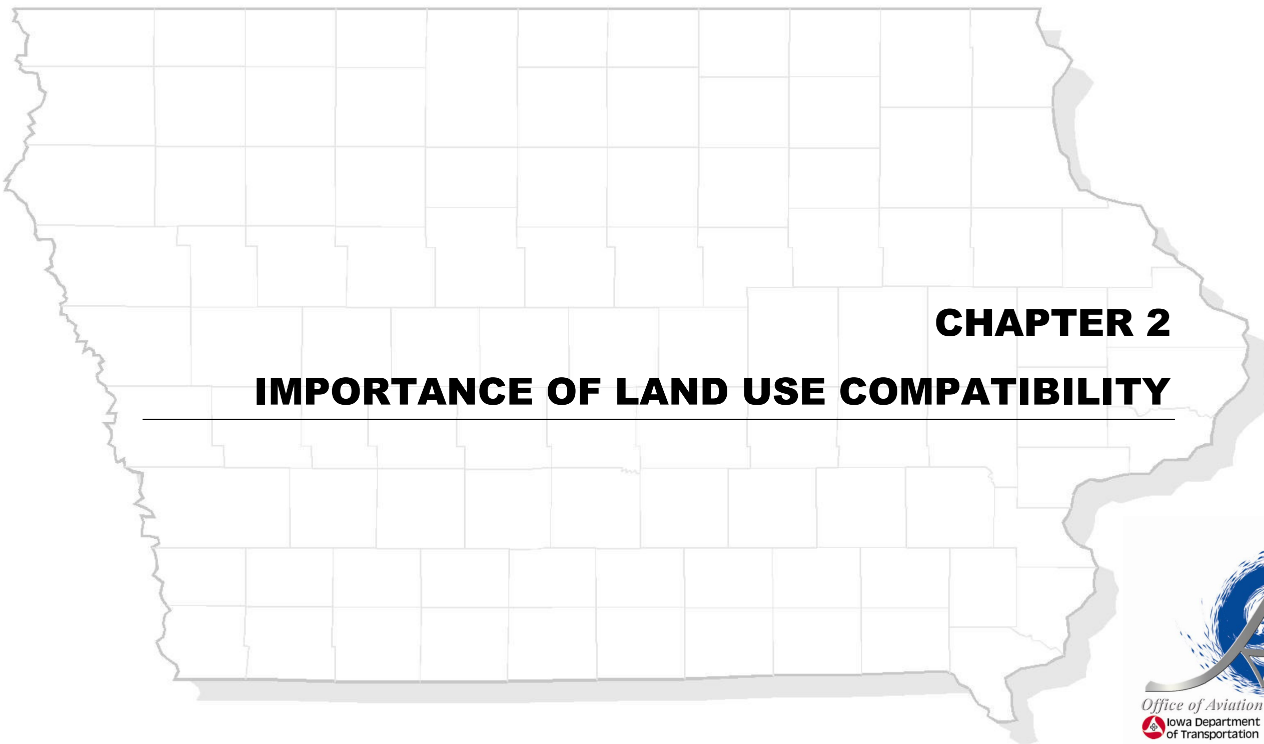
Iowa Airport Land Use Guidebook



CHAPTER 2

IMPORTANCE OF LAND USE COMPATIBILITY

Office of Aviation
Iowa Department of Transportation

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2.0 Importance of Land Use Compatibility

The need to plan for compatible land use near airports is not a new concept. Compatible land use was recognized as early as 1952 in a document entitled *The Airport and Its Neighbors – The Report of the President's Airport Commission*. This report, commonly referred to as the Doolittle Report, recommended that airports and metropolitan areas be planned jointly so that each develops to serve the other, with large fan-shaped areas at runway ends zoned to restrict development. Unfortunately, the recommendations laid out in the Doolittle Report have not been significantly implemented throughout the nation's aviation system. The incidence of incompatible land uses and impact on airport operations and development have escalated. As decisions to allow incompatible land uses near airports threaten the nation's aviation system, implementation of compatible land use controls have become an industry priority.

Compatible land use planning within the vicinity of an airport is essential to provide safety for aircraft and Iowans.

It is important to maintain an obstruction-free airport and associated airspace. This includes the area that encompasses the airport, runway protection zones, approach areas, and general vicinity of the airport. While some of these areas are owned by airports, the bulk of the land beyond airport boundaries is privately owned and need to be managed by the local municipality in which the airport jurisdiction falls. The primary tools available to local governments to prevent incompatible development are zoning and land use controls such as comprehensive plans, airport land use plans, and airport overlay zoning ordinances.

To assist local governments in the development of these plans and zoning ordinances, each community should consult the Federal Aviation Administration (FAA) Advisory Circulars (AC) to ensure that their individual airport meets current design criteria. Too often, local governments review and approve land uses and structures with little consideration on how the land use or structure will affect airport operations. FAA criteria, such as grant assurances and design guidelines, along with aviation accident statistics, provide the foundation and the justification for compatible land uses.

Local governments are the front line to ensuring compatible land uses.

As previously mentioned, the Iowa DOT Office of Aviation through the *Iowa Aviation System Plan 2004-2024*, has established a clear vision to ensure safety, quality facilities, and aviation services that support transportation demands while meeting economic and quality of life needs throughout the state.

Federal, state, and local resources have been invested to develop airport infrastructure necessary to support aviation activity in Iowa. Protecting airports and their airspace through compatible land use will help maximize infrastructure return on investment, as well as maintain a safe operating environment.

This chapter contains information related to the challenges of defining and the need for compatible land uses. The need can be identified using criteria such as FAA ACs, accident statistics, and aircraft and airport variables. A community's comprehensive land use plan should consider each of these elements to provide protection for its airport environment.

2.1 Definition of Compatible Land Use

One of the primary challenges with compatible land use is establishing a specific definition of what is considered either compatible or incompatible to airport and aircraft operations. Airport compatible land uses are defined as those developments that comply with generally accepted restrictions on location, height, and activity that provide for safe aircraft movement and airport operations. Additionally, it includes the preservation of public health, safety, and welfare for those persons located in the airport's environs.

Each community is unique and must develop compatible land uses that meet the individual needs of the local community and local airport.

This definition can appear vague since no specific land use types are specified. The vagueness is intentional because nearly every type of land use can be both compatible and incompatible depending upon the particular aspects of the land use, including the management of the land use, location of the land use relative to the airport, and ancillary types of impacts associated with the land use. For example, land uses typically considered to be compatible with airport operations include commercial, industrial, and agricultural activities.

However, each of these may also contain aspects considered incompatible such as:

- Commercial uses may have dense concentrations of people
- Industrial uses often have tall smoke/ventilation stacks that generate smoke/steam that create visual obstructions
- Agricultural operations can act as wildlife attractants

Planners within the local municipality must assess the compatibility of the land use in greater detail as it relates to individual communities and airport operations. Descriptions of land use issues include high concentrations of people, tall structures, visual obstructions, and wildlife and bird attractants, are discussed further in Chapter 3 *Compatibility Concerns*.

Local planners play a key role in assessing the compatibility of local land uses near airports.

2.2 Primary FAA Criteria Related to Land Use

There are three FAA criteria that lay the foundation for land use compatibility. They include:

- Grant assurances, which are part of the Airport Improvement Program (AIP) funding process.
- FAA design standards, which pertain to the physical layout of an airport.
- Federal Aviation Regulation (FAR) Part 77 Surfaces, which provide guidance on navigable airspace around an airport.

These three criteria are discussed in the following sections to illustrate the primary reasons the FAA recommends compatible land uses near airports.

2.2.a. Grant Assurances, Airport and Airway Improvements Act of 1982, United States Code (USC), Title 49, subtitle VII as amended

Communities that have accepted federal funding for their airport have signed grant assurances, which require compatible land use around the airport.

Grant assurances are required as part of a project application from airport sponsors who are eligible to request federal funds. Upon acceptance of grant money, these assurances are incorporated into and become part of the grant agreement. The airport sponsor is obligated to comply with specific assurances, which include the maintenance of compatible land use within the vicinity of the airport. The assurances that apply to planning related projects are limited compared to other types of projects and have stipulations that are outlined in the grant agreement documents. A complete list of assurances can be found at Web site:
www.faa.gov/airports_airtraffic/airports/aip/grant_assurances/media/airport_sponsor_assurances.pdf

Assurances include, but are not limited, to the following:

- Compliance with all applicable federal laws, regulations, executive orders, policies, guidelines, and requirements as they relate to the project.
- Responsibility and authority of the sponsor to carry out the proposed project.
- Availability of the local share of funds for the proposed project.
- Preservation of the rights and powers of the sponsor and airport.
- Consistency with local plans.
- Accurate accounting, auditing, and recordkeeping process.
- Public access to project information and planning processes.
- Compliance with civil rights issues.
- Provision of engineering and design services.
- Compliance with current policies, standards, and specifications.

Specifically, Grant Assurance 21 included in the September 1999 amendment to 49 USC 47107, requires all airports that accept federal money to take appropriate action against incompatible land uses in the immediate vicinity of the airport. Such actions include adopting zoning laws and zoning changes that will increase airport land use compatibility. This grant assurance obligates an airport sponsor to protect the federal investment through the maintenance of a safe operating environment.

2.2.b. FAA Design Standards

Safety areas, as defined by FAA AC 150/5300-13, *Airport Design*, are implemented for the safe and efficient operation of an airport. There are many design requirements contained in this advisory circular. The complete advisory circular 150/5300-13 can be found at FAA Web site: www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/index.cfm?template=Document_Listing&Keyword=150/5300-13&DocumentSelected=1

Airport design standards are defined and explained within the FAA Advisory Circular 150/5300-13, Airport Design.

The requirements discussed below are directly related to areas in proximity to runway ends and approach areas near runways. These areas fulfill safety-related functions for an airport and for aircraft using the airport. It is important to fully understand the role of each area during land use discussions. The safety areas focus on requirements on the ground and include:

- **Runway Protection Zones**

  Runway Protection Zones (RPZs), formerly known as clear zones, were originally established to define land areas below aircraft approach paths in order to prevent the creation of airport hazards or development of incompatible land use. First recommended in a 1952 report by the President's Airport Commission titled *The Airport and Its Neighbors*, the establishment of clear areas beyond runway ends was deemed worthy of federal management. These clear areas were intended to preclude the construction of obstructions potentially hazardous to aircraft and to control building construction for the protection of people on the ground. The U.S. Department of Commerce concurred with the recommendation on the basis that this area was "primarily for the purpose of safety for people on the ground." The FAA adopted clear zones with dimensional standards to implement the commission's recommendation.

  Areas around runways and runway ends must be protected.

  RPZs are designed with the intent to protect people and property on the ground. They are located at the end of each runway and should ideally be controlled by the airport. Control is preferably exercised by acquisition of sufficient property interest to achieve and maintain an area that is clear of all incompatible land uses, objects, and activities.

The RPZ is trapezoidal in shape and centered on the extended runway centerline. Dimensions for a particular RPZ are based upon the type of aircraft and approach visibility minimums associated with the runway end. Unless noted by a special circumstance, the RPZ begins 200 feet beyond the end of the runway and has specific land use restrictions in order to keep the approach and departure areas clear of obstructions. **Table 2-1** provides dimensional information for the various RPZ sizes. **Figure 2-1** provides a graphic representation of the RPZ dimensions. The RPZ has two specific areas; first is the central portion of the RPZ, which is equal in width to the runway Object Free Area (OFA). The second area is the controlled activity area, which is adjacent to the central portion of the RPZ.

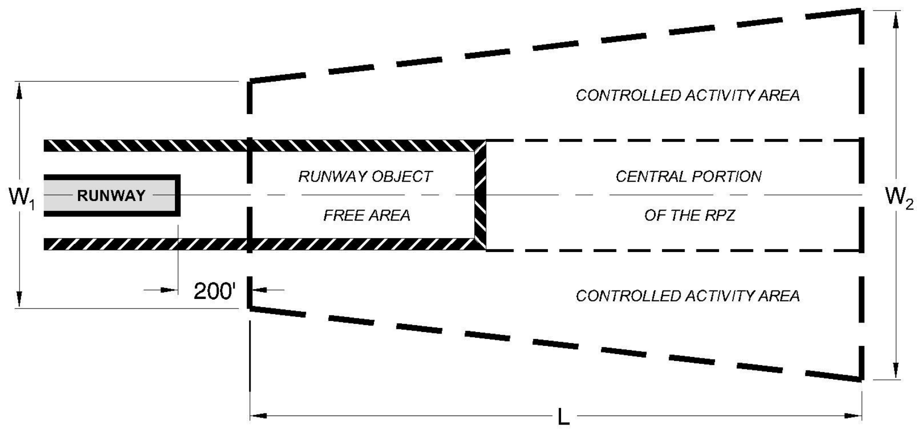
Table 2-1 Runway Protection Zone Dimensional Requirements

Approach Visibility Minimums 1	Facilities Expected to Serve	Dimensions			
		Length **L** feet (meters)	Inner Width W_1 feet (meters)	Outer Width W_2 feet (meters)	RPZ acres
Visual and not lower than 1-Mile (1,600m)	Small aircraft exclusively	1,000 (300)	250 (75)	450 (135)	8.035
	Aircraft Approach Categories A & B	1,000 (300)	500 (150)	700 (210)	13.770
	Aircraft Approach Categories C & D	1,700 (510)	500 (150)	1,010 (303)	29.465
Not lower than ¾-mile (1.200m)	All Aircraft	1,700 (510)	1,000 (300)	1,510 (453)	48.978
Lower than ¾-mile (1,200 m)	All Aircraft	2,500 (750)	1,000 (300)	1,750 (525)	78.914

1 The RPZ dimensional standards are for the runway end with the specified approach visibility minimums. The departure RPZ dimensional standards are equal to or less than the approach RPZ dimensional standards. When an RPZ begins other than 200 feet (60m) beyond the runway end, separate approach and departure RPZs should be provided. Refer to FAA AC 150/5300-13 Change 11, Appendix 14 for approach and departure RPZs.

Source: *FAA AC 150/5300-13 Change 11, Airport Design Standards*

Figure 2-1 Runway Protection Zone Diagram



Source: *FAA AC 150/5300-13 Change 11, Airport Design Standards*

- **Runway Safety Areas**
  Runway Safety Areas (RSAs) are rectangular, two-dimensional areas surrounding a runway. FAA notes that RSAs should be cleared, graded, properly drained, and free of potentially hazardous surface variations. RSAs should also be capable of supporting snow removal, aircraft rescue and fire fighting (ARFF) equipment, or an aircraft that overshoots the runway without causing damage to that aircraft. Taxiways also have similar safety area requirements. The actual size of an RSA is dependant upon the FAA classification of the runway (A-I, B-II, C-III, etc).

- **Runway Object Free Areas**
  Runway Object Free Areas (OFAs) are two-dimensional ground areas surrounding runways where all aboveground objects must be removed unless fixed by their function, such as runway lights. FAA standards prohibit objects and parked aircraft from being located within the runway OFA. Taxiways also have OFAs.

Runway Protection Zones can often extend beyond airport property.

RSAs and OFAs are almost always contained within airport property. However, RPZs can often extend beyond airport property. Therefore, from an off-airport land use compatibility perspective, the critical safety zone identified by FAA design standards is the RPZ. The FAA recommends that, whenever possible, the entire RPZ be owned by the airport and be clear of all obstructions if practicable. Where ownership is impracticable, avigation easements are recommended to obtain the right to maintain the height of structures and vegetation within the RPZ footprint. Obtaining easements that are often restrictive enough to limit building opportunities, as well as height, are often just as costly to procure as purchasing the property outright.

2.2.c. Title 14 Code of Federal Regulation (CFR) Part 77 *Objects Affecting Navigable Airspace* (FAR Part 77)

Basis for FAR Part 77 Surfaces are defined and explained within FAA FAR Part 77, Objects Affecting Navigable Airspace.

FAR Part 77 establishes standards for determining and defining objects that may pose potential obstructions to air navigation. While design standards contained in AC 150/5300-13 are intended to protect specific ground areas, FAR Part 77 was developed by the FAA to protect specific airspace areas in proximity to an airport. The airspace areas governed by FAR Part 77 are referred to as 'imaginary surfaces.' The following FAA Web site provides a link to FAR Part 77 dimensional requirements and illustrations, as well as other information relating to the process for reviewing airspace issues: https://oeaaa.faa.gov/oeaaa/external/portal.jsp

Under FAR Part 77, the FAA is authorized to undertake an aeronautical study to determine whether a structure or vegetation is or could be a hazard to air navigation. However, the FAA is not authorized to regulate tall structures nor is there specific authorization in any statute that permits the FAA to limit structure heights or determine which structures should be lighted or marked. In fact, in every aeronautical study determination, the FAA acknowledges that state or local authorities control the appropriate use of property beneath an airport's airspace. This illustrates the need for local land use controls to support the findings of the FAA. The imaginary surfaces outlined in FAR Part 77 relating to land use compatibility can be found on the FAA web page and are explained on the following page:

- **Primary Surface**

  The primary surface must be clear of all obstructions except those fixed by their function, such as runway edge lights, navigational aids, or airport signage. The majority of the primary surface is already controlled by runway safety area criteria contained in FAA AC 150/5300-13 Change 11, *Airport Design Standards* and therefore does not warrant inclusion as a land use zone.

  It is important to protect airports from tall structures that can obstruct navigable airspace.

  Even though the primary surface is not included as a land use zone, it functions as an important safety area since it is longitudinally centered on a runway and is intended to provide an obstruction-free area around the runway surface. When the runway has a prepared hard surface, the primary surface extends 200 feet beyond each end of that runway. When the runway does not have a prepared hard surface, or planned hard surface, the primary surface terminates at each end of the runway. The width of a primary surface ranges from 250 to 1,000 feet depending on the existing or planned approach and runway type (visual, non-precision, or precision). **Appendix B** illustrates the classification and runway specification for Iowa's 111 publicly-owned airports.

  Table 2-2, Figure 2-2, and **Figure 2-3** depict various dimensional requirements for the primary surface and other FAR Part 77 surfaces. A visual approach runway has relatively small surfaces with approach and horizontal surfaces extending 5,000 feet from the primary surface at an approach slope of 20 feet horizontally for each one foot vertically (20:1). For a non-precision approach runway, both the approach and horizontal surfaces extend either 5,000 or 10,000 feet from the primary surface, depending on the design category of the runway. The approach surfaces for precision approach runways are similar to those for non-precision approach runways except that the approach surface extends 50,000 feet from the primary surface, and the horizontal surface extends 10,000 feet from the primary surface.

With the recent development of new approach procedures such as Global Positioning Systems (GPS), Area Navigation (RNAV), and Lateral Precision with Vertical Guidance (LPV) approaches, there is a greater degree of flexibility in the definition of non-precision and precision instrument approaches. FAA has not altered the text related to FAR Part 77 to reflect these changes to date.

Table 2-2 FAR Part 77 Surface Dimensional Requirements

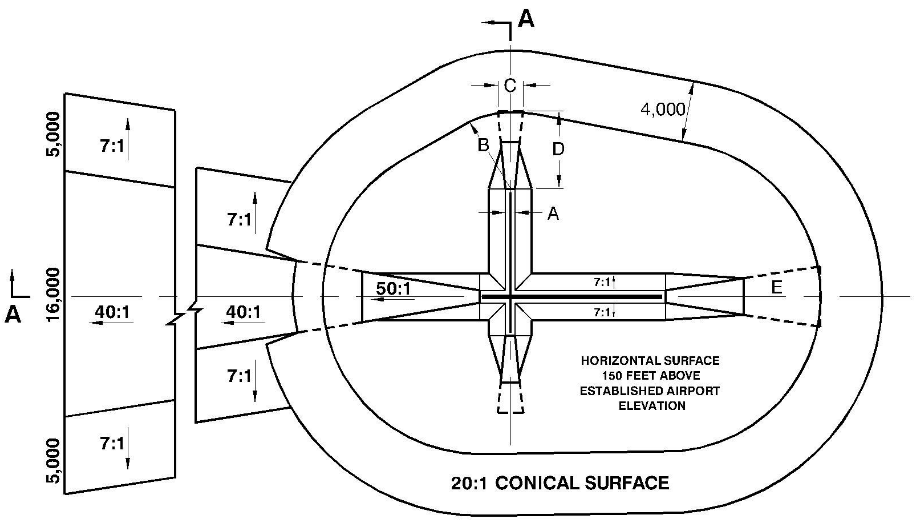
Dimensions shown in Figure 2-2	Item	Dimensional Standards (Feet) for Runway Classifications (*see legend below*)					
		Visual Runway		Non-Precision Instrument Runway			Precision Instrument Runway
				A	B		
		A	B		C	D	
A	*Primary surface* width and approach surface width at inner end	250	500	500	500	1,000	1,000
B	*Horizontal surface* radius	5,000	5,000	5,000	10,000	10,000	10,000
C	*Approach surface* end width	1,250	1,500	2,000	3,500	4,000	16,000
D	*Approach surface* length	5,000	5,000	5,000	10,000	10,000	*
E	Approach slope	20:1	20:1	20:1	34:1	34:1	*
F	*Conical surface* width	4,000	4,000	4,000	4,000	4,000	4,000
G	*Transitional surface width*	7:1	7:1	7:1	7:1	7:1	4,000

Runway Classification Legend
A – Utility runway.
B – Runway larger than utility.
C – Visibility minimums greater that ¾ of a mile.
D – Visibility minimums as low as ¾ of a mile.
* – Precision instrument approach slope is 50:1 for inner 10,000 feet and 40:1 for an additional 40,000 feet.

Runway Definitions
- Utility runway means a runway that is constructed for and intended to be used by propeller driven aircraft of 12,500 pounds maximum gross weight and less.
- Visual runway means a runway intended solely for the operation of aircraft using visual approach procedures, with no straight-in instrument approach procedure.
- Non-precision instrument runway means a runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance or area type navigation equipment, for which a straight-in non-precision instrument approach procedure has been approved.
- Precision instrument runway means a runway having an existing instrument approach procedure utilizing an Instrument Landing System (ILS), or a Precision Approach Radar (PAR).

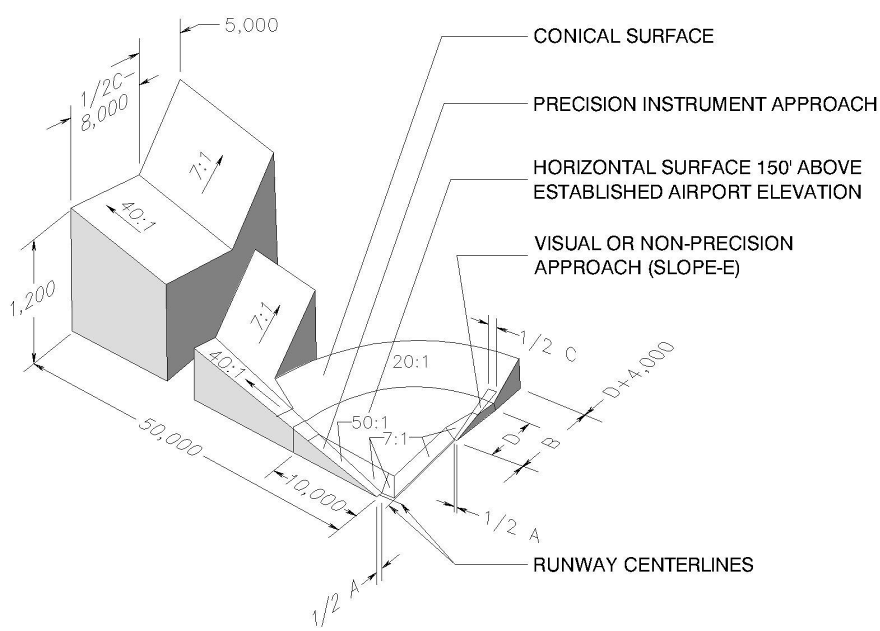
Source: *FAR Part 77 Object Affecting Navigable Airspace*

Figure 2-2 FAR Part 77 Surfaces – Plan View



Source: *FAR Part 77 Object Affecting Navigable Airspace*

Figure 2-3 FAR Part 77 Surfaces – 3D Isometric View of Section A



Source: *FAR Part 77 Object Affecting Navigable Airspace*

- **Transitional Surface**
  The transitional surface extends outward and upward at right angles to the runway centerline and extends at a slope of seven feet horizontally for each one-foot vertically (7:1) from the sides of the primary and approach surfaces. The transitional surfaces extend to the point at which they intercept the horizontal surface at a height of 150 feet above the established airport elevation. For precision approach surfaces that project through and beyond the limits of the conical surface, the transitional surface also extends 5,000 feet horizontally from the edge of the approach surface and at right angles to the runway centerline. **Table 2-2, Figure 2-2,** and **Figure 2-3** depict the dimensional requirements of the transitional surface.

- **Horizontal Surface**
  The horizontal surface is a horizontal plane located 150 feet above the established airport elevation and encompasses an area from the transitional surface to the conical surface. The perimeter is constructed by generating arcs from the center of each end of the primary surface and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc for all runway ends (designated as utility or visual) is 5,000 feet and 10,000 feet for precision and non-precision runway ends. **Table 2-2, Figure 2-2,** and **Figure 2-3** depict the dimensional requirements of the horizontal surface.

- **Conical Surface**
  The conical surface extends upward and outward from the periphery of the horizontal surface at a slope of 20 feet horizontally for every one foot vertically (20:1) for a horizontal distance of 4,000 feet. **Table 2-2, Figure 2-2,** and **Figure 2-3** depict the dimensional requirements of the conical surface. Height limitations for the surface range from 150 feet above the airport reference elevation at the inner edge to 350 feet at the outer edge.

- **Approach Surface**
  The approach surface is longitudinally centered on the extended runway centerline and extends outward and upward from the end of the primary surface. The approach slope of a runway is a ratio of 20:1, 34:1, or 50:1, depending on the approach type. The length of the approach surface varies from 5,000 to 50,000 feet and also depends upon the approach type. The inner edge of the approach surface is the same width as the primary surface and expands uniformly to a width ranging from 1,250 to 16,000 feet, depending on the type of runway and approach. **Table 2-2, Figure 2-2,** and **Figure 2-3** depict the dimensional requirements of the approach surface.

2.2.d. Other Airport Related Surfaces

In addition to the Runway Protection Zone and FAR Part 77 Surfaces, there are other surfaces which are evaluated by the FAA for obstructions. Two of these surfaces are worth mentioning since they may contribute to the height limitations for airports with instrument approaches and in some instances air carrier operations.

- **Departure Surface for Instrument Runways**
  This surface is applied to runways with an instrument approach and is defined in FAA AC 150/5300-13, Change 11, Appendix 2.

  This surface has a slope of 40:1 with corresponding dimensions of 1,000 foot inner width, 6,466 foot outer width, 10,200 foot in length. Objects penetrating this surface may affect departure procedures, just as approach procedures can be affected by these same penetrations.

- **One-Engine Inoperative Obstacle Identification Surface**
  For runways and airports that support air carrier operations, FAA AC 150/5300-13, Change 11, Appendix 2 requires the clearance of this additional departure surface.

Providing a 62.5:1 slope, the inner dimensions of the surface is 600 foot wide, with the outer width at 12,000 feet wide. The corresponding length is the 50,000 feet.

Both of these surfaces, while important to be maintained clear of height obstructions may also be considered for compatible land use decisions.

2.3 Aircraft Accident Information

The ability to manage airport land use compatibility and maintain a safe environment for aircraft and area residents is a daunting challenge for airport sponsors, local planners, and host communities. Consequently, a greater understanding of aviation safety issues, including statistics related to aircraft accidents, is essential in maintaining the integrity of compatible land uses within the vicinity of an airport. While data is limited due to the relatively low number of accidents per hours flown, available accident statistics can be reviewed by location of accidents, operational phase of flight where accidents occur, and causes of accidents to help understand the need for compatible land use.

Although aircraft accident rates are low compared to hours flown, knowing where accidents occur helps identify area where compatible land uses are important.

It is important to define what is meant by aircraft accidents. According to FAA Order 8020.11B, *Aircraft Accident and Incident Notification, Identification and Reporting*, the definition of aircraft accident is *"an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and until such time as all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft received substantial damage."*

2.3.a. Aircraft and Airport Accident – Location

Knowledge of the location of aircraft accidents in relation to an airport is important to determine which areas around an airport should be protected. Data compiled by the National Transportation Safety Board (NTSB) indicates that the highest number of aircraft accidents occur on-airport property. Additionally, the vast majority of off-airport accidents occur within five-miles of the airport runway; most of which occur within one-mile of the airport.

Specific data regarding the location of general aviation aircraft accidents, relative to existing airport locations, is available from the NTSB. The geographic location of an aircraft accident is most often described using one of three terms:

- **On-airport**
  On-airport typically meaning land owned and maintained by the airport.
- **Airport vicinity**
  Airport vicinity typically meaning the area within a three- to five-mile radius of an airport, which is often the area considered to be the airport traffic pattern area where aircraft maneuver during departure and approach phases of flight.
- **En-route**
  En-route typically meaning the area outside a five-mile radius of an airport, where aircraft transverse between airports/destinations.

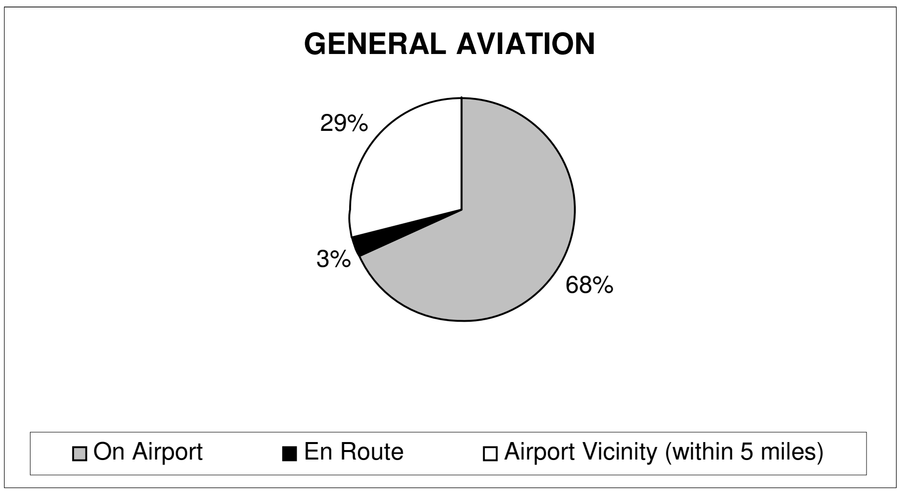
As shown in **Table 2-3, Figures 2-4,** and **Figure 2-5**, the NTSB data from 1990 to 2000 reveals that 68 percent (68%) of general aviation and 67 percent (67%) of commercial aircraft accidents take place on-airport property. Another three percent (3%) of general aviation and seven percent (7%) of commercial aviation occur while the aircraft are en-route to a destination. The remaining 29 percent (29%) of general aviation accidents and 26 percent (26%) of commercial aviation accidents occurred within five-miles of an airport.

Table 2-3 General Aviation and Commercial Aircraft Accident Data

	General Aviation	Commercial Aviation
On-Airport	68%	67%
Airport Vicinity	29%	26%
En-Route	3%	7%

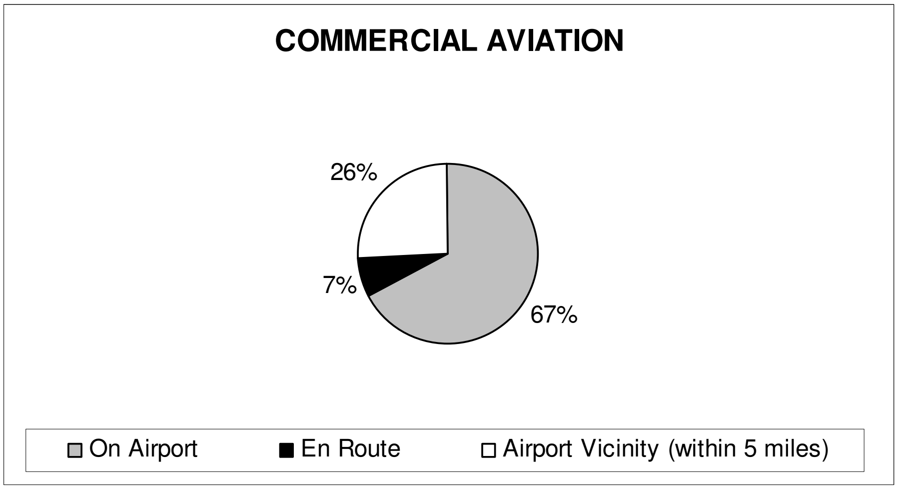
Source: *NTSB Aviation Accident Database, 1990-2000*

Figure 2-4 Proximity of General Aviation Accidents to Nearest Airport



Source: *Data Complied from NTSB Aviation Accident Database: General Aviation – Calendar years 1990-2000*

Figure 2-5 Proximity of Air Carrier Accidents to Nearest Airport



Source: *Data complied from NTSB Aviation Accident Database: General Aviation – Calendar years 1990-2000*

2.3.b. Aircraft and Airport Accident – Phase of Flight

Aircraft accidents are often assessed by the operational phase of flight. The phase of flight is determined by the aircraft's location at the time of the accident. These phases of flight related to accidents are defined as:

- **Approach**
  The phase of flight when aircraft align with the runway to land.
- **Departure**
  The phase of flight when aircraft take-off from a runway.
- **Threshold**
  Either the phase when an aircraft commences the action of take-off by accelerating down a runway or the location where an aircraft touches-down when landing on a runway.
- **Take-off roll**
  The accelerating action of an aircraft during take-off prior to lift-off from the runway pavement.

Most aircraft accidents occur during the departure and approach phases of flight. Accident data collected by the NTSB reveals that it is vital to protect departure and approach areas of runway ends. The majority of general aviation aircraft landing accidents take place on or immediately adjacent to a runway. The NTSB reported that between 1990 and 2000, 77 percent (77%) of all general aviation landing accidents occurred during touchdown or during the roll-out to a departure. The remaining 23 percent (23%) of general aviation accidents took place in the landing pattern (traffic pattern).

Most aircraft accidents occur during the departure and approach phases of flight.

The NTSB data also shows that of the general aviation aircraft accidents that occurred near airports, 33 percent (33%) happened within one-quarter mile of the airport and 29 percent (29%) occurred within an airport traffic pattern. FAA documents support the need to clear runway safety areas of natural or man-made structures on or near airport environs.

The majority of single-engine propeller plane accidents tend to be clustered close to runway ends and near the extended runway centerline. For example, accidents that occur while an aircraft is on approach to land take place at a median distance of 520 feet from the landing threshold, the point at which the aircraft touches-down. For departure accidents, the median distance to the accident site is 500 feet from the departure end and 4,177 feet from the start of the take-off roll. Nearly 90 percent (90%) of the departure accident locations lay within 9,000 feet of a take-off roll.

Multi-engine airplanes, including jets, experience the majority of approach accidents within 500 feet of both sides of the runway centerline, but the median distance is more than 2,200 feet from the landing threshold. Departure accidents are widely scattered, although the median accident site distance is 1,100 feet from the departure end of the runway. Accident sites are spread evenly within 5,000 to 10,000 foot range, measured from the start of the take-off roll.

These statistics provide general guidelines for the development of safety related areas for compatible land uses within the airport's environs. For example, airports serving predominantly single-engine aircraft should control an area around the airport that is at least 550 feet from runway ends. It also illustrates that airports serving multi-engine aircraft should protect an area of not less than 2,200 feet from runway ends from incompatible land uses.

2.3.c. Aircraft and Airport Accidents – Causes

The causes of accidents are often classified as either those within the pilot's control or those outside the pilot's control. To illustrate, a pilot is expected to maintain safe operation of an aircraft within FAA guidelines and the operational capabilities of the aircraft. Maintaining insufficient airspeed or improper spacing between multiple aircraft could potentially create an accident that would fall within the realm of a pilot's control. Factors considered to be outside a pilot's control include adverse weather conditions, loss of engine or power, hazardous terrain, or wildlife hazards.

According to accident figures, there is a strong correlation between aircraft accidents and proximity to the runway.

NTSB data suggests that general aviation aircraft accidents are most often related to human error resulting from natural terrain or natural and man-made obstructions within the vicinity of an airport. A pilot's preoccupation with the terrain and structures immediately surrounding an airport can contribute to accidents. Structures in the approach path of a runway can also contribute to aircraft accidents. For the safety of both air passengers and the general public, it is best to maintain obstruction-free airspace as part of an airport compatible land use plan. It is important to note that assigning a specific accident cause may be subjective and that conclusive results are therefore often difficult to determine.

Pilots should experience minimal obstructions that distract them within the airspace near an airport. Adherence to compatible land use recommendations that reduce or eliminate obstructions enhances safe aircraft operation.

2.4 Summary

Land use compatibility is a requirement for eligibility to receive FAA grant money for airport improvements.

This chapter provides information regarding safety design criteria and general aircraft accident statistics and how they relate to the importance of compatible land use near airports for both the safety of pilots and those in the vicinity of airports. According to accident figures, there is a strong correlation between aircraft accidents and proximity to the runway. Consequently, the FAA has established standards (FAR Part 77 and FAA Design Standards) for the development of airport runways and airspace. FAA standards help to minimize runway incidents, protect adjacent properties, and attempts to minimize the presence of incompatible land uses. The success of these design standards rests with the host community and their desire to maintain a safe airport. The development of compatible land uses near airports is supported through cooperative comprehensive planning that includes the FAA standards presented in this chapter. Land use compatibility is a requirement for eligibility to receive FAA grant money for airport improvements. Adjacent land uses that are not compatible with airports may result in the loss of federal or state funding for airports.