictate. Nevertheless, WSDOT Aviation encourages counties, cities, and towns that have airports in their jurisdictions to identify the area within which airport proximity disclosure would be appropriate and to make this information known to real estate agents and others who are regularly involved in facilitating real estate transactions.

Other Tools for Enhancing Compatibility

Tools for Addressing Specific Airport Land Use Compatibility Issues

The land use compatibility tools described in the first part of this chapter are ones that apply broadly throughout a community and typically are employed during the comprehensive plan update process. The group of tools outlined here may be enabled through the comprehensive plan or zoning ordinance, but are more narrowly focused in their application. Typically, they will come into play with regard to a specific land use development proposal.

Clustering of Development

Clustering is the grouping of a particular development's structures on a portion of available land. This reserves a significant amount of the site as protected open space. Cluster developments are appropriate for all types of development activity. They may be used in conjunction with commercial, industrial, mixed-use, and residential development. The advantage of this land-use technique to the community is that it preserves open space and critical areas. The advantage to the developer is the opportunity to construct at a higher intensity or height and a lower cost of infrastructure and the ability to develop open space for passive uses.

Clustering

How can *Cluster Development* be used to promote airport land use compatibility?

Clustering has several advantages for airport land use compatibility planning. It can be especially valuable with respect to safety if portions of the remaining undeveloped land are not just free of buildings, but also relatively flat and clear of other large objects such as trees and poles. If large enough—about a football field in size—these "open land" areas can potentially serve as emergency landing spots for small aircraft. For residential uses, clustering the dwellings into multi-family buildings can make them less susceptible to noise intrusion.

One caution to recognize with clustering is that its use should be limited in areas where the potential for aircraft accidents is elevated. Providing open land areas can enhance the prospects for successful near-airport emergency landings when the aircraft is under control while descending. However, many accidents involve aircraft that are out of control and will strike whatever is in their path. Allowing too high of a concentration of people in the high-risk compatibility zones is not wise.

Transfer of Development Rights

A transfer of development rights (TDR) program is a market-based mechanism that encourages the voluntary transfer of growth from places where a community would like to see less development (referred to as sending areas), to places where a community would like to see more development (referred to as receiving areas). The owner of a site within a sending area retains property ownership, but gives up all or part of the rights to develop the property in the manner that local zoning would have otherwise allowed. The owner of a site within a receiving area may purchase transferable development rights from an owner or owners of property in the sending area, allowing the sending area owners to obtain

Transfer of Development Rights

value for the property and the receiving area owner to develop the receiving property to a greater density or intensity than would have otherwise been permitted.

How can *Transfer of Development Rights* be used to promote airport land use compatibility?

Use a Transfer of Development Rights program to:

- Designate sending areas for residential development rights within the airport influence area. Target aviation environments impacted most by airport operations.
- Keep critical areas clear of all development - residential, commercial, industrial, etc.
- Designate receiving areas for residential development rights outside the airport influence area.
- Increase density and allow greater structure heights adjacent to transit hubs.
- Encourage infill development to maximize preexisting infrastructure such as power, water and sewer.
- Promote compatible commercial and industrial development.
- Promote preservation of open space by sending incompatible activities to appropriate locations.

Infill Development

Every jurisdiction across the state has property that is either vacant or underdeveloped relative to its potential use as identified in the comprehensive plan and zoning maps. Infill is the practice of developing or redeveloping vacant or underutilized land in the midst of a community, especially land that is surrounded by existing uses similar to the ones proposed. This may mean further subdivisions of existing parcels to accommodate additional growth, redevelopment of under-utilized property to increase its density or intensity, or simply creation of new development on vacant land. Infill is often a desirable goal since it utilizes existing infrastructure and reduces development pressure on land outside the UGB. In many cases infill development results in a higher residential density.

Tips

- From a practical standpoint, it is usually impossible to prevent a small, vacant piece of property located in the midst of a larger area of airport-incompatible uses from being developed in the same manner as its neighbors. Compatibility conflicts unrelated to the airport would occur. Still, it is important not to let infill become the rationale for permitting extensive new airport-incompatible development to move forward. An acreage limit and other qualifications should be set on infill development.
- Consider establishing the following conditions for infill uses:
  - Limit the size to 20 acres
  - Require the site to be two-thirds surrounded by existing uses similar to the one proposed
  - Restrict the new development to a density and/or intensity no greater than that of the surrounding uses

How can *Infill Development* be used to promote airport land use compatibility?

Use infill development to maintain or increase the current level of community compatibility. When appropriate, use infill development to encourage transitions within the community to a more harmonious environment. Promote the addition of mixed use, commercial, light industrial, or, when left with no viable alternative and in an appropriate environment, multi-family. Always remember, residential development should be avoided in critical aviation environments. In an urban environment, creative zoning designations may be employed that allow the addition of a mixture of land uses. For example a professional classification may be added that allows existing land to be developed for convenience retail, art studios, office, auto sales, and many more. Use infill development to maintain preexisting commercial and industrial uses.

Redevelopment

As older, established communities grow and change over time, there often is a need to remove all or most of the existing structures so that something new can be constructed. Redevelopment can be powerful tool for revitalizing deteriorating, under-utilized property. However, when the property proposed to be redeveloped is occupied by an existing airport-incompatible land use, every effort should be made to use this as an opportunity to enhance airport compatibility.

Basically, unless a site is small and can qualify as infill, redevelopment should be considered the same as new development. The proposal should be required to meet all of the applicable airport land use compatibility criteria.

Tips

- Communities change over time and often start to transition before jurisdictions even become aware of the change. Be sure to do a physical survey of the area to check for precursors of community transition. Undocumented home-based businesses are often good indicators of a transition to commercial or light industrial uses.

How can *Redevelopment* be used to promote airport land use compatibility?

Use redevelopment as an opportunity to enhance airport compatibility, not simply to continue or worsen compatibility conflicts. Look for opportunities to encourage office, light industrial, and other uses that are not high intensity or noise sensitive. If residential uses need to be a component of the redevelopment, make the uses multi-family as this type of structure reduces the intrusiveness of noise.

Mixed Use Development

Mixed-use development is the combination of residential, commercial, industrial, office, institutional, or other uses in a building or group of buildings. In theory, this practice promotes a more walkable, sustainable, vibrant and livable community.

How can *Mixed Use Development* be used to promote airport land use compatibility?

Mixed-use developments are often compatible with aviation because they often have higher background noise levels that tends to mask aircraft noise. Mixed-use developments may be either used to transition a pre-existing development area to a more aviation-compatible environment, or to promote compatibility in new developments within non-critical aviation areas, such as beneath the downwind leg of the traffic pattern. To achieve a more aviation-compatible environment, jurisdictions should carefully review mixed-use criteria implementing this technique. Mixed-use criteria should include:

- Compatibility with existing and planned airport operational environments
- Compatibility with existing land uses
- Adequate infrastructure in place
- Sufficient public facilities and public services
- Served by adequate transportation infrastructure

Airport-Directed Actions

These are a few of the tools that airport management can employ to help encourage land use compatibility.

Airport Development Review Committee

An Airport Development Review (ADR) committee is a volunteer board, appointed by the airport or local jurisdiction, that ensures compliance with the jurisdiction's goals, policies and implementation regulations.

Committee members volunteer their time and expertise to ensure that development within the airport influence area is compatible with the current and future airport environment.

How can an *Airport Development Review Committee* be used to promote airport land use compatibility?

Use the Airport Development Review Committee to review proposed development within the airport influence area. Draw upon local skills and expertise in regards to airport operations and planning. Be sure to include a variety of stakeholders. The goal of the committee is to assess the compatibility of proposed uses in relation to the jurisdiction's goals, policies and development regulations. Have the committee meet once a month to review applications and make recommendations to the jurisdiction's planning staff. The committee may be used to review Planned Unit Developments (PUD), variances, and conditional-use permits.

Airport Stormwater Design Manual (ASDM): Discouraging Wildlife Attractants

Stormwater and other hazardous wildlife attractants near airports pose a significant safety risk. In fact, about 75 percent of all civil aviation air strikes occur near airports. Waterfowl, gulls and raptors represent 77 percent of reported bird strikes causing damage to aircraft in the U.S. In 2009, WSDOT Aviation, in coordination with WSDOT Environmental Services and the Federal Aviation Administration (FAA), developed a stormwater design manual to assist in the design, construction and maintenance of stormwater facilities on and near airports. The manual focuses on design modifications to decrease the attractiveness of stormwater facilities to wildlife rather than active wildlife removal measures.

How can an *Airport Stormwater Design Manual* be used to promote airport land use compatibility?

Use the Airport Stormwater Design Manual to implement stormwater best management practices within the airport influence area. Require that any new stormwater detention facilities within the approach meet or exceed recommendations found in WSDOT's Airport Stormwater Manuals.

Fly Friendly Procedure

A Fly Friendly procedure is a voluntary noise abatement program that helps airports reduce their noise footprint within the community. They are educational programs that promote recommended piloting practices and navigation techniques to help minimize impacts on surrounding land uses. Fly friendly procedures are advisory in nature and serve to help pilots be better neighbors.

They are not:

- A tool to discriminate against aircraft propulsion systems, (i.e., jets).
- A way of giving preferential treatment to specific aircraft types (i.e., fixed wing, rotorcraft, etc.).
- A way to limit commercial service or interstate commerce.

- A way to supersede Federal Aviation Regulations that govern flight or the pilot in command's responsibility for safety air navigation.

How can *Fly Friendly Procedures* be used to promote airport land use compatibility?

Working towards a more aviation compatible environment is everyone's responsibility and by implementing voluntary fly friendly procedures airport sponsors and pilots can help minimize aviation impacts on surrounding land uses. Airport sponsors can work with the pilot community on ways to minimize aircraft impacts near noise sensitive uses and residential development.

Friendly procedures may:

- Designate a preferred runway for all traffic.
- Identify the preferred pattern for fixed wing aircraft.
- Identify the preferred pattern for rotor aircraft.
- Identify overflight areas to avoid.
- Recommend a pattern altitude.
- Recommend a reduced power setting on takeoff, as soon as safe and practical.
- Encourage use of the full runway to gain maximum altitude before overflying adjacent neighborhoods.
- Recommend a climb-out distance and turn to avoid sensitive areas, if at a safe and appropriate altitude.

Scenarios

[to be added]

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Appendix **A**

Learning More About: The Legal Framework for Compatibility Planning

Introduction

The legal framework on which airport land use compatibility planning is conducted is provided by a variety of federal and state laws and regulation and legal decisions. Some of these laws and regulations must be followed by airports when they receive grant money from the Federal Aviation Administration. Mostly, though, the tools only provide guidance. In Washington State the responsibility for ensuring compatibility between an airport and surrounding land uses rests with local jurisdictions in coordination with the airport operator. Local jurisdictions include jurisdictions in which the airport is located, as well as other jurisdictions into which the airports influence area extends.

Summarized in this section are the major laws, regulations, and state Growth Management Hearings Board decisions that have an important bearing on airport land use compatibility and the issues discussed earlier in this chapter.

State Laws and Regulations

The Revised Code of Washington (RCW) is a compilation of all permanent state laws. The following list highlights some of the laws affecting airports and development around them.

Aeronautics Laws (RCW Title 14)

Laws pertaining to aeronautics are mostly gathered under Title 14.

- **RCW 14.07 and 14.08 Municipal Airports Act.** Adopted in 1941 and amended1945, the act provides for the acquisition and sponsorship of airports by Washington cities, towns, counties, port districts, and airport districts.
- **RCW 14.12 Airport Zoning Act.** This act establishes definitions and criteria, and allows local jurisdictions to adopt zoning controls to protect critical airspace from buildings, structures, or other airspace obstructions. The law provides direction and guidance to cities and counties on how to manage airport hazards.

Planning Enabling Act (RCW Chapter 36.70)

Washington's Planning Enabling Act is a set of state laws that describe planning authorities and responsibilities for towns, cities and counties. Sections particularly applicable to airport land use compatibility planning include the following.

- **RCW 36.70.320 Comprehensive Plan.** Under this section, counties are required to prepare a "comprehensive plan for the orderly physical development of the county, or any portion thereof…" RCW 35A.63.060 establishes similar comprehensive planning requirements for cities

and towns. The two required elements of comprehensive plans are a land use element and a circulation element (RCW 36.70.330). Other elements are optional (RCW 36.70.350).

- **RCW 36.70.547 General Aviation Airports**. This section mandates that:

  "Every county, city, and town in which there is located a general aviation airport that is operated for the benefit of the general public, whether publicly owned or privately owned public use, shall, through its comprehensive plan and development regulations, discourage the siting of incompatible uses adjacent to such general aviation airport."

Plans may only be adopted following formal consultation with aviation stakeholders, including WSDOT Aviation. WSDOT Aviation is tasked with providing technical assistance to local agencies preparing plans and regulations consistent with this section. All proposed and adopted plans and regulations shall be filed with the aviation division of the department of transportation within a reasonable time after release for public consideration and comment.

Growth Management Act (RCW Chapter 36.70A)

Adopted in 1990, the Growth Management Act (GMA) was enacted in response to rapid population growth and concerns with suburban sprawl, environmental protection, quality of life, and related issues. The act expands the Planning Enabling Act requirements for comprehensive planning in the state's most populous and rapidly growing counties. Twenty-nine counties are either required to fully plan under the GMA or have chosen to do so. These counties make up about 95 percent of the state's population. The remaining ten counties have limited planning requirements under the act.

Several sections are important to airports.

- **RCW 36.70A.070 Comprehensive plans – Mandatory elements.** This section lists eight elements that must be included in comprehensive plans. Most of the elements potentially affect airports in that they guide the development that may occur in nearby areas. The land use element is particularly significant to land use compatibility matters and the rural element also may be consequential to some airports. The transportation element requires an inventory of facilities and services needs, including general aviation airports, "to define existing capital facilities and travel levels as a basis for future planning."
- **RCW 36.70A.110 Comprehensive plans – Urban growth areas.** Each county that is required or chooses to plan under the GMA must designate an urban growth area or areas within which urban growth is to be encouraged and outside of which growth can occur only if it is not urban in nature. Urban growth area boundaries must be reviewed at least every 10 years and adjusted as necessary to accommodate the urban growth projected to occur in the county for the succeeding twenty-year period (RCW 36.70A.130).

> For airports located near the edge of urban areas, airport land use compatibility should be considered in determining the location of the urban growth boundary.

- **RCW 36.70A.140 Comprehensive plans – Ensure public participation.** Each county and city that is required or chooses to plan under RCW 36.70A.040 shall establish and broadly disseminate to the public a public participation program identifying procedures providing for early and continuous public participation in the development and amendment of comprehensive land use plans and development regulations implementing such plans. The procedures shall provide for broad dissemination of proposals and alternatives, opportunity for written comments, public meetings after effective notice, provision for open discussion, communication programs, in-

formation services, and consideration of and response to public comments. In enacting legislation in response to the board's decision pursuant to RCW 36.70A.300 declaring part or all of a comprehensive plan or development regulation invalid, the county or city shall provide for public participation that is appropriate and effective under the circumstances presented by the board's order. Errors in exact compliance with the established program and procedures shall not render the comprehensive land use plan or development regulations invalid if the spirit of the program and procedures is observed.

- **RCW 36.70A.200 Siting of essential public facilities – Limitation on liability.** This section deals with essential public facilities that are typically difficult to site. Airports are explicitly identified as an example of this type of facility. Others include: state education facilities, state or regional transportation facilities, state and local correctional facilities, solid waste handling facilities, and in-patient facilities including substance abuse facilities, mental health facilities, group homes, and secure community transition facilities. Counties and cities planning under GMA must have a process for identifying and siting essential public facilities. No local comprehensive plan or development regulation may preclude the siting of essential public facilities.
- **RCW 36.70A.210 Countywide planning policies.** Recognizing that counties are regional governments within their boundaries and that cities are primary providers of urban governmental services within urban growth areas, this section establishes requirements for adoption of countywide planning policies. Such policies are to serve as a countywide framework from which county and city comprehensive plans are developed and adopted and made consistent with each other. Specific topics to be covered by the policies are listed.

> Although airport land use compatibility is not explicitly listed as a topic for countywide planning policies, the statutes allow topics other than those listed to be addressed.

Findings of the Washington State Growth Management Hearings Boards

The following four decisions are ones most directly relevant to airport land use compatibility matters. The implications are noted here along with a brief indication of the topic addressed by the decision.

- ***Stephen Pruitt and Steven Van Cleve v. Town of Eatonville* – Central Puget Sound Growth Management Hearings Board (CPSGMHB Case No. 06-3-0016, December 18, 2006).** Legitimized WSDOT's role in defining the compatibility policies that need to be incorporated into a community's comprehensive plan. Guidelines developed by WSDOT could include minimum standards that would be given great weight by growth management hearing boards. However, these guidelines would be recommendations, and not regulatory in nature.
- ***State of Washington Department of Corrections and Department of Social and Health Services v. City of Tacoma* – Central Puget Sound Growth Management Hearings Board (CPSGMHB Case No. 00-3-0007, November 20, 2000).** Expansion of essential public facilities must also be accommodated by local agencies. A community's comprehensive plan therefore must support planned expansion of any airport that lies within the area covered by the plan. Guidance for expansion of airport facilities, volume of traffic and changes in aircraft fleet mix can be taken from an airport's master plan. Where a current airport master plan does not exist, the required facility planning can be done as a component of development of the comprehensive plan.

- ***Port of Seattle v. City of Des Moines*** **–Central Puget Sound Growth Management Hearings Board (CPSGMHB Case No. 97-3-0014, August 13, 1997).** The requirement to accommodate expansion of essential public services includes necessary supporting facilities and services. While this is likely to be most important at larger commercial service airports, it clearly establishes that comprehensive plans must facilitate all elements necessary for an airport to function. At commercial airports this could include such off-airport facilities as: rental car facilities, airport shuttle businesses, air freight consolidators, and airline catering companies.
- ***Hapsmith et al v. City of Auburn*** **–Central Puget Sound Growth Management Hearings Board (CPSGMHB Case No. 95-3-0075c, May 10. 1996).** Although this decision specifically addresses mitigations for a new essential public facility, it suggests that the external impacts of these uses need to be addressed. Compatibility policies contained in comprehensive plans can be viewed as a form of mitigation in that they are intended to minimize the noise and safety effects of airports. This case does not provide any guidance on the substance of mitigation. However, it does legitimize including mitigation of impacts as one more reason to include compatibility policies in comprehensive plans.

Additional decisions of interest include these:

- Local jurisdiction required to consult with airport prior to adoption of comprehensive plan amendments having an effect on the airport.
- *Son Vida II v. Kittitas County* (EWGMHB Case No. 01-1-0017; March 14, 2002)
- *NFRD v. City of Yakima* (EWGMHB Case No. 02-1-0009; December 5, 2002)
- *McHugh v. Spokane County* (EWGMHB Case No. 05-1-0004; December 16, 2005)
- High-density residential zones adjacent to airports are inappropriate/incompatible uses; jurisdictions must preclude uses non-compatible with an airport to comply with GMA.
- *CCARE v. Anacortes* (WWGMHB Case No. 01-2-0019; December 12, 2001)
- *Klein v. San Juan County* (WWGMHB Case No. 02-2-0008; October 18, 2002)
- *Futurewise v. Whatcom County* (WWGMHB Case No. 05-2-0013 September 20, 2005)

Federal Laws and Regulations

Federal airport land use compatibility policies are concerned mostly with noise issues. Several statutes deal specifically with aircraft noise. These statutes are implemented through regulations and policies of individual federal agencies, in particular the Federal Aviation Administration (FAA). Federal guidance with regard to airport land use safety compatibility is primarily limited to FAA regulations concerning airport design and the protection of airport airspace.

Statutes

Three statutes are of particular relevance to airport land use compatibility planning in that they both support and, at the same time, limit the actions that airports and communities can take to mitigate noise impacts. It is important to note, however, that these statutes only apply to airports in the federal system of airports (NPIAS).

- **Aviation Safety and Noise Abatement Act of 1979 (ASNA).** Among the stated purposes of this act is "to provide assistance to airport operators to prepare and carry out noise compatibility programs." The law establishes funding for noise compatibility planning and sets the re-

quirements by which airport operators can apply for funding. The law does not require any airport to develop a noise compatibility program; the decision to do so is the choice of each individual airport proprietor. Regulations implementing the act are set forth in Federal Aviation Regulations Part 150.

- **Airport and Airway Improvement Act of 1982 (AAIA).** This act established the Airport Improvement Program (AIP) through which federal funds are made available for airport improvements and noise compatibility planning. The act has been amended several times, but remains in effect as of late 2009. Land use compatibility provisions of the act are implemented primarily by means of the assurances that airports must provide in order to receive federal airport improvement grants.
- **Airport Noise and Capacity Act of 1990 (ANCA).** In adopting this legislation, Congress' stated intention was to try to balance local needs for airport noise abatement with national needs for an effective air transportation system. To accomplish this objective, the act did two things: (1) it directed the FAA to establish a national program to review noise and access restrictions on aircraft operations imposed by airport proprietors; and (2) it established requirements for the phase-out of most older model, comparatively louder, "Stage 2" airline aircraft from the nation's airline fleet by January 2000. These two requirements are implemented by Federal Aviation Regulations Part 161 and 91, respectively.

Federal Aviation Administration Policies

The most significant FAA policies having a bearing on airport land use compatibility are found in Federal Aviation Regulations and, secondarily, in certain Advisory Circulars.

- **Federal Aviation Regulations Part 36, Noise Standards: Aircraft Type and Airworthiness Certification.** This part of the Federal Aviation Regulations sets the noise limits that all newly produced aircraft must meet as part of their airworthiness certification.
- **Federal Aviation Regulations Part 91, General Operating and Flight Rules.** This part of the Federal Aviation Regulations sets many of the rules by which aircraft flights within the United States are to be conducted. Rules governing noise limits are set forth in Subpart I. This FAR implements the requirements set forth in the Airport Noise and Capacity Act of 1990.
- **Federal Aviation Regulations Part 150, Airport Noise Compatibility Planning.** As a means of implementing the Aviation Safety and Noise Abatement Act of 1979, the FAA adopted these regulations establishing a voluntary program that airports can utilize to conduct airport noise compatibility planning. Part 150 prescribes a system for measuring airport noise impacts and presents guidelines for identifying incompatible land uses. Airports that choose to undertake a Part 150 study are eligible for federal funding both for the study itself and for implementation of approved components of the local program. Completion of a Part 150 study is a prerequisite to FAA funding of many noise abatement implementation measures.

> The FAR Part 150, Airport Noise Compatibility Planning requirements does not apply to most airports within Washington State . First, an airport must be in the NPIAS to participate. Even among those airports that are eligible, FAR Part 150 studies are generally valuable only for airline and busy general aviation facilities.

See Advisory Circular 150/5020-1, *Noise Control and Compatible Planning for Airports* at: http://www.faa.gov/airports_airtraffic/airports/environmental/airport noise/

- **Federal Aviation Regulations Part 161, Notice and Approval of Airport Noise and Access Restrictions.** This part of the federal regulations implements the Airport Noise and Capacity Act of 1990. It codifies the analysis and notification requirements for airport proprietors proposing aircraft noise and access restrictions on Stage 2 or Stage 3 aircraft weighing 75,000 pounds or more. Among other things, an extensive cost-benefit analysis of proposed restrictions is required. The analysis requirements are closely tied to the process set forth in FAR Part 150 and are more stringent with respect to the quieter, Stage 3 aircraft than for Stage 2.

When notified of a proposed construction, the FAA conducts an aeronautical study to determine whether the object would constitute an airspace hazard. Simply because an object (or the ground) would exceed an airport's airspace surfaces established in accordance with FAR Part 77 criteria does not mean that the object would be considered a hazard. Various factors, including the extent to which an object is shielded by nearby taller objects, are taken into account. The FAA may recommend marking and lighting of obstructions.

- **Federal Aviation Regulations Part 77, Objects Affecting Navigable Airspace.** FAR Part 77 establishes standards for determining obstructions to navigable airspace and the effects of such obstructions on the safe and efficient use of that airspace. The regulations require that the FAA be notified of proposed construction or alteration of objects—whether permanent, temporary, or of natural growth—if those objects would be of a height that would exceed the FAR Part 77 criteria. The height limits are defined in terms of imaginary surfaces in the airspace extending about two to three miles around airport runways and approximately 9.5 miles from the ends of runways having a precision instrument approach.
- **FAA Advisory Circular 150/5300-13, Airport Design.** The primary function of this Advisory Circular is to establish standards for dimensions and other features of airport runways, taxiways, and other aircraft operating areas. Also included are standards for runway protection zones (RPZs), trapezoidal-shaped areas located immediately beyond the runway ends. The FAA strongly encourages airports to own this property and its acquisition is eligible for FAA grants. When not airport-owned, the airport or community should still greatly restrict the land uses there.

Other Federal Agencies

- **U.S. Environmental Protection Agency (EPA).** A report published in 1974 by the EPA Office of Noise Abatement and Control continues to be a source of useful background information. Entitled *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, this report is better known as the "Levels Document." The document does not constitute EPA regulations or standards. Rather, it is intended to "provide state and local governments as well as the federal government and the private sector with an informational point of departure for the purposes of decision-making."
- **Department of Housing and Urban Development (HUD).** HUD guidelines for the acceptability of residential land use are set forth in the Code of Federal Regulations Title 24, Part 51, "Environmental Criteria and Standards."
- **Department of Defense Air Installations Compatibility Use Zones (AICUZ) Program.** The AICUZ Program was established by the DOD in response to growing incompatible urban development around military airfields. DOD Instruction Number 4165.57 (November 8, 1977) provides the overall guidance for the program and mandates preparation of an AICUZ plan for each installation. Each of the military services has its own individual guidelines for implement-

ing the basic instructions. AICUZ plans prepared for individual military airfields serve as recommendations to local land use jurisdictions, but have no regulatory function.

- **Department of Defense Joint Land Use Study (JLUS) Program.** In 1985, congress authorized the DOD to make available community planning assistance grants (*Title 10 U.S.C. Section 2391)* to state and local government to help better understand and incorporate the AICUZ technical data into local planning programs. The Office of Economic Adjustment (OEA) manages the JLUS program. A JLUS is a cooperative land use planning effort between the affected local government and the military installation. The JLUS presents a rationale, justification, and a policy framework to support the adoption and implementation of recommended compatible development criteria. These measures are designed to prevent urban encroachment; safeguard the military mission; and protect the public health, safety, and welfare.

See also, AOPA's Guide to Airport Noise and Land Use Compatibility http://www.aopa.org/asn/land_use/

Appendix **B**

Learning More About: Describing and Evaluating Airport Noise Impacts

Measuring Airport Noise

Measurement of Sound

Regardless of whether particular sounds are pleasant to hear or represent annoying or disruptive noise, their physical properties are measured in terms of three basic components: magnitude, frequency, and duration.

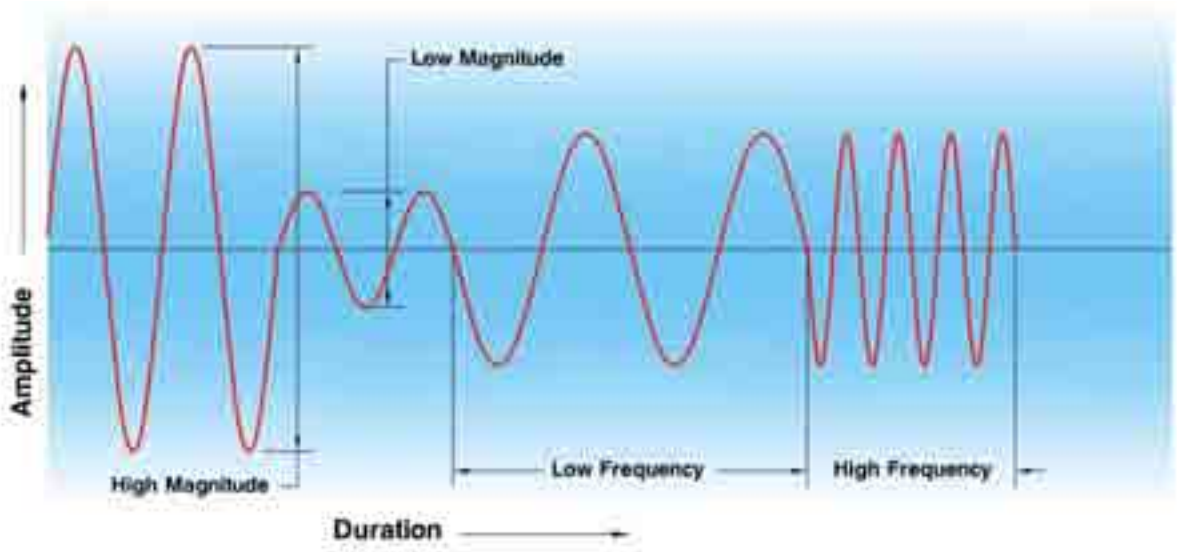
Sound is transmitted through the air when the movement of an object displaces the adjacent air particles which then bump into the next particles and so on. These actions form sets of pressure waves that strike our eardrums, causing them to vibrate and the sound to be heard.

- **Magnitude.** Magnitude is a measure of the strength or amount of acoustic energy carried by a sound wave. Because the energy level of sounds we can hear varies in magnitude by a factor of 1 to 100 trillion—that is 10^{14} or 1 followed by 14 zeros—we measure magnitude using a logarithmic scale rather than a linear one. Each step in this scale from 0 to 14 is referred to as one *bel* in honor of Alexander Graham Bell. More commonly, each bel is divided into tenths, thus the term *decibel* which is abbreviated as *dB*.

  Magnitude is related to loudness, but isn't the same. Loudness describes how we perceive sounds. We perceive any sound level increase of 10 dB (1 bel) as representing a doubling of loudness regardless of whether the increase is from 40 to 50 dB or from 80 to 90 dB. In each case, though, the acoustic energy or magnitude of the sound is actually increasing by a factor of 10.

- **Frequency.** Frequency describes the spacing between sound pressure waves. We hear differences in frequency as *tone*—a low-pitched tone has a long spacing or wavelength and a high-pitched done has a short wavelength. Measured relative to the number of cycles per second, the scale used is called *hertz*, abbreviated *Hz*. Most sounds do not consist of a single frequency—a pure tone—but are instead comprised of a mixture of different frequencies, each usually having its own magnitude.

  We don't hear all sound frequencies equally well. To balance what we perceive to be equally loud sounds of different frequencies, the measurement of sound magnitude is usually adjusted or weighted using A-weighted decibels expressed as dBA.



Noise Waves

- **Duration.** The final component is the time period over which a sound occurs. Measuring the duration of a sound is not always as simple as it would seem, however. Many sounds, such as those from an aircraft overflight begin softly, increase to a maximum magnitude, then drop away. Where we begin and end the measurement depends on what we can hear. Moreover, what we can hear often depends on the background or *ambient* sound level. Thus, a sound that barely reaches above the background level may seem to have a short duration, but in a quieter environment, we may find its duration to be much longer. In effect, a high background noise level masks much of the noise from individual aircraft overflights.

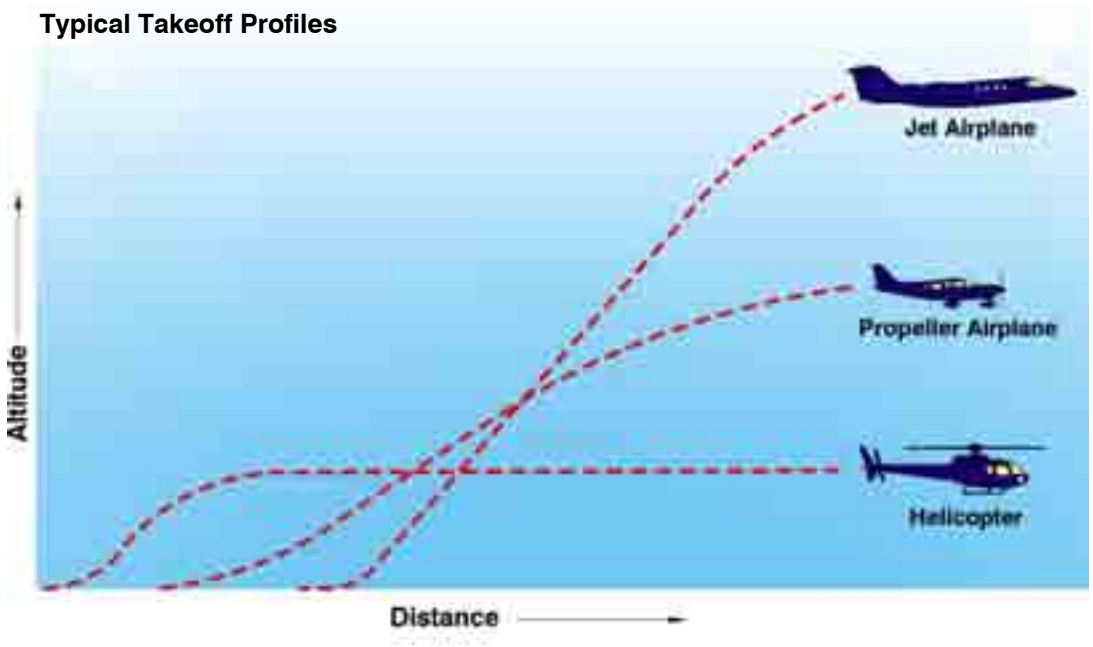
Noise Variations among Aircraft Types

Different types of aircraft sound differently. The magnitude, frequency, and duration of the sounds they create all differ. Moreover, variations occur not just among different types of aircraft, but even among different overflights of the same type of aircraft. The way the pilot flies the aircraft makes a difference.

- **Jet Airplanes.** The noise from jet airplanes was once distinct from other aircraft both by being louder and because it had a high pitch that was particularly annoying. Technology has enabled today's jets to be much quieter than their predecessors and the frequency is lower. Pound for pound, modern jets are quieter than equivalent propeller airplanes. However, on average, jets are larger than propeller planes and thus are typically noisier. Research is continuing into making jets still quieter, but there are tradeoffs between noise levels, fuel efficiency, and the amount of emissions produced.
- **Propeller Airplanes.** The dominant noise from propeller airplanes, whether driven by piston or turbine engines, is from the propeller itself. Unlike jet aircraft, the noise levels produced by propeller airplanes has changed very little over the years. Moreover, the potential for future technology to enable significant noise reduction is limited. Also, private airplanes such as found at general aviation airports are not replaced by newer models at anywhere near the rate common to airline aircraft. In all, no major changes in propeller airplane noise can be anticipated.

- **Helicopters.** Helicopter noise has unique characteristics. The relatively slow turning main rotor produces an impulsive sound that is particularly noticeable as the helicopter is approaching the listener. The noise is greatest during high-speed cruise and low-speed descents.

The amount of noise generated by different aircraft types is only one factor affecting how much noise is heard on the ground. Atmospheric conditions such as cloud cover that can make the sound bounce back to the ground can affect the noise levels that people hear. Another key factor is the altitude at which the aircraft are flying. In locations close to runways, the distinct performance capabilities of the different aircraft types greatly influences the noise impacts. As the illustration below shows, jets usually need more runway length to take off than propeller planes need, but then they climb much faster. At some point within a couple of miles of the runway end, jets will have reached a higher altitude than the more slow climbing propeller planes and their noise level on the ground will diminish more rapidly as they continue to climb more steeply. Helicopters don't need a runway to get airborne and they climb more steeply than airplanes (although they don't go straight up as is sometimes believed). Also, helicopters generally cruise at lower altitudes than airplanes and fly different routes. Thus several miles from an airport, helicopters may be the loudest aircraft around.



In general, aircraft noise impacts are greater below the takeoff paths than at the arrival end of the runway. These differences, though, depend both on the aircraft type and on the distance from the runway. For example, as depicted by the preceding illustration, at some distance from the runway, jets will have climbed high enough that they may produce much less noise on the ground than the slower climbing propeller airplanes. When landing, all jets and propeller planes follow about the same approach slopes, thus noise differences depend mostly on the aircraft size and engine types. Also, because engines are set to low power levels on approach, the noise produced by the airframe from such features as wing flap and extended landing gear may be greater than the engine noise.

Noise Contours

Noise contours are used to map or graphically depict areas of equal noise exposure around a noise source, such as an airport or highway. Just about any noise metric data can be illustrated in this manner. For land use compatibility planning purposes, though, noise contours are usually associated

with cumulative noise level metrics such as DNL (day-night level or L_{dn}). DNL contours are commonly shown at 5 decibel increments so that they resemble topographic contours.

These days, noise contours for civil airports are produced using an FAA-approved computer program: the Integrated Noise Model, known commonly as INM. Most of the data about the performance capabilities and noise generated by various types of aircraft are stored in the program. The user must enter data regarding the number of operations by each aircraft operating at the airport, the time of day when the operations occurred (day versus night), the runways used, and the flight tracks followed. INM is capable of taking into account the actual ground elevations around an airport, thus increasing the calculated noise levels where the terrain is high and aircraft are consequently flying at a lower altitude than would be the case with flat terrain.

For many airports, especially those with relatively little activity, noise and other impacts associated with aircraft overflight can be more significant than the noise described by DNL contours. See the discussion of overflight in the next appendix.

To get an idea of how big the noise contours are for some typical small airports, see the illustrations on the next page.

Preparation of noise contours showing current and projected airport noise impacts is generally done as part of an airport master plan and is usually a required component of environmental documents for airport expansion projects. Also, noise contours are the central element of noise compatibility plans done under Part 150 of the Federal Aviation Regulations. For busy airports where significant noise impacts, as measured by DNL, extend well beyond the airport boundary, noise contours are an essential airport land use planning tool.

However, for many small airports, particularly ones that are not eligible for Federal Aviation Administration funding, noise contours may never have been done. *This is not a fatal shortcoming to your compatibility planning process and does not mean that you must create noise contours for your airport.* Indeed, when an airport has a low volume of aircraft operations and little or no jet activity, the DNL contours might not extend far beyond the runways. In these situations, overflight impacts as discussed in the next appendix need to be weighed heavily in compatibility planning.

Approaches to Addressing Airport Noise Impacts

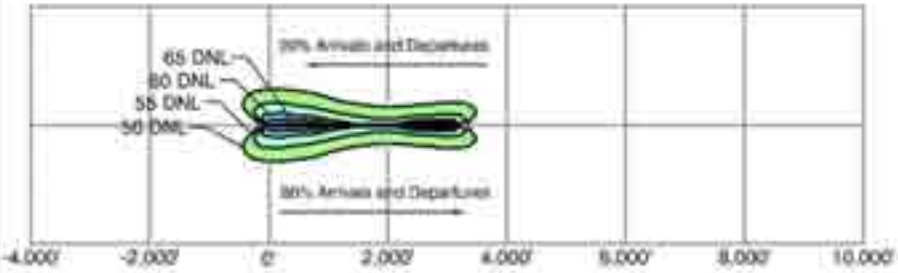
Acceptable Noise Exposure Levels

Noise impacts are a primary determinant of the acceptance of an airport in a community. Conversely, community planning for new development near airports must take into account the current and projected airport noise levels. The fundamental decision that local agencies will need to make in this regard is what exposure level is acceptable for new development, particularly residential and other noise-sensitive land uses. Your first thoughts on this topic may well be to simply adopt the criteria indicated by the FAA in its Federal Aviation Regulations Part 150, *Airport Noise Compatibility Planning Program*, and in other policies. In FAR Part 150, the FAA considers all uses compatible where the noise exposure is less than 65 dB DNL.

However, this is often not the best noise exposure threshold to use for compatibility planning purposes. Indeed, in other guidelines such as those for addressing the noise impacts of airport expansion, the FAA recognizes that noise impacts may be significant at levels below 65 dB DNL and should be considered depending upon the circumstances. Also, in the assurances that the FAA requires from airports receiving federal grants, the airport sponsor must agree to "take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations."

General Assumptions

- Straight-in/straight-out flight tracks
- 3,200' Runway
- Airport elevation of 800'
- 85° F is average high temperature for hottest month
- 80% of single-engine piston operations are fixed pitch
- 20% of single-engine piston operations are variable pitch
- 80%-20% runway use distribution

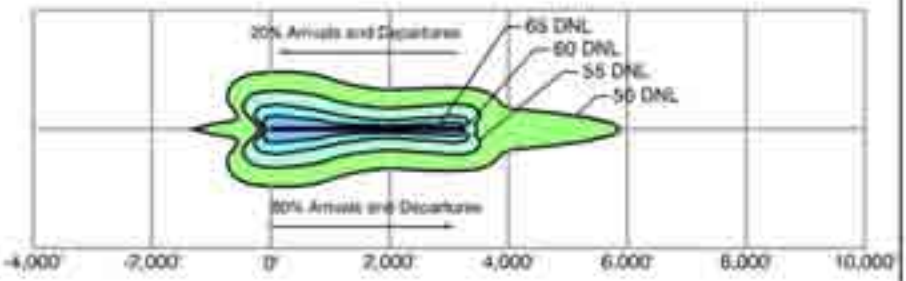


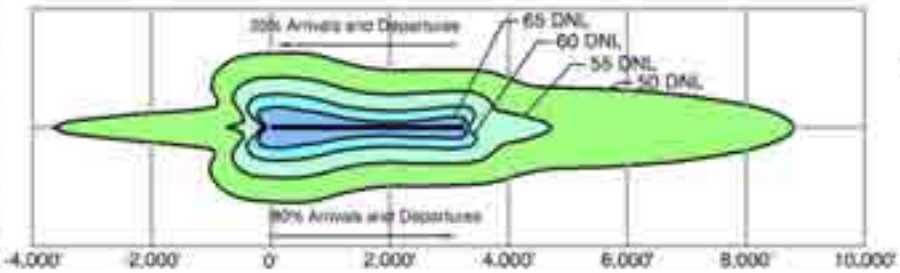
3,000 Annual Operations

- 100% Daytime
- 100% Single Engine Piston

10,000 Annual Operations

- 99% Daytime
- 1% Night Time
- 96% Single Engine Piston
- 3% Twin-Engine Piston
- 1% Light Turbo Prop





20,000 Annual Operations

- 98% Daytime
- 2% Night Time
- 93% Single Engine Piston
- 5% Twin-Engine Piston
- 2% Light Turbo Prop

Generic Noise Contours for Typical Small Airports

Several facts about the basis for the 65 dB DNL standard are important to recognize:

- The underlying sociological studies date back more than 30 years. Chief among these was one done by Schultz in 1978 which itself was a compilation of prior studies. One product of this study was the so-called "Schultz curve." This curve shows that 13% of the population living near an airport can be expected to be highly annoyed when the noise exposure is 65 dB DNL. Presumably, the percentage of people who are moderately annoyed would be even higher.
- The studies involved major air carrier airports in noisy urban environments. The degree to which people in quieter communities would be annoyed at lower noise exposures was not studied.
- Even though the loudness of individual jet aircraft operations has been significantly reduced since the 1970s, people continue to be bothered by the noise. This may be due to an increase in the number of operations or simply because people's expectations regarding quiet are greater.
- Compatibility does not mean that activities will not be disrupted by individual noise events. Even cumulative noise exposures of 60 or 55 dB DNL can include individual loud events that may be disruptive.
- The FAA's use of the 65 dB DNL as the threshold of environmental impact significance for noise impacts was and largely continues to be driven by economics. Airports can obtain FAA funding to install sound attenuation in homes and other noise-sensitive uses exposed to noise levels of 65 dB DNL or greater. Reducing the standard to a lower noise exposure level would vastly increase the number of buildings eligible and the costs would be large.

To reiterate, the prominence of the 65 dB DNL standard notwithstanding, FAA policy does not preclude local jurisdictions from setting a lower threshold of compatibility for new land use development. The FAA's Aviation Noise Abatement Policy 2000 states:

> "Based upon local factors, local jurisdictions may take a more comprehensive approach to aviation noise exposure below DNL 65. Some communities are more noise sensitive than others. Part 150 guidelines recognize local discretion to define noise sensitivity."

WSDOT encourages communities to seriously examine the significance of noise impacts at levels below 65 dB DNL—along with the single-event noise levels, vibration, odors, annoyance, and other impacts of regular aircraft overflights—and to avoid new development that might be incompatible with these noise levels. The affects of aircraft overflights and the annoyance associated with it, as addressed in the next appendix, should be considered as well.

Noise Insulation

The mass of buildings' structural components greatly reduces the amount of aircraft noise heard indoors compared to outside. Modern, energy efficient, wood frame buildings typically reduce the exterior to interior noise levels by as much as 30 dB when windows are closed. Even with windows open, other parts of the structure can serve to substantially reduce the indoor sound levels caused by exterior noise.

Heavier structures, such as ones with concrete walls, or buildings designed with added noise insulation features can further enhance the noise level reduction. These qualities have often lead to the view that aircraft noise impacts do not need to be a deciding factor in siting of noise-sensitive land uses near airports provided that adequate sound insulation is incorporated into the building design.

Noise insulation should not be thought about in this manner. *The most appropriate application for structural noise insulation is for existing buildings.* It is a method of improving existing incompatible conditions when changing the land use to something less noise sensitive is not practical. Even then, there are limitations. *Noise insulation is not effective for land uses in which noise-sensitive activities take place outdoors.* Unlike the case with ground-based noise sources, sound walls and other such devices do nothing to block noise from aircraft while they are in the air.

With regard to new development, noise insulation should be regarded as a measure of last resort. It is not a substitute for good land use compatibility planning in the first place. Exterior noise levels should generally be the primary consideration in evaluation of proposed land uses, especially residential development and other land uses where noise-sensitive outdoor activities are normal and important features.

Furthermore, when deciding upon the exterior noise exposure level deemed acceptable for new residential development, it is important to remember the difference between cumulative noise exposure metrics such as DNL and the single-event noise levels that can be disruptive or annoying. A DNL of 65 dB or even 55 dB can involve individual events loud enough to conflict with quiet outdoor activities.

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Appendix **C**

Learning More About: Describing and Evaluating Aircraft Overflight Impacts

Introduction

Experience at many airports has shown that noise-related concerns do not stop at the boundary of the outermost mapped DNL contours. Many people are sensitive to the frequent presence of aircraft overhead even at relatively low levels of noise. These reactions are frequently expressed in the form of *annoyance*.

At many airports, particularly air carrier airports, complaints often come from locations beyond any of the defined noise contours. Indeed, heavily used flight corridors to and from metropolitan areas are known to generate noise complaints 50 miles or more from the associated airport. The basis for such complaints may be a desire and expectation that outside noise sources not be intrusive—or, in some circumstances, even distinctly audible—above the quiet, natural background noise level. Elsewhere, especially in locations beneath the traffic patterns of general aviation airports, a fear factor also contributes to some individuals' sensitivity to aircraft overflights. Also, vibration, fumes, and even just the sight of aircraft overhead can contribute to the annoyance at overflights.

- **Vibration.** The most notable source of vibration associated with general aviation activity comes from helicopters. The rotating blade produces a phenomenon known as blade slap that varies in degree depending upon the speed and descent rate of the helicopter. Vibration can also be an issue in areas behind the start of takeoff roll for jet aircraft. It seldom is a problem with light, piston-engine airplanes.
- **Fumes.** Normal aircraft operations can produce extremely small particles of carbon-based chemicals. These particles can be easily inhaled and may promote respiratory inflammation in some cases. Exposure to these chemicals has also been associated with an increased risk of lung disease. Exposure to these hazards may be greater for people who live near smaller airports. Some community members have expressed concern about increased air pollution and its effect upon young children. Fumes are particularly noticeable from turbine-powered aircraft (jets, turbo-props, and some helicopters).
- **Low-flying Aircraft.** The sight and sound of low flying aircraft in overflight areas of the traffic pattern may be perceived by some as a threat of danger, and as a result produce a negative emotional response. Fear and anxiety are two common emotional responses linked with perceived threats. Fear is often related to the specific event or events. Fear may be related to future events, such as worsening of a situation, or continuation of a situation that is unacceptable. Anxiety is often a result of ongoing or multiple threats, which are perceived to be uncontrollable or unavoidable. These emotional responses often increase stress and fuel opposition to normal airport operations.

While these impacts may be important community concerns, the question of importance here is whether any land use planning actions can be taken to avoid or mitigate the impacts or otherwise address the concerns. Commonly, when overflight impacts are under discussion in a community, the focus is on modification of the flight routes. Indeed, some might argue that overflight impacts should be addressed solely through the aviation side of the equation—not only flight route changes,

but other modifications to where, when, and how aircraft are operated. Such changes are not always possible because of terrain, aircraft performance capabilities, FAA regulations, and other factors. These limitations notwithstanding, there are steps that local land use jurisdictions, often together with airport management, can and should take to help minimize overflight impacts.

Where Aircraft Fly

The first step in evaluating aircraft overflight impacts is knowing where aircraft fly in the vicinity of the airport. There are several possible sources for this data:

- **Airport Master Plan.** Look first in the airport master plan if there is one for your airport. It may contain generalized flight track data that can be used as a starting place for assessing the traffic pattern location. Recognize, though, that aircraft do not fly the exact lines that are typically shown—the actual traffic pattern will be a wide band.
- **Radar Data.** An excellent source, although again not one available for most airports, is radar data. For airports where radar coverage is available at a low enough altitude to be useful—that is, at least down to the traffic pattern—this is the ideal source because it precisely shows where flights have occurred. Try contacting the staff of the airport where the radar is located or the FAA. It is not necessary to obtain data for an entire year, but be sure to get enough to be representative of all conditions: that is, make sure to have data for when each runway has been in use and for busy days when the traffic pattern my grow larger than normal.
- **Airport Manager and Other Airport Personnel.** For most airports, especially general aviation airport, radar data is unavailable. Either the airport is too far from the nearest radar facility or intervening terrain prevents coverage at an altitude low enough to be useful. In these instances, anecdotal information from airport personnel who are familiar with the local aircraft traffic is usually the best alternative. Flight instructors are a particularly good source of information because they need to be able to tell students where they should be flying. Moreover, because they are in the air, they are in a position to see where aircraft are flying relative to landmarks on the ground.

> **Tips**
> - Even if your airport does not have a radar antenna or even an air traffic control tower, it may still have radar coverage from a nearby major airport.

Once flight track location data has been obtained, the question to be decided is how large to show the overflight area for land use compatibility planning purposes. In general, the objective should be to encompass locations where aircraft regularly fly as the approach, depart, or engage in flight training at an airport. By "regular," we suggest trying to include approximately 80% of these flights. There will always be some random flights associated with an airport that do not follow the typical patterns—and may be the cause of noise complaints—but these are hard to predict and it is typically not cost-effective to control land uses in these areas.

Addressing Annoyance

To avoid creating opportunities for annoyance, the preferred land use compatibility strategy is to keep residential development and other noise sensitive uses away from where aircraft regularly fly. Overflight impacts should be considered whenever drawing or redrawing of urban growth boundaries is contemplated. For airports located well outside urban areas, preventing extensive new resi-

dential development may not be difficult and having a few scattered rural residences is seldom a major compatibility concern.

Close to or inside the urban growth boundary, the challenge can be much greater, but there are still several strategies that can minimize overflight annoyance.

- **Plan for Uses with Low Noise Sensitivity.** As described in Chapter 3, most commercial and industrial land uses do not involve outdoor activities that would be disrupted by noise. As much as possible, these are the types of uses that should be planned for beneath the airport traffic pattern.

> **Tips**
> - Be cautious that allowing a few residences doesn't become a precedent for many more.
> - Be cautious about high intensities within the runway approach zones—see the discussion in Appendix E on safety.
> - A caveat to this approach, of course, is that it is only practical in locations where safety is not a major concern.

- **High Residential Density.** Though seemingly illogical, higher residential densities can be better than low density when it comes to overflight annoyance. High-density residential development, particularly multi-family uses, typically generates more noise of its own. Higher ambient noise makes aircraft and other transportation noise sources less intrusive (the amount of time that the noise is above the background noise level is less). Additionally, multi-family dwellings each have fewer external walls than a single-family house and the amount of outdoor living space is usually less.
- **Buyer Awareness.** The third approach takes advantage of the fact that some people are more annoyed by aircraft noise than others. Establishing mechanisms to alert prospective residents to the proximity of a nearby airport and the impacts it creates thus can reduce the overall level of annoyance in the community. A real estate transaction disclosure statement prepared at the time that a property is offered for sale is one such mechanism and has the advantage of working both for new dwellings and ones that are being resold. For new development, another possible option is for the local jurisdiction to require that, as a condition for approval of the development, an airport-proximity disclosure statement be recorded as part of the property deed. In this manner the statement would automatically be passed forward to subsequent owners of the property rather than relying on the sellers and their agents to do so. *See Chapter 3 for more discussion of these tools.*

Supplemental Noise Metrics

Most supplemental metrics focus either on individual noise events or on other ways of describing how disruptive the noise events are or can be expected to become. These metrics are best suited to describing noise levels such as might result from an airport development project. For land use compatibility planning policy purposes, supplemental noise metrics have limited utility at this time largely because thresholds of significance have not been widely agreed upon. For example, how much time or how many events louder than a certain noise level need to occur to be warrant limiting land uses within the impacted area, and what should that threshold noise level be?

> Beyond DNL, several types of noise metrics have been developed as means of providing supplemental information about airport noise. Some of these may be useful in helping to define the area within which overflight impacts are significant.

Australia has been at the forefront of developing supplemental noise metrics. Other noise metrics have recently been suggested in a paper written by the noise consulting firm Harris Miller Miller & Hanson. An important consideration with regard to all of these supplemental metrics is that they focus on addressing a particular issue

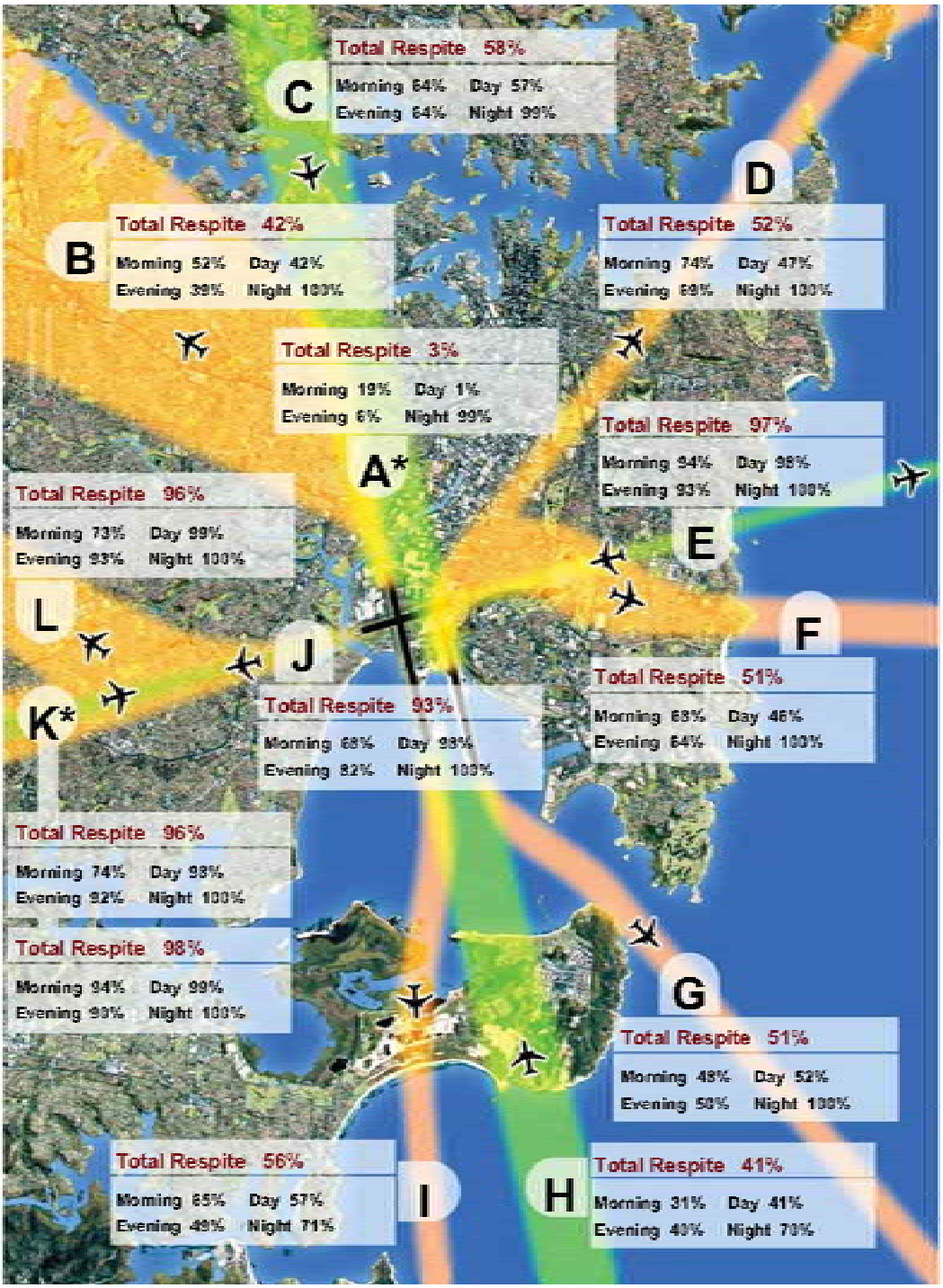
whether it be annoyance, speech interference, sleep disruption, or some other factor. Additionally, more research remains to be done before the meaning of the data presented by any given supplemental metric can be better understood and perhaps applied to land use planning. In the meantime, any application of supplemental metrics should indicate the purpose for which the particular metric was created and acknowledge the limitations of the data and its interpretation.

www.hmmh.com/presentations/TRB07Eagan_final.PDF

- **One-Hour Average Steady Noise Level.** The American National Standards Institute (ANSI) has developed a standard for classrooms that states that the sound levels during the noisiest hour should not exceed a one-hour average A-weighted steady background noise level (L_{eq}) of 40 dB for schools exposed to intermittent sources, such as airport and other transportation noise. The criteria further states that the one-hour Leq should not be exceeded more than 10% of the noisiest hour10.
- **Level Exceeded.** This metric evaluates the amount of time over which each noise level occurs, then indicates the level exceeded a given percentage of time. For example, L_{10} and L_{50} are the noise levels exceeded 10% and 50% of the time, respectively. Typically, Level Exceeded measures are calculated for short time periods—24 hours or less. The Level Exceeded metric is one of the primary noise metrics employed in analysis of relatively continuous noise, such as from a highway. It is seldom used for airport-related noise.
- **Time Above.** Unlike most noise metrics which provide a noise level measurement in decibels for a specified time duration, the Time Above (TA) metric measures the amount of time a given noise level is exceeded. Typically, the measurements are stated as a number of minutes relative to an average day and are depicted for a grid of points within an airport vicinity. Separate calculations are required for each noise level evaluated.
- **Number Above.** The number of daily aircraft noise events (N) exceeding a specified (xx) dBA at a given location—abbreviated, for example, as N70. Contours similar to DNL contours are used to display the data.
- **Respite.** The number of whole clock hours (e.g. 7 a.m. to 8 a.m.) per day or for a particular part of the day during which no aircraft noise event exceeds a certain threshold (e.g., 70 dBA). The data is presented as a series of point analyses for areas around an airport (see the example from Sydney Airport, below.

Sydney Airport : Jet Aircraft Respite (R60)

1 March 2009 to 28 Feb 2010, All Jets



Note : Track A is Tracks B and C combined. Track K* shows departures (top box) and arrivals (bottom box).*

A respite interval is a 60 minute period when there are no jet movements (R60).

Morning: 06:00 to 07:00 Day: 07:00 to 20:00 Evening: 20:00 to 23:00 Night: 23:00 to 06:00

Total Respite: 06:00 to 23:00

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Appendix **D**

Learning More About: Describing and Evaluating Airport Airspace Protection

Introduction

Relatively few aircraft accidents are initially caused by land use conditions that are hazards to flight. The potential exists, however, and protecting against it is essential to airport land use compatibility. In addition, and importantly, land use conditions that are hazards to flight may impact the continued viability of airport operations and limit the ability of an airport to operate in the manner identified by the airport proprietor in an adopted airport master plan and airport layout plan. For example, obstructions to an airport's airspace can necessitate reducing the usable length of a runway or increasing the weather minimums under which an instrument approach procedure can be used.

There are three basic types of hazards that must be considered when establishing land use compatibility policies to protect airport airspace:

- **Airspace Obstructions.** The best recognized among airspace hazards is the potential for tall structures and other objects to obstruct the flight paths of aircraft operating at the airport.
- **Wildlife Hazards.** Bird strikes are the most common type of wildlife hazards to aircraft operations, but animals on the runway are also a concern at some airports.
- **Other Physical, Visual, or Electronic Hazards.** Thermal plumes from power plants, smoke, glare, lights that can be confused with airport lights, and electronic interference with aircraft communication or navigation all are potential hazards to flight.

These hazards are examined in general terms in the body of the *Guidebook*. Additional, more detailed information on selected topics is provided in this appendix.

Federal Aviation Regulations Part 77

To help ensure protection of the airspace essential to the safe operation of aircraft at and around airports, the Federal Aviation Administration has established a process that requires project proponents to inform the agency about proposed construction of objects that could affect the airspace. The standards by which this airspace is defined are set forth by the federal government in Federal Aviation Regulations Part 77 (FAR Part 77), *Objects Affecting Navigable Airspace* (officially Title 14, Part 77 of the Code of Federal Regulations or 14 CFR Part77). Additionally, FAR Part 77 establishes requirements for notifying the FAA with regard to any proposed construction that could be deemed a hazard and it provides for aeronautical studies of these proposals to be conducted by the FAA.

Limits on Federal Authority under Part 77

The FAA's authority to promote the safe and efficient use of the navigable airspace, whether concerning existing or proposed structures, is predominantly derived from Title 49 U.S.C. Section 44718 (Section 44718). However, Section 44718 does not provide specific authority for the FAA to regu-

late or control how land (real property) may be used in regard to structures that may penetrate navigable airspace.

The FAA has no authority to remove or to prevent construction or growth of objects deemed to be obstructions. Local governments having jurisdiction over land use are typically responsible for establishing height limitation ordinances that prevent new, and enable removal of existing, obstructions to the FAR Part 77 surfaces. Federal action in response to new airspace obstructions is primarily limited to three possibilities:

- For airports with instrument approaches, an obstruction could necessitate modification to one or more of the approach procedures (particularly greater visibility and/or cloud ceiling minimums) or even require elimination of an approach procedure.
- Airfield changes such as displacement of a landing threshold could be required (especially at airports certificated for commercial air carrier service).
- The owner of an airport could be found in noncompliance with the conditions agreed to upon receipt of airport development or property acquisition grant funds and could become ineligible for future grants (or, in extreme cases, be required to repay part of a previous grant).

Notification Requirements

Note that these notification surfaces have a much shallower slope and extend farther from the runway than the obstruction surfaces typically shown in an airspace plan as described below.

Subpart B of the regulations requires that the FAA be notified of any proposed construction or alteration within 20,000 feet of a runway and having a height that would exceed a 100:1 imaginary surface (1 foot upward per 100 feet horizontally) beginning at the nearest point of the runway. This requirement applies to runways more than 3,200 feet in length; for shorter runways, the notification surface has a 50:1 slope and extends 10,000 from the runway. Notification is required with regard to any public-use or military airport.

Also requiring notification is any proposed object more than 200 feet in height regardless of proximity to an airport.

Exceptions to the notification requirement are allowed for "any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded would not adversely affect safety in air navigation."

When determining the height of structures, it is important to consider all of its components including elevator shafts, flag poles, and antennas that would extend above the roof level. Furthermore, proposed objects do not need to be permanent to require submittal of a notification. Notice also must be provided for temporary objects such as construction cranes. Such objects are critically important to airspace protection in that they often are taller than the ultimate height of the structure. Mobile objects on roads must be taken into account as well. To allow for vehicles, 17 feet must be added to the road elevation of Interstate highways, 15 feet added for other public roadways, and 10 feet to private roads. A 23-foot clearance over railroad lines is required.

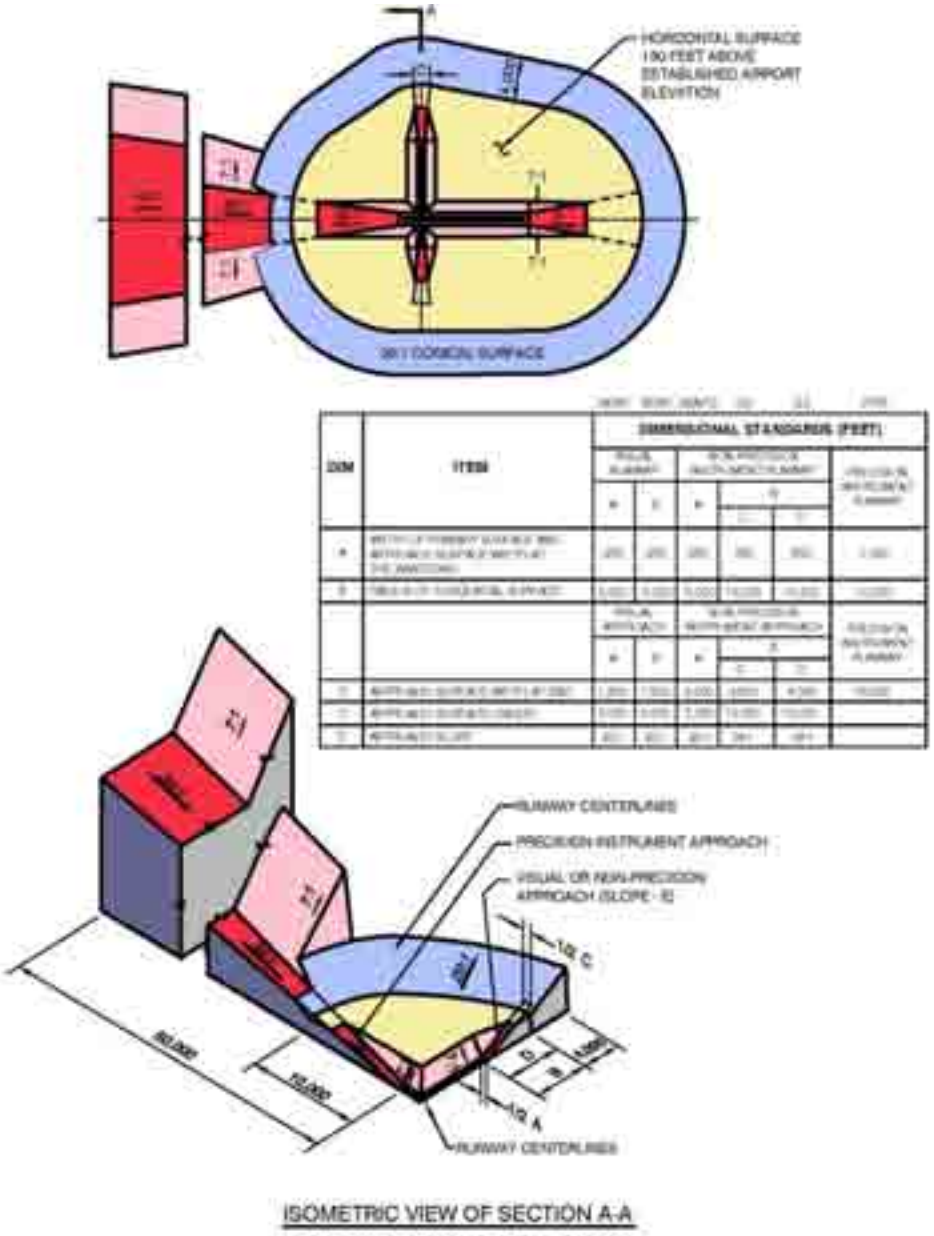
The notification is to be provided using FAA Form 7460-1, Notice of Proposed Construction or Alteration. These days, the notice can be submitted on-line (see Attachment 1 to this appendix for hints about on-line submittal of Form 7460). Receipt of the notice enables the FAA to evaluate the

effect of the proposed object on air navigation and chart the object or take other appropriate action to ensure continued safety. There is no cost associated with the filing.

There is no cost for filing the Form 7460 notice. However, persons failing to comply with the provisions of FAR Part 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended and pursuant to 49 U.S.C. Section 46301(a).

Airspace Plan

The standards for identifying obstructions to the airspace are set forth in Subpart C of FAR Part 77. This subpart defines a set of imaginary surfaces that differ from those used for FAA notification. As shown in the diagram below, there are five types of surfaces: primary, approach, transitional, horizontal, and conical. It is this set of surfaces that is depicted in an airspace plan that typically accompanies the airport layout plan in the set of drawings prepared for most airports.



By definition, any object that penetrates one of the imaginary surfaces is deemed an obstruction to air navigation. Not all obstructions are necessarily hazards, however. The determination of whether an object would be a hazard to air navigation is made as part of an aeronautical study conducted by the FAA as described below.

In general, local governments should restrict the heights of objects near airports to below the FAR Part 77 Subpart C obstruction surfaces. Exceptions can be made for areas of high terrain, objects that are shielded by taller nearby objects, and objects that the FAA has determined to not be hazards. To assist in this regard, the FAA has developed a model zoning ordinance that local governments can use for this purpose. The model ordinance is built around the airspace plan drawing.

www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentNumber/150_5190-4A

Aeronautical Studies

When the FAA receives a notice submitted by the project proponent in accordance with Subpart B requirements, Subpart D dictates that the agency conduct an aeronautical study of the proposal.

See Attachment 2 to this appendix for more on aeronautical studies.

"In the aeronautical studies, present and future IFR and VFR aeronautical operations and procedures are reviewed and any possible changes in those operations and procedures and in the construction proposal that would eliminate or alleviate the conflicting demands are ascertained."

Several divisions of the FAA are involved in conducting aeronautical studies. Each division contributes to the review based on its particular area of expertise. The regulations do not specify a time limit for the FAA to complete an aeronautical study, but a typical turn-around time is 30 to45 days.

After the FAA completes its aeronautical study of the proposed construction, it usually issues a form letter indicating its determination as to whether the specific proposal studied would be a hazard to air navigation. If the object is shielded by other taller objects or is located away from the normal traffic patterns and instrument approach routes, the outcome in most cases will be a "Determination of No Hazard" even if the object is technically an obstruction. As a condition for non-objection, the FAA may recommend that the object be marked and lighted in accordance with FAA standards.

The responsibility for preventing hazardous obstructions to airport airspace rests with state and local governments and the airport operator. The FAA merely provides technical expertise.

If the aeronautical study finds that the object could adversely affect air navigation, the FAA will work with the proponent to seek modification to eliminate the problem. Adjustments to aviation requirements that would accommodate the proposed object are investigated as well. Ultimately, a "Determination of Hazard" could be issued. Even under these circumstances, however, the determination is advisory and the FAA has no authority to prevent construction of the object. Federal action in response to new airspace obstructions is primarily limited to three possibilities:

- For airports with instrument approaches, an obstruction could necessitate modification to one or more of the approach procedures (particularly greater visibility and/or cloud ceiling minimums) or even require elimination of an approach procedure.
- Airfield changes such as displacement of a landing threshold could be required (especially at airports certificated for commercial air carrier service).
- The owner of an airport could be found in noncompliance with the conditions agreed to upon receipt of airport development or property acquisition grant funds and could become ineligible for future grants (or, in extreme cases, be required to repay part of a previous grant).

In the broader context of airport land use compatibility planning, the significance and limitations of FAA aeronautical study determinations are essential to recognize. These studies *only* address airspace issues. *Simply because the FAA has issued a Determination of No Hazard indicating that it has no objection to a proposed construction does not mean that the proposal is compatible with the airport.* Project proponents are known to wave the FAA determination in front of local decision-makers and say that, because the federal government has no concerns, the local agency should approve the proposal. Compatibility with regard to noise, the density or intensity or the land use, and other factors also must be considered in the local decision. Height of the structure and its affect on airspace is only one part of the puzzle.

Critical Concept!

Simply because the FAA has issued a Determination of No Hazard indicating that it has no objection to a proposed construction does not mean that the proposal is compatible with the airport.

Bird and Wildlife Hazards

Although tall structures may be the most obvious land use conflict with airport airspace, other threats occur. Another major concern is the hazard posed by birds and other wildlife. Bird or wildlife strikes of aircraft can cause significant damage and even lead to crashes.

- About 75 percent of all civil aviation bird strikes occur near airports.
- Waterfowl, gulls and raptors represent 77 percent of reported bird strikes causing damage to aircraft in the U.S.

Bird and wildlife strikes have increased substantially in recent years due primarily to three factors:

- The use of more efficient and quieter two-engine jet aircraft, as opposed to louder aircraft with three- or four-engine aircraft;
- The increase in the volume of air traffic; and
- Substantially increases in the populations of many wildlife species commonly involved in strikes, such as the Canada goose and white-tail deer.

As with other land use-related matters that affect compatibility between airports and their surroundings, the FAA has little regulatory authority over mitigation of bird and wildlife hazards. Its primary avenues for dealing with the issues are via certification requirements for air carrier airports and the assurances to which any airport receiving a federal grant must agree.

- **FAR Part 139.** FAA regulations associated with wildlife hazards are addressed in FAR Part 139 (14 CFR 139), "Certification of Airports." Section 139.337 requires holders of Airport Operating Certificates (or air carrier airports) to "take immediate action" to address potential wildlife hazards once they are identified.

  On-line copies of FARs can be found at:
  http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title14/14tab_02.tpl

- **Grant Assurances.** While none of the standard grant assurances explicitly addresses mitigation of bird and wildlife hazards, three establish requirements that can broadly be applied to the issue. These assurances require airports to:
  - Operate and maintain the facilities in a safe and serviceable condition (no. 19);
  - Remove, lower, relocate, mark, light, or otherwise mitigate existing airport hazards and prevent the establishment or creation of future airport hazards (no. 20); and

- Take appropriate action to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations (no. 21).

Beyond these two sources, federal guidance is advisory. Several FAA advisory circulars address particular aspects of the issue.

- *Wildlife Hazard Management at Airports: A Manual for Airport Personnel* (July 2005). FAA's most thorough reference document. The manual includes background information, agencies and organizations involved in wildlife hazard management at airports, and applicable legislation, regulations, and policies as well as direct and indirect controls for addressing potential hazards.

  Available at: http://wildlife.pr.erau.edu/EnglishManual/2005_FAA_Manual_complete.pdf

- AC 150/5200-32A, *Reporting Wildlife Aircraft Strikes* (December 2004). Explains the importance of reporting collisions between aircraft and wildlife and describes FAA's Bird/Other Wildlife Strike Reporting system. Provides instructions on how to report a wildlife strike in paper or electronic format, and provides links to wildlife strike reporting mechanism.

  Available at: http://www.faa.gov/documentLibrary/media/advisory_circular/150-5200-32A/150_5200_32A.pdf

- AC 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports* (August 2007). Serves as the foundation for wildlife hazard management practices at airports. Provides guidance on land uses that have the potential to attract hazardous wildlife on or near public-use airport (i.e., within three miles of airports serving piston-powered aircraft and within five miles of airports serving turbine-powered aircraft.) Identifies land use practices on or near airports that potentially attract hazardous wildlife, procedures to manage wildlife, and recommended changes in land use reduce wildlife strike hazards.

  Available at: http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/532dcafa8349a87286257354006 8c023/$FILE/150_5200_33b.pdf

Additional guidance regarding mitigation of wildlife hazards is available from WSDOT Aviation. In 2009, the Aviation Division, in coordination with WSDOT Environmental Services and the Federal Aviation Administration (FAA), developed a stormwater design manual to assist in the design, construction and maintenance of stormwater facilities on and near airports. The manual focuses on design modifications to decrease the attractiveness of stormwater facilities to wildlife rather than active wildlife removal measures.

The WSDOT *Airport Stormwater Guidance Manual* can be found on-line at www.wsdot.wa.gov/aviation/AirportStormwaterGuidanceManual.htm

Tips

- A database listing of wildlife strikes on aircraft can be found at the following website. Reviewing the data to see if there have been problems at your airport can help determine the emphasis you place on this issue.

http://wildlife-mitigation.tc.faa.gov/public_html/index#access

Attachment **1**

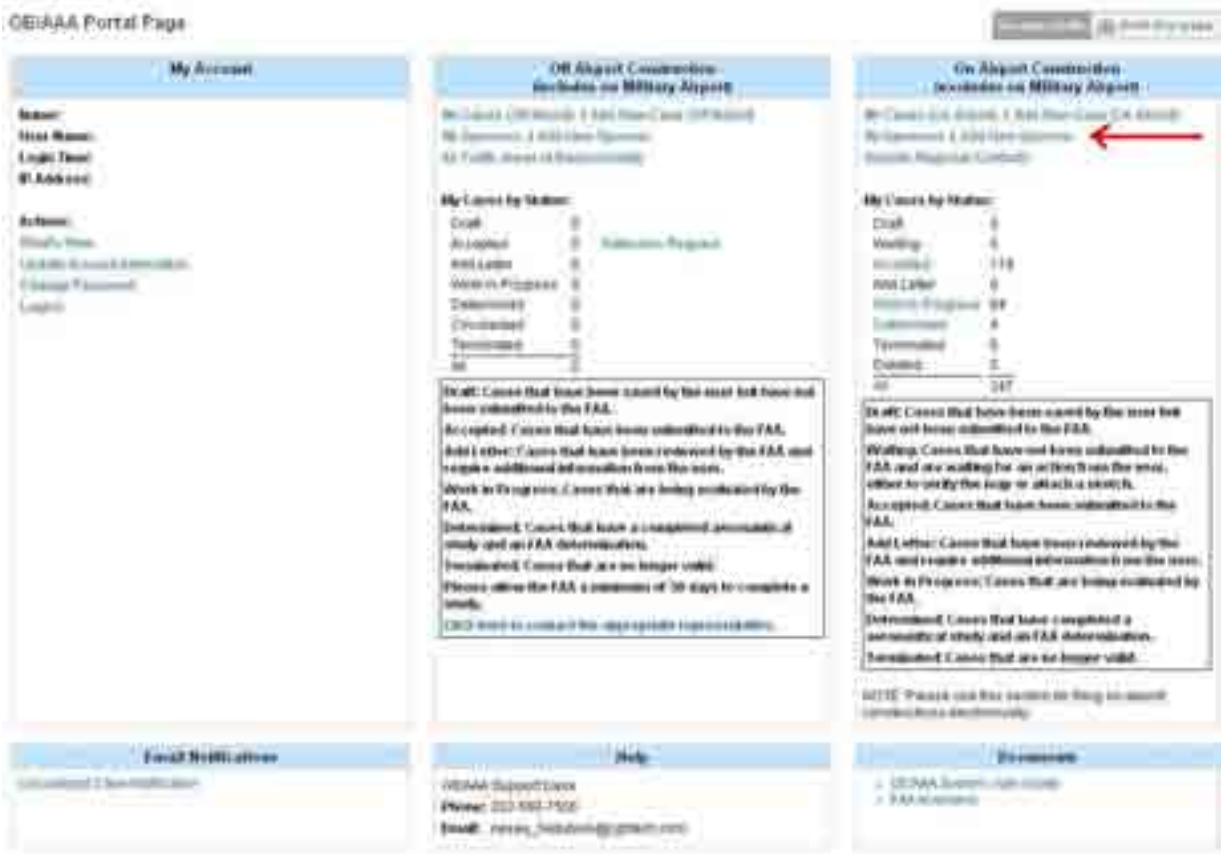
7460 Supplemental Guide

Screen Image 1

Once a user has created an account, they will be able to log in and will be directed to the OE/AAA Portal Page. This page displays a summary of any projects which have been entered into the website, categorized by off-airport and on-airport projects.

Adding a Sponsor

Before a user can enter project specific information, a project sponsor must be created. A sponsor is the person who is ultimately responsible for the construction or alteration. All FAA correspondence will be addressed to the sponsor. The sponsor could be the airport manager for projects proposed by the airport, or the developer proposing off airport construction. To create a sponsor contact, click "Add New Sponsor" on the "portal" page. From there the user can add sponsors for various projects.



Screen Image 2

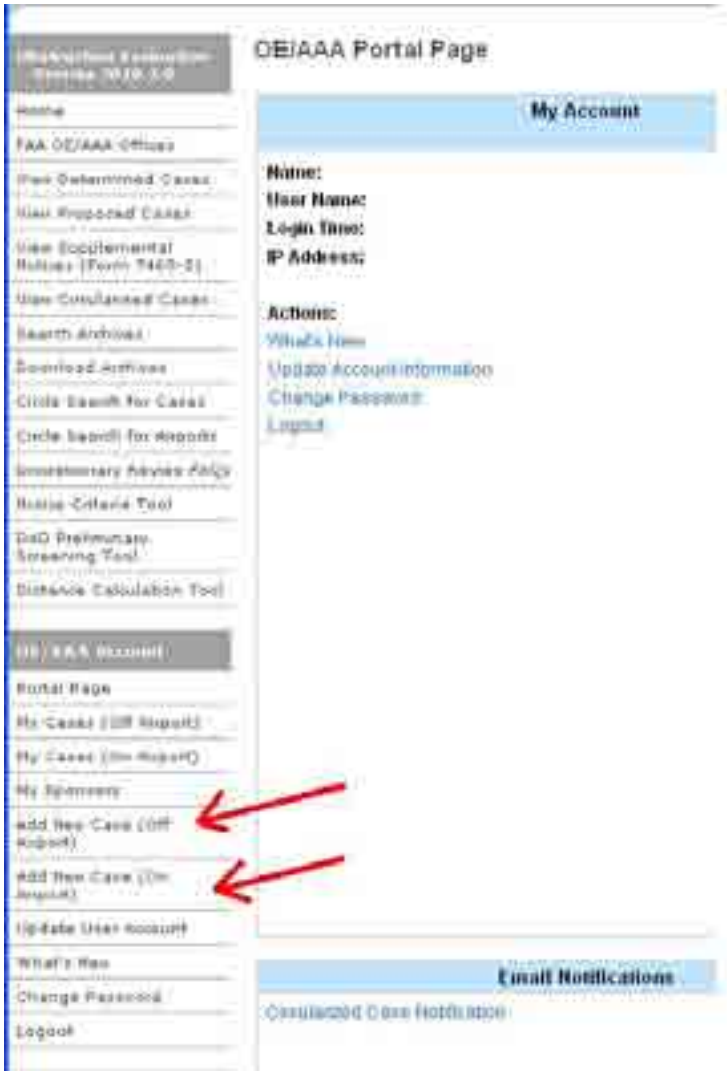
When the user selects "Add New Sponsor", they will be presented with the following screen:

NOTE: The party submitting information through the FAA website **DOES NOT** have to be the same as the sponsor. Often, a consultant or other party under direction from the sponsor makes the submittal through the website

Screen Image 3

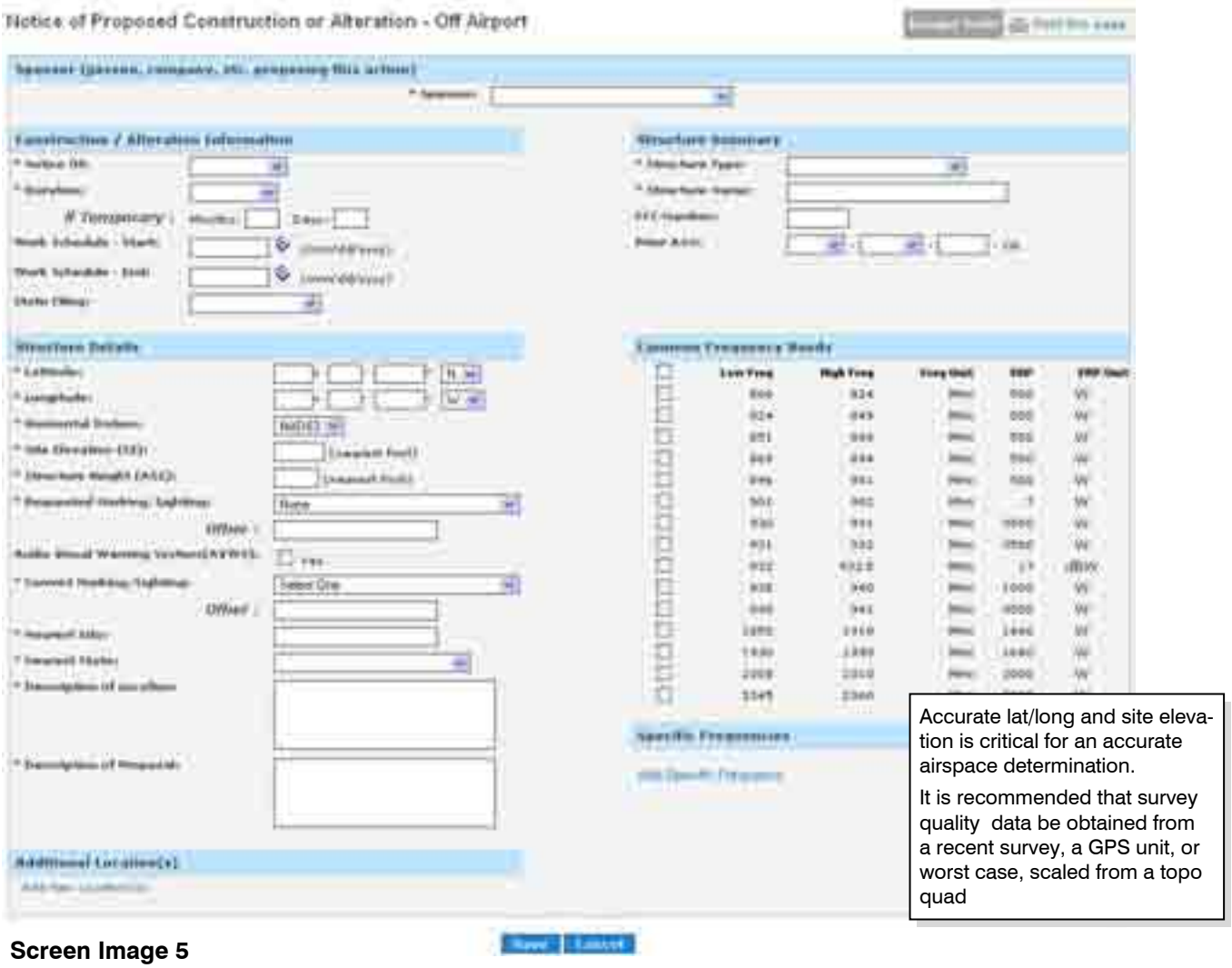
Creating a New Submittal

There are two options for creating a new 7460 submittal. Again on the left side, either click "Add New Case (off airport)" or "Add New Case (on airport)"



Screen Image 4

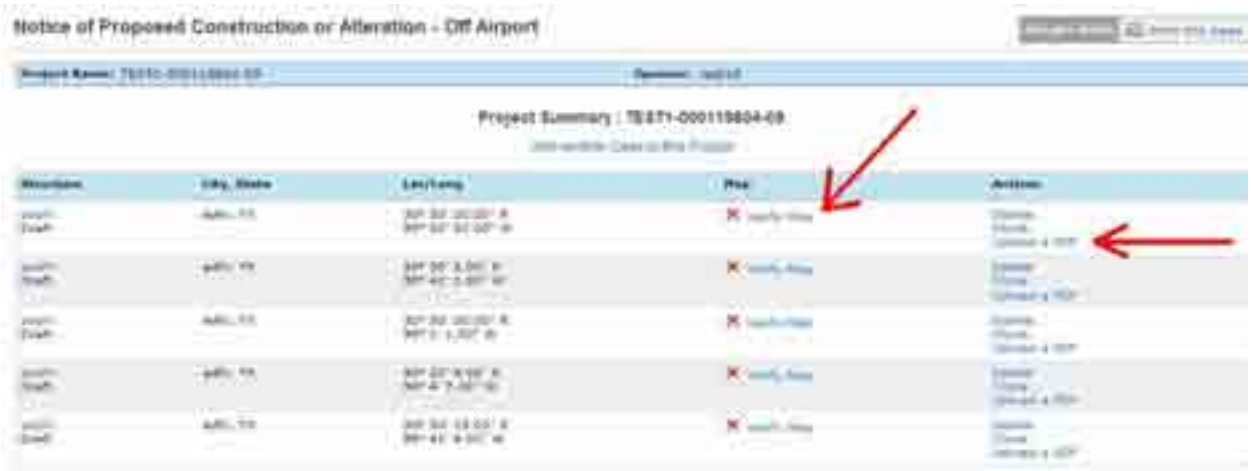
There are some differences in the required fields for "on airport" vs. "off airport" but the differences are minor and self explanatory. One tip: for off airport submittals there is a field for "requested marking/lighting". If the user does not have a preference, select other from the pull down menu and in the "other field" state "no preference".



Screen Image 5

- The most common "notice of" is construction. Select from pull down menu.
- Latitude and longitude must be entered for the structure/construction activity.
- Most 7460 submittals will require multiple points with lat/long unless the 7460 is for a pole/tower/ or other single point object. Buildings and construction areas all require points indicating the extents of the building or area. More information is provided below on how to add additional points to a submittal.
- There is a field to describe the activity taking place. In some complex activities the field does not provide enough room for the required text. An additional explanatory letter can be attached. Additional information is provided in this section on how to add a letter or document to the submittal.
- Red asterisks indicate the required fields.
- Unless there has been a previous aeronautical study for this submittal leave the "prior study" fields blank.
- Only select "common frequency bands" if the proposed structure will transmit a signal.

If the submittal is a building or construction area that is more than a single lat/long point the user must save the data first. Click save at the bottom of the page. This will bring up a summary screen of the case. To add more points click "clone" under the heading "actions".



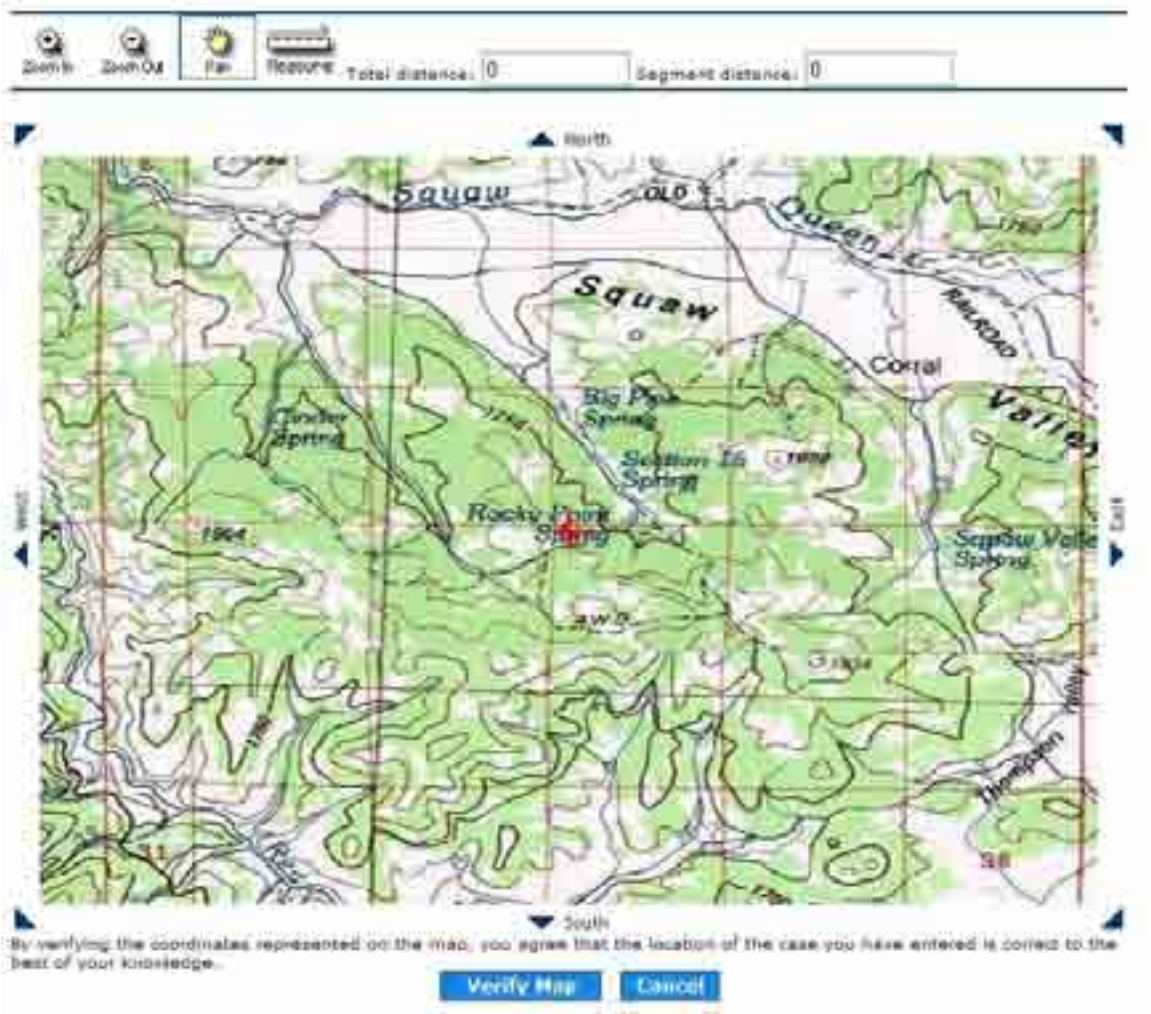
Screen Image 6

The clone tool copies all the relevant information to a new page where an additional lat/long and elevation can be entered. However, the clone process does not number the various points of a proposed project. When entering the details for a point (see Image 5) it is helpful if the user assigns a number to the point and references the total number of points for the project (e.g. point 2 of 20). The numbering can be included in the project "description/remarks" field for each point.

It should be noted that each individual point associated with a project (e.g. each corner of a building) is evaluated individually, thus the importance of including a numbering system (2 of 20) in the text/description box.

Once done, click "save" again. Now the user will see two records under the "project summary" heading. Continue this process of cloning for all the remaining points.

Once all the points have been entered, each point must be verified. There is a red X with the words "verify map" indicating the user has not verified the location. Click Verify Map, a popup will display the lat/long point on a topo map and the user must verify that it is in the correct location. After clicking "verify map" on the popup, the red X will become a blue checkmark. It seems to be more efficient to enter all of the points associated with a project and then return to verify each point on the map at one time.



Screen Image 7

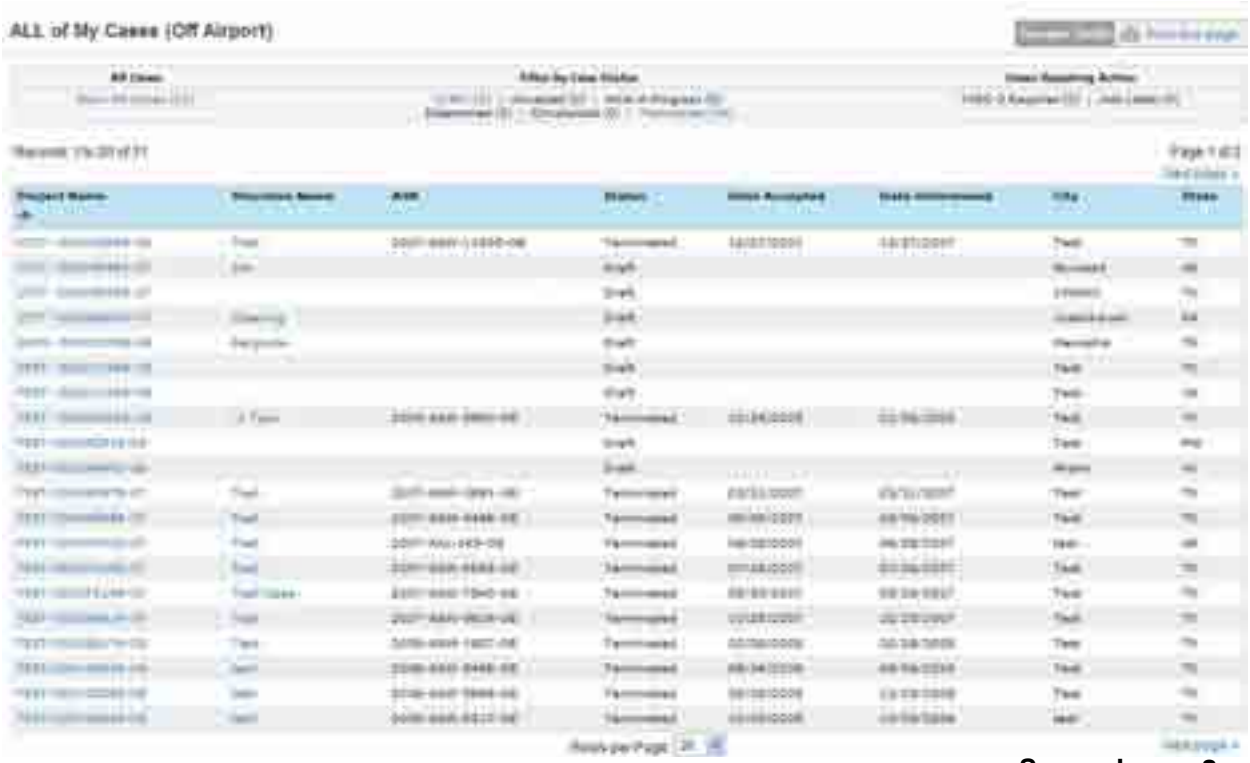
All on-airport project submittals must have a "project sketch" included. Under the "actions" column select "upload a PDF". Once you have uploaded a sketch for all the points associated with the project the red X under "sketch" will turn to a green check mark. Off-airport projects do not require a "project sketch", but the user can still upload one for informational purposes.

If the user needs to add any other information such as an explanatory letter, clicking on "upload a PDF" will allow the user to upload more documents, although only one at a time. Keep in mind that if additional PDFs or information are being provided, like the project sketch it must be uploaded to every point associated with the project.

Once the maps have been verified and sketches uploaded for all points associated with the case, the user will be able to submit the 7460 to the FAA for review.

Status of Submitted Projects

To check the status of a submittal, click on either "my cases (off airport)" or "my cases (on airport)" to see a list of what has been submitted. Each of the multiple points associated with one project will be listed as if they are separate, although still associated. The points will have a status:



Screen Image 8

Project Status Definitions:

Draft: Cases that have been saved by the user but have not been submitted to the FAA.

Waiting: Cases that have not been submitted to the FAA and are waiting for an action from the user, either to verify the map or attach a sketch.

Accepted: Cases that have been submitted to the FAA.

Add Letter: Cases that have been reviewed by the FAA and require additional information from the user.

Work in Progress: Cases that are being evaluated by the FAA.

Determined: Cases that have a completed aeronautical study and an FAA determination.

Terminated: Cases that are no longer valid.

These definitions are also shown at the bottom of the summary screen.

Attachment **2**

Aeronautical Studies

When the FAA receives a Notice of Proposed Construction (Form 7460), it disseminates the information to four different divisions within the agency. Each division specializes in different FAA regulations and orders and provides comments within their own expertise.

After input is received from the individual divisions, the results will be compiled and the FAA will typically issue one of the following form-letter determinations:

- **Determination of No Hazard (DNH).** The study did not reveal any substantial adverse effect and can proceed on that basis. The letter may include optional information such as the basis from which the conclusion was made, identification of obstruction standards exceeded, cautionary aeronautical/operational impacts (e.g., to VFR operations, traffic patterns, etc.), valid aeronautical comments received during circulation/review, marking/lighting requirements, petition deadlines, etc.
- **Notice of Presumed Hazard (NPH).** Indicates the proposed structure exceeds obstruction standards and/or will have an adverse effect on navigable airspace. The goal of the notice is to allow the proponent an opportunity to amend the proposal to avoid the impact. These letters normally require a response within 60 days of issuance. Once the deadline passes, the FAA assumes the project has been terminated. No further action will be taken unless the proponent submits a new 7460 submission to restart the process. Alternatively, a written response from the proponent before the deadline will result in either a new determination (e.g., DNH) or will require the FAA to undertake further study to determine adverse impacts.
- **Determination of Hazard (DOH).** This letter indicates that substantial adverse impact could not be eliminated during the negotiation period following the NPH and the affected aeronautical operations cannot be adjusted to accommodate the structure without substantial adverse effect.

Unless otherwise specified in the letter, DNH and DOH determinations are valid for a period of 18 months from the issue date. The letter will normally include a petition deadline 30 days following the issue/effective date. Unless a valid petition is filed, the determination becomes final 40 days following the issue/effective date.

Appendix **E**

Learning More About: Describing and Evaluating Airport Safety Concerns

Aircraft Accident Data

Location Patterns

For airport land use compatibility planning purposes, the most essential information to have about aircraft accidents is data showing where accidents have historically occurred around airport runways. For general aviation aircraft accidents, the most comprehensive database currently available is the one compiled for the *California Airport Land Use Planning Handbook* published in 2002 by the California Division of Aeronautics. This database contains data on nearly 900 accidents that took place within 5 miles of an airport, but not on the runway itself. The data is from accidents nationwide and covers the 10 years from 1983 to 1992, though not all accidents during this period are included.

Figures E-1 and E-2 on the following pages depict the geographic distribution of arrival and departure accidents relative to the end of the runway that was used or intended to be used. These figures show all the accidents in the database. The California *Handbook* also presents a variety of subset of this data—the distributions for runways of different lengths, for example.

Along with the accident location points, the two figures also show a set of risk contours. The purpose of these contours is to indicate the relative concentration of the accident points. The contours simply divide the data points into five equal groups. The innermost contour indicates the shape that encompasses 20% of the points in the least possible area. The remaining contour contain 40%, 60%, and 80% of the points, with the balance of the points lying beyond the 80% contour.

Among the key findings apparent from the data are these:

- About half of arrival accidents and a third of departure accidents take place within the FAA-defined runway protection zone for a runway with a low-visibility instrument approach procedure (a 2,500-foot long trapezoid, varying from 1,000 feet wide at the inner edge to 1,750 feet in width at the outer end). This fact lends validity to the importance of the runway protection zones as an area within which land use activities should be minimal.
- Although the runway protection zones represent the locations within which risk levels are highest, a significant degree of risk exists well beyond the runway protection zone boundaries. Among all near-airport accidents, over 80% are concentrated within 1.5 to 2.0 miles of a runway end.
- Arrival accidents tend to be concentrated relatively close to the extended runway centerline. Some 80% occur within a strip extending 10,000 feet from the runway landing threshold and 2,000 feet to each side of the runway centerline.
- Departure accidents are comparatively more dispersed laterally from the runway centerline, but are concentrated closer to the runway end. Many departure accidents also occur lateral to the runway itself, particularly when the runway is long. Approximately 80% of the departure accident sites lie within an area 2,500 from the runway centerline and 6,000 feet beyond the runway end or adjacent to the runway.

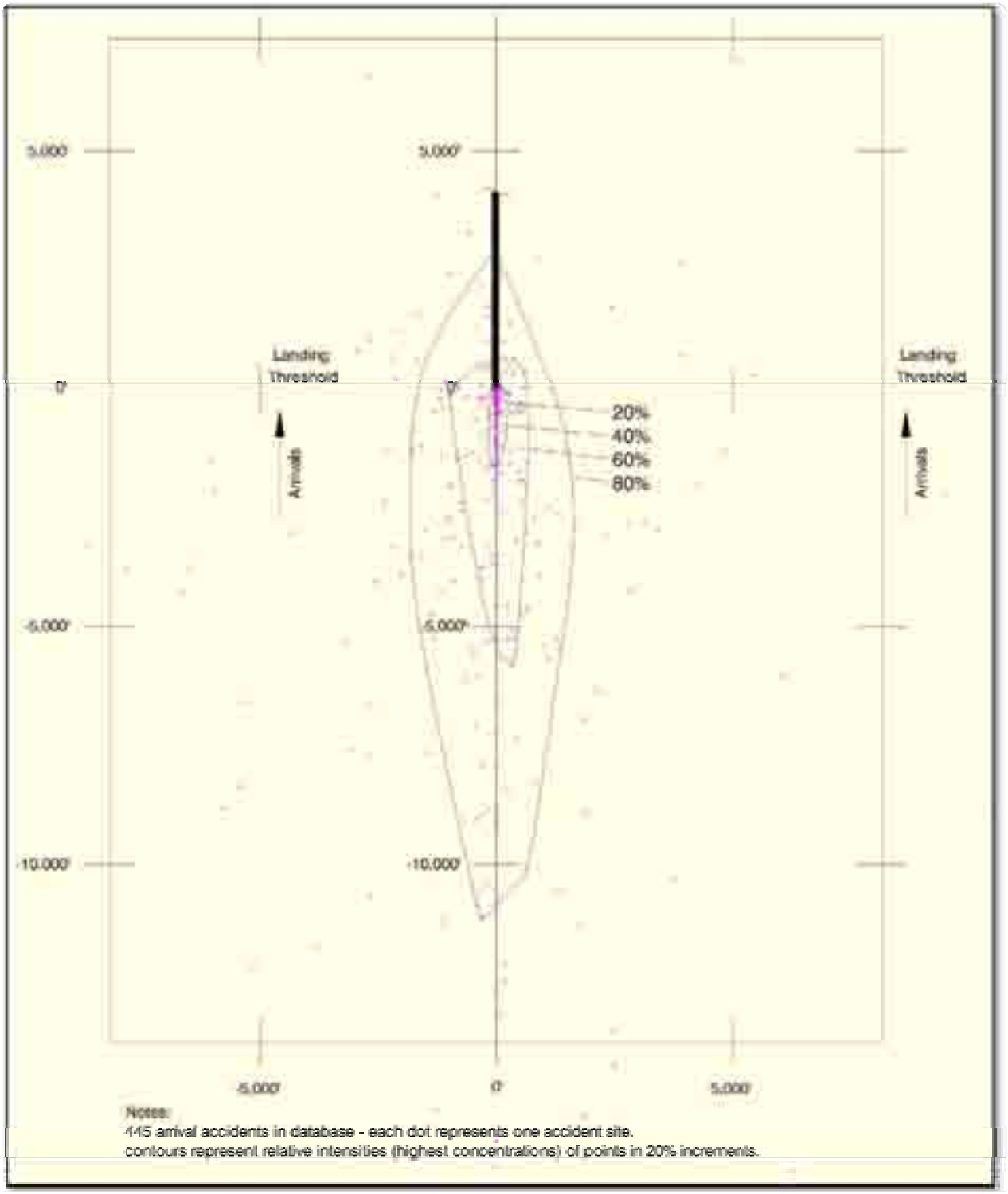


Figure E-1

General Aviation Accident Distribution Contours

All Arrivals

Source: California Airport Land Use Planning Handbook (2002)

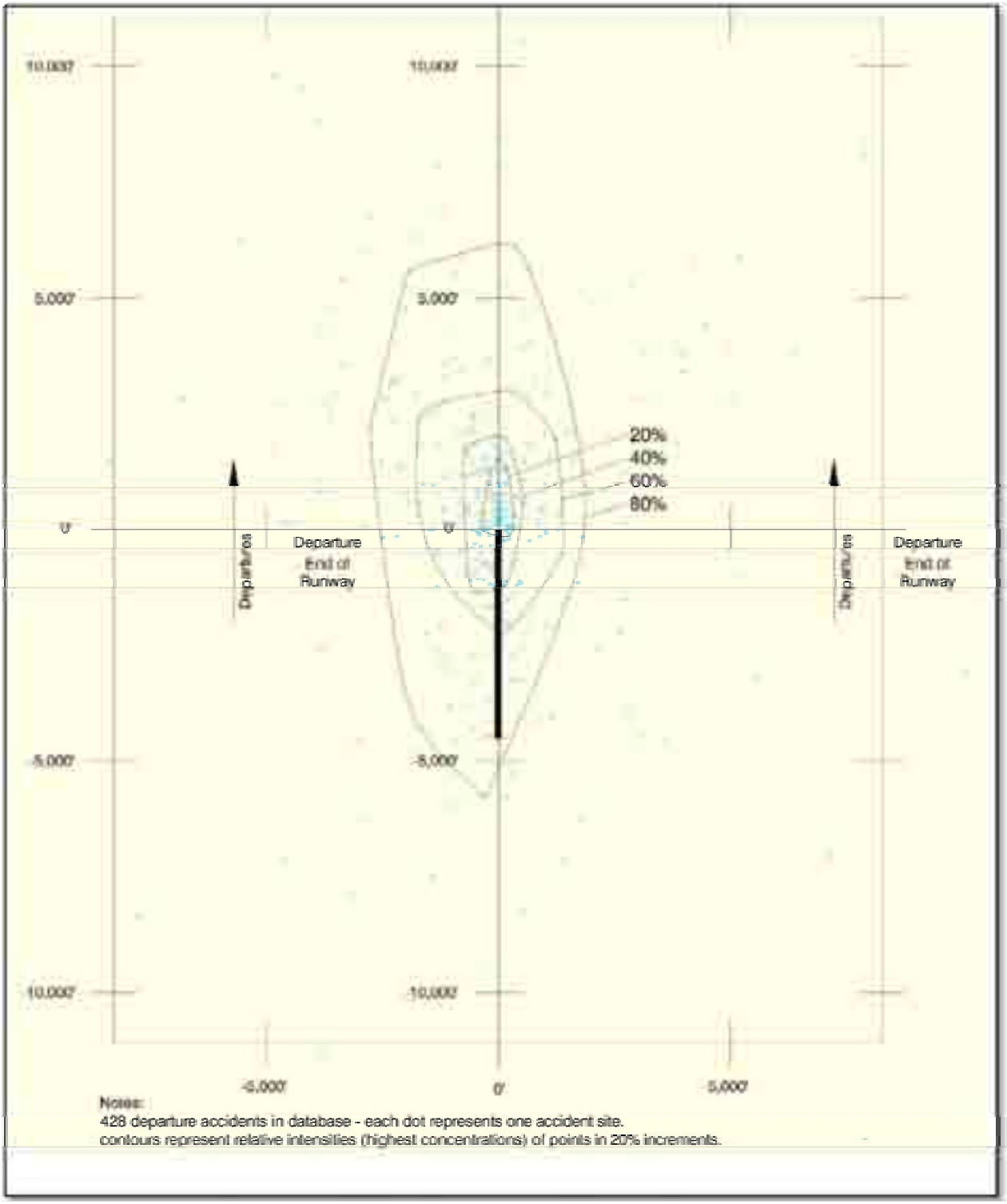


Figure E-2

General Aviation Accident Distribution Contours

All Departures

Source: California Airport Land Use Planning Handbook (2002)

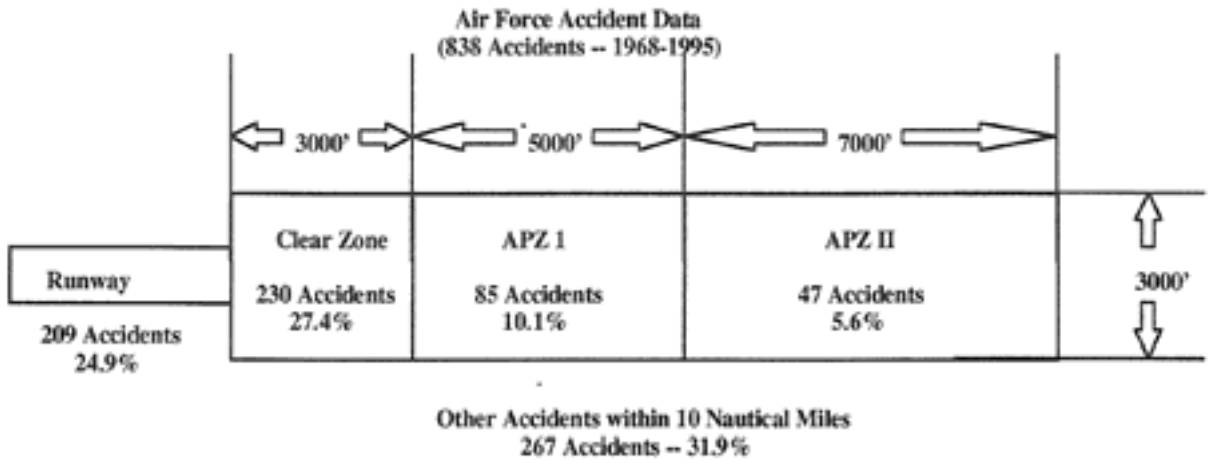
- Runway length affects the distribution pattern of accidents. Arrival and departure accident locations tend to be clustered closer to the runway ends of short runways than is the case with longer runways.

For more detail, see Appendices E and F of the *California Airport Land Use Planning Handbook* (2002) available at: http://www.dot.ca.gov/hq/planning/aeronaut/documents/ALUP/CT%20ALUPH%20Appendix%20E.pdf and http://www.dot.ca.gov/hq/planning/aeronaut/documents/ALUP/CT%20ALUPH%20Appendix%20F.pdf

The FAA has summarized similar data for commercial aircraft operations. The database, though, is limited in size and has not been updated to include accidents that have taken place over the last 20 years. As Figure E-3 shows, all of the accidents represented are located within 2 miles of the runway end. The arrival accident sites are heavily concentrated along the extended runway centerline, while the departure accident sites are comparatively more scattered. The pattern is similar to that for general aviation accidents, particularly those associated with long (6,000 feet or more) runways.

The DOD data on military aircraft accident locations is presented in a more summarized format as illustrated in **Figure E-3**.

Figure E-3. Air Force Accident Data (1968 - 1995)



Source: AICUZ Program Manager's Guide. Air Force Handbook 32-7084 (March 1999)

The database represents 838 Air Force aircraft accidents over a 28-year period ending in 1995. Equivalent data for Navy and Marine aircraft is not available. The diagram indicates the percentages of accidents on the runway and within distinct zones near the runway ends. As with general aviation and commercial aircraft accidents, the highest concentrations are close to a runway end. Excluding the accidents on the runway itself, a 3,000-foot by 3,000-foot area accounts for 36% of the accidents within 10 nautical miles of the runway. Approximately 57% of the off-runway accidents have historically occurred within a 3,000-foot wide strip extending 15,000 feet from a runway. The remainder have taken place farther away including an unknown percentage that can be considered en route accidents beyond the 10-nautical-mile distance from a runway.

Other Characteristics of Aircraft Accidents

A variety of other data regarding the characteristics of aircraft accidents is available in the California *Handbook* and from Federal Aviation Administration and National Transportation Safety Board (NTSB) web sites. A few pieces of information of value to airport land use compatibility planning are summarized below.

- **Aircraft Types.** The type of aircraft operated at an airport or on an individual runway at a multi-runway airport is an important compatibility planning consideration. Large, heavy aircraft, especially jets, have the potential to cause major destruction on the ground if an accident occurs. However, all of the aircraft operated by airlines, as well as most business jets operated by corporations, are flown by professional pilots and are maintained at high standards that significantly reduce the frequency of accidents compared to small, private airplanes. On the other hand, these small planes generally produce much less damage on the ground when accidents happen. From a land use compatibility perspective, these differences somewhat balance each other out and other factors—particularly where the accidents occur—become the dominant planning considerations.
- **Relative Frequency of Arrival versus Departure Accidents.** On the whole, more aircraft accidents occur during the approach/landing phase of operation than during the takeoff/departure phase. However, many landing accidents take place on or immediately adjacent to the runway. Among off-runway, near airport accidents, arrival and departure accidents happen in about equal numbers. This is explicitly true for general aviation, but the more limited data for air carrier accidents suggests it is true for them as well.
- **Controlled versus Uncontrolled Accidents.** In planning for land use compatibility near airports, consideration must be given to the two different forms of aircraft accidents: those in which the aircraft is descending, but is flying and under directional control of the pilot; and those in which the aircraft is out of control as it falls. Available data indicates that a substantial percentage, if not the majority, of general aviation aircraft accidents fall into the former category. Moreover, these data do not include the incidents in which the pilot made a successful emergency landing.
- **Accident Swath.** Swath size is another useful piece of information, especially with respect to planning around general aviation airports. It indicates the area over which accident debris is spread. Swath size in turn depends upon the type of aircraft and the nature of the accident: was the aircraft in controlled flight (an engine failure for example), but then collided with something on the ground or did a catastrophic event (such as a mid-air collision or stall-spin) result in the aircraft making an uncontrolled descent? For small general aviation aircraft, the swath size data suggests that a controlled emergency landing in which the aircraft occupants have a strong chance of surviving is possible in an area about the size of a football field: 75 feet by 300 feet or about 0.5 acre. For larger aircraft, the minimum flight speed is so much higher that the consequences for people on board and anyone in the path on the ground are likely to be severe regardless of the land use or terrain characteristics.

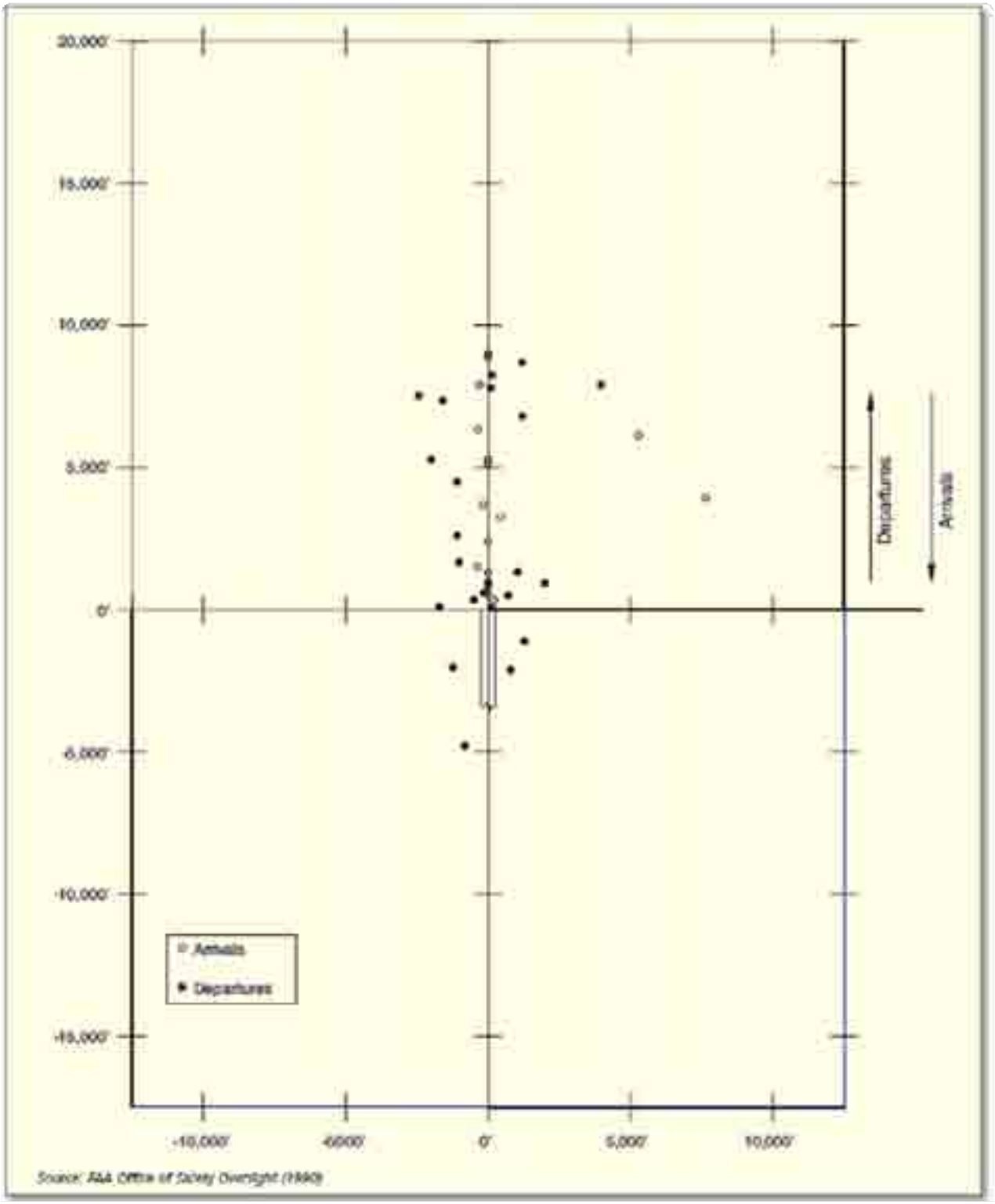


Figure E-4

Commercial Aircraft Accident Location Pattern

Risk Concepts

Central to the task of addressing the safety aspects of airport land use compatibility is the concept of risk. Locations near airport runways are exposed to a greater risk of being involved in an aircraft accident than sites farther away. As these lands are developed, the likelihood that people or property on the ground will be harmed if an accident occurs can only increase. The question is: how much and what type of development is reasonable? To put is another way: what level of risk is acceptable?

There is no easy answer to these questions; no formula into which all the data can be inserted and a set of safety zones and criteria will result. While the probability of an aircraft accident occurring near an airport can be calculated—see the discussion in the following sections—the real issue is what the response to that risk should be. This aspect of risk isn't quantifiable.

It is beyond the scope of this *Guidebook* to provide a comprehensive discussion of risk concepts. Nevertheless, several points are important to highlight.

A more in-depth review of can be found in the *California Airport Land Use Planning Handbook* (2002) available at: http://www.dot.ca.gov/hq/planning/aeronaut/landuse.html

Judging Risk Acceptability

The risk of something negative resulting from an otherwise desirable activity can be measured in terms of two variables:

- The anticipated frequency of the negative event occurring; and
- The potential consequences associated with the event's occurrence.

Frequency is calculated in terms of the number of events within a specific time period and location. Consequences can be physical or financial. Physical consequences can be measured in various ways depending on the nature of the event: injuries, fatalities, lost productivity, property damage, etc.

The combination of these two variables can then be used to judge whether the risk is:

- Negligible or acceptable risk (no action is necessary to reduce or protect against the risk);
- Significant, but tolerable risk (the cost of reducing or protecting against the risk must be weighed against the benefits to be gained); or
- Intolerable risk (the risk cannot be justified except in extraordinary circumstances).

Intolerable risks are usually associated with events that have both high likelihood of occurrence and high consequences. Significant risks can result from events that have high frequency or high consequences or moderate levels of both, but not high levels of both. The table below illustrates the relationship between the two variables and the overall level of risk.

		Potential Consequences				
		Negligible	Minor	Major	Severe	Disastrous
Anticipated Frequency of Occurrence	Frequent					
	Occasional					
	Uncommon					
	Rare					
	Extraordinary					

Legend	Negligible/Acceptable Risk	Significant/Tolerable Risk	Intolerable Risk

In this chart, aircraft accidents can be considered to fall into the range of rare to extraordinary frequency. To hold the risks to an acceptable level therefore means that actions should be taken to avoid potential consequences that are disastrous or, where accidents are comparatively common, severe. The question to be answered thus becomes: what land use actions are appropriate in response to a significant risk?

Cost of Risk Response

One means of answering this question is to consider not just the risk itself, but the cost of the response. Risks that are deemed intolerable warrant a response almost irrespective of the cost. An acceptable risk on the other hand generally needs no specific action. It is in the middle range of risks—those that are merely tolerable—that costs become important. While avoidance of the risk may be desirable, society has limited resources for addressing risks and priorities often must be set. Risks that fall toward the intolerable end of the spectrum may warrant a response unless the cost is very high; whereas, if the risk is close to being acceptable, action may be appropriate only if the cost is relatively minimal.

When considering this issue in the context of aircraft accidents, two key variables are apparent.

- **Existing versus Proposed Uses.** One clear distinction is that the cost of reducing or limiting risks is usually greater where development already exists than where land is undeveloped. The cost of removing an incompatible development is greater than the cost of avoiding its construction in the first place. An implication of this point is that allowing an existing incompatible use to remain may be considered tolerable, but permitting a similar new use may be unacceptable.
- **Urban versus Rural Areas.** A second difference is between urban and rural environments. In urban locations, land values and other development costs typically are higher than in rural areas. The cost—represented by lost opportunity—of limiting development to what might, if not for airport compatibility concerns, otherwise be the land's highest and best use is thus typically greater in urban areas. Also a factor is that, in urban areas, there are often fewer options as to where land uses that are needed in the community can be placed. Less than ideal location choices consequently may be the best choices. Land uses that may not be entirely compatible with each other may nevertheless be considered as acceptable neighbors. People living in urban areas usually consider these risks as reasonable tradeoffs for the benefits that cities also provide. For these reasons, a particular use may be acceptable near an urban airport, but be inappropriate in an identical location near a rural airport.

Risk Perceptions

Another factor that greatly affects the response to risk is how the risk is perceived. This factor accounts for why two different risks that have very similar likelihood of occurrence and potential consequences may produce very different responses. Public response to a risk is usually driven more by the perception of the risk than by the actual risk based on historical experience or mathematical calculations.

A related factor is perspective—that is, who benefits from the activity and who bears the risk? Risks that may be acceptable to society as a whole, may not be acceptable to an individual or vice versa.

Some of the key variables that affect risk perception are listed in the tabulation below. Also noted is where aircraft accident risks fit with regard to these variables. When looked at in this manner, it is difficult to think of any other types of risks that are highly comparable to those posed to people and property on the ground by the threat of aircraft accidents. To be comparable to aircraft accident risks, not only must the likelihood of occurrence be similarly low, but the character of the risks must be qualitatively similar.

Also evident is that for all of the variables listed, aircraft accidents fall at the end of the spectrum that causes the perception of the risk to be greater than the mathematical risk. Even though the frequency of aircraft accidents is low, people focus on the consequences as they have historically occurred and potentially could happen again. For these reasons, a stronger response can be justified for aircraft accident risks than might be warranted for other accident risks.

Risk Perceptions	
A risk is perceived to be higher if:	***Aircraft accidents are perceived as:***
The general public has limited understanding of how the technology or system operates	Involving a form of transportation that is not well understood by most people because they don't fly airplanes
After a failure in the technology or system, no one, including experts in the field, seems to know and understand the cause (as opposed to events for which the cause is clear)	Not well understood—and even if experts may eventually ascertain the cause of an accident, the public may not see or understand the conclusions
The possible consequences of the hazard evoke feelings of dread, especially concerns about death	Giving no advance warning (and people don't tend to look upward for potential danger)
The possible consequences seem unbounded (in magnitude or persistence over time) or are believed to be potentially catastrophic	Including consequences which are unpredictable and potentially catastrophic
The activity is not under one's own control (the risks are not affected by one's own skills)	Not controllable as a function of the individual's skills
The risk exposure is not on a voluntary basis (the exposure cannot readily be reduced by changes in one's lifestyle)	Not voluntary except to the extent that people choose to live near an airport
The hazard is unnatural (not an act of nature)	Not an act of nature
The potential personal or societal benefits to be gained from the activity involved appear to be minimal or nonexistent	Involving an activity (flying) that provides little or no benefit to the people and property owners on the ground who bear the risk
The distribution of risks and benefits among groups or geographically is inequitable	Placing the cost of mitigating the risk on owners of property near the airport
The groups at risk include children, elderly, the infirm, or others regarded as having comparatively little control over their own lives	Placing greater risk on these groups because they would have greater difficulty getting away from the site of an aircraft accident
Highly negative imagery about the technology or system is widespread in the media (especially pictures on television and in newspapers)	Often worthy of nationwide media coverage

Establishing Safety Compatibility Policies

Safety Zones

The discussion in this appendix focuses on aircraft accidents and how this data should be used in addressing the safety compatibility of new development around airports. On this basis, we call the zones described here "safety zones." However, for many airports, noise, overflight, and, to some extent, airspace protection factors can be folded into the safety zones to create composite "compatibility zones" and a composite set of compatibility criteria created to match.

Critical Concept!

When considering the locations of aircraft accidents relative to the typical traffic patterns at the airport, it is important to recognize that where aircraft normally fly may not be where they fly under emergency conditions. Aircraft accidents often occur in locations that might not be expected merely from examination of flight tracks.

While the risk contours described above are helpful as means of portraying the geographic pattern of aircraft accident risks near an airport, they are difficult to directly use as the basis for defining safety compatibility policies. Their irregular shape is one drawback—although, in that respect, they are no different from noise contours. More important is the lack of precision that results from the modest size of the database. Also a consideration is that the irregular shapes do not specifically reflect the different phases of aircraft flight around and airport and the different risk characteristics associated with each phase.

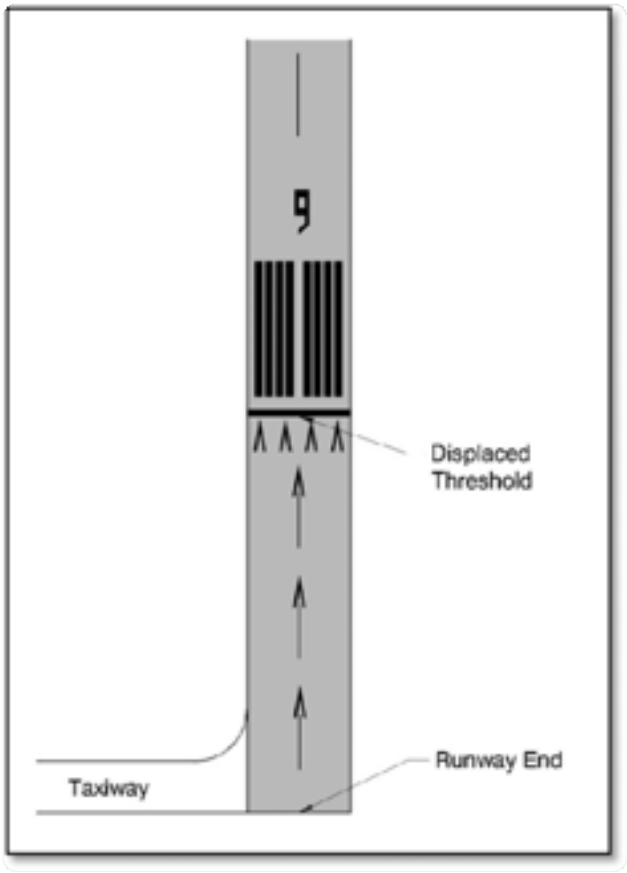
More useful for compatibility planning purposes is to define a set of safety zones based upon the accident location distribution data and risk contours, but having regular geometric shapes. Diagrammed below is a set of six zones originally recommended in the California *Handbook* and utilized in Washington and other states. These zones were defined using the nationwide database of general aviation aircraft accidents described earlier. (See Figure E-5).

The California *Handbook* recommends variations on the zones to take into account different runway lengths, types of approach procedures, traffic pattern location, and other factors. As shown in the diagrams on the next page, the suggested zones are larger for longer runways that accommodate larger, faster aircraft than for short runways used only by light aircraft. The same basic shapes and characteristics of the zones apply, however. The six zones can be characterized as follows:

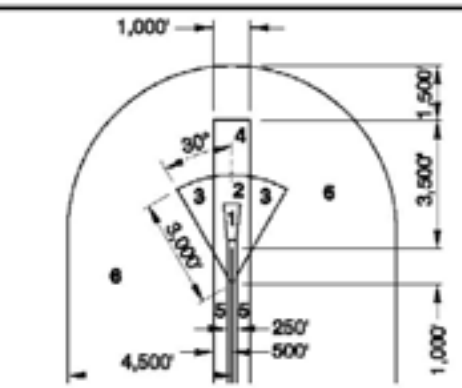
- **Zone 1 – Runway Protection Zone.** This zone encompasses the runway protection zone (RPZ) at each end of the runway and should use the RPZ dimensions established in accordance with FAA standards (RPZ dimensions depend mostly on the visibility minimums for the approach to that runway end). Also included in the zone are the strips of land immediately adjacent to the runway where FAA standards preclude structures. Zone 1 is where the greatest concentration of accidents take place.
- **Zone 2 – Inner Approach/Departure Zone.** Zone 2 wraps around and extends beyond Zone 1 along the runway centerline. Next to the RPZ, it represents the area where the risk of aircraft accidents is the greatest. On departure, aircraft are typically at full power in the initial phase of climb. On approach, they are at low altitude as they prepare for landing.
- **Zone 3 – Inner Turning Zone.** Zone 3 is a wedge-shaped area lying along the sides of Zone 2. It is primarily significant at general aviation airports where most of the flights are visual. At airports where most aircraft approach and depart on instrument flight plans, then the close-in turns which are the concern with Zone 3 can be a narrow wedge. When operating visually, departing aircraft may begin turning over this area to fly toward their destination or to remain in the traffic pattern. Arriving aircraft often overfly this area as well, especially if they are flying a tight pattern. One type of accident known to occur in this area is a low-altitude stall-spin that can happen if a pilot attempts to make too tight of a turn.

- **Zone 4 – Outer Approach/Departure Zone.** This area lies beyond Zone 3 along the extended runway centerline. Aircraft flying straight out or in overfly this area at low-altitude. The zone is particularly significant on runways where much of the operations are on instrument procedures and at busy airports where elongated traffic patterns are common. The risks in this area are moderate, but less than in Zones 1 through 3.
- **Zone 5 – Sideline Zone.** Lying in narrow bands along each side of the runway, aircraft do not normally fly over the sideline zone. The principal risk is from aircraft that lose directional control while landing or just after takeoff. The risks are lower than in Zones 1 through 3 and similar to those of Zone 5.
- **Zone 6 – Traffic Pattern Zone.** The final zone contains the remainder of the airport environment where aircraft fly as they approach and depart the airport or are engaged in flight training. In area, Zone 6 is typically larger than the other zones combined. A substantial percentage of accidents take place here, but they are scattered over the large area.

Each airport is unique. Thus, it is essential to adjust safety zones to fit the airfield configuration, usage characteristics, and other factors associated with a specific airport. Adjusting for runway length is the first step. Additionally, adjustments for approach type, fleet mix, traffic pattern location, etc. may be appropriate for individual runways. For example, adjustments could be considered for runways having displaced landing thresholds, particularly if most landings are made at that end of the runway and few takeoffs come toward that end. Runways having traffic patterns only on one side may dictate some adjustment to Zone 3. Regular use of a runway by special-purpose airplanes such as agricultural, fire attack, and military or by helicopters also may warrant consideration.

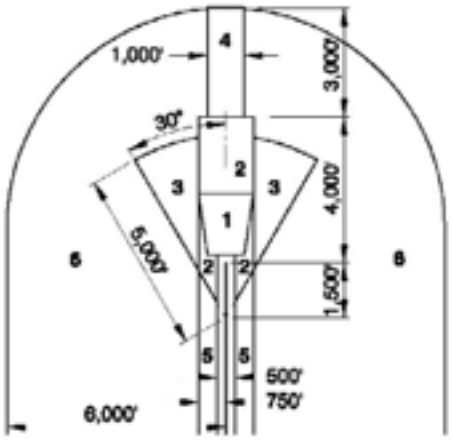


Beyond these types of adjustments, reliance on nationwide rather than airport-specific accident data is essential. Because aircraft accidents are infrequent occurrences, the pattern of accidents at anyone airport cannot be used to predict where future accidents are most likely to happen around that particular airport.



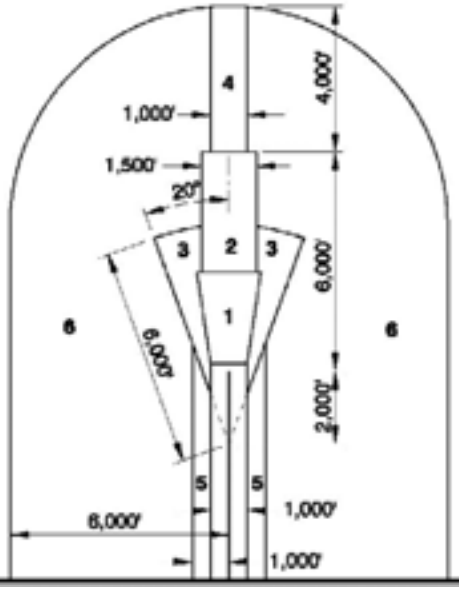
Example 1:
Short General Aviation Runway

Assumptions:
- Length less than 4,000 feet
- Approach visibility minimums ≥ 1 mile or visual approach only
- Zone 1 = 250' x 450' x 1,000'



Example 2:
Medium General Aviation Runway

Assumptions:
- Length 4,000 to 5,999 feet
- Approach visibility minimums ≥ 3/4 mile and < 1 mile
- Zone 1 = 1,000' x 1,510' x 1,700'



Example 3:
Long General Aviation Runway

Assumptions:
- Length 6,000 feet or more
- Approach visibility minimums < 3/4 mile
- Zone 1 = 1,000' x 1,750' x 2,500'

Figure E-5

Safety Compatibility Zone Examples

General Aviation Runway

Source: California Airport Land Use Planning Handbook (2002)

Safety Criteria

The second half of the process of establishing safety policies is to decide upon the criteria that should apply within each of the zones you have delineated. Even more than for the mapping of the zones, there are no absolute rules here, only general guidance. Ultimately, the decision comes back to the issue of acceptable risk.

Several types of land use characteristics are particular concerns with regard to safety compatibility. Criteria should be written to address each of these.

- **High-Intensity Uses.** Given that the potential for injury or death to people on the ground is usually considered the greatest potential land-use-related consequence that could result from aircraft accidents, then limiting the number of people in harm's way is the foremost safety compatibility objective. Typically, the limit is defined in terms of a maximum acceptable number of people per acre of a project site and referred to as a "usage intensity" limit. Deciding upon a specific limit for each safety zone can be challenging, so you may want to instead emphasize land use types. See Chapter 3 for guidance on what land use types are compatible or incompatible with the airport.

> While the criteria outlined here are all safety related, creation of a combined set of criteria that also considers noise, overflight, and airspace protection is encouraged.

- **Residential Uses.** Residential development is usually described in terms of density—the number of dwelling units per acre—rather than intensity or people per acre. Mathematically, a relationship can be drawn between the two by knowing the average number of persons per household. For safety compatibility purposes, however, residential density limitations should not be equated to the usage intensity limitations for nonresidential uses. Society tends to seek a higher degree of protection for people's homes than for most other types of land uses. On this basis, restricting residential development to a density lower than the equivalent nonresidential intensity limit is desirable. Better yet, because of noise and overflight impacts, the best choice is to not introduce new residential development in the approach safety zones (Zones 1 through 5) except perhaps if the densities are very low (less than 1 unit per 5 acres).
- **Uses Having Vulnerable Occupants.** These uses are ones in which the majority of occupants are children, elderly, and/or disabled—people who have reduced effective ability or may be unable to respond to emergency situations and get out of harm's way. Primary uses in this category include: children's schools (grades K–12); day care centers; hospitals and other health care facilities, especially where anesthesia is used during operations or patients remain overnight; and nursing homes.
- **Hazardous Materials Storage.** Aboveground storage of large quantities of hazardous (flammable, explosive, corrosive, or toxic) poses special concerns to the extent that an aircraft accident could cause release of the materials and thereby pose dangers to people and property in the vicinity. Avoidance of such uses or ensuring that the facilities are adequately protected against the consequences of an aircraft accident are recommended.
- **Critical Community Infrastructure.** This category pertains to facilities the damage or destruction of which would cause significant adverse effects to public health and welfare well beyond the immediate vicinity of the facility. Particular examples include: emergency services facilities such as policies and fire stations; emergency communications facilities; and power plants and other utilities.

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Appendix **F**

Compatibility Criteria

Table F-1

Maximum Residential Density						
Compatibility Zones	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
average number of dwelling units per gross acre						
Agricultural (Farmland / Forest)	0	Maintain current comprehensive plan designation and zoning designation				
Rural (outside an urban growth boundary)	0	1 d.u. per 15 acres	1 d.u. per 10 acres [A]	1 d.u. per 5 acres [A]	1 d.u. per 10 acres [A]	1 d.u. per 5 acres
Urban (within the urban growth boundary)	0	0	B	C	B	C

[A] Cluster to preserve open space to maintain open approach corridor at and near runway ends
[B] Infill development up to average of surrounding residential area is allowed, but is appropriate only if nonresidential uses are not feasible
[C] Promote high density and intensity mixed use development (15 to 30 d.u. per acre)

Maximum Intensities for Nonresidential Uses (Commercial, Industrial, Offices, and Activities)						
Compatibility Zones	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
average number of people per gross acre						
Agricultural (Farmland / Forest)	1-5 [E]	D, E	D, E	D, E	D, F	D
Rural (outside an urban growth boundary)	1-5 [E]	10-25 [E]	10-25 [E]	40-60 [E]	100-150 [E]	100-150 [G]
Urban (within the urban growth boundary)	1-5 [E]	50-75 [E]	80-120 [E]	100-150 [E]	100-150 [E]	No Limit [G]

[D] Maintain current comprehensive plan designation and zoning designation
[E] Special Function Land uses should be prohibited
[F] 50-100 people per acre allowed if on airport and aviation-related
[G] Special Function Land uses should be avoided

Table F-2

Airport Land Use Matrix

COMPATIBILTY ZONES	1	2	3	4	5	6
Permitted Land Uses						

Chart Symbols

- "L" Limited – uses or activities that may be compatible with airport operations depending on their location, size, bulk, height, density and intensity of use.
- "P" permitted,– uses or activities that should be permitted, however, these activities should be reviewed to ensure that they will not create height hazard obstructions, smoke, glare, electronic, wildlife attractants, or other airspace hazards.
- "X" Prohibited. – uses or activities that should not be constructed near the airport.

All uses or activities identified herein are subject to intensity and density limitations set forth in Table F-1. Particular attention should be given to developments that when located in combination with other permitted or limited activities may create cumulative impacts on airport operations. All uses should be reviewed to ensure that they will not create airspace hazards

A. RESOURCE OPERATIONS						
(1) AGRICULTURAL (COMMERCIAL)	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Agriculture, Horticulture, General Farming* (crops only, not feedlots and stockyards)	P	P	P	P	P	P
Agricultural Building *	L	L	P	P	P	P
Agricultural Chemical Sales/Storage	X	L	P	P	P	P
Agricultural Market (*)	X	X	P	P	X	P
Agricultural Related Industries (*)	X	L	P	P	P	P
Animal Husbandry	X	L	L	L	X	P
Agricultural Feeding Operation or stockyards	X	X	X	X	X	X
Agriculture or Food Processing Facility (*)	X	L	P	P	L	P
Livestock Auction	X	X	X	L	X	P
Fairgrounds	X	X	X	X	X	P
Floriculture, Aquaculture	X	L	P	P	P	P
Fruit Bin Sales / Storage	X	L	P	P	P	P
(2) FOREST (COMMERCIAL)	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
General forest silver culture (*)	L	L	P	P	P	P
Forest product processing	X	L	P	P	P	P
(3) MINING/REFINING/OFFSITE HAZARDOUS WASTE TREATMENT	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Asphalt paving and roofing materials, rock crushing	X	X	L	L	L	P
Mining including sand and gravel pits (*)	X	L	L	L	X	P
Stockpiling of earthen materials (*)	X	L	L	L	X	P
B. RURAL DEVELOPMENT						
(1) RURAL RESIDENTIAL	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Single family dwelling (*)	X	X	L	P	X	P
Single family dwelling, rural centers	X	X	L	L	X	L
Residential Cluster Development, 40% open(*)	X	X	L	X	X	P

COMPATIBILTY ZONES	**1**	**2**	**3**	**4**	**5**	**6**
Permitted Land Uses						
Chart Symbols • "L" Limited – uses or activities that may be compatible with airport operations depending on their location, size, bulk, height, density and intensity of use. • "P" permitted,– uses or activities that should be permitted, however, these activities should be reviewed to ensure that they will not create height hazard obstructions, smoke, glare, electronic, wildlife attractants, or other airspace hazards. • "X" Prohibited. – uses or activities that should not be constructed near the airport. All uses or activities identified herein are subject to intensity and density limitations set forth in Table F-1. Particular attention should be given to developments that when located in combination with other permitted or limited activities may create cumulative impacts on airport operations. All uses should be reviewed to ensure that they will not create airspace hazards						
Multi-family dwelling (*)	X	X	X	X	X	P
Temporary Farm housing (*)	X	X	P	P	L	P
(2) RURAL CENTERS	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Single Family dwellings	X	X	L	L	X	P
Multi-family dwelling (*): 2-12 Dwelling Units/Acre	X	X	L	L	X	P
13+ Units/Acre	X	X	L	L	X	P
Agriculture/Forest/Mineral Resources or industry (*) (see item A)						
Community Services (*) (see remarks)						
Retail and Commercial Service (*) (see remarks)						
Industrial/Manufacturing (*) (see remarks)						
C. EDUCATION FACILITIES						
(1) EDUCATION FACILITIES	**Zone 1**	**Zone2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Junior or Community College	X	X	L	L	L	P
Schools, K-12 Elementary, Middle Senior High (*)	X	X	X	X	X	X
Business school	X	L	P	P	L	P
Vocational Schools (*)	X	X	P	P	L	P
D URBAN DEVELOPMENT						
(1) RESIDENTIAL	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Single family dwelling (*)	X	X	X	X	X	L
Two family dwelling (duplex) (*)	X	X	X	X	X	L
Multi-family dwelling (*): 3-12 DU/NRA	X	X	L	L	X	L
13+ DU/NRA	X	X	P	P	X	P
Mixed use office/commercial/residential use (*)	X	X	P	P	X	P
Residential Development Cluster, (*) 40% > open space	X	X	L	L	X	L
Residential Infill (*)	X	X	L	L	L	P
Mobile home parks (*)	X	X	L	L	X	L
Boarding House (*)	X	X	L	L	X	L
Retirement homes (*)	X	X	X	X	X	L
(2) COMMUNITY SERVICES	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Cemetery	P	P	P	P	L	P

COMPATIBILTY ZONES	**1**	**2**	**3**	**4**	**5**	**6**
Permitted Land Uses						
Chart Symbols • "L" Limited – uses or activities that may be compatible with airport operations depending on their location, size, bulk, height, density and intensity of use. • "P" permitted,– uses or activities that should be permitted, however, these activities should be reviewed to ensure that they will not create height hazard obstructions, smoke, glare, electronic, wildlife attractants, or other airspace hazards. • "X" Prohibited. – uses or activities that should not be constructed near the airport. All uses or activities identified herein are subject to intensity and density limitations set forth in Table F-1. Particular attention should be given to developments that when located in combination with other permitted or limited activities may create cumulative impacts on airport operations. All uses should be reviewed to ensure that they will not create airspace hazards						
Churches, synagogues, temples (*)	X	X	L	L	X	L
Community Center (*) meeting halls, fraternal organizations	X	X	L	L	X	P
Convalescent, nursing home and group homes (*)	X	X	X	X	X	L
Day Care Facilities (not home occupation): Family in-Home (*)	X	X	L	L	X	L
Day Care Center (*)	X	X	L	L	X	L
Funeral Home	X	X	P	P	X	P
Police, Fire Stations, ambulance service	X	X	P	P	P	P
Hospital (*)	X	X	X	X	X	X
Correction Facilities	X	X	L	L	X	L
Libraries	X	X	P	P	X	P
Museums, art galleries, except aviation related	X	X	X	X	X	X
Zoo (*)	X	X	P	P	X	P
(3) AMUSEMENT AND RECREATION	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Amusement Park (Permanent) (*)	X	X	X	X	X	L
Bowling Alleys	X	X	P	P	X	P
Campground (*)	X	L	L	P	L	P
Recreational Vehicle Parks- *short term*	X	L	L	P	L	P
Drive-in Theatres	X	X	L	L	L	P
Fairgrounds	X	L	P	L	L	P
Golf Courses	L	L	P	P	L	P
Gymnasiums, Exercise Facilities	X	L	L	L	L	P
Horse Racing Tracks, Speedways	X	X	X	X	X	X
Miniature Golf Courses	X	X	P	P	X	P
Movie Theatres, Auditoriums Exhibition Halls	X	X	L	L	X	P
Parks (*)	L	L	P	P	L	P
Roller Skating Rink	X	X	L	L	X	P
(4) RETAIL TRADE AND SERVICE	**Zone 1**	**Zone2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Addressing, Mailing, and Stenographic Services	X	L	P	P	L	P
Advertising Agencies	X	L	P	P	L	P
Airport Uses and activities commercial/industrial (*)	L	P	P	P	P	P

COMPATIBILTY ZONES	**1**	**2**	**3**	**4**	**5**	**6**
Permitted Land Uses						
Chart Symbols • "L" Limited – uses or activities that may be compatible with airport operations depending on their location, size, bulk, height, density and intensity of use. • "P" permitted,– uses or activities that should be permitted, however, these activities should be reviewed to ensure that they will not create height hazard obstructions, smoke, glare, electronic, wildlife attractants, or other airspace hazards. • "X" Prohibited. – uses or activities that should not be constructed near the airport. All uses or activities identified herein are subject to intensity and density limitations set forth in Table F-1. Particular attention should be given to developments that when located in combination with other permitted or limited activities may create cumulative impacts on airport operations. All uses should be reviewed to ensure that they will not create airspace hazards						
Animal Clinic/ Hospital (*)	L	P	P	P	P	P
Antique Stores	X	L	P	P	X	P
Automobile, Truck, Manufactured Home & Travel Trailer Sales	L	P	P	P	L	P
Weekend Automobile and Recreational Vehicle (RV) Sales	L	P	P	P	L	P
Automotive: Car wash	L	P	P	P	L	P
Sales lot/auto center	L	P	P	P	P	P
Parking Lots & Garages	L	P	P	P	P	P
Maintenance & Repair Shops	X	P	P	P	P	P
Paint & Body Repair Shops	L	P	P	P	P	P
Parts & Accessories (Tires, Batteries, etc.)	X	P	P	P	P	P
Specialized Repair Shops (Radiator, etc.)	L	P	P	P	P	P
Towing Services	L	P	P	P	P	P
Automotive: Wrecking & Dismantling Yard (*)	L	P	P	P	L	P
Bakery	X	P	P	P	L	P
Beauty & Barber Shops	X	L	P	P	X	P
Bed & Breakfast Inn	X	X	L	L	X	P
Boats & Marine Accessories	X Except storage L	P	P	P	P	P
Books, Stationery, Office Supplies	Storage only	P	P	P	L	P
Building and Trade (e.g. Plumbing, Heating, Electrical, Painting, etc.)	Storage only	P	P	P	L	P
Clothing & Accessories	X	L	P	P	L	P
Communication Towers (*)	X	X	L	L	L	
Computer & Electronic Stores	X	L	P	P	L	P
Department, Discount, Variety stores	X	X	P	P	X	P
Drug Stores (*) (Optical goods, Orthopedic Supplies)	X	L	P	P	L	P
Employment Agencies (private)	X	P	P	P	L	P
Farm & Implements, Tools & Heavy Construction Equipment (*)	P	L	P	P	L	P
Farm Supplies	L	P	P	P	L	P
Financial Institutions	X	X	P	P	L	P
Food store	X	X	P	P	L	P

COMPATIBILTY ZONES	**1**	**2**	**3**	**4**	**5**	**6**
Permitted Land Uses						
Chart Symbols • "L" Limited – uses or activities that may be compatible with airport operations depending on their location, size, bulk, height, density and intensity of use. • "P" permitted,– uses or activities that should be permitted, however, these activities should be reviewed to ensure that they will not create height hazard obstructions, smoke, glare, electronic, wildlife attractants, or other airspace hazards. • "X" Prohibited. – uses or activities that should not be constructed near the airport. All uses or activities identified herein are subject to intensity and density limitations set forth in Table F-1. Particular attention should be given to developments that when located in combination with other permitted or limited activities may create cumulative impacts on airport operations. All uses should be reviewed to ensure that they will not create airspace hazards						
Furniture, home furnishings, appliances	X	X	P	P	L	P
General hardware, garden equipment and supplies	X	X	P	P	L	P
Grocery / Convenience store	X	L	P	P	L	P
Heavy equipment storage, maintenance and repair	X	L	P	P	L	P
Insurance agents, brokers and service agencies	X	P	P	P	L	P
Kennels (*)	L	P	P	P	L	P
Laundries, Laundromats and dry cleaning plants	X	P	P	P	L	P
Liquor Stores	X	L	P	P	L	P
Lumber yards	L	P	P	P	L	P
Medical and dental laboratory, offices and clinic	X	X	L	P	x	P
Mini Storage (*)	P	P	P	P	P	P
Motels and Hotels	X	L	P	P	P	P
Motorcycles sales/ repair (including maintenance)	X	P	P	P	L	P
Paint, glass and wallpaper stores	X	P	P	P	L	P
Pet stores, pet supplies and dog grooming	X	L	P	P	L	
Professional office buildings for architects, attorneys, government, etc.	X	L	**P**	P	P	P
Rental: Auto, truck, trailer, fleet leasing services	L	P	P	P	L	P
Repair's: Small Appliances, TV', Business Machines, Watches, etc	L	P	P	P	L	P
Restaurant, Cafe and Drive-in Eating Facilities (*)	X	L	P	P	P	P
Service Station (*)	X	L	P	P	**L**	P
Sporting Goods, Bicycle Shops	X	P	P	P	P	P
Taverns(*),Bars, Dance Establishments	X	L	P	P	L	P
(5) INDUSTRY/MANUFACTURING	**Zone 1**	**Zone2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Aircraft parts	Storage only	L	P	P	P	P
Aircraft Industrial (*)	Storage only	L	P	P	P	P
Apparel and accessories	X	**L**	P	P	X	P
Bakery products (wholesale)	L	L	P	P	X	P
Beverage industry	L	L	P	P	X	P
Canning, Preserving and packaging fruits vegetables and other foods	X	X	L	L	X	P

COMPATIBILTY ZONES	**1**	**2**	**3**	**4**	**5**	**6**
Permitted Land Uses						
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Cement and Concrete plants(*)	X	L	L	L	X	P
Chemicals (industrial, agricultural, wood, etc.)	X	X	L	L	X	L
Concrete, gypsum and plaster products	Storage only	L	P	L	L	P
Confectionery and related products (wholesale)	Storage only	P	P	P	L	P
Mini Storage (*)	P	P	P	P	P	P
Product assembly	Storage only	L	P	P	L	P
Prefabricated structural wood products and containers	Storage only	P	P	P	L	P
Printing, publishing and binding	Storage only	P	P	P	L	P
Rendering plants, slaughter houses	X	X	X	X	X	X
Rubber products	X	L	P	P	L	P
Sawmills and planing mills	X	L	P	P	L	P
Sheet metal and welding shops	Storage only	P	P	P	L	P
Stone products (Includes finishing of monuments for retail sale)	Storage only	P	P	P	L	P
(6) WHOLESALE TRADE-STORAGE	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Warehouses (*)	L	P	P	P	P	P
Wholesale trade						
Storage facilities, bulk (*)	L	P	P	P	P	P
Commercial (*)	L	P	P	P	P	P
mini-storage						
E. TRANSPORTATION AND UTILITIES						
(1) TRANSPORTATION	**Zone 1**	**Zone2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
Bus terminals	X	L	P	P	L	P
Transportation storage facilities and maintenance facilities	L	P	P	P	P	P
Transportation brokerage (*) offices; without truck parking	L	P	P	P	P	P
With truck parking	L	P	P	P	P	P
Contract truck hauling, rental of trucks with drivers	L	P	P	P	P	P
Rail, truck terminals (for short term storage, office, etc.)	L	P	P	P	P	P
Air storage and office use	L	P	P	P	P	P

COMPATIBILTY ZONES	1	2	3	4	5	6
Permitted Land Uses						
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Railroad switch yards, maintenance and repair facilities, etc.	X	P	P	P	P	P
Taxicab terminals, maintenance and dispatching centers, etc.	X	P	P	P	P	P
(2) UTILITIES						
Power generating facilities	L	L	L	L	L	L
Utility services (substations, etc.)	L	L	L	L	L	P
Wholesale trade	L	P	P	P	L	P
Storage facilities, bulk (*)	L	P	P	P	P	P
Commercial (*)	L	P	P	P	P	P

Appendix **G**

Glossary of Terms

Above Ground Level (AGL): An elevation datum given in feet above ground level.

Accident Potential Zones (APZs): A set of safety-related zones defined by AICUZ studies for areas beyond the ends of military airport runways. Typically, three types of zones are established: a clear zone closest to the runway end, then APZ I and APZ II. The potential for aircraft accidents and the corresponding need for land use restrictions is greatest with the clear zone and diminishes with increased distance from the runway.

Air Carriers: The commercial system of air transportation, consisting of the certificated air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

Air Installation Compatible Use Zones (AICUZ): A land use compatible plan prepared by the U.S. Department of Defense for military airfields. AICUZ plans serve as recommendations to local governments bodies having jurisdiction over land uses surrounding these facilities.

Aircraft Accident: An occurrence incident to flight in which, as a result of the operation of an aircraft, a person (occupant or nonoccupant) receives fatal or serious injury or an aircraft receives substantial damage.

- Except as provided below, *substantial damage* means damage or structural failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft, and that would normally require major repair or replacement of the affected component.
- Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered substantial damage.

Aircraft Incident: A mishap associated with the operation of an aircraft in which neither fatal nor serious injuries nor substantial damage to the aircraft occur.

Aircraft Mishap: The collective term for an aircraft accident or an incident.

Aircraft Operation: The airborne movement of aircraft at an airport or about an en route fix or at other point where counts can be made. There are two types of operations: local and itinerant. An operation is counted for each landing and each departure, such that a touch-and-go flight is counted as two operations. (FAA Stats)

Airport: An area of land or water that is used or intended to be used for the landing and taking off of aircraft, and includes its buildings and facilities if any. (FAR 1)

Airport Elevation: The highest point of an airport's useable runways, measured in feet above mean sea level. (AIM)

Airport Layout Plan (ALP): A scale drawing of existing and proposed airport facilities, their location on an airport, and the pertinent clearance and dimensional information required to demonstrate conformance with applicable standards.

Airport Master Plan (AMP): A long-range plan for development of an airport, including descriptions of the data and analyses on which the plan is based.

Airport Reference Code (ARC): A coding system used to relate airport design criteria to the operation and physical characteristics of the airplanes intended to operate at an airport. (Airport Design AC)

Ambient Noise Level: The level of noise that is all encompassing within a given environment for which a single source cannot be determined. It is usually a composite of sounds from many and varied sources near to and far from the receiver.

Approach Protection Easement: A form of easement that both conveys all of the rights of an avigation easement and sets specified limitations on the type of land uses allowed to be developed on the property.

Approach Speed: The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration. (AIM)

Aviation-Related Use: Any facility or activity directly associated with the air transportation of persons or cargo or the operation, storage, or maintenance of aircraft at an airport or heliport. Such uses specifically include runways, taxiways, and their associated protected areas defined by the Federal Aviation Administration, together with aircraft aprons, hangars, fixed base operations, terminal buildings, etc.

Avigation Easement: A type of easement that typically conveys the following rights:

- A right-of-way for free and unobstructed passage of aircraft through the airspace over the property at any altitude above a surface specified in the easement (usually set in accordance with FAR Part 77 criteria).
- A right to subject the property to noise, vibrations, fumes, dust, and fuel particle emissions associated with normal airport activity.
- A right to prohibit the erection or growth of any structure, tree, or other object that would enter the acquired airspace.
- A right-of-entry onto the property, with proper advance notice, for the purpose of removing, marking, or lighting any structure or other object that enters the acquired airspace.
- A right to prohibit electrical interference, glare, misleading lights, visual impairments, and other hazards to aircraft flight from being created on the property.

Based Aircraft: Aircraft stationed at an airport on a long-term basis.

Ceiling: Height above the earth's surface to the lowest layer of clouds or obscuring phenomena. (AIM)

Circling Approach/Circle-to-Land Maneuver: A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or not desirable. (AIM)

Clear Zone: The military airport equivalent of runway protection zones at civilian airports.

Combining District: A zoning district that establishes development standards in areas of special concern over and above the standards applicable to basic underlying zoning districts.

Commercial Activities: Airport-related activities that may offer a facility, service or commodity for sale, hire or profit. Examples of commodities for sale are: food, lodging, entertainment, real estate, petroleum products, parts and equipment. Examples of services are: flight training, charter flights, maintenance, aircraft storage, and tiedown. (CCR)

Commercial Operator: A person who, for compensation or hire, engages in the carriage by aircraft in air commerce of persons or property, other than as an air carrier. (FAR 1)

Compatibility Plan: As used herein, a plan, usually adopted by an Airport Land Use Commission that sets forth policies for promoting compatibility between airports and the land uses that surround them. Often referred to as a *Comprehensive Land Use Plan (CLUP)*.

Controlled Airspace: Any of several types of airspace within which some or all aircraft may be subject to air traffic control. (FAR 1)

Day-Night Average Sound Level (DNL): The noise metric adopted by the U.S. Environmental Protection Agency for measurement of environmental noise. It represents the average daytime noise level during a 24-hour day, measured in decibels and adjusted to account for the lower tolerance of people to noise during nighttime periods. The mathematical symbol is L_{dn}.

Decibel (dB): A unit measuring the magnitude of a sound, equal to the logarithm of the ratio of the intensity of the sound to the intensity of an arbitrarily chosen standard sound, specifically a sound just barely audible to an unimpaired human ear. For environmental noise from aircraft and other transportation sources, an *A-weighted sound level* (abbreviated dBA) is normally used. The A-weighting scale adjusts the values of different sound frequencies to approximate the auditory sensitivity of the human ear.

Deed Notice: A formal statement added to the legal description of a deed to a property and on any subdivision map. As used in airport land use planning, a deed notice would state that the property is subject to aircraft overflights. Deed notices are used as a form of buyer notification as a means of ensuring that those who are particularly sensitive to aircraft overflights can avoid moving to the affected areas.

Designated Body: A local government entity, such as a regional planning agency or a county planning commission, chosen by the county board of supervisors and the selection committee of city mayors to act in the capacity of an airport land use commission.

Displaced Threshold: A landing threshold that is located at a point on the runway other than the designated beginning of the runway (see *Threshold*). (AIM)

Easement: A less-than-fee-title transfer of real property rights from the property owner to the holder of the easement.

Equivalent Sound Level (L_{eq}): The level of constant sound that, in the given situation and time period, has the same average sound energy as does a time-varying sound.

FAR Part 77: The part of the Federal Aviation Regulations that deals with objects affecting navigable airspace.

FAR Part 77 Surfaces: Imaginary airspace surfaces established with relation to each runway of an airport. There are five types of surfaces: (1) primary; (2) approach; (3) transitional; (4) horizontal; and (5) conical.

Federal Aviation Administration (FAA): The U.S. government agency that is responsible for ensuring the safe and efficient use of the nation's airports and airspace.

Federal Aviation Regulations (FAR): Regulations formally issued by the FAA to regulate air commerce.

Findings: Legally relevant subconclusions that expose a government agency's mode of analysis of facts, regulations, and policies, and that bridge the analytical gap between raw data and ultimate decision.

Fixed Base Operator (FBO): A business that operates at an airport and provides aircraft services to the general public including, but not limited to, sale of fuel and oil; aircraft sales, rental, maintenance, and repair; parking and tiedown or storage of aircraft; flight training; air taxi/charter operations; and specialty services, such as instrument and avionics maintenance, painting, overhaul, aerial application, aerial photography, aerial hoists, or pipeline patrol.

General Aviation: That portion of civil aviation that encompasses all facets of aviation except air carriers. (FAA Stats)

Glide Slope: An electronic signal radiated by a component of an ILS to provide vertical guidance for aircraft during approach and landing.

Global Positioning System (GPS): A navigational system that utilizes a network of satellites to determine a positional fix almost anywhere on or above the earth. Developed and operated by the U.S. Department of Defense, GPS has been made available to the civilian sector for surface, marine, and aerial navigational use. For aviation purposes, the current form of GPS guidance provides en route aerial navigation and selected types of nonprecision instrument approaches. Eventual application of GPS as the principal system of navigational guidance throughout the world is anticipated.

Helipad: A small, designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters. (AIM)

Heliport: A facility used for operating, basing, housing, and maintaining helicopters.

Infill: Development that takes place on vacant property largely surrounded by existing development, especially development that is similar in character.

Instrument Approach Procedure: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority (refer to *Nonprecision Approach Procedure* and *Precision Approach Procedure*). (AIM)

Instrument Flight Rules (IFR): Rules governing the procedures for conducting instrument flight. Generally, IFR applies when meteorological conditions with a ceiling below 1,000 feet and visibility less than 3 miles prevail. (AIM)

Instrument Landing System (ILS): A precision instrument approach system that normally consists of the following electronic components and visual aids: (1) Localizer; (2) Glide Slope; (3) Outer Marker; (4) Middle Marker; (5) Approach Lights. (AIM)

Instrument Operation: An aircraft operation in accordance with an IFR flight plan or an operation where IFR separation between aircraft is provided by a terminal control facility. (FAA ATA)

Instrument Runway: A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved. (AIM)

Inverse Condemnation: An action brought by a property owner seeking just compensation for land taken for a public use against a government or private entity having the power of eminent domain. It is a remedy peculiar to the property owner and is exercisable by that party where it appears that the taker of the property does not intend to bring eminent domain proceedings.

Land Use Density: A measure of the concentration of land use development in an area. Mostly the term is used with respect to residential development and refers to the number of dwelling units per acre. Unless otherwise noted, policies in this compatibility plan refer to *gross* rather than *net* acreage.

Land Use Intensity: A measure of the concentration of nonresidential land use development in an area. For the purposes of airport land use planning, the term indicates the number of people per acre attracted by the land use. Unless otherwise noted, policies in this compatibility plan refer to *gross* rather than *net* acreage.

Large Airplane: An airplane of more than 12,500 pounds maximum certificated takeoff weight. (Airport Design AC)

Localizer (LOC): The component of an ILS that provides course guidance to the runway. (AIM)

Mean Sea Level (MSL): An elevation datum given in feet from mean sea level.

Minimum Descent Altitude (MDA): The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided. (FAR 1)

Missed Approach: A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. (AIM)

National Transportation Safety Board (NTSB): The U.S. government agency responsible for investigating transportation accidents and incidents.

Navigational Aid (Navaid): Any visual or electronic device airborne or on the surface that provides point-to-point guidance information or position data to aircraft in flight. (AIM)

Noise Contours: Continuous lines of equal noise level usually drawn around a noise source, such as an airport or highway. The lines are generally drawn in 5-decibel increments so that they resemble elevation contours in topographic maps.

Noise Level Reduction (NLR): A measure used to describe the reduction in sound level from environmental noise sources occurring between the outside and the inside of a structure.

Nonconforming Use: An existing land use that does not conform to subsequently adopted or amended zoning or other land use development standards.

Nonprecision Approach Procedure: A standard instrument approach procedure in which no electronic glide slope is provided. (FAR 1)

Nonprecision Instrument Runway: A runway with an approved or planned straight-in instrument approach procedure that has no existing or planned precision instrument approach procedure. (Airport Design AC)

Obstruction: Any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used therein, the height of which exceeds the standards established in Subpart C of Federal Aviation Regulations Part 77, *Objects Affecting Navigable Airspace*.

Overflight: Any distinctly visible and/or audible passage of an aircraft in flight, not necessarily directly overhead.

Overflight Easement: An easement that describes the right to overfly the property above a specified surface and includes the right to subject the property to noise, vibrations, fumes, and emissions. An overflight easement is used primarily as a form of buyer notification.

Overflight Zone: The area(s) where aircraft maneuver to enter or leave the traffic pattern, typically defined by the FAR Part 77 horizontal surface.

Overlay Zone: See *Combining District*.

Precision Approach Procedure: A standard instrument approach procedure where an electronic glide slope is provided. (FAR 1)

Precision Instrument Runway: A runway with an existing or planned precision instrument approach procedure. (Airport Design AC)

Referral Area: The area around an airport defined by the planning area boundary adopted by an airport land use commission within which certain land use proposals are to be referred to the commission for review.

Runway Protection Zone (RPZ): An area (formerly called a *clear zone*) off the end of a runway used to enhance the protection of people and property on the ground. (Airport Design AC)

Safety Zone: For the purpose of airport land use planning, an area near an airport in which land use restrictions are established to protect the safety of the public from potential aircraft accidents.

Single-Event Noise: As used in herein, the noise from an individual aircraft operation or overflight.

Small Airplane: An airplane of 12,500 pounds or less maximum certificated takeoff weight. (Airport Design AC)

Sound Exposure Level (SEL): A time-integrated metric (i.e., continuously summed over a time period) that quantifies the total energy in the A-weighted sound level measured during a transient noise event. The time period for this measurement is generally taken to be that between the moments when the A-weighted sound level is 10 dB below the maximum.

Straight-In Instrument Approach: An instrument approach wherein a final approach is begun without first having executed a procedure turn; it is not necessarily completed with a straight-in landing or made to straight-in landing weather minimums. (AIM)

Taking: Government appropriation of private land for which compensation must be paid as required by the Fifth Amendment of the U.S. Constitution. It is not essential that there be physical seizure or appropriation for a *taking* to occur, only that the government action directly interferes with or substantially disturbs the owner's right to use and enjoyment of the property.

Terminal Instrument Procedures (TERPS): Procedures for instrument approach and departure of aircraft to and from civil and military airports. There are four types of terminal instrument procedures: precision approach, nonprecision approach, circling, and departure.

Threshold: The beginning of that portion of the runway usable for landing (also see *Displaced Threshold*). (AIM)

Touch-and-Go: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. (AIM)

Traffic Pattern: The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach. (AIM)

Visual Approach: An approach where the pilot must use visual reference to the runway for landing under VFR conditions.

Visual Flight Rules (VFR): Rules that govern the procedures for conducting flight under visual conditions. VFR applies when meteorological conditions are equal to or greater than the specified minimum-generally, a 1,000-foot ceiling and 3-mile visibility.

Visual Runway: A runway intended solely for the operation of aircraft using visual approach procedures, with no straight-in instrument approach procedure and no instrument designation indicated on an FAA-approved airport layout plan. (Airport Design AC)

Zoning: A police power measure, enacted primarily by units of local government, in which the community is divided into districts or zones within which permitted and special uses are established, as are regulations governing lot size, building bulk, placement, and other development standards. Requirements vary from district to district, but they must be uniform within districts. A zoning ordinance consists of two parts: the text and a map.

Glossary Sources

FAR 1: Federal Aviation Regulations Part 1, Definitions and Abbreviations

AIM: Aeronautical Information Manual

Airport Design AC: Federal Aviation Administration, *Airport Design* Advisory Circular 150/5300-13

FAA ATA: Federal Aviation Administration, *Air Traffic Activity*

FAA Stats: Federal Aviation Administration, *Statistical Handbook of Aviation*

NTSB: National Transportation and Safety Board

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