AIRPORTS AND COMPATIBLE LAND USE VOLUME 1

Washington State
Department of Transportation
Aviation Division

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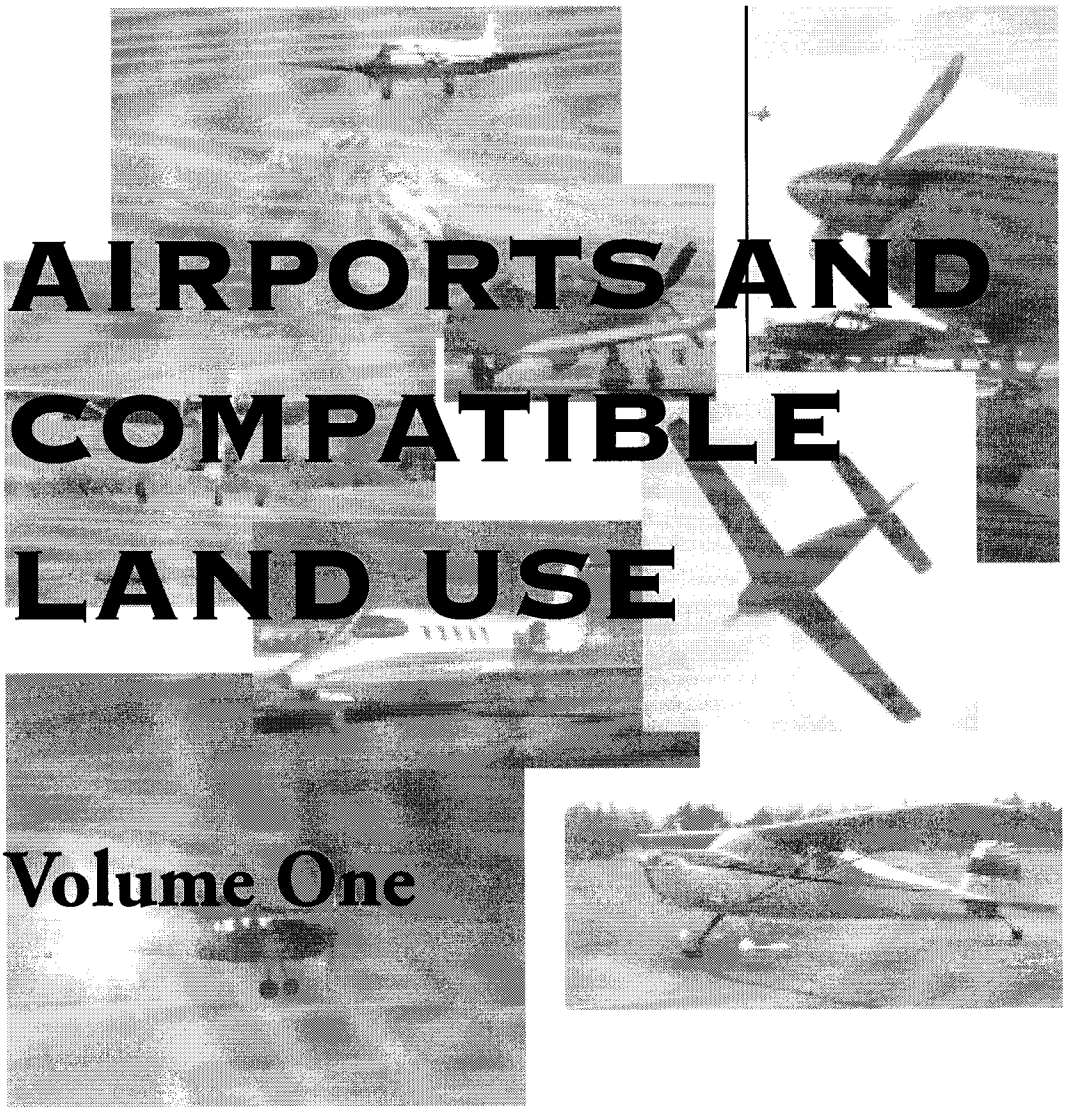

AIRPORTS AND COMPATIBLE LAND USE

Volume One

An Introduction and Overview for Decision-Makers

Washington State Department of Transportation
Aviation Division
King County International Aiport
8900 East Marginal Way South
Seattle, WA 98108

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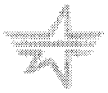
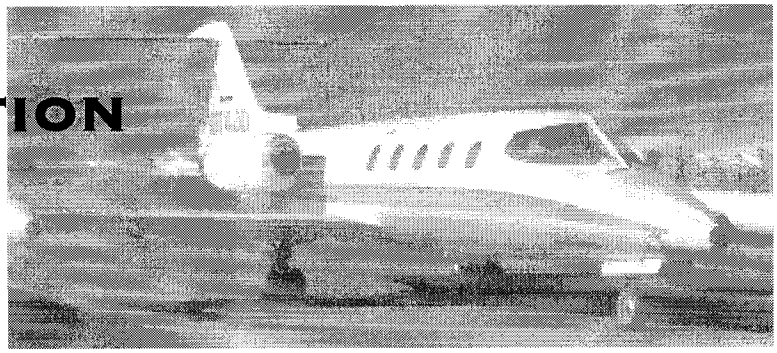


INTRODUCTION



BACKGROUND

Aviation is important to the economic health of Washington and the quality of life of its citizens, businesses and visitors. One of the major challenges of our day is to balance aviation needs with the needs of local communities. In Washington State, there are 129 public use airports identified in the *Washington State Aviation System Plan.* All of the airports are available for general aviation use and thirteen facilities offer scheduled commercial service. The state has an interest in a healthy aviation system. However, because the state has an ownership interest in only a small percentage of aviation facilities in Washington state, its actual role is most frequently one of partnership and advocacy.

Sponsorship of the public use airports contained in the *Washington State Aviation System Plan* are largely under the authority of local governments, which invest resources to preserve the aviation infrastructure and to keep these airports operational for the aircraft which use them. Of the 129 public use airports in the *Washington State Aviation System Plan*, sponsorship is greatly decentralized and breaks out as follows:

- 40 (31%) are owned by cities,
- 13 (10%) are owned by counties,
- 31 (24%) are owned by public port districts,
- 24 (19%) are owned privately,
- 17 (13%) are owned by the state,
- 04 (03%) are jointly owned by cities and counties or between cities.

Protection of these valuable facilities is of paramount importance to both the economic viability and the quality of life in Washington State. With population and development increases experienced in our state, airports are coming under increasing pressure from encroaching development. Through the *Washington State Aviation Policy*, the Washington State Transportation Commission finds three areas in which the loss, or potential loss of airports will be played out: lack of funding for investment in basic infrastructure preservation and safety improvements, incompatible land uses, and inappropriate environmental mitigation. In 1996, the Washington State Legislature also recognized the importance of protecting aviation facilities from incompatible land uses.

Through Washington State *Senate Bill 6422*, which amended the Washington State Growth Management Act and associated provisions in the act, the state recognized the inherent social and economic benefits of aviation. The law requires every city and town, code city, charter city and county having a general aviation airport in its jurisdiction to discourage the siting of land uses that are incompatible with the airport. The policy to protect airport facilities must be implemented in the comprehensive plan and development regulations as they are amended in the normal course of land use proceedings. Formal consultation with the aviation community is required and all plans must be filed with the Washington State Department of Transportation WSDOT Aviation Division. Further, the law requires the establishment of an airport land use compatibility technical assistance program available to local jurisdictions.

Finally, some administrators and policy makers believe that the challenges facing airport preservation — incompatible land use decisions, competing priorities for local funding, and incompatible environmental mitigation policies — may result from of a lack understanding among their colleagues and the general public about the importance of airports to state and local economies

The Washington State Growth Management Act recognizes airports as essential public facilities and local jurisdictions are required to plan accordingly to protect these facilities. However, much resource information is needed by jurisdictions to ensure opportunities for informed land use decision-making. This challenge is being met by the WSDOT Airport Land Use Compatibility Technical Assistance Program through the development of resource information regarding safety; economic dependence of airports on local, regional and state economies; risk and liability and their affect on incompatible land use decision-making; and a desktop reference guide for cities, counties and airport sponsors to provide technical examples and model approaches to protecting aviation infrastructure and balancing quality of life.

PURPOSE

The State of Washington is not the local land use authority nor empowered to make land use decisions. *The Washington State Growth Management Act* establishes land use planning requirements upon cities and counties and through the Airport Land Use Compatibility program, the law empowers the state to offer technical assistance and policy advice to cities and counties. In offering resource information and the facilitation of the program's advocacy and partnership role, the Airport Land Use Compatibility Program presents the following:

- An introduction to the Airport Land Use Compatibility Program;
- A working knowledge of the history, mandates processes, and issues surrounding this program;
- An introduction to the technical vocabulary and conceptual framework necessary to enable decision-makers to make the best use of the tools and resources offered by the Airport land Use Compatibility Program in it's best practices handbook.

ORGANIZATION

- ***Part One*** of this volume will examine the roots of state interest in aviation planning and outline the enabling legislation.
- ***Part Two*** of this volume will introduce the Airport Land Use Compatibility Program, it's functions, and the challenges facing it.
- ***Part Three*** of this volume will cover the technical attributes of the challenges facing airport preservation and planning.
- ***Part Four*** of this volume will introduce the concept of risk and risk assessment, and discuss the current understating of liability issues.
- ***Part Five*** of this volume is the conclusion which takes a quick look at the challenges presented to decision-makers in the State of Washington relative to airport compatible land use planning.

PART ONE

STATE INTEREST IN AVIATION AND AUTHORIZING LEGISLATION

STATE INTEREST

The state has broad interests in transportation to promote economic vitality, to improve the quality of life, and to protect the environment. The state government's authority in meeting state interest is achieved primarily through advocacy and partnership. In Washington, with decentralized ownership of the transportation system by local governments, federal agencies, regional agencies and the private sector, much of the state interest is accomplished by these other governments or private business. The state has an interest that is carried out by the owners of the transportation systems and, at a minimum, has a role in advocating for the state's interest.

State interest in aviation is guided by the adopted policy objectives of the Washington State Transportation Commission which is charged with broad oversight of transportation. The eight policy objectives, adopted in 1996, are as follows:

- ***Protect Our Investments*** by keeping transportation infrastructure in sound operating condition.
- ***Operate Transportation Systems*** to work reliably and responsibly for the customer.
- ***Improve Safety*** through continuous reduction in the societal cost of accidents.
- ***Provide Viable Mobility Choices*** for the customer and expand the system to accommodate growth.
- ***Support the Economy*** through reduced barriers to the movement of people, products, and information.
- ***Meet Environmental Responsibilities.***
- ***Cooperate and Coordinate*** with public and private transportation partners so that systems work together cost effectively.
- ***Continuously Improve*** the efficient and effective delivery of agency programs.

Primary Areas of State Interest

The primary areas of aviation interest for the State of Washington are airport preservation, safety, capacity, and environmental preservation:

Preservation

It is the State's interest to preserve a system of airports which provides access for all regions of the state to the nation's air transportation system, provides for emergency management, and supports local economies.

Safety

It is the State's interest that travel by air be safe.

Capacity

It is the State's interest to insure sufficient airport capacity to respond to growth in demand in order to provide air access within the state, and between the state and points in the nation and the world.

Environmental Protection

It is the state's interest that negative environmental impacts of airports on people, communities, and the environment be minimized.

Authorizing Legislation

In addition to these statements contained in the *Washington State Aviation Policy*, the state's interest in various modes of transportation is defined in **RCW 47.06**. This statute requires the Department of Transportation to develop a balanced and multimodal transportation plan. This plan is to include transportation facilities and services provided directly by the state, including highways, state ferries, and state-owned airports. It also must address state-interest modes of transportation. These state-interest modes are defined to include public transportation, freight rail, intercity passenger rail, marine ports and navigation, non-motorized transportation, and aviation. The plan must define the extent of state interest in these modes, and propose investments and advocacy actions needed to meet this state interest.

Further, **RCW 47.68** outlines the authority of the Aviation Division and presents its mandate. In 1947, the state created a new agency, the Aeronautics Commission (now the WSDOT Aviation Division). The agency's task is to perform state functions in air transportation, in cooperation with federal authorities and local governments in the state.

The major functions of the agency have been to: advocate for the development of an adequate system of public use airports in Washington State, implemented through local government; promote aviation safety, airmark towns and cities; provide tourist information; activate and manage air search and rescue for civilian aircraft; promote aviation legislation; and promote aviation in general, through close liaison with aviation clubs and associations. The authorizing language in **RCW 47.68** drives the Aviation Division's role in aviation advocacy through the Airports Program (Local Airport Aid), State Airports, Aviation Planning, Air Search and Rescue Management, Pilot and Aircraft Registration, Aviation Education, State Aircraft Fleet Management, Aviation Outreach, and Administration.

Matrix of State Interest and Authority in Aviation

State Interest	Primary Responsibility	Supporting Responsibility
Preservation of a system of airports	Airport Owners	FAA, WSDOT Aviation Division, and Local Governments with zoning authority
Safe air travel	Federal Aviation Admin. Airport owners Airlines	WSDOT Aviation Division
Adequate Airport Capacity	Airport owners	FAA, and WSDOT Aviation Division
Minimizing the negative impacts of airport operations	Airport owners	State and Federal environmental protection agencies

State Aviation Policy

The Washington State Transportation Commission adopted Resolution 567 on March 24, 1998 thereby establishing *The Washington State Aviation Policy.* The Transportation Commission adopted the recommendations of the Aviation Policy Advisory Committee which identified aviation issue areas and recommended an expanded state role in the following areas:

Preservation

Issues areas and expanded state role included land use encroachment, economic role of airports, wetland mitigation strategies, and general aviation airport preservation funding. The Transportation Commission identified that the extent of state's system of airports are at a minimum level of service. This means the airports contained in *The Washington State Aviation System Plan* are critical facilities, essential to providing access to the air transportation system, meeting needs for emergency response, and rural isolation.

Safety

Issue areas included safety improvements at general aviation airports, and the importance of airports in emergency response.

Capacity

One of the major aviation challenges of our day is to balance aviation capacity needs with the needs of local communities. Meeting the state interest of adequate capacity is carried out on the local level by airport sponsors and their host jurisdiction. It is the responsibility of local decision-makers to plan for increased capacity needs for their constituencies at their airport facilities.

In most cases, local governments recognize the economic benefit of meeting airport capacity needs and work together to provide the necessary capacity. When local governments disagree on an appropriate solution, or when they fail to address an airport capacity need, the state interest of adequate air capacity may not be met. The state role in meeting its interest in adequate air capacity now includes:

- Advocating the position that airports are essential public facilities and communicating the importance of these facilities to local jurisdictions;
- Establishing a mechanism allowing the mitigation of impact from regional and statewide transportation facilities through a broader regional approach;
- Coordinating and communicating surface transportation connection needs relative to airport activity growth.

Environmental Protection

The Transportation Commission did not recommend any changes in this area of interest since compliance with *SEPA, NEPA* and the federal *Airport Noise and Capacity Act of 1990* is expected.

WASHINGTON STATE GROWTH MANAGEMENT ACT

In 1990, the Washington State Legislature determined that uncoordinated and unplanned growth, together with a lack of common goals expressing the public's interest in the conservation and the wise use of our lands, pose a threat to the environment, sustainable economic development, and the health, safety and high quality of life enjoyed by the residents of Washington State. The Legislature concluded that it is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning. Further, they found that it is in the public interest that economic development programs be shared with communities experiencing insufficient economic growth.

RCW 36.70A.510 General Aviation Airports — Siting of Incompatible Uses

Through Washington State *Senate Bill 6422*, which amended the Washington State Growth Management Act and associated provisions in the Act, the state recognized the inherent social and economic benefits of aviation. The law requires every city and town, code city, charter city and county having a general aviation airport in its jurisdiction to discourage the siting of land uses that are incompatible with the airport.

The policy to protect airport facilities must be implemented in the comprehensive plan and development regulations as they are amended in the normal course of land use proceedings. Formal consultation with the aviation community is required and all plans must be filed with the Washington State Department of Transportation Aviation Division. Further, the law requires the establishment of an airport land use compatibility technical assistance program, by the Aviation Division, and available to local jurisdictions.

RCW 36.70A.200 Siting of Essential Public Facilities

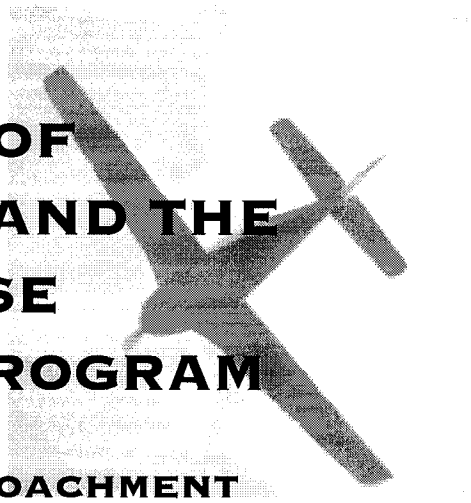
The Washington State Growth Management Act requires that the comprehensive plan of each county and city that plans under GMA include a process for identifying and siting essential public facilities. Essential public facilities include those facilities that are typically difficult to site, such as airports, state education facilities and state or regional transportation facilities, state and local correctional facilities, solid waste handling facilities, and inpatient facilities including substance abuse facilities, mental health facilities, and group homes. The Office of Financial Management will maintain a list of facilities that are required or that are to be built within six years; no local comprehensive plan or development regulation may preclude the siting of essential public facilities.

In their final decision and order, *Port of Seattle v. City of Des Moines, Case No. 97-3-0014*, the Central Puget Sound Growth Management Hearings Board provided further clarity on this issue. They stated that there are two duties imposed under **RCW 36.70A.200**: 'A duty to adopt in the comprehensive plan a process to site essential public facilities, and a duty not to preclude their siting in the plan or implementing development regulations.

Airports are specifically identified as Essential Public Facilities. There is no credible argument that an existing EPF is not an EPF, even though it predates the GMA. In addition, there is no credible argument that expansion of an existing EPF is not within the scope of **RCW 36.70A.200**. Likewise, **RCW 36.70A .200** does not support the notion of precluding necessary support activities for the expansion of the EPF that occur within the jurisdiction.'

PART TWO

THE CHALLENGE OF ENCROACHMENT AND THE AIRPORT LAND USE COMPATIBILITY PROGRAM



THE CHALLENGE OF ENCROACHMENT

Airports are unique facilities in that they tend to occupy large parcels of land, have unique siting requirements, produce noise, and generate complex safety concerns all of which impact neighboring communities. Because of their unique characteristics, airports cannot be easily relocated.

Local land use authorities are responsible for ensuring compatible land use and appropriate zoning requirements around airports. The Washington State Transportation Committee noted a disturbing trend of disregard relative to the unique siting and use characteristics of airports by local land use jurisdictions. This disregard, or in some cases, a lack of information on the particular needs of airports, is evidenced in the number of approved, incompatible adjacent land uses.

The continuance of accepted, incompatible land uses adjacent to airport lands — irrespective of their relationship to the operational needs of airports — may result in the loss, or significantly impede, of some of the airports within the state aviation system. This loss would endanger the state's mission to preserve a system of essential public facilities that provides access for all regions of the state to the nation's air transportation system, emergency management, and needed support for local economies.

These concerns form the basis for the creation and enactment of *Senate Bill 6422.* This bill requires local jurisdictions to protect airports from encroachment by incompatible land use, and provides the mechanisms by which this may be accomplished.

THE AIRPORT LAND USE COMPATIBILITY PROGRAM

To meet the challenge posed by encroachment upon public use airport lands, Washington State sponsors a progressive land use compatibility program protecting airports from encroachment by incompatible land uses. The law, Washington State *Senate Bill 6422,* codified as **RCW 36.70. 547** and **RCW 36.70A.510** requires cities and counties to protect airports from incompatible development. As previously mentioned, the law includes the formation of a land use compatibility technical assistance program for cities and counties. The law, which went into effect June 1996, has significantly changed the approach to land use planning adjacent to airports and the service provided by the WSDOT Aviation Division.

To meet the challenge of airport encroachment head on, WSDOT Aviation Division created the Airport Land Use Compatibility Program. Although the state has a vested interest in promoting a healthy and vital aviation system, it is not empowered with the authority to make land use decisions to prevent the encroachment of aviation facilities. The primary authority for meeting this state interest rests with the owners of Washington's airports. The Airport Land Use Compatibility Program's charge is both forging partnerships with and between jurisdictions and airport sponsors, and with acting as an advocate for compatible land uses surrounding airports.

The assumptions within the Airport Land Use Compatibility Program are based upon *Title Fourteen, Code of Federal Regulations, Subchapter C, Part 77, Objects Affecting Navigable Airspace* and data from the National Transportation Safety Board, analyses performed on the NTSB data, case law, and other general resource areas. Comprehensive research data on land use compatibility and the risks associated with incompatible development are quite limited.

The Airport Land Use Compatibility Program recognizes the value of the scientific analysis performed by Hodges and Shutt plotting accident locations identified by the NTSB. The plotted NTSB data from the years 1983-1994 indicates a significant trend of aircraft accidents concentrated at an airport's runway end to five thousand feet. The safety data serves as a guide in identifying possible situations of reduced safety and potential incompatible land use development.

Airport Land Use Compatibility Program Implementation

The Airport Land Use Compatibility Program is identified in four areas: General Technical Assistance, Best Practices Handbook and resource development, Comprehensive Plan Review, and Technical Outreach.

General Technical Assistance

The primary function of the technical assistance program is to provide technical guidance to customers through advocacy. Requests for assistance continue at an accelerated rate. A large percentage of requests relate to facilitating communication between airport sponsors and neighboring communities. The program emphasizes bridging communication linkages where gaps exist, and is intended to encourage a cooperative spirit between local governments and airport sponsors to work through issues.

Best Practices Handbook

In providing information assistance and easing the burden of program implementation on cities, counties and airport sponsors, the Airport Land Use Compatibility Program will offer a "best practices" handbook to serve as a desktop reference to cities, counties and airport sponsors. The handbook will provide supportive information, model ordinances, and examples of ordinances presently used by communities utilizing the program.

Comprehensive Plan Review

In relation to RCW 36.70A.510, the Airport Land Use Compatibility Program conducts reviews and provides comments on local comprehensive plans. The comments are coordinated with the Washington State Department of Community, Trade and Economic Development and considered by the Growth Management Hearings Boards, when appealed.

Technical Outreach

WSDOT Aviation, in partnership with the Department of Community, Trade and Economic Development (DCTED), offers general outreach workshops for cities, counties and airport sponsors to inform them about the program in order to foster informed decision- making. Contact DCTED or the WSDOT Aviation Division if your area is interested in participating.

Critical Compatibility Areas

The Airport Land Use Compatibility Program identified three areas which embody critical quality of life and safety issues relevant to airport operation and community health and welfare; they are concerns surrounding height hazards, safety and noise.

These critical compatibility areas form a nexus around which decision-makers and stakeholders must craft responsible land use policies to preserve airports and to protect the health, safety and welfare of communities.

Height Hazards

The Airport Land Use Compatibility Program assists in long range and current planning decision-making. In Washington state, the state standard for height hazards accepts the national standard, *14 CFR Part 77 Objects Affecting Navigable Airspace.* Any object which penetrates these imaginary surfaces is considered an obstruction.

Imaginary surfaces are defined in relation to the airport and to each runway. The size of these imaginary surfaces is based on the category of each runway according to the current approach, and to any future approach planned for that runway. The slope and dimensions of the approach surface applied to each end of a runway are determined by the most precise instrument approach existing or planned for that runway. The height hazards element of the Airport Land Use Compatibility Program supports the parameters of the Federal Aviation Administration (FAA) 7460-1 Program and supplements where FAA authority is limited by the Federal Communications Commission.

14 CFR Part 77 clearly identifies the boundaries which constitute the imaginary surfaces for an airport. The federal authority under the FAA Obstructions Evaluation program, identified under *Part 77*, is limited in scope, however. Under *14 CFR Part 77*, the FAA is required to meet the airspace needs of all users, aviation related or not, and as far as possible, revise aeronautical procedures and operations to accommodate antenna structures to fulfill broadcast requirements. Further, the authority of the FAA is limited to requiring mitigation for lighting and marking an obstruction. In rendering a decision of No Hazard, the findings issued by the FAA are advisory in nature and provisions for enforcing mitigation measures do not exist. The provisions of *14 CFR Part 77* do not empower the FAA to recommend alternate sites, options for site revision, or no build.

Approach to Height Hazards

The role of the program is to provide the best available information to the jurisdiction prior to their land use decision-making. The best available technical information provided to the jurisdictions relies on the parameters of *14 CFR Part 77*, the findings of the courts, and guidance provided by the Washington State Municipal Attorneys Association and the Municipal Insurance Boards. In *Reminga v UNITED STATES*, the courts offered clarity on the effectiveness of the obstructions evaluation program, the limitations and scope of the federal recommendations, and the responsibility of parties to ensure adequate levels of safety are met.

The courts clearly stated that a "No Hazard" determination does not mean the obstruction is safe to construct. On the contrary, the finding means the FAA has the ability to steepen the approach to the airport without closing the approach. The only finding the FAA is empowered to give is a finding of "No Hazard" unless the approach to the airport is not able to support the steepened access to the airport.

Obstructions are typically located on land outside the airport boundary and found on county or city land. This land is insured through the jurisdiction's self-insurance or through the city or county insurance pools. In relation to cellular phone services, the program recommends a removal clause requiring the provider remove the facility within six months of abandonment. This provision recognizes the reality of next generation satellite dependence for cellular phone systems.

Land use decisions are long term decisions. Incorporating development regulations which fan obstructions outside of the imaginary surface help to preserve the integrity of the airport, preserve quality of life and protect the jurisdiction in the case of a challenge.

Safety

From the perspective of safety, there are factors that determine which areas around an airport need to be protected from incompatible land uses based upon historical data. The factors include 1) the phase of aircraft operation when accidents most often occur (approach, descent, landing, takeoff, climb and cruise), 2) the major cause of accidents and incidents, 3) the location of these accidents in relation to the proximity to an airport. Based upon historical data from the National Transportation Safety Board

(NTSB) the areas adjacent to airports are more susceptible to aircraft accidents. Therefore, caution must be exercised when land is zoned and construction permits are issued in areas adjacent to airports in an effort to reduce the severity of an accident, loss of life or injury, based upon historical trends.

According to the NTSB, during the years 1984-1993, approximately 47% of all air carrier and commuter accidents occurred during the approach, descent and landing at an airport. During the same time period, approximately 64% of all general aviation accidents occurred during approach, descent, landing and takeoff climb phase of operation at an airport. It can be concluded that many of the risks inherent in air transportation are associated with the takeoff and landing phase of flight. Therefore, for purposes of maintaining safety and implementation of good land use planning, the most critical areas to protect from incompatible land use are those areas below the approach and departure paths to an airport.

General Aviation Accident Trends

According to the NTSB's *Annual Review of Aircraft Accident Data,* United States General Aviation, Calendar Year 1994,

> "Single reciprocating engine airplanes accounted for 77 percent of all of the general aviation accidents that occurred in calendar year 1994; with a total of 1,539 accidents, 281 fatal accidents, and 494 fatalities, resulting in an accident rate of 9.76 and a fatal accident rate of 1.78 per 100,000 hours flown. By far, the highest accident rates (31.18 accidents and 6.18 fatal accidents per 100,000 hours flown) in the eleven years tabulated in this report occurred in reciprocating engine rotorcraft."

In addition, the report stated that between the years 1983-1993, the broad causes or factors leading to aircraft accidents were as follows:

Pilot Error	82.6%
Terrain/Weather Conditions	24.7%
Weather	23.7%
Engine System	22%
Objects	14.1%
Other Person (not aboard)	8.9%
Light Conditions	6.8%
Landing Gear	4.5%
Instrumentation	4.4%
Airframe	1.9%
Flight Control System	1.6%
NAVAIDs	0.8%
Other Person (aboard)	0.6%

Note: *There is typically more than one cause or factor leading to an aircraft accident.*

Historic Accident Zones Adjacent to Airports

In 1993, the firm Hodges and Shutt, sponsored by the California Transportation Institute, conducted scientific analyses to illustrate where aircraft accidents were more likely to occur. The foundation of the analyses was National Transportation Safety Board (NTSB) data collected on 400 general aviation aircraft accidents occurring within 5 miles of an airport. Aircraft accidents were separated into categories based on runway length, pilot control, multi/single engine, VFR (visual flight rules), IFR (instrument flight rules) and accidents occurring on approach or departure.

Plotting of Accidents: Methodology

Accident locations were plotted and safety zones were applied to represent areas capturing the accidents within the particular cluster areas. In developing these zones, the adopted strategy focused on having greater land use restrictions where accident risks are higher.

Two basic research objectives were used to evaluate the historical accident location data. The first objective focused on identification of the particular shape of the zones, to encompass the greatest cluster of accident sites within the smallest acreage. The second objective identified points on the continuum where the ratio of accidents per acre changes noticeably, for example, the point of diminishing marginal returns for accidents captured within a zone. While repeat occurrence of an accident in the same location was not 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 do with this information?

The program is designed to react to current planning issues, such as construction requests, and encourages cities and counties to create proactive policies and development regulations which protect the airport from incompatible development in the future.

Recognizing that one size does not fit all, WSDOT Aviation and DCTED developed a matrix offering a menu of recommendations for compatible development adjacent to an airport. The recommendations are based upon the accident rate per acre within the particular zone. The matrix is designed for airports other than primary airports. Since the accident rate differs for commercial and primary airports, an additional matrix is under development to present recommendations for compatibility reflecting the revised accident rate and extended runway length.

Noise

Cities and counties seek to protect the health, safety and welfare of its citizens. Striking a balance between infrastructure preservation and preserving quality of life is a challenge jurisdictions and airport sponsors must strive for. The FAA has an extensive and exhaustive program relating to aircraft noise at commercial airports and the opportunities for mitigating the impact of commercial uses. The documentation of noise contours is clear and serves as a formidable tool in identifying the varying degrees of noise impacts.

The Airport Land Use Compatibility Program expects jurisdictions and airport sponsors to work together to balance the preservation of airport infrastructure and the impacts of noise. It is the responsibility of the jurisdiction to factor noise realities into land use decision-making for the protection of the health, safety and welfare of its constituents. It is the responsibility of the airport sponsor to commit to seeking a balance in the preservation of the facility and the quality of life of its neighbors prior to decisions for incompatible development. The commitment both parties make must include effective communication and the creation of an environment which lends itself to cooperation between the sponsor and the jurisdiction.

The Airport Land Use Compatibility Program has experienced attitudes by both airport sponsors and jurisdictions that neither cares to work with the other until absolutely necessary. This approach is archaic and ineffective. Land use decisions are long term decisions, and proactive policies and development regulations take much time and work, on the part of both parties, to create. It is in interest of both parties to incorporate proactive language, policies and procedures which protect the airport and the community from incompatible land use decision-making.

Appropriate land uses and densities which enable community identification and airport preservation must be incorporated into planning documents. The overlay of noise contour mapping with comprehensive plan mapping, the factoring of airports as essential public facilities, the fanning of incompatible uses and high densities away from noise affected areas is paramount to the protection of the health, safety and welfare of all parties.

The political realties associated with tough land use decision-making make good land use planning decisions exceedingly complex. The financial realities associated with these tough decisions do not evaporate when the baton is passed from party to party. The tough decisions come at a cost. WSDOT Aviation encourages jurisdictions and sponsors to recognize these financial realities prior to land use decision-making. Shifting costs from one party to the other is an ineffective approach. Advocacy, bridging communication, and utilizing valid research and current data are the components to moving land use decision-making to an effective level.

PART THREE

IMPACT OF THE CHALLENGE: HEIGHT HAZARDS, SAFETY AND NOISE

Scope of the Impacts

The challenge presented by the encroachment of incompatible land uses around Washington's airports and how the challenge is met, impacts the entire process of decision-making for local jurisdictions. The unique nature of airports - size, physical site requirements, and status as an essential public facility - often impacts the decision-making process in a community in basic areas of land use policy formation:

- determining the scale on which objectives can be measured or gauged,
- formulating land use strategies,
- establishing development and use criteria.

These basic components of the policy formation process, essentially craft the specific land use components which meet the requirements of law, address local social and economic needs, and, above all, protects the safety of the community as a whole.

Critical Compatibility Areas

This section examines the three critical areas in which airport land use compatibility issues occur. When balance is not achieved, land use challenges occur.

- *Safety*: Areas beyond the runway and other areas of the community routinely flown over by aircraft to and from the airport; these are the sites where accidents have historically taken place.
- *Height Hazards*: Flight takes place in a vertical environment, therefore, this space must be kept clear of natural or built objects that penetrate this airspace; these are areas surrounding an airport or under low level air routes where the penetration of structures will create hazards to aerial navigation.
- *Noise*: The measurable sound generated by aircraft flight or ground operations that is perceived by those on the ground as annoying.

Safety concerns, in general, present the greatest challenge to land use decision-makers. Since a majority of accidents occur within 5,000 feet of a runway, the ability of the pilot to bring the aircraft down in a manner that minimizes the severity of an accident is dependent upon the type of land use permitted within the adjacent zoning to an airport. It is the responsibility of local government to protect the health and general welfare of its citizens, and jurisdictions may be called upon to demonstrate that they exercised due diligence in permitting certain land uses adjacent to airports.

Due Diligence and Liability

Due diligence concerns become paramount should an accident or incident occur resulting in damage to property, loss of livelihood, injury, or death. Should an investigation show a jurisdiction ignored relevant safety data or best practices recommendations, that jurisdiction becomes liable to legal action for damage recovery.

The Airport Land Use Compatibility Program provides the best available information and best practice recommendations to jurisdictions in order to enable informed, responsible land use choices relative to compatible zoning. These zoning choices are important for two reasons:

- accidents will occur at some point during the life of an airport, the tools to minimize and perhaps avoid damage to persons or property should not be ignored;

- multiple use conflicts and property rights concerns generate additional legal challenges to zoning decisions. Using factual data rather than anecdote, provides a defensible basis for decision-making.

Many times, airport sponsors, host communities and constituencies expend valuable, and often scarce resources, to either engage in legal battles or to circumvent them. Basing land use decisions upon fact, historic data, and applying best practice recommendations supplied by the Airport Land Use Compatibility Program, assists jurisdictions in crafting defensible, objective zoning laws and aid in avoiding costly litigation.

Objective Basis for Recommendations and Best Practices

Comprehensive research data on land use compatibility and the risks associated with incompatible development are quite limited. Given this reality and program expectation, the Airport Land Use Compatibility Program utilizes the best available objective information as a basis for sound technical assistance and informed advocacy. These resources include:

- National Transportation Safety Board (NTSB) data and analyses of this data;
- case law relative to liability and risk;
- current risk identification and assessment data and practices.

Thinking in Multi-Dimensional Levels

The space around airports is conceptualized as conical surfaces and depicted as a inverted cone superimposed over the dimensions of the airport. For the purposes of this discussion, it is helpful to think of the space above and around an airport, in multi-dimensional terms:

- The vertical element encompasses the space above the airport containing the approach to the airport and other flight critical elements;
- The horizontal element encompasses the ground space immediately underneath aircraft approach and transitional areas;
- Noise is often described as the subjective, unwanted, and annoying aspect of sound; since sound is a measurable phenomena it can be described in two dimensions, spatial as magnitude and frequency, and time as duration.

Height Hazards: Attributes and Issues

The loss of navigable airspace to non-aviation uses particularly within the flight critical airspace to an airport approach, creates a hazard to flight activity, aircraft passengers, and to people and property on the ground; additionally, these obstructions inhibit the safe and efficient operation of the airport, in general. As previously mentioned, the Washington State standard for height hazards is the national standard, *14 CFR Part 77.*

Two things are necessary to fully understand the seriousness of height obstructions: one, the concept of imaginary surfaces and their relation to runway approaches, and two, the nature of flight in the vicinity of an airport.

Imaginary Surfaces and Runway Approaches

As previously mentioned, the size of a runway's imaginary surface is determined by the type of approach established for each runway end:

- *Visual*
  Visual approach is the most basic approach; no special navigational aids are required, reasonable weather conditions are necessary, and the approach slope is 20:1;

- *Non-Precision*
  No special navigational needs are required, but this approach takes a longer corridor, has a required minimum descent altitude, and an approach slope of 20:1;

- *Precision*
  Special navigational support; approach is always aligned with a specific runway and is related to a specific glide path; approach slope 50:1 for inner 10,00 feet, then 40:1 for outer 40,000 feet; weather conditions not as important as reliance for safe landing is upon instruments; often served by an Instrument Landing System, sometimes a Microwave Landing System, and soon a Global Positioning Satellite approach. Precision approaches are typically found at busier facilities.

Understanding imaginary surfaces puts thinking in multi-dimensional terms to the test and is critical for an understanding of the impact height obstructions have on an airport's operation.

Nature of Flight in Airport Vicinity

Flight in the vicinity of an airport occurs at low altitudes. The majority of take-off and landing phases of flight follow a path defined along the center line of the runway. Runways are established on magnetic headings. Barring any extenuating circumstance such as air traffic or weather conditions,

- Approaching planes turn on to the magnetic heading roughly five miles from the airport;

- Conversely, a departing plane may turn from the runway's center line (magnetic heading) relatively soon after it becomes airborne and is in stable flight;

- Aircraft enter the air traffic area (a rectangular configuration) at lower altitudes in preparation for landing on a selected runway or a larger circular path (ILS approach) when visibility is restricted.

Role of FAA in Regulating Height Hazards

As previously discussed, FAA has limited authority and scope to insure that imaginary surfaces are free of obstructions. Although FAA authority is limited in that their findings are advisory in nature only, they still have the ability to affect the status of a project. For example, should a determination of hazard be issued for a structure requiring an FCC license, and the structure would eliminate the FAA's ability to steepen the approach to the airport, the FCC may deny the permit.

Local Responsibility for Regulating Height Hazards

With a lack of federal enforcement capabilities, it is up to local jurisdictions to see that height obstructions do not compromise the safety of air traffic, and that the safety of those on the ground is protected. Further, should a jurisdiction allow the construction of a structure to penetrate the imaginary surface, regardless of FAA recommendations, liability will increase for the jurisdiction on that project.

Safety: Attributes and Issues

Safety is synonymous with compatibility. An understanding of the following factors is crucial when crafting land use ordinances for airport districts:

- The nature of flight in the vicinity of an airport;
- Operational requirement of basic types of aircraft i.e., runway length, navigation instrumentation, approach slope;
- The phase of aircraft operation when accidents most often occur — approach, descent, landing, take-off, climb and cruise;
- The major cause of accidents and incidents;
- The location of accidents relative to an airport.

The most important factors are the areas most susceptible to accidents. Ironically, these areas are desired by developers for certain types of development, many times incompatible, because they have the same physical site requirements as airports or land is inexpensive.

As previously mentioned, historical data provided by the National Transportation Safety Board (NTSB) shows that the areas adjacent to airports are the most susceptible to aircraft accidents. NTSB data identified during 1984-1993 tell us that —

- Approximately 47% of all air carrier and commuter accidents occurred within 5,000 feet of the end of the runway during an approach, a descent or a landing at an airport;
- Approximately 64% of all general aviation accidents occurred within 5,000 feet or the runway end during approach, descent, landing, and take-off climb phase of operation at an airport.

It can be concluded from this data that much of the risk associated with air transportation is associated with the take-off and landing phase of flight. For purposes of maintaining safety and for the implementation of good land use planning, the most critical areas to protect from incompatible land use are those areas below the approach and departure paths to an airport.

General Aviation Accident Trend Data: What to do with it?

Along with understanding site factors and historical accident data, it is necessary to identify and examine future trends in aviation. Studying these trends will allow jurisdictions to assess the impact current zoning may have on future development. Once these impacts are identified, jurisdictions can then craft the revisions and amendments necessary to give their development and land use codes the flexibility to respond to future conditions.

Historic Accident Zones Adjacent to Airports

In addition to the information provided under Part Two of this document, the purpose of the Hodges and Shutt study was two fold:

- Identify and describe accurately from historical data provided by the NTSB, the particular shape of the accident zones to encompass the greatest cluster of accident sites within the smallest acreage;

- Identify points on a continuum where the ratio of accidents per acre changes noticeably, for example, the point of diminishing marginal returns for accidents captured within a zone.

While repeat occurrence of an accident in the same location was not 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.

Utilizing the information gathered by the NTSB and plotted by Hodges and Shutt, the WSDOT Aviation Division has developed a matrix of recommendations for land use compatibility based upon the accident rate per acre within the particular zone. The recommendations focus densities and incompatible land uses away from the critical areas of flight.

Other Safety-Related Concerns

Finally, because of the large federal role in aviation safety, there are two issues which are closely linked to the state's interest in safe air travel and which need to be fully addressed, in light of this association:

- *General Aviation Safety Improvements*: This issue relates to funding needs at general aviation airports. The Washington State Transportation Commission identified $60 million of general aviation airport infrastructure needs basic to safety improvement such as obstruction removal, and lighting systems, as well as the preservation of runways and other basic facility needs.

- *Emergency Response*: This issue relates to seaplane bases, heliports, and helicopter landing sites as well as general aviation airports; these facilitates play a vital role in emergency response and emergency management. Emergency response relates to rural isolation in the event of medical emergencies, pharmaceutical and blood deliveries. In the event of natural disasters or other emergencies, airports provide access to all areas of the state, serve as staging areas for rescue functions, and provide quick response to medical emergencies. Emergency management needs reinforce the state's interest in preserving an adequate system of airports.

Noise: Attributes and Issues

Noise is the most common negative impact associated with airports. The most simplistic definition of noise is unwanted sound. Sound can be accurately measured, while noise is a perceptual concept, and as such subject to considerable variability.

Measuring Sound

To understand the difference between sound and noise, what follows is a short description of the physical properties of sound, which are objectively measured:

- *Magnitude*: describes the effect of pressure displacing air particles; not synonymous with loudness; it is measured in decibels;

- *Frequency:* describes the tonal quality of sound measured in cycles per second (Hertz/Hz); this is a range that represents the rapidity of air pressure generated by the magnitude of a sound; often frequencies are a mixture of magnitudes;

- *Duration*: this term describes the length of time over which a sound occurs: sounds may either have a clear and sharp beginning and end, or may increase or diminish over the length of the incident.

Describing Noise

The perception of a particular sound event as noise is not subject to objective measurement. Most research attempts to focus on acceptability to the whole community rather than individuals.

In addition to this subjective parameter of noise, there are two main aspects of sound/ noise that affect noise regulation decisions:

- *Physiological*: Temporary effects include startle reactions, and sustained sleep interference; permanent effect would include actual physical injury such as deafness.

- *Behavioral*: Usually measured by interference in activities, speech interference and the interruption of listening pleasure are the most common effects cited; interruption of concentration, and sleep disruption.

Nature and Source of Airport Noise

The level of noise experienced on the ground are primarily dependent upon three factors: inherent loudness of the aircraft engine, the aircraft altitude, and the horizontal distance between the observers and the flight track of the aircraft. Several other factors affect this noise level as well:

- *Type of Aircraft:* Different aircraft produce differing magnitudes and frequencies of sound:

  Jet Aircraft: The newer designs produce lower sound magnitudes and frequencies. Although improved, jets are still perceived as top noise-producers;

  Propeller-Driven Aircraft (turbine or piston): Noise generated from propeller itself; this sound is variable and depends upon 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 "blade slap" caused by a slow-turning main rotor; this sound is most notable on low speed descents, and high speed cruise; it is most audible on the approach; also, it is known to create vibration or rattle in structures

- *Engine Run-up Noise:* Caused by pre-flight warm up by aircraft, typically at the end of runways; generates sound levels frequently higher than take-off or landings;

- *Piloting Techniques:* One aircraft type can generate several differing noise levels depending upon:

  Angle of climb while on taking off,

  Propeller pitch (aircraft with variable pitch) especially at high take-off settings,

  Power adjustments during take-off, such as air speed, lift adjustments such as flap settings.

- *Traffic Patterns:* While certain primary traffic corridors are defined, deviation from the general patterns occur when wind, low traffic volumes and pilot requests are factored in. Even if aircraft follow the suggested pattern, variations may occur in flight configurations due to wind, traffic levels, obstacles on runway surfaces, etc. Noise abatement flight procedures are utilized at many facilities to decrease the incidents of noise;

- *Aircraft Maintenance Operations:* Maintenance testing of aircraft requires use of high power settings with an accompanying increase of noise levels;

- *Air Temperature:* Density altitude changes the size of air molecules based upon temperature and airport altitude. On hot days, planes cannot ascend as rapidly because air molecules are fatter and less dense. Consequently, noise impacts are stretched over greater distance from the runway end. On cold crisp days, air molecules are more dense providing greater performance of propellers and aircraft lift surfaces;

- *Sound Deflection:* Sound waves may bounce off nearby structures, steep terrain, and low cloud cover may reflect sound and increase noise levels;

- *Topography:* Elevation changes may increase or reduce the actual sound level experience on the ground.

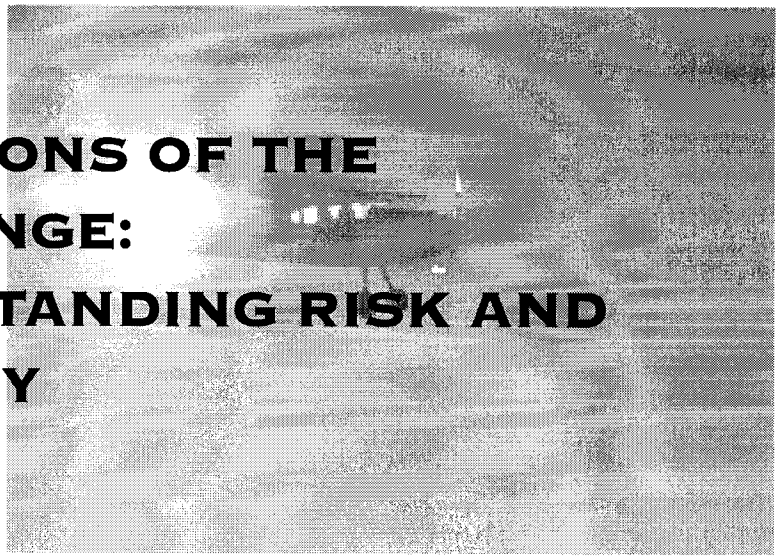
Acceptable Noise Levels

Just what is determined to be an "acceptable' level of noise surrounding airport? Airport noise exposure is measured in a day-night average sound level (DNL) and is used to analyze and characterize multiple aircraft noise events, and for determining the cumulative exposure of such noise to individuals around airports. DNL means the 24-hour average sound level, in decibels, for the period from midnight to midnight, obtained after the addition of ten decibels to sound levels for periods between midnight and 7:00 am, and between 10:00 pm and midnight. The yearly day-night average sound level means the 365-day average, in decibels. The symbol for YDNL is also Ldn.

According to the FAA, noise exposure mapping is required when values of 65 Ldn or greater exist at an airport. Noise exposure mapping means a scaled, geographic depiction of an airport with its noise contours, surrounding development, and forecast land uses.

The Airport Land Use Compatibility Program encourages jurisdictions and airport sponsors to work together regarding noise management. Ultimately, it is the responsibility of the jurisdiction to factor noise realities into land use decision-making for the protection of the health, safety and welfare of its constituents.

PART FOUR



DIMENSIONS OF THE CHALLENGE: UNDERSTANDING RISK AND LIABILITY

Risk

Risk is one of the most pervasive preoccupation's in our modern society, and has been intuitively understood by people given the pervasivness of games of chance. Risk is also understood through precise statistical statements which allow us to make assumptions about probabilities, or the odds in winning or losing. Simply put, risk can be defined as exposure to the chance of loss, on one hand, and to the expectation of net benefit, on the other.

It is in this area of public risk-taking that a conundrum exists; judicious and responsible risk-taking is deemed necessary to maintaining a healthy economy and continued high standard of living. However, what constitutes judicious and reasonable risk-taking to one, may seem reckless and irresponsible to another.

Risk becomes controversial when it moves from the personal realm where an individual voluntarily enters into risk situations, to the public realm where an individual's participation in risk situations is involuntary. Individuals fear being liable for losses for which they will be held liable and uncompensated. To understand how this conflict arises between perceptions of acceptable risk levels, we must first understand the attributes of risk.

Possibility and Probability

At the heart of any discussion of risk, lies the concept of probability. The language of probability allows us to measure and assign value to uncertainty. It is "figuring the odds" that allows humans to function productively by enabling a choice among differing courses of action.

The concept of probability developed out of games of chance and is applicable when all possibilities have an equal chance of occurring. But as there are many situations for which all possibilities cannot be all considered equally likely to occur, we instead state the probability of an event occurring.

In order to do this, we utilize records kept over a long period of time which enable us to make predictive statements in a way that has utility and meaning for decision-making. For example, we can say that the probability of a flight from Chicago to Seattle will arrive here on time is 0.88; what we are saying is that similar flights have arrived on time 88% of the time.

We can perform the same exercise with the historical record of accidents and incidents around an airport. Plotting their locations over time, we can determine what the odds are that an accident will occur in the same areas in which historically accidents have occurred in the past, and to what degree.

Conventional wisdom says that most people have difficulty understanding probabilistic expressions, tend to overestimate the frequency of rare events, and under estimate the frequency of common events. Yet, research shows that this discrepancy is more a function of a misunderstanding of the underlying mechanisms of risk perception than it is an understanding of probabilities.

Risk Perception and Risk Acceptability

Research has shown that while error does exist in public perceptions of risk, it is due mainly to a lack certain information about risks and hazards. The public's perception of risk, however, has consistently shown to be far more sophisticated and richer than that of many experts.

Researchers William Leiss and Christina Chociolko (Risk and Responsibility, 1994) list three main factors that influence how a risk is perceived by the public:

- The degree to which the hazard is known and understood;
- The degree to which it involves feelings of dread, especially fatalities;
- The size and type of the population at risk, especially groups such as children, the elderly, infirm, or others viewed as having less control over their lives.

Researchers have also observed additional parameters of risk perception that are usually left out of professional risk assessment yet have a great influence on how individuals assess and frame perceived risk:

- Individuals will voluntarily accept higher levels of risk for themselves than for society as a whole.
- Individuals tend to simplify complexity by relying on conventional wisdom or "rule of thumb," tradition or appeals from authority figures to assist individuals in framing uncertainty in familiar forms.
- Individuals do not perceive all lives as of equal value.

- The public has difficulty in detecting omissions in technical information.

- The contention between expert (scientific) assessment and the public assessment of risk factors.

Finally, it should be kept in mind that there is a probabilistic basis for all ideas of acceptable risk. This means that there will always exist some element of risk, greater than zero, of some event occurring. This level of probability defines the threshold of acceptable risk, which if exceeded, will not be acceptable to either public or private risk takers.

Risk Comparisons and Acceptable Risk

The ability of humans to sense and avoid harmful situations and to learn from past experiences is the basis for risk perception. As a survival mechanism it serves us well. However, in an increasing complex world, new situations arise for which there is often no prior experience to guide us in evaluating a situation in terms of its risk potential. One powerful tool for assessing and evaluating perceived risks, is making comparisons among or between other known risks.

Risk comparison can be a powerful tool. This method, however, is not without some dangerous pitfalls. First, this type of comparison may tend to over simplify differences between the risks, or not consider both the qualitative and quantitative attributes of the risks involved. Secondly, a comparison of risks may gauge its acceptability solely in terms of the probability of fatalities or material damages, while ignoring the context in which the risk occurs. Context is that attribute of a situation that allows us to gain perspective on the size and scope of the risk and make determinations on how acceptable it is.

Researchers have articulated some conditions which determine whether or not a perceived risk will be acceptable:

- The level of risk does not exceed a threshold derived from a comparison with other risks, or it is judged to be the less costly of an alternative risk;

- The benefits clearly outweigh risks, with intuitive bias counting high;

- Ideas concerning social equity are not compromised; no one group bears a disproportionate burden of risk relative to the benefits derived for society as a whole.

The acceptability of risk factors is closely related to how the public views risk in general. In addition, these perceptions are by no means static and will often change overnight as new information becomes available.

An additional dimension of risk perception is risk aversion. Aversion to risk-taking activities in the public arena is mostly attributable to the fear of involuntary, uncompensated loss. But there is some evidence to suggest that risk aversion may be attributed to an intuitive understanding of instances where calculated under-assessment of risk by dominant institutions was made resulting in situations detrimental to the public at large. In particular, the public remembers the perceived willful neglect of decision-makers that allowed workers and children to be negligently exposed to hazardous substances or processes.

The public has experienced an overall growing sense of vulnerability and preoccupation with risk over the past 20 years. Some researchers attribute this as an unintended result of society's growing inclination to assign a numeric value to all aspects of life. Risks, once considered an unavoidable part of life, have now taken on a new and threatening dimension.

Finally, it is important to note that risk aversion also has costs for society: the cost of regulation, court battles, and missed opportunities can take a toll upon valuable resources.

Communicating Risk

It is well and good for public entities to consider the parameters of risk perception and evaluation when engaging in the decision-making process, yet there is one additional critical step that often gets little attention; this is the manner and process by which risk information is communicated to the public.

The flow of information and risk assessments among technical experts, decision-makers, interest groups, and the general public is receiving increasing attention. The methods utilized by decision-makers and individuals to advance and negotiate their interests include all tools of the communication process: persuasion, analysis of concerns, distribution of new information or findings, and various attempts to change attitudes and behavior.

The process of communication can often become a center of controversy itself. We are all too familiar with charges leveled among interest groups of media bias or distortion, selective use of information, misuse of statistical methods, hidden agendas, and the unwillingness or inability of public agencies to communicate vital technical, information on terms the general public can understand.

Paul Slovic, a prominent researcher in risk perception, sheds additional light on the difficulty of communicating risk. His research shows that the public understands some things quite well, but in cases where misunderstanding is present, the cause of miscommunication is most often traced to biased experiences which education may not overcome. He lists additional sources of miscommunication as:

- A sensitivity to potential for catastrophic accidents;
- A witnessing of expert disagreement about the probability and magnitude of risks;
- An awareness of serious mistakes made by both experts, agencies and decision-makers in the past;
- An awareness that many of their qualitative concerns are not only unaddressed, but are dismissed as irrelevant or worse, irrational.

Finally, he states that research has shown the public to be quite rational about their perception and definition of risk. While experts define risk in quantitative, narrow terms, the public has a more complex definition that incorporates legitimate value considerations such as uncertainty, dread, catastrophic potential, and controllability. It is the failure of technical experts and decision-makers to take into account these factors that makes the public feel alienated from discussions of public policy that entail risk.

Following this research into public perception of risk, William Leiss and Christina Chociolko (Risk and Responsibility, 1994) have determined that there are several things that can be done by decision-makers to bring about productive public dialogue regarding risk:

- Present quantitative data in intuitively meaningful terms that do not over-simplify uncertainty,
- Present consequences of risk and probabilities of occurrence to impact at the personal level where people, as individuals, decide how they will respond to risk information,
- Explore the basis for formulating acceptable risk for the public,
- Evaluate public information needs on risk as well as the adequacy of the presentation of the information,
- Monitor how messages about risk are received by the public.

Each side in the process has a substantive role to play and information to contribute; to argue about which methods are right and logical, which are wrong and irrational, is to add an additional burden to an already over burdened process of risk communication.

LIABILITY

The right to take risks is an integral part of our social and political fabric. Indeed judicious risk taking helps to maintain our standard of living and drive economic growth. Given that uncertainty can be objectively measured, and that the consequences of a choice of action can be described in terms of the risks involved, it is possible to manage risk to minimize factors that may precipitate loss. Some of these actions can be in the form of regulation or the adoption of best practices. But to guard against the occasion when the odds run against the risk-taker, one can manage the magnitude of loss due to risk-taking by purchasing insurance.

INSURANCE AND RISK TAKING

Insurance manages and regulates the distribution of risk by apportioning it among a large number of individuals so that in the event of loss, the liability for that loss is spread out among many.

In return for paying a small fee, an individual or entity receives a promise from the insurance carrier that liability will be covered in the event risk-taking behavior results in loss. In essence a larger, uncompensated loss is kept at bay by substituting a small, controllable loss. The insurer in turn protects itself against uncompensated loss by covering a large number of different insurers.

Insurers set the price of their coverage based upon the probability of loss multiplied by the magnitude of the loss. Engaging in excessive risk-taking activities, making decisions based upon irrelevant criteria or using less than best available information have serious implications. In the event loss occurs as the result of poor or negligent decision-making, the insured becomes liable for damages, the insurer has the option of raising the premium cost to the insured, or in extreme cases, the carrier may simply cancel their coverage.

THE AIRPORT LAND USE COMPATIBILITY PROGRAM AND LIABILITY

The Airport Land Use Compatibility Program has the responsibility to assist jurisdictions and airport sponsors secure the best available technical information on hazards and risk, and to advocate the preservation of valuable airport lands. It is the responsibility of the jurisdiction to make responsible and judicious decisions regarding public safety and permitted uses on lands adjacent to public use airports.

In that each of these players fulfills to the best of their ability their respective mandates and responsibilities, loss liability is kept to a minimum. This fact is further clarified by a pivotal case, Reminga v. the United States, where the concept of the "discretionary function" exception to government tort liability contained in the Federal Tort Claims Act is clearly delineated.

Liability and Negligence: Reminga v. United States

The plaintiffs in this case were the estate executors of two passengers in a small private plane who were killed when the plane struck a guy wire which supported a 1729-foot television tower; the wires extended approximately 450 feet above the ground and out to 1850-1900 feet beyond the tower itself. Additionally, the section chart used by the pilot incorrectly placed the location of the tower west and south of railroad tracks. Since the flight was a VFR flight, this also increased the probability of an accident.

While the court found the acts and omissions of the FAA and USGS negligent, it did not find that the agency was liable under the "discretionary function" exception to government tort liability contained in the *Federal Tort Claims Act.* The implications of this ruling and others (see *Barton v. United Sates, Albuquerque v. United States*, and *Miller v. United States*) is to clarify the liability of government entities.

The courts hold that public entities are only exempt from tort liability if, in the performance of their statutory activities, they must act without fixed or readily ascertainable standards; this makes their decisions discretionary and within the exception of the *Tort Claims Act*, even though the discretion proves to be negligent. However, should there exist a standard against which decision-making may be measured, such actions or decisions are NOT within the exception allowed by the *Tort Claims Act.*

Finally, for our purposes Reminga is significant because it clearly defines what the responsibilities under law are for the FAA regarding height hazards.

Taking Responsibility: Jurisdictions

Given that uncertainty can be objectively measured and that the consequences of action can be described in terms of the risks it entails, it is possible to craft a set of best practices for jurisdictions to help to minimize uncompensated risk and liability.

By utilizing the technical expertise and best practices guidelines provided by the Airport Land Use Compatibility Program, jurisdictions may acquire the tools to make responsible decisions regarding components of risk that may impact their liability. These tools will help them:

- Assess qualitative and quantitative risk factors,
- Develop a matrix to help define what constitutes acceptable risk-taking in specific situations,
- Craft strategies to develop effective and inclusive risk communication practices to facilitate building consensus among agency representatives, stakeholders and the general public.

It can not be stated firmly enough that should a jurisdiction decide to reject implementing best practices, ignore historic accident data, or ignore the recommendations of the Airport Land Use Compatibility Program or the FAA regarding appropriate airport land use, it is the jurisdiction that embraces the cost of uncompensated loss and liability — and ultimately the consequences of this action in the terms of higher insurance premiums or possible canceled coverage.

Taking Responsibility: Airport Land Use Compatibility Program

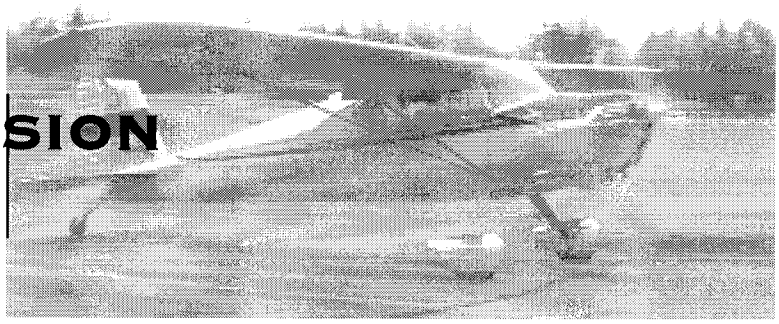
The role of the Airport Land Use Compatibility Program is to advocate for the protection of airports from incompatible development by providing the best available information to jurisdictions prior to their land use decision-making. The support provided by this program not only gives jurisdictions the ability to craft responsible land use practices, it provides jurisdictions with an additional risk management tool to protect themselves from liability incurred through decision-making based upon irrelevant criteria or anecdotal evidence.

The program typically states, when evidence warrants it, that it is the opinion of the Washington State Department of Transportation Aviation Division that a proposed incompatible development would be in direct conflict with **RCW 36.70A.510** and development adjacent to the airport would clearly be an incompatible land use.

Further, the program also issues a disclaimer prior to the jurisdiction's deliberation and action on a zoning request that the WSDOT Aviation Division has fully disclosed to the jurisdiction the best available intelligence on the historic aircraft accident trends that affect lands and land uses on and adjacent to airports.

PART FIVE

CONCLUSION



SUMMARY

The Airport Land Use Compatibility Program is empowered through the Growth Management Act. Most planning organizations seek good land use planning opportunities. Many need information and coordination long before current communication paths are initiated. The Airport Land Use Compatibility Program works to serve as an advocate and technical resource for cities, counties and airport sponsors in balancing our valuable resources — communities and infrastructure, and has proven to be effective in protecting airports from incompatible land uses. The process is slow because the demand for program support is great and continues to grow at an accelerated rate.

It cannot be stressed enough that information from all interested groups — technical experts, stakeholders, agency representatives and the general public — be provided to land use decision-makers. As we have seen in the section exploring the dimensions of risk and risk communication, advocacy, bridging communication, valid research and data are the key components in moving land use decision-making to an effective level. It is only when working together in trust and mutual respect that we can preserve our state's airport system, and enhance our quality of life.

SHAPING THE FUTURE

Identifying appropriate land uses adjacent to airports, and promoting the population densities associated with them, as well as understanding risk and liability will shape the way issues and concerns are framed for a communities in the future.

All of the methods mentioned in the previous sections — overlaying noise contour maps on comprehensive plan maps, recognizing airports as essential public facilities, fanning incompatible uses and high densities away from noise and safety affected areas — are ways to protect the health, safety and welfare of communities while preserving our valuable aviation system.

Land use decisions are long term decisions, and crafting proactive policies and development regulations takes a willingness to collaborate on the part of both parties. It is in the interest of all parties to incorporate proactive language, policies and procedures which protect the airport and the community from making incompatible land use decisions.

The political realties associated with tough land use decision making make good land use planning decisions exceedingly complex. The financial realities associated with these tough decisions do not evaporate when the baton is passed from party to party. The tough decisions come at a cost. WSDOT Aviation encourages jurisdictions and sponsors to recognize these financial realities prior to land use decision-making. Shifting costs from one party to the other is an ineffective approach. Advocacy, bridging communication, valid research and data are the components to moving land use decision making to an effective level.

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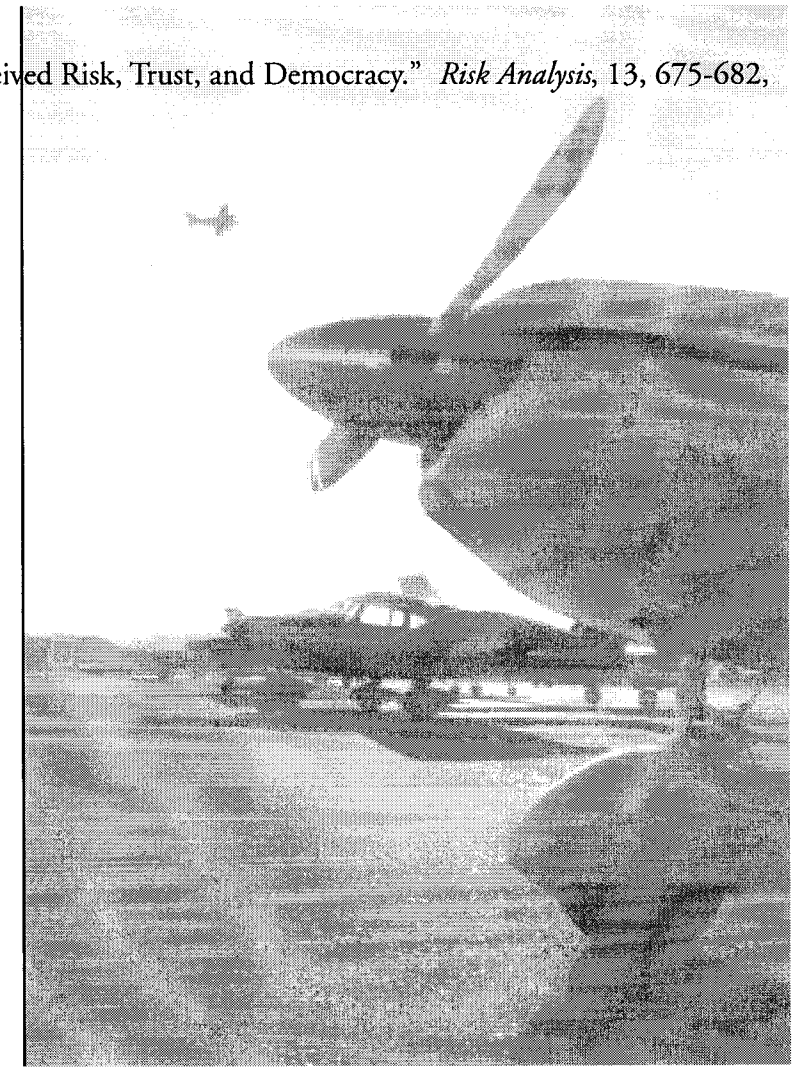
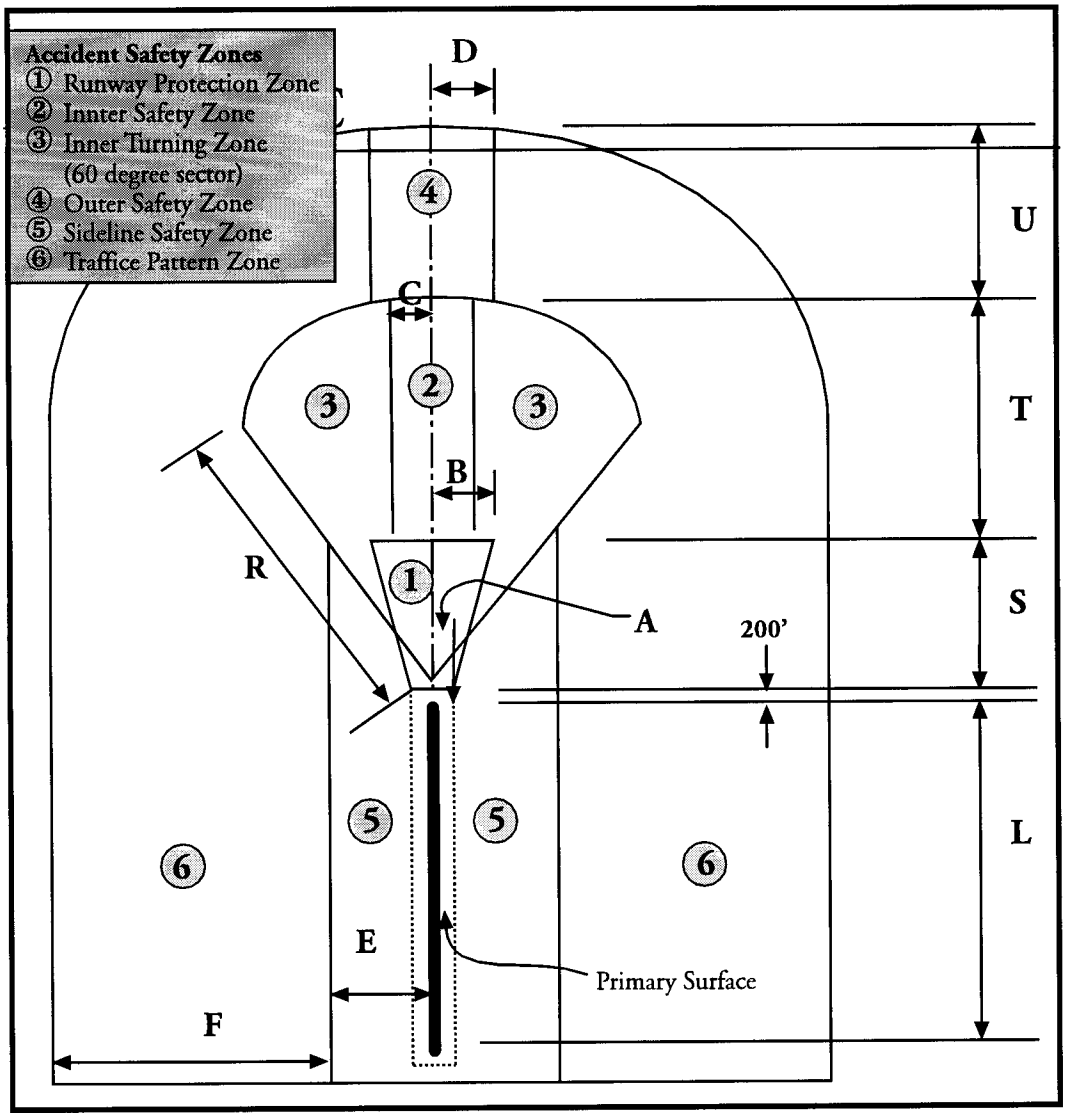


APPENDIX A

AIRCRAFT ACCIDENT SAFETY ZONE DIAGRAM



SAFETY ZONE DIMENSION (IN FEET)

Dimension	Runway Length Category (L)		
	Runway less than 4,000	Runway 4,000 to 5,999	Runway 6,000 or more
A	125	250	500
B	225	505	875
C	225	500	500
D	225	500	500
E	500	1,000	1,000
F	4,000	5,000	5,000
R (60°Sector)	2,500	4,500	5,000
S	1,000	1,700	2,500
T	1,500	2,800	2,500
U	2,500	3,000	5,000

Note:
Data Source: NTSB accident investigations 1984-1991. Illustration Source: Hodges and Shutt, Institute of Transportation Studies, University of California, Berkley, 1993.

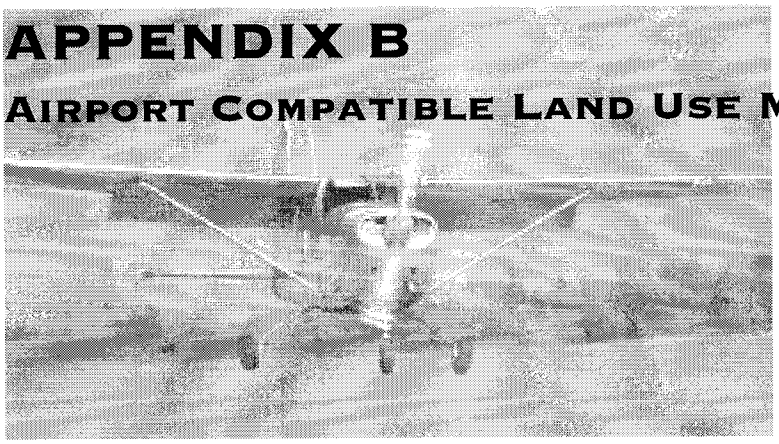
Accident Safety Zones and Capture Rates for Aircraft Accidents

RUNWAY LENGTH	Zone	Zone Size (acres)	ARRIVALS % Accidents (per Zone)	ARRIVALS % Accidents (per Zone/Acre)	DEPARTURES %Accidents (per Zone)	DEPARTURES % Accidents (per Zone/Acre)	TOTAL ACCIDENTS % Accidents (per Zone)	TOTAL ACCIDENTS % Accidents (per Zone/Acre)
Less Than 4,000'	1	8	31	3.88	20	2.46	24.00	3.01
	2	16	10	0.63	9	0.61	10.00	.62
	3	113	8	0.07	16	0.14	13.00	0.11
	4	26	3	0.13	1	0.04	2.00	0.07
	5	72	18	0.25	34	0.48	28.00	0.40
	6	700	8	0.01	13	0.02	11.00	0.16
Sub Totals		**935**	**78**	**4.97**	**93**	**3.75**	**88.00**	**4.37**
4,000-5,999'	1	30	23	0.77	17	0.57	20.00	0.67
	2	64	8	0.13	3	0.05	6.00	0.09
	3	365	5	0.01	9	0.03	7.00	0.02
	4	69	7	0.06	5	0.07	6.00	0.08
	5	232	19	0.08	23	0.10	21.00	0.09
	6	940	10	0.01	35	0.04	23.00	0.02
Sub Totals		**1,700**	**72**	**1.06**	**92**	**0.86**	**83.00**	**0.97**
6,000' or Greater	1	79	22	0.28	18	0.23	18.00	0.23
	2	57	6	0.10	3	0.06	3.00	0.06
	3	451	15	0.03	15	0.03	15.00	0.03
	4	115	10	0.09	6	0.05	6.00	0.05
	5	234	6	0.03	11	0.05	11.00	0.05
	6	1247	19	0.02	24	0.04	24.00	0.04
Sub Totals		**2,183**	**78**	**0.55**	**77**	**0.46**	**77.00**	**0.46**

NOTE: Computations based upon NTSB Data, 1984-1993.
Totals may not directly sum to 100% due to mathematical rounding.

APPENDIX B

AIRPORT COMPATIBLE LAND USE MATRIX



ACCIDENT SAFETY ZONES, LAND USE GUIDELINES AND PLANNING STRATEGIES FOR NEW DEVELOPMENT

Accident Safety Zone	Land Use Characteristics	Land Use Guidelines	Land Use Planning Strategies *All aviation uses are acceptable.
Zone 1 (See Special Note)	**Population Density**	Avoid land uses which concentrate people indoors or outdoors.	1. 0-5 people/acre 2. Airport sponsor should purchase property if possible. 3. Zone land uses, which by their nature, will be relatively unoccupied by people (i.e.: mini-storage, small parking lots)
	Residential vs Non-Residential Land Use	Prohibit all residential land uses. All non-residential land uses permitted outright subject to the Population Density and Special Function Land Use guidelines.	1. Create a height hazard overlay ordinance around the airport. 2. Airport sponsor should purchase property if possible. 3. Airport sponsor should obtain avigation and obstruction easements. 4. During site development process, shift all structures away from the runway centerlines if possible. 5. Landscaping requirements shall establish only low growing vegetation. 6. Prohibit high overhead outdoor lighting. 7. Require downward shading of lighting to reduce glare. 8. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Prohibit overhead utilities and all noise sensitive land uses. 2. Zone land for uses other than for schools, play fields, hospitals, nursing homes, daycare facilities and churches. 3. Limit storage of large quantities of hazardous or flammable material. 4. Ensure permitted uses will not create large areas of standing water, or generate smoke/ steam, etc.

Special Note: Since the dimensions of Zone 1 correspond to the dimensions of the Runway Protection Zone (RPZ), those airports receiving federal grant dollars from the FAA's Airport Improvement Program, should strongly consider purchasing the RPZ or otherwise acquire rights to the property for the RPZ.

COMPATIBLE LAND USE MATRIX

Accident Safety Zone	Land Use Characteristics	Land Use Guidelines	Land Use Planning Strategies *All aviation uses are acceptable.
Zone 2	**Population Density**	Avoid land uses which concentrate people indoors or outdoors.	1. 0-5 people/acre 2. Zone land uses, which by their nature, will be relatively unoccupied by people (i.e.: mini-storage, small parking lots)
	Residential vs Non-Residential Land Use	Prohibit all residential land uses. All non-residential land uses permitted outright subject to the Population Density and Special Function Land Use guidelines.	1. Create a height hazard overlay ordinance around the airport. 2. Obtain avigation and obstruction easements. 3. During site development process, shift all structures away from the runway centerlines if possible. 4. Prohibit mobile home parks. 5. Landscaping requirements shall establish only low growing vegetation. 6. Prohibit high overhead outdoor lighting. 7. Require downward shading of lighting to reduce glare. 8. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Prohibit overhead utilities and all noise sensitive land uses. 2. Zone land for uses other than for schools, play fields, hospitals, nursing homes, daycare facilities and churches. 3. Limit storage of large quantities of hazardous or flammable material. 4. Ensure permitted uses will not create large areas of standing water, or generate smoke/ steam, etc.
Zone 3	**Population Density**	Avoid land uses which concentrate people indoors or outdoors.	1. <25 people/acre 2. Zone land uses, which by their nature, will be relatively unoccupied by people (i.e.: mini-storage, small parking lots)
	Residential vs Non-Residential Land Use	Runway <4,000 feet – Prohibit all residential land uses. Runway 4,000 to 5,999 feet – Limit residential development to 1 dwelling unit per 5 acres. Runway >6,000 feet – Limt residential development to 1 dwelling unit per 5 acres. All non-residential land uses permitted outright subject to the Special Function Land Use guidelines.	1. Create a height hazard overlay ordinance around the airport. 2. Obtain avigation and obstruction easements. 3. During site development process, shift all structures away from the runway centerlines if possible. 4. Prohibit mobile home parks. 5. Landscaping requirements shall establish only low growing vegetation. 6. Prohibit high overhead outdoor lighting. 7. Require downward shading of lighting to reduce glare. 8. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Prohibit overhead utilities and all and avoid noise sensitive land uses. 2. Zone land for uses other than for schools, play fields, hospitals, nursing homes, daycare facilities and churches. 3. Limit storage of large quantities of hazardous or flammable material. 4. Ensure permitted uses will not create large areas of standing water, or generate smoke/ steam, etc.

COMPATIBLE LAND USE MATRIX

Accident Safety Zone	Land Use Characteristics	Land Use Guidelines	Land Use Planning Strategies *All aviation uses are acceptable.
Zone 4	**Population Density**	Limit population concentrations.	1. <40 people/acre in buildings, <75 persons/ acre outside buildings
	Residential vs Non-Residential Land Use	Runway <4,000 feet – maximum 1 du/5 acre in rural or urban area. Runway 4,000 to 5,999 feet – maximum 1 du/5 acre in rural area, 1 du/2.5 acre in urban area. Runway >6,000 feet – maximum 1 du/5 acre in rural area, 1 du/2.5 acre in urban area. All non-residential land uses permitted outright subject to the Special Function Land Use Guidelines.	1. Create a height hazard overlay ordinance around the airport. 2. Obtain avigation easements. 3. Clustered development to maintain density as long as open space remains unbuilt. Place clustered development away from extended runway centerline. 4. Prohibit mobile home parks. 5. Require downward shading of lighting to reduce glare. 6. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Evaluate noise sensitive land uses in light of aircraft noise contour lines (if available) when establishing new zoning. 2. Prohibit high overhead utilities and all noise sensitive land uses. 3. Zone land for uses other than for schools, play fields, hospitals, nursing homes, daycare facilities and churches. 4. Limit storage of large quantities of hazardous or flammable material. 5. Ensure permitted uses will not create large areas of standing water, or generate smoke/ steam, etc.
Zone 5	**Population Density**	Avoid land uses which concentrate people indoors or outdoors.	1. 0-5 people/acre 2. Zone land uses, which by their nature, will be relatively unoccupied by people (i.e.: mini-storage, small parking lots)
	Residential vs Non-Residential Land Use	Prohibit all residential land uses. All non-residential land uses permitted outright subject to the Population Density and Special Function Land Use guidelines.	1. Airport sponsor should purchase property if possible. 2. Create a height hazard overlay ordinance around the airport. 3. Obtain avigation and obstruction easements. 4. During site development process, shift all structures away from the runway centerlines if possible. 5. Landscaping requirements shall establish only low growing vegetation. 6. Prohibit high overhead outdoor lighting. 7. Require downward shading of lighting to reduce glare. 8. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Prohibit overhead utilities and all noise sensitive land uses. 2. Zone land for uses other than for schools, play fields, hospitals, nursing homes, daycare facilities and churches. 3. Limit storage of large quantities of hazardous or flammable material. 4. Ensure permitted uses will not create large areas of standing water, or generate smoke/ steam, etc.

COMPATIBLE LAND USE MATRIX

Accident Safety Zone	Land Use Characteristics	Land Use Guidelines	Land Use Planning Strategies *All aviation uses are acceptable.
Zone 6	**Population Density**	Limit large concentrations of people	1. <100 people/acre in buildings, <150 persons/acre outside buildings
	Residential vs Non-Residential Land Use	Runway <4,000 feet – maximum 1 du/5 acre in rural areas or 1 du/5 acre in urban area. Runway 4,000 to 5,999 feet – maximum 1 du/5 acre in rural area, 1 du/2.5 acre in urban area. Runway >6,000 feet – maximum 1 du/5 acre in rural area, 1 du/2.5 acre in urban area. All non-residential land uses permitted outright subject to the Special Function Land Use Guidelines.	1. Prohibit mobile home parks near runways longer than 4,000 feet. 2. Create a height hazard overlay ordinance around the airport. 3. Obtain avigation and obstruction easements. 4. Clustered development to maintain density as long as open space remains unbuilt. Place clustered development away from extended runway centerline. 5. Prohibit mobile home parks. 6. Require downward shading of lighting to reduce glare. 7. Evaluate all possible permitted conditional uses to assure compatible land use.
	Special Function Land Use	Prohibit all Special Function Land Uses.	1. Prohibit all Special Function Land Uses 2. Evaluate noise sensitive land uses in light of aircraft noise contour lines (if available) when establishing new zoning.

APPENDIX C

RCW 36.70.547 AND RCW 36.70A.510

RCW 36.70.547 General aviation airports – Siting of incompatible uses.
Every county, city, and town in which there is sited 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. Such plans and regulations may only be adopted or amended after formal consultation with: Airport owners and managers, private airport operators, general aviation pilots, ports, and the aviation division of the department of transportation. 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. Each county, city, and town may obtain technical assistance from the aviation division of the department of transportation to develop plans and regulations consistent with this section.

Any additions or amendments to comprehensive plans or development regulations required by this section may be adopted during the normal course of land-use proceedings.

This section applies to every county, city, and town, whether operating under chapter 35.63, 35A.63, 36.70, [or] 36.70A RCW, or under a charter. [1996 c 239 § 2.]

NOTE: RCW 36.70A510 (Growth Management Act) refers to this site for implementation.