
APPENDIX B: GENERAL AVIATION AIRPORTS 101

Introduction

This appendix provides background information for various issues that are pertinent to airports. The issues covered in this appendix include the following:

- Airport Governance and Management
- Airport Classification
- Airport Funding
- Airport Design Standards

Airport Management/Governing Structure

Airports function as public entities and are managed or governed in a variety of forms. Before outlining the current governing and management structure for Riddick Field Airport, this section will provide an overview of the variety of options that airports use to govern and manage their affairs.

Governing Structures

There are four predominant types of airport governing structures used to provide public oversight for airports:

City/County Department – the City/County governing board serves as the airport’s governing board for all matters such as contracting, capital improvements, finance’ and similar matters. The City/County may use its taxing authority to help support the airport or there may be provisions in state statutes that allow additional limited taxing authority to support the airport.

City/County Department with Advisory Board – the City/County governing board serves as the airport’s governing board for all matters but looks to the Airport Advisory board for recommendations on actions. The City/County may use its taxing authority to help support the airport or there may be provisions in state statutes that allow additional some limited taxing authority to support the airport.

Airport Board – there are provisions in state statutes that allow for a first or second class city to create an Airport Board with limited and specific governing authority. The type of authority that exists with the board varies but in general this structure allows the airport to operate semi-autonomously from the City while final responsibility for the airport still rests with the City which owns the airport. The City may use its taxing authority to help support the airport or there may be provisions in state statutes that allow some limited taxing authority to support the airport.

Airport Authority – there are provisions in state statutes that allow for the creation of an independent airport authority. These may be created by a City/County or created through a separate process. Once created, these entities have complete authority to govern the activities at the airport. Depending on state statutes, these governing bodies may also have independent, but limited, taxing authority to aid in funding the airport.

Management Structures

There are three general types of management structures for an airport. These different management structures are necessary to ensure that the policies established by the governing body can be carried out on a day by day basis in the operation and delivery of services at the airport. These are as follows:

Appointed Airport Manager – an appointed airport manager is one whose sole responsibility is the operation of the airport. The airport manager is selected by the governing body, the city/county manager or through the city/county's established human resources structure through a qualifications-based selection process. The airport manager then serves at the will of the city/county.

City/County Department Head also assigned as Airport Manager – this person is assigned as airport manager in title but often has larger responsibility such as public works director, city engineer, or transportation director. Like the appointed manager, this person is selected by the governing body, the city/county manager, or through the city/county's human resources system through a qualifications based selection process.

FBO Appointed as Airport Manager – this person is assigned as airport manager mostly in order to provide a physical presence at the airport and assure the day to day operation of the airport. This person also serves as the FBO at the airport and therefore has a concerted interest in the operation of their FBO business. When an FBO is appointed as airport manager, the governing body often retains more responsibility as to formulating capital improvement plans, financial planning, leasing, and similar matters.

FBO/Aircraft Services

The final element of the airport's management and governing structure has to do with the provision of Fixed Base Operator (FBO) type aircraft servicing. At many small airports, it is not financially feasible for an FBO to operate. At some larger airports, the airport has chosen to provide FBO-type aircraft servicing in order to retain the profits from such an activity to fund the airport. In accordance with FAA policy, airports have the 'Proprietary Exclusive Right' to provide any and all types of aeronautical services if they wish. Information regarding the 'Proprietary Exclusive Right' may be found in AC 150/5190-6 "Exclusive Rights at Federally-Obligated Airports" and FAA Order 5190-6b Airport Compliance Manual (Chapter 8). The decision to operate one way or another is an economic and policy choice made by the governing body.

Private FBO – this arrangement has a private company operating under an agreement with the governing body to use space at the airport. The FBO provides services for aircraft and pilots which may include fueling, maintenance, hangaring, aircraft handling, instruction etc.

Airport providing Aircraft Servicing (similar to an FBO) – this structure carries out all the traditional responsibilities of an airport to maintain the airfield and additionally provides FBO-type aircraft services. This direct customer service role adds another dimension to the variety of duties that an airport manager will encounter on a daily basis.

Riddick Field Airport

Granite County of Montana is the governing body which owns and is responsible for the operations and capital development of the airport and is considered the 'Airport Sponsor'. The airport does not have an airport manager onsite and does not have an FBO.

Airport Classification

Airports are given different classifications or designations, depending on the source. This section discusses the various sources or systems used nationally, regionally, or locally to classify an airport. The primary systems used to classify an airport include:

- a. FAA National Plan of Integrated Airport Systems (NPIAS)
- b. Regional or State Aviation System Plans (SASP)
- c. FAA General Aviation Airport Report (ASSET)

National Plan of Integrated Airport Systems

The Airport and Airway Improvement Act of 1982 directed the Secretary of Transportation to prepare, publish, and biannually revise a national system plan – the National Plan of Integrated Airport Systems (NPIAS) – for the development of public-use airports in the United States. This requirement can be found in Public Law 97-421 United States Code § 47103. The NPIAS is a system that emphasizes system planning and development to meet current and future aviation needs. It includes the development considered necessary to provide a safe, efficient, and integrated airport system to meet the needs of civil aviation, national defense, and the United States Postal Service. It takes into account the relationship of each airport to the rest of the transportation system in a particular area, the forecast of technological developments in aeronautics, and the development forecast in other modes of transportation.

To be eligible for funding under the Airport Improvement Program (AIP), an airport must be included in the NPIAS. The FAA determines whether an airport can be included in the NPIAS and the requirements for inclusion in the NPIAS are defined by law and FAA policy. As general criteria, the airport must be a publicly-owned, public-use airport serving civil aviation (privately-owned, public use airports may be included under certain circumstances) with an eligible sponsor, must have at least 10 based aircraft, and must be located at least 20 miles from another NPIAS airport.

Although it is not a factor in determining an airport's classification in the NPIAS, it is important to note that, after an airport is included in the NPIAS and accepts a federal grant for AIP funds, the airport sponsor is contractually obligated to meet the terms and conditions of the AIP grant. These terms and conditions, typically called grant assurances, are established by federal law and define the requirements a sponsor must comply with in the safe and efficient operation and maintenance of the airport.

NPIAS Airport Classification

The public law that created the NPIAS plan defines airports by categories of airport activities. Those categories are defined as follows:

Commercial Service

Commercial service airports are defined as publicly owned airports that have at least 2500 passenger boardings each calendar year and receive scheduled passenger service. Commercial service airports are further categorized based on the number of annual passenger boardings.

Primary commercial service: a commercial service airport with more than 10,000 passenger boardings each year.

Nonprimary commercial service: a commercial service airport with at least 2,500 but no more than 10,000 passenger boardings each year. These airports are commonly referred to as **Commercial Service** airports.

Because of the wide range in levels of passenger boardings throughout the United States, primary commercial service airports are further categorized by the percentage of total passenger boardings in the United States.

Large Hub: a primary commercial service airport with 1 percent or more of the annual national passenger boardings. Commonly referred to as **Large Hub** airports, annual passenger boardings typically range above 8 million.

Medium Hub: a primary commercial service airport with at least 0.25 percent but not more than 1 percent of the annual national passenger boardings. Commonly referred to as **Medium Hub** airports, passenger boardings typically range from 2 million to 8 million.

Small Hub: a primary commercial service airport with at least 0.05% but not more than 0.25 percent of the annual national passenger boardings. Commonly referred to as **Small Hub** airports, passenger boardings typically range from 350,000 to 2 million.

Non-hub: a primary commercial service airport with more than 10,000 but less than 0.05 percent of the annual national passenger boardings. Commonly referred to as **Non-hub Primary** airports, passenger boardings typically range from 10,000 to 350,000.

General Aviation

Most airports that are not considered commercial service airports fall into this category. Although some general aviation airports do have scheduled passenger service, they have fewer than 2500 annual boardings and therefore are not classified as commercial service airports. See the section **General Aviation Airport: A National Asset** for more detail on general aviation airports.

Reliever

Reliever airports are general aviation airports designated by the FAA to relieve congestion at a commercial service airport and to provide more general aviation access to the overall community.

Riddick Field Airport Classification

Riddick Field is not currently included in the NPIAS however has started the process of inclusion. It would be classified as a general aviation airport in the current NPIAS.

State Aviation System Plan

An integrated State airport system plan is the representation of facilities required to meet immediate and future needs as well as achieve overall goals of the State. It recommends the general role, location, and characteristics of new airports or the nature of expansion for existing ones. In order for an airport to be considered for inclusion in the NPIAS, it must first be included in the State's Aviation System Plan (SASP). Each SASP may use different terms or definitions for the role of an airport within the state, and those roles are defined below.

Montana State Aviation System Plan

Airports in Montana are organized in a variety of roles based on the users they serve and support. Montana airports are classified in one of seven categories, each with a unique set of characteristics and services. See the following section **Airport Design Standards** for more information on ARC codes. The airport roles are defined as follows:

Commercial Service Airport: These airports accommodate scheduled major/national or regional/commuter commercial air carrier service; or relieve scheduled air carrier airports of corporate aviation activity.

Essential Air Service (EAS) Airport: These airports provide a level of scheduled air service to communities that otherwise would have limited access to the nation's air transportation system.

General Aviation - Level 1 Airport: These airports maintain a consistent and contributing role in enabling the local, regional, and state-wide economy to have access to and from the national and global economy.

General Aviation - Level 2 Airport: These airports maintain a contributing role in supporting the local and regional economies and connecting the community to the state and national economies.

General Aviation - Level 3 Airport: These airports maintain a supplemental contributing role for the local economy and community access.

General Aviation - Level 4 Airport: These airports maintain a limited contributing role for the local economy and community access.

General Aviation - Level 4 Airport (Remote): These airports maintain a limited contributing role for the local economy and community access to rural regions of the state.

Riddick Field Airport is classified as a Level 4 General Aviation airport in the current Montana State Aviation System Plan.

General Aviation Airports: A National Asset

This report, commonly known as the ASSET 1 Study, documented an 18-month study of the nearly 3000 general aviation (GA) airports, heliports, and seaplane bases identified in the FAA's National Plan of Integrated Airport Systems (NPIAS). The in-depth analysis highlighted the pivotal role GA airports play in our society, economy, and the aviation system. The study also aligned the GA airports into four categories – national, regional, local, and basic – based on their existing activity levels. The categories are a tool to help the FAA and state aeronautical agencies make more consistent planning decisions for the nation's GA airports. They reflect the current aviation activity at GA airports, such as the number and type of based aircraft, the number of passenger boardings, and the number of flights.

During the initial study, the FAA found that almost 500 GA airports did not clearly fit into the four defined categories. As a result, the FAA initiated a second phase of the study in 2013 to define a category for those airports, as well as reassign airports to different categories, based on updated information. That study, known as the ASSET 2 study, assigned 212 previously unclassified airports to one of the four categories.

ASSET Study Airport Categories

The current version of the ASSET study includes four categories. These categories are National, Regional, Local, and Basic. As the second phase of the study was completed, the number of airports considered unclassified was reduced from 497 to 281.

National Airports

These 84 GA airports are located in metropolitan areas near major business centers and support flying throughout the nation and the world. Currently located within 31 states, they account for 13 percent of total flying at the studied airports and 35 percent of all filed flight plans at the airports in the four categories. These 84 airports support operations by the most sophisticated aircraft in the GA fleet. Many flights are by jet aircraft, including corporate and fractional ownership operations and air taxi services. These airports also provide pilots with an alternative to busy primary commercial service airports. There are no heliports or seaplane bases in this category. The criteria used to define the National category include:

- 5,000 + instrument operations, 11+ based jets, 20+ international flights, or 500+ interstate departures: or
- 10,000+ enplanements and at least 1+ charter enplanement by a large certificated air carrier: or
- 500+ million pounds of landed cargo weight.

Regional Airports

The 468 airports in the Regional Airport category are located in metropolitan areas and serve relatively large populations. These airports support interstate and some long distance (cross country) flying with more sophisticated aircraft. 49 states, with the exception of Hawaii, currently have Regional airports. These airports account for 37 percent of total flying at the studied GA airports and 42 percent of filed flight plans. There is a substantial amount of charter (air taxi), jet flying, and rotorcraft at regional airports. There are no heliports or seaplane bases in this category. The criteria used to define the Regional category include:

- Metropolitan Statistical Area (Metro or Micro) and 10+ domestic flights over 500 miles, 1,000+ instrument operations, 1+ based jet, or 100+ based aircraft; or
- The airport is located in a metropolitan or micropolitan statistical area, and the airport meets the definition of commercial service.

Local Airports

The 1,263 airports in the Local category are the backbone of the general aviation system, with at least one Local airport in every state. They are typically located near larger population centers but are not necessarily in metropolitan or micropolitan areas. Local airports account for 42 percent of the general aviation airports eligible for Federal funding. They also account for approximately 38 percent of the total flying at the studied GA airports and 17 percent of filed flight plans. Most of the flying is by piston aircraft in support of business and personal needs. In addition, these airports also typically accommodate flight training, emergency services, and charter passenger service, and the flying tends to be within a state or immediate region. There are no heliports, but there are four seaplane bases in this category. The criteria used to define the Local category include:

- 10+ instrument operations and 15+ based aircraft; or

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- 2,500+ passenger enplanements.

Basic airports

The 852 airports in the Basic category are often able to fulfill their role with a single runway, helipads, seaplane area, and limited infrastructure. 43 states have Basic airports and these airports fulfill the role of a community airport providing a means for private GA flying and linking the community to the national airport system. Basic airports account for approximately 7 percent of the total flying at GA airports and 2 percent of filed flight plans. Most of the flying is self-piloted for business and personal reasons using propeller-driven aircraft. A fair amount of air charter (taxi) services is provided at these airports. There are also 3 heliports and 20 seaplane bases in this category. The criteria used to define the Basic category include:

- 10+ based aircraft; or
- 4+based helicopters; or
- The airport is located 30+ miles from the nearest NPIAS airport; or
- The airport is identified and used by the US Forest Service, US Marshals, US Customs and Border Protection (designated, international, or landing rights), or US Postal Service (air stops), or has Essential Air Service; or
- The airport is a new or replacement facility activated after January 1, 2001; and
- Publicly owned or privately owned and designated as a reliever with a minimum of 90 based aircraft.

General Aviation airports not classified

There are 281 airports that did not fit into one of the four categories. Most of these airport have been in the NPIAS for decades and may have seen an erosion of based aircraft and activity (because of population or economic shifts or recession) or may have no based aircraft. 54 of these airports are privately owned and were originally included in the national system as relievers for commercial service airports, but no longer met the entry criteria. Others may be seasonal airports, military airfields recently converted to general aviation use, or airports used to access important state airports with related national interests. These airports account for approximately 6 percent of total flying at the studied GA airports and 2 percent of filed flight plans. However, none are commercial service airports and none received scheduled air service through the Essential Air Service program.

Riddick Field Airport ASSET Classification

Riddick Field is not currently included in the NPIAS however has started the process of inclusion. It would be further classified as a Basic Airport in the current ASSET report.

Airport Funding

This section provides background information on available Federal, State, and local funding, and lists the various projects that have been undertaken at the Riddick Field Airport (U05).

Federal Funding

Most funding for airport development comes from federal government programs. The predominant federal funding program is the Airport Improvement Program (AIP), managed by the Federal Aviation Administration.

Federal Funding Legislation

The Federal Aviation Administration (FAA) issues grants for airport planning and development in the United States under Public Law 49 United States Code (USC) § 47104(a). Two separate legislative actions - an authorization and an appropriation are needed in order to issue grants and operate the Airport Improvement Program (AIP) grant program.

- **Authorization.** The FAA authorization legislation has numerous titles but is often referred to as the FAA Reauthorization and is passed by Congress for varying lengths of time. The authorization sets yearly limits on AIP funding levels and gives the FAA contract authority to issue grants.
- **Appropriation.** Congress establishes an annual appropriation that allows the FAA to incur obligations and make payments for specific purposes. Although the FAA reauthorization typically establishes an annual authorized funding level for the AIP program, Congress may also use the appropriation law to adjust the authorized AIP funding level for the current year.

Airport and Airway Trust Fund (Source of AIP)

AIP funds are drawn from the Airport and Airway Trust Fund, referred to as the Trust Fund. The Trust Fund receives revenues solely from a variety of sources in the aviation industry, including the domestic ticket tax, a domestic passenger flight segment fee, a departure tax for flights to Hawaii and Alaska, a passenger ticket tax at rural airports, international departure and arrival taxes, frequent flyer taxes, domestic freight and mail taxes, a commercial aviation fuel tax, and a general aviation fuel tax.

AIP Funding Categories

The AIP legislation determines the amount of funding available in each period. Once that amount is established, a complex set of formulas defined by the FAA authorization law, determines how much funding is available within each airport category. In general, AIP funding is distributed in the following categories:

Entitlements

Entitlement funds are AIP funds available to individual airports and fall into various categories based on the number of enplaned passengers.

Cargo Entitlements

Airports receiving cargo shipments may be eligible for cargo entitlements. Cargo entitlements are based on the distribution of 3.5 percent of the total available AIP funds, divided on a pro-rata basis according to an airport's share of total US landed cargo weight.

Primary Entitlements

These funds are available to airports with scheduled passenger service and enplaning more than 10,000 passengers per year. Passenger entitlements are calculated based on the following formula:

- \$7.80 for each of the first 50,000 passenger enplanements
- \$5.20 for each of the next 50,000 passenger enplanements
- \$2.60 for each of the next 400,000 passenger enplanements
- \$0.65 for each of the next 500,000 passenger enplanements
- \$0.50 for each passenger enplanement greater than 1 million

The annual minimum is \$650,000 and the annual maximum is \$22 million per airport. By a special provision in the authorization, when \$3,200,000,000 or more AIP is appropriated in the fiscal year, each level doubles (i.e., instead of \$7.80 for each of the first 50,000, the rate becomes \$15.60, etc.), the annual minimum becomes \$1 million, and the maximum becomes \$26 million per airport.

Nonprimary Entitlements

The special provision in the authorization (as noted above) stipulates that airports not receiving passenger entitlements will receive nonprimary entitlements when AIP appropriations are \$3,200,000,000 or more in the fiscal year. These entitlements are the lesser of \$150,000 or 20 percent of an airport's 5-year development costs listed in the biennial National Plan of Integrated Airport Systems (NPIAS) report to Congress.

State Apportionment

These funds are available for eligible airport development projects within a state. Normally, 18.5 percent of total available AIP grant funds are apportioned for airports based on an area/population formula. These funds are generally limited to commercial service, nonprimary, and general aviation airports.

Discretionary

The appropriated funds remaining after the other types of funds have been allocated are referred to as "discretionary" funds. A portion of the discretionary funds are directed toward specific, or "set-aside," programs, such as noise-related projects or the Military Airport Program. Of the discretionary funds remaining after set-asides, 75 percent are to be used for enhancing capacity, safety, security, and noise compatibility planning and programs. The remaining 25 percent, known as pure discretionary funds, may be used for any eligible project at any airport, as determined by the FAA.

As a general rule pure discretionary funds typically account for less than four percent of the available AIP funds. However, during the fiscal year some airport sponsors may decide not to proceed with an AIP project or may have funds remaining after the completion of a project. Those funds are returned to FAA and converted to discretionary funds, creating additional discretionary funds to be used for eligible projects.

Federal Share of Project Funding

AIP funds typically do not cover the entire cost of an airport development project. Although there are some exceptions, the current legislation limits the federal share of allowable AIP costs to 90 percent for most non-hub primary or smaller airports. The remaining 10 percent is considered the local share and is the sponsor's responsibility.

Types of Potential AIP Funding Available for Riddick Field

By law, only public-use airports in the NPIAS are eligible for AIP funding. These airports are classified into various categories based on their usage and level of passenger enplanements, and those categories determine the type of airport funding eligibility. **Riddick Field Airport will meet the definition for non-primary airport and will receive non-primary entitlement funding for eligible projects once included into the NPIAS. For this planning project, Granite County and the State of Montana will be funding the project in full, with an expected reimbursement to Granite County from a Federal Aviation Administration (FAA) Airport Improvement Program (AIP) grant.**

Most AIP-eligible projects would also be eligible for discretionary funding. However, as stated earlier, the assignment of discretionary funds is determined by the FAA, and extensive coordination with the FAA is required to determine the potential availability of discretionary funding for specific projects.

The Federal AIP Grant Process

Once AIP funding has been identified, the airport sponsor must go through an established process to receive the federal funds and apply them towards an airport development project. The current version of FAA Order 5100.38 contains a detailed explanation of all requirements and processes. In addition, coordination with the Airports District Office (ADO) is strongly encouraged to ensure there is no confusion.

Basic Grant Steps

While there are numerous steps in the FAA AIP grant process, all AIP grants proceed through the same basic steps.



Pre-Grant Actions

Pre-grant actions must be taken before an AIP-eligible project is ready to be considered for inclusion in a grant. The most critical action is the need for early and extensive coordination between the sponsor and the FAA. The majority of the sponsor’s interface with the FAA is at the local level with the appropriate ADO.

Sponsors must develop a Capital Improvement Plan (CIP), typically based on the airport’s 20-year development plan. This CIP is submitted to the ADO, where it is reviewed to identify the projects that meet all of the applicable requirements. The ADO enters those projects into an automated AIP system, which is then used to create a five-year NPIAS report, outlining projects eligible for AIP funding. The FAA creates an Airports Capital Improvement Plan (ACIP) to identify the projects that may be funded with AIP over the next three years. Inclusion of a project in the ACIP represents the initial FAA concurrence with the project. However, inclusion of a project in the NPIAS or the ACIP is not a guarantee of funding, nor does the FAA consider the value of the project a final determination.

The ADO will typically notify the sponsor of the favorable potential for receiving federal funding in the upcoming fiscal years. However, it is not a commitment nor a guarantee of funds; rather, it is simply a notice that funding for the project appears favorable and the sponsor should consider initiating those actions that require long lead times in order to avoid delays in the grant process. In addition, the sponsor must develop a realistic project schedule, setting realistic sponsor deadlines for key steps in the grant process and coordinate this schedule with the ADO.

Grant Programming

A grant is “programmed” when the ADO creates a proposed grant in the automated AIP system. These proposed grants are typically based on estimated costs. The grant is then reviewed within the FAA Office of Airports. If the grant is approved, it then enters into the congressional notification process.

The FAA posts the grant on the official FAA Office of Airports website after the congressional notification process is complete. This is considered formal notification that the ADO has authority to issue the grant. The sponsor is typically notified in writing through a Tentative Allocation letter.

Grant Application, Offer and Acceptance

The following steps must be completed after the sponsor has been notified that they will receive a grant:

- Submittal of Grant Application Package
- Grant Application Review
- Fund Reservation
- Grant Offer
- Grant Acceptance

Grant Acceptance

If the sponsor agrees with the grant offer an authorized representative of the sponsor must sign the grant agreement. The sponsor's attorney must also sign the grant agreement, confirming the sponsor is legally able to enter into the contract with the US government. No funds can be drawn from the grant allocation until the ADO receives an original signed agreement and enters it into the FAA's system.

Grant Payments

The sponsor may begin requesting payments from the FAA once the grant agreement has been fully executed and returned to the ADO. It is important to note a number of requirements in the payment process.

- All grant payment requests must be processed through the currently approved DOT grant payment system.
- Payment requests must be submitted at least annually, unless the ADO requests more frequent submissions. The sponsor may submit payment requests more frequently as costs are incurred.
- Payment requests must be based on costs already paid by the sponsor. Advance payments must be approved by the ADO.
- The last 10 percent of the federal share of the grant must be withheld until the ADO receives the final grant closeout report.
- The sponsor must retain all the documentation supporting the grant payment for the required time period and must make this information available on request.

Grant Amendments

A grant agreement can be amended under certain circumstances. Only the ADO can change a grant agreement and amendments are the process used to implement such changes. In general, a grant agreement can be amended with certain limitations for the following reasons:

- To increase or decrease the grant amount. Grants for planning projects cannot be increased. In addition, amendments to increase the grant amount are limited to a maximum of 15 percent.
- To clarify the project description.
- To add, delete or modify a project.

The Sponsor must coordinate with the ADO to determine requirements for grant amendments.

Grant Closeouts

The final step in the process after the project has been completed is to complete all the administrative actions to close out the grant. This step is particularly important to the sponsor, since the FAA is required to withhold the last 10 percent of the federal share of the grant amount until the closeout report has been submitted to the ADO. The basic steps of the process are:

- Physically complete all projects in the grant.
- Complete all grant administrative and financial requirements
- Complete the closeout process

A project is physically complete when all work funded by the grant has been satisfactorily completed in accordance with all specifications or requirements. Before the ADO can process the closeout, they must receive the appropriate documentation demonstrating that the grant project requirements have met, the sponsor has met all of the grant requirements and all project costs are properly documented.

After the ADO has received all required documentation and verified that all requirements have been met, they will prepare a FAA Final Project Report. The ADO will then send written notification to the sponsor of the final payment amount. After the final payment has been made, the ADO will coordinate with other FAA offices to close the grant. When all these actions have been completed, the ADO will notify the sponsor in writing that the grant is physically and financially complete and the grant is officially closed.

Post-Grant Actions

Once the FAA has officially closed the grant, the sponsor:

- Is required by law to retain all grant-related documentation for three years. If there is litigation, the sponsor must retain the documentation until the issue is resolved or three years, whichever is later;
- Must meet grant assurances and special conditions. Most grant assurances and special conditions remain in effect for 20 years after the grant was signed. Some assurances or special conditions are in effect for the life of the equipment or facility, while other obligations remain in effect for in perpetuity.
- Must comply with the Office of Management and Budget (OMB) single audit requirements. If a sponsor expends more than \$500,000 in federal funds (all federal funds, not just AIP) in a fiscal year. Unless the sponsor is an independent airport authority, this requirement applies to the airport's governing organization, i.e., city, county, state, etc.
- Must receive FAA approval to dispose of equipment or land acquired with AIP funds.

NOTE: The above narrative on the AIP grant process is a summary of current program guidance and does not include all the available details and program requirements. A more detailed description of all of the elements of the AIP grant process can be found in the current version of *FAA Order 5100.38, Airport Improvement Program Handbook*. In addition, sponsors are strongly encouraged to consult their local ADO for the latest policy and guidance.

State Funding

State governments typically have a variety of airport development funding programs available. These funding programs typically use funds from a variety of sources, such as aviation fuel taxes or aircraft registration fees, and are often used to fund a portion of an airport sponsor's local share of federally-funded airport development projects.

Montana State Aviation Funding

The Montana Department of Transportation's Aeronautics Division, under the direction of the Montana Aeronautics Board, manages State funding for airport development. This funding comes primarily from aviation fuel taxes.

Airports may apply for funds to cover up to 100 percent of the local share for federal AIP-funded projects. For projects not eligible for federal AIP-funds or airports not included in the NPIAS, non-federal funding through state grants are available. Loans through the Aeronautics Division are also available to airports to cover 100% of project costs.

Local Funding

While funding for airport development is typically derived from federal or state sources, portions of most capital projects and the majority of airport operating expenses must be funded through local sources. Ideally, the airport generates sufficient revenue to meet those costs. However, for many smaller airports, airport expenses and funding requirements typically exceed available airport revenue and the airport must rely on other funding sources. This section reviews local revenue and identifies possible revenue or funding sources for airport capital development projects, growth, and operation and maintenance expenses.

Project Funding

An airport does not typically satisfy its capital development needs with internal funding sources alone. Federal, state, and private funding, together with airport funds and bond proceeds, are usually combined to produce the total funds required for capital projects. Federal sources, including Airport Improvement Program (AIP) funds, are subject to modification by Congress or other entities having authority over a funding source.

The specific project eligibility criteria may vary depending on the funding source. In identifying potential sources of funds, it is necessary to examine each project element to determine its eligibility for funding. It's also important to consider the availability of funds for each funding source. AIP funding, as the primary source of federal funding, is described in the previous **Federal Funding** section, and potential state funding is described in the previous **State Funding** section. The following paragraphs briefly describe other funding sources available to the airport.

General Obligation (GO) Bonds

GO bonds are backed by the creditworthiness and taxing power of the municipality operating the airport. They usually bear low interest rates because of their high degree of security. However, state laws may limit a municipality's overall debt, and competition from other community financing requirements may preclude their use for an airport project. Some states have an exemption from the debt limitation rule for general obligation bonds because they are used for a revenue producing enterprise.

Third Party Development

Third party financing may be appropriate in a case where an airport sponsor uses a third-party developer or a tenant to finance a construction project. Only projects with a strong positive cash flow can support this type of financing. Generally, the third party would lease the structure for a period of years to the tenant paying the airport ground rents. According to the terms of the agreement, the airport sponsor receives ownership of the asset upon expiration of the lease.

Local Funds

The remaining portion of project costs must be funded from local sources. The local share of project costs can come from cash flow at the airport or with unrestricted cash balances available to the airport sponsor.

Airport Design Guidelines

Guidance on minimum FAA airport design standards is found in FAA AC 150/5300-13A, *Airport Design (Change 1)*. Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. Careful selection of basic aircraft characteristics for which the airport will be designed is important. Airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft unlikely to operate at the airport are not economical.

Critical Design Aircraft

Planning a new airport or improvements to an existing airport requires the selection of one or more “critical aircraft.” FAA design standards for an airport are determined by a coding system that relates the physical and operational characteristics of an aircraft to the design and safety separation distances of the airfield facility. The design aircraft is the most demanding aircraft operating or forecast to operate at the airport on a regular basis, which is typically considered 500 annual takeoff and landing operations. The design aircraft may be a single aircraft, or a grouping of aircraft.

The first consideration should be the safe operation of aircraft that regularly use the airport. According to FAA AC 150/5300-13A, any operation of an aircraft that exceeds design criteria of the airport may result in either an unsafe operation or a lesser safety margin unless air traffic control (ATC) Standard Operating Procedures (SOPs) are in place for those operations. However, the AC also states that it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently, and it is appropriate and necessary to develop ATC SOPs to accommodate faster and/or larger aircraft that use the airport occasionally.¹

The FAA typically only provides funding for design standards required by the existing and approved forecasted critical aircraft that are expected to exceed 500 annual operations.

Airport & Runway Classifications

The FAA has established aircraft classification systems that group aircraft types based on their performance and geometric characteristics. These classification systems (see **Figure B-1**) are used to determine the

¹ FAA Advisory Circular 150/5300-13A, *Airport Design*

appropriate airport design standards for specific runway, taxiway, apron, or other facilities, as described in FAA AC 150/5300-13A.

- **Aircraft Approach Category (AAC):** a grouping of aircraft based on approach reference speed, typically 1.3 times the stall speed. Approach speed affects the dimensions and size of runway safety and object free areas.
- **Airplane Design Group (ADG):** a classification of aircraft based on wingspan and tail height. When the aircraft wingspan and tail height fall in different groups, the higher group is used. Wingspan affects the dimensions of taxiway and apron object free areas, as well as apron and parking configurations.
- **Approach Visibility Minimums:** relates to the visibility minimums expressed by Runway Visual Range (RVR) values in feet. This is the minimum distance pilots must be able to see the runway to execute an approach to land. Visibility categories include visual (V), non-precision (NPA), approach procedure with vertical guidance (APV) and precision (PA). Lower visibility minimums require more complex airfield infrastructure and enhanced protection areas.
- **Taxiway Design Group (TDG):** a classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. TDG affects taxiway/taxilane pavement width and fillet design at intersections. See **Figure B-2** for the TDG chart.

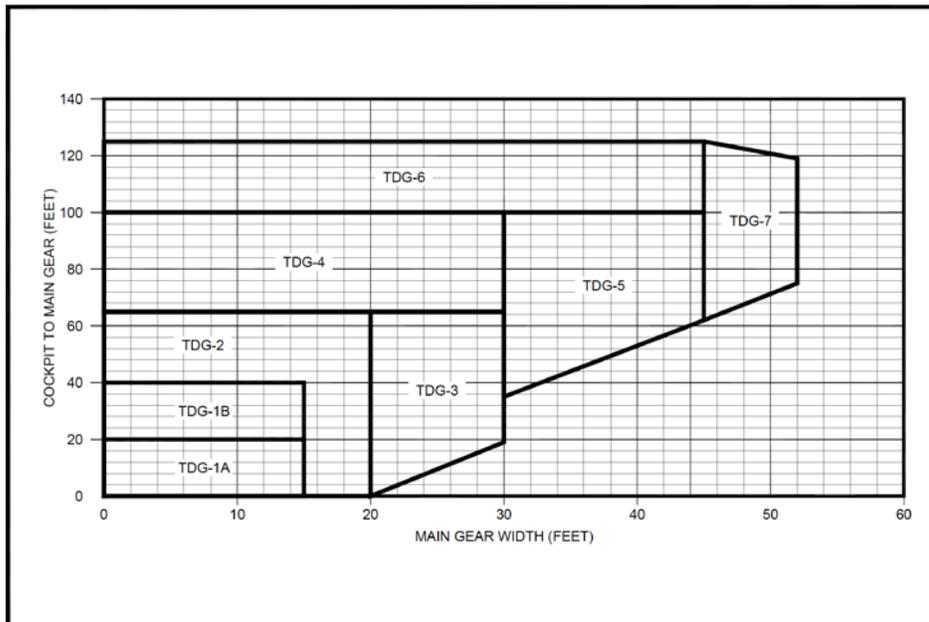
Figure B-1 – Airfield Classification Systems

Aircraft Approach Category (AAC)		
AAC	Approach Speed	
A	Approach speed less than 91 knots	
B	Approach speed 91 knots or more but less than 121 knots	
C	Approach speed 121 knots or more but less than 141 knots	
D	Approach speed 141 knots or more but less than 166 knots	
E	Approach speed 166 knots or more	
Airplane Design Group (ADG)		
ADG	Tail Height (ft.)	Wingspan (ft.)
I	< 20'	< 49'
II	20' - < 30'	49' - < 79'
III	30' - < 45'	79' - < 118'
IV	45' - < 60'	118' - < 171'
V	60' - < 66'	171' - < 214'
IV	66' - < 80'	214' - < 262'
Approach Visibility Minimums		
RVR (ft.)*	Instrument Flight Visibility Category (statue mile)	
N/A (VIS)	Visual (V)	
5000	Not lower than 1 mile (NPA)	
4000	Lower than 1 mile but not lower than ¾ mile (APV)	
2400	Lower than ¾ mile but not lower than ½ mile (CAT-I PA)	
1600	Lower than ½ mile but not lower than ¼ mile (CAT-II PA)	
1200	Lower than ¼ mile (CAT-III PA)	

Source: FAA AC 150/5300-13A – Change 1, Airport Design; *Runway Visibility Range (RVR) values are not exact equivalents
 APV = Approach with Vertical Guidance, PA = Precision Approach

Figure B-2 – Taxiway Design Group

Source: FAA AC 150/5300-13A – Change 1, Airport Design



Airport Design Principles

Other airport design principles are important to consider for a safe and efficient airport design:

- **Runway/Taxiway Configuration:** The configuration of runways and taxiways affects the airport's capacity/delay, risk of incursions with other aircraft on the runway and overall operational safety. Location of and type of taxiways connecting with runways correlates to runway occupancy time. The design of taxiway infrastructure should promote safety by minimizing confusing or complex geometry to reduce risk of an aircraft inadvertently entering the runway environment.
- **Approach and Departure Airspace & Land Use:** Runways each have imaginary surfaces that extend upward and outward from the runway end to protect normal flight operations. Runways also have land use standards beyond the runway end to protect the flying public as well as persons and property on the ground from potential operational hazards. Runways must meet grading and clearance standards considering natural and man-made obstacles that may obstruct these airspace surfaces. Surrounding land use should be compatible with airport operations. Airports should develop comprehensive land use controls to prevent new hazards outside the airport property line. Obstructions can limit the utility of a runway.
- **Meteorological Conditions:** An airport's runways should be designed so that aircraft land and takeoff into the prevailing wind. As wind conditions change, the addition of an additional runway may be needed to mitigate the effects of significant crosswind conditions that occur more than five percent of the year. Airports that experience lower cloud ceiling and/or visibility should also consider implementing an instrument procedures and related navigational aids to runways to maximize airport utility.
- **Controller Line of Sight:** The local Airport Traffic Control Tower (ATCT) relies on a clear line of sight from the controller cab to the airport's movement areas which includes the runways, taxiways, aprons, and arrival/departure corridors. Structures on an airport need to consider this design standard, and in some

cases, require the completion of a shadow study to demonstrate no adverse impact. This standard only applies to airports with a local ATCT.

- **Navigation Aids & Critical Areas:** Visual navigational aids (NAVAIDs) to a runway or the airfield require necessary clear areas for these NAVAIDs to be effective for pilots. Instrument NAVAIDs on an airport require sufficient clear areas for the NAVAID to properly function without interference to provide guidance to pilots. These NAVAID protection areas restrict development.
- **Airfield Line of Sight:** Runways need to meet grading standards so that objects and aircraft can be seen along the entire runway. A clear line of sight is also required for intersecting runways within the Runway Visibility Zone to allow pilots to maintain visual contact with other objects and/or aircraft that may pose a hazard.
- **Interface with Landside:** The airfield configuration should be designed to provide for the safe and efficient operation of aircraft as they transition from the airfield to landside facilities such as hangars and terminals.
- **Environmental Factors:** Airport development must consider potential impacts in and around the airport environs through the National Environmental Policy Act (NEPA). Additionally, development should also reduce the risk of potential wildlife hazards such as deer and birds that may cause hazards to flight operations.

Design Codes

Runway designs are based on specific FAA runway design standards. These standards, found in FAA AC 150/5300-13A, provide basic guidelines for a safe and efficient airport system, and are based on the most demanding or “design” aircraft expected to use the runway. Runway lengths are related to the design aircraft but are determined in accordance with procedures detailed in the current version of FAA AC 150/5325-4, *Runway Length Requirements for Airport Design*. All other critical dimensions related to the design aircraft are found in FAA AC 150/5300-13A, including dimensions for runway widths, safety areas and separations from other infrastructure.

There are several ways in which the codes from **Figure B-1** are used. These include codes that recognize existing conditions, codes that identify planned capabilities, codes that are for specific runways and codes for the airport. These codes are as follows.

Airport Reference Code (ARC)

The Airport Reference Code (ARC) is an airport designation that represents the AAC and ADG of the aircraft that the entire airfield is intended to accommodate on a regular basis. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely on the airport.

Runway Design Code (RDC)

RDC is a code signifying the design standards to which the overall runway is to be planned and built, typically based on the AAC, ADG and approach visibility minimums for a runway. RDC provides the information needed to determine the design standards that apply.

Approach Reference Code (APRC)

The APRC is composed of the AAC, the ADG, and the visibility minimums. See **Figure B-3**. APRC signifies the current operational capabilities of a runway and associated parallel taxiway for landing operations. The visibility minimums are linked to critical standards that determine which aircraft can operate on taxiways adjacent to a runway under meteorological conditions with no special operational procedures necessary.

Figure B-3 – Approach Reference Code

Visibility Minimums	Runway to Taxiway Separation (ft)									
	≥150	≥200	≥225	≥240	≥250	≥300	≥350	≥400	≥500	≥550
Visual	B/I(S)/VIS	B/I(S)/VIS	B/I/VIS	B/II/VIS	B/II/VIS	B/III/VIS D/II/VIS	B/III/VIS	D/IV/VIS D/V/VIS	D/VI/VIS	D/VI/VIS
Not lower than 1 mile	B/I(S)/5000	B/I(S)/5000	B/I/5000	B/II/5000	B/II/5000	B/III/5000 D/II/5000	B/III/5000	D/IV/5000 D/V/5000	D/VI/5000	D/VI/5000
Not lower than 3/4 mile	B/I(S)/4000	B/I(S)/4000	B/I/4000	B/II/4000	B/II/4000	B/III/4000 D/II/4000	B/III/4000	D/IV/4000 D/V/4000	D/VI/4000	D/VI/4000
Lower than 3/4 mile but not lower than 1/2 mile		B/I(S)/2400	B/I/4000 B/I(S)/2400	B/II/4000	B/I/2400	B/III/4000 ¹ D/II/4000 B/II/2400	B/III/2400	D/IV/2400 D/V/2400	D/VI/2400	D/VI/2400
Lower than 1/2 mile								D/V/2400 D/IV/1600	D/VI/2400 D/V/1600	D/VI/1600

Notes: (S) denotes small aircraft

Entries for Approach Category D also apply to Approach Category E. However, there are no Approach Category E aircraft currently in the civil fleet.

Source: FAA AC 150/5300-13A, Airport Design

Departure Reference Code (DPRC)

DPRC signifies the runway’s operational capabilities for takeoff operations. See **Figure B-4**. The DPRC code is the like the APRC code, but is comprised of two components, AAC and ADG. It represents those aircraft that can takeoff from a runway while any aircraft are present on adjacent taxiways, under meteorological condition with no special procedures necessary.

Figure B-4 – Departure Reference Code

Runway to Taxiway Separation (ft)					
≥ 150	≥ 225	≥ 240	≥ 300	≥ 400	≥ 500
B/I(S)	B/I	B/II	B/III D/II	D/IV D/V ¹	D/VI ²

Notes: (S) denotes small aircraft

Entries for Approach Category D also apply to Approach Category E. However, there are no Approach Category E aircraft currently in the civil fleet.

Source: FAA AC 150/5300-13A, Airport Design

Small Category

One additional unique coding is the use of the term ‘small’. Small aircraft are those that have a maximum certificated takeoff weight of 12,500 pounds or less. Aircraft in categories A and B may be further designated as ‘small’ which has different standards than larger aircraft. The ‘small’ term is used with the ARC or RDC but not with APRC or DPRC. The term small is not used for C, D, or E aircraft. As an example, the term will be used as ‘B-II (Small)’ with a small aircraft as compared to ‘B-II’ only when referring to larger aircraft.

Code Context

It is critical to understand the context in which the specific code is being used. For example, depending where the code is being used, a C-II-2400 code would have the following meanings:

- **Critical Design Aircraft:** A C-II aircraft is what the runway was either built for what the runway is being designed for. Referencing **Figure B-1**, a C-II aircraft is an aircraft with an approach speed between 121 and 140 knots, and a wingspan between 49 and 78 feet or a tail height between 20 and 29 feet.
- **Runway Design Code (RDC):** The planned runway will be designed to meet the FAA runway design standards for a C-II aircraft with a visibility minimum as low as ½ mile.
- **Approach Reference Code (APRC):** The runway currently meets the FAA runway design standards for a C-II aircraft with a visibility minimum as low as ½ mile and with a C-II aircraft on the adjacent parallel taxiway.
- **Departure Reference Code (DPRC):** The runway currently meets the FAA runway design standards for a C-II aircraft departing the runway with a C-II aircraft on the adjacent parallel taxiway.
- **Airport Reference Code (ARC):** The ARC can be used to discuss the operational capability of an existing airport, i.e., if the highest RDC of existing runways at an airport is C-II, the airport would have an ARC of C-II. The ARC can also be used to discuss the planned capability of an airport, i.e., an airport will be designated as an ARC C-II airport when the highest RDC of the planned runways is C-II.

Runway Design Standards

Basic runway design standards vary based on the RDC and RRC as established by the design aircraft. Some of the safety standards include:

- **Runway Width:** The physical width of the runway pavement.
- **Runway Safety Area (RSA):** A defined graded surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot or excursion from the runway. The RSA must be free of objects, except those required to be in the RSA to serve their function. The RSA should also be capable to supporting airport equipment and the occasional passage of aircraft.
- **Runway Object Free Area (ROFA):** An area centered on the ground on a runway provided to enhance the safety of aircraft operations by remaining clear of objects, except for objects that need to be in the OFA for air navigation or aircraft ground maneuvering purposes.
- **Runway Obstacle Free Zone (ROFZ):** The OFZ is the three-dimensional volume of airspace along the runway and extended runway centerline that is required to be clear of taxiing or parked aircraft as well as other obstacles that do not need to be within the OFZ to function. The purpose of the OFZ is for protection of aircraft landing or taking off from the runway and for missed approaches.
- **Runway Protection Zone (RPZ):** The RPZ is a trapezoidal area located 200 feet beyond the runway end and centered on the extended runway centerline. The RPZ is primarily a land use control that is meant to enhance the protection of people and property near the airport through airport control. Such control includes clearing of RPZ areas of incompatible objects and activities. If a special application of declared distances is used, separate approach and departure RPZs are required.

-
- **Runway Line of Sight:** Along individual runways, a point 5 feet above the runway must be mutually visible with any other point 5 feet above the runway centerline. For intersecting runways, Runway Visibility Zone (RVZ) standards require a clear visible 5-foot high line-of-sight to enhance safety amongst airport users when runways intersect.

Other basic runway design standards include:

- Runway surface gradient
- Runway shoulder width to prevent soil erosion or debris ingestion for jet engines,
- Blast pad to prevent soil erosion from jet blast
- Required separation distances to markings, objects, and other infrastructure for safety
- Parallel runway separation distances

There are also critical areas associated with navigational aids as well as airspace clearance requirements for runways.

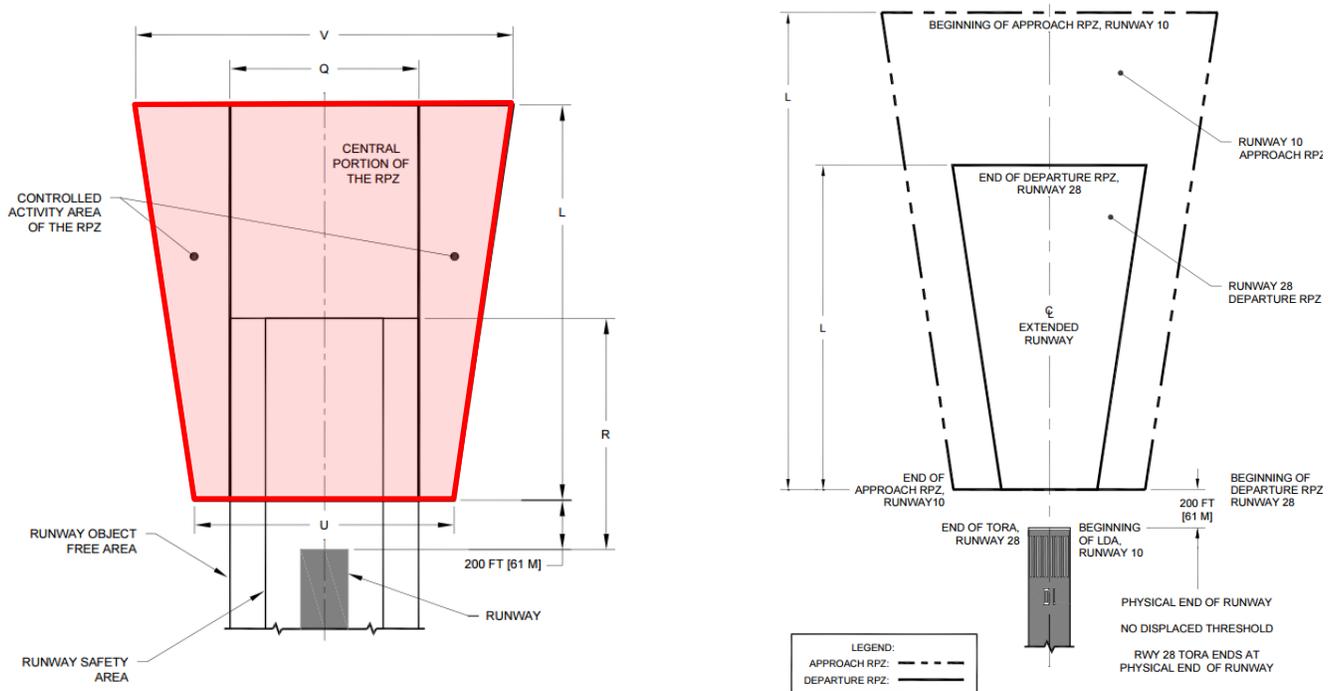
Runway Protection Zones

The Runway Protection Zone (RPZ) is a trapezoidal land use area at ground level prior to the landing threshold or beyond the departure runway end. The RPZ's function is to enhance the protection of people and property on the ground. The RPZ size varies based on the runway's RDC. The RPZ is further broken down into two types and two areas:

- **Approach RPZ:** Approach RPZ starts 200 feet from the runway threshold.
- **Departure RPZ:** Departure RPZ extends 200 feet from the runway end or claimed Takeoff Runway Available (TORA).
- **Central Portion:** Land within the RPZ centered on runway centerline with a width matching the width of the ROFA.
- **Controlled Activity Area:** Land with the RPZ on the sides of the central portion.

FAA permissible land uses without further evaluation include farming that meets airport design standards, irrigation channels that do not attract wildlife, controlled airport service roads, underground facilities and unstaffed NAVAIDs that are required to be within the RPZ. Airport owners should, at a minimum, maintain the RPZ clear of all facilities supporting incompatible activities. It is desirable to clear all above-ground objects from the RPZ. **Figure B-5** graphically depicts the characteristics of an RPZ.

Figure B-5 – FAA Runway Protection Zone



Source: FAA AC 150/5300-13A, Change 1 (Airport Design)

Protection of the RPZ is achieved through airport control over RPZs including fee title ownership or clear zone easement. The increased emphasis has resulted in additional requirements to monitor and analyze RPZs for conformance to established policies and standards.

In September 2012, FAA issued an interim policy on activities within an RPZ providing airports with guidance on land use compatibility standards. The standards from the interim guidance are summarized below:

- **New or Modified Land Uses:** FAA coordination is required for new or modified land uses within the RPZ because of an airfield project, change in RPZ dimensions or local development proposal.
- **Land Uses Requiring FAA Coordination:** Building and structures, recreational land uses, transportation facilities (i.e. roads, parking, rail), fuel storage, hazardous material storage, wastewater treatment, above-ground utility infrastructure
- **Alternatives Analysis:** A full range of alternatives must be evaluated prior to FAA coordination that avoid introducing the land use into the RPZ, minimize the impact of the land use in the RPZ and mitigate risk to people and property on the ground.
- **Existing Land Uses in the RPZ:** No change in policy, airports should work with FAA to remove or mitigate the risk of any existing incompatible land uses in the RPZ. Incompatible land uses in the RPZ from previous FAA guidance include but are not limited to residences, places of public assembly (i.e. uses with high concentration of persons), fuel storage facilities and wildlife attractants.

FAA has acknowledged the ongoing update to the land use compatibility advisory circular where an RPZ land use consideration section will be added.

FAA Runway Approach/Departure Surfaces

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for safety for landing and departing aircraft. These surfaces are identified in Table 3-2 of FAA AC 150/5300-13A. FAA Engineering Brief 99A modified this table which is shown in **Figure B-6** and is currently the governing standard. All objects must clear the surface for the applicable runway operational design standard to meet minimum aviation safety standards for a given runway landing threshold location. Approach airspace penetrations typically require the removal of the object, operational restrictions, or the runway landing threshold to be shifted or displaced down the runway.

The departure surface applies to runways where instrument departures are allowable. It begins at the end of the takeoff distance available and extends upward and outward at a 40:1 slope. No new penetrations are allowed unless an FAA study has been completed and a determination of no hazard has been issued. Penetrations to the departure surface may require the obstacle to be published, or require mitigation including increasing the minimum aircraft climb rate or runway length operational restrictions.

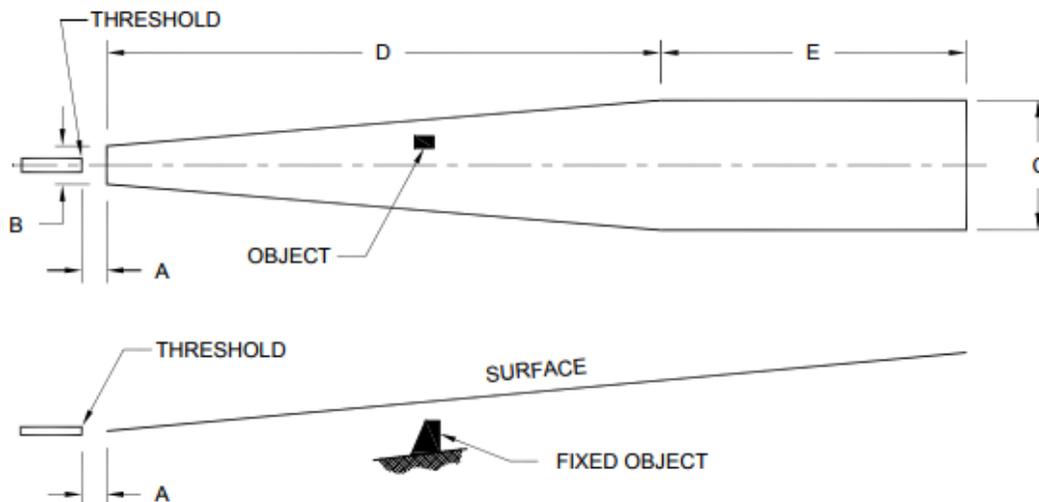
Mitigation options generally include obstruction removal, lighting/markings, declared distances and/or adjustment of the visual guidance slope indicator angle. Other long-term options include reconfiguring the runway or modifying design standards. New development should be clear of airspace surfaces.

Figure B-6 – FAA Approach/Departure Standards Table

Table 3-2. Approach and Departure Standards Table ^{1,2}

Runway Type	DIMENSIONAL STANDARDS*					Slope
	Feet (Meters)					
	A	B	C	D	E	
1 Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night).	0 (0)	120 (37)	300 (91)	500 (152)	2,500 (762)	15:1
2 Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night).	0 (0)	250 (76)	700 (213)	2,250 (686)	2,750 (838)	20:1
3 Approach end of runway expected to serve large airplanes. (Visual runways only, day/night).	0 (0)	400 (122)	1,000 (305)	1,500 (457)	8,500 (2591)	20:1
4 Approach end of runways expected to accommodate instrument approaches having visibility greater than or equal to 3/4 statute mile. ³	200 (61)	400 (122)	3,400 (1036)	10,000 ⁴ (3048)	0 (0)	20:1
5 Approach end of runways expected to accommodate instrument approaches having visibility minimums less than 3/4 statute mile.	200 (61)	800 (244)	3,400 (1036)	10,000 ⁴ (3048)	0	34:1
6 ⁵ Approach end of runways expected to accommodate instrument approaches with vertical guidance.	0 (0)	Runway Width + 200 (61)	1520 (463)	10,000 ⁴ (3048)	0 (0)	30:1
7 Departure runway ends used for any instrument operations.	Runway Width (RW)	500 (152) – ½ RW	7,512 (2290)	12,152 (3704)	6,160 (1878)	40:1

* The letters are keyed to those shown in Figure 3-2 of AC 150/5300-13A. For Row 7, refer to Figure 1 of this Engineering Brief



Source: FAA AC 150/5300-13A, Change 1 (Airport Design), FAA Engineering Brief 99A

Taxiway Design Standards

Taxiways provide for the safe and efficient movement of aircraft between the runway and other operational areas of the airport. The taxiway system should provide critical links to airside infrastructure, increase capacity and reduce the risk of an incursion with traffic on the runway.

System Design

FAA has placed a renewed emphasis on taxiway design in their updated airport design standards. Fundamental elements help develop an efficient system to meet demands, reduce pilot confusion and enhance safety.

Considerations include:

- Design taxiways to meet FAA design standards for existing and future users considering expandability of airport facilities.
- Design taxiway intersections so the cockpit is over the centerline with a sufficient taxiway edge safety margin.
- Simplify taxiway intersections to reduce pilot confusion using the three-node concept, where a pilot has no more than three choices at an intersection.
- Eliminate “hot spots” identified by the FAA Runway Safety Action Team where enhanced pilot awareness is encouraged.
- Minimize the number of runway crossings and avoid direct access from the apron to the runway.
- Eliminate aligned taxiways whose centerline coincides with a runway centerline.
- Other considerations include avoiding wide expanses of pavement and avoiding “high energy intersections” near the middle third of a runway.

Design Standards

Taxiways are subject to FAA design requirements such as pavement width, edge safety margins, shoulder width, and safety and object free area dimensions. The design standards vary based on individual aircraft geometric and landing gear characteristics. The Taxiway Design Group (TDG) and Airplane Design Group (ADG) identified for the design aircraft using a taxiway. The FAA standards in relation to taxiways (as defined in FAA AC 150/5300-13A) are described below. See **Figure B-7** for Taxiway Design Standards.

- **Taxiway Width:** The physical width of the taxiway pavement.
- **Taxiway Edge Safety Margin:** The minimum acceptable distance between the outside of the airplane wheels and the pavement edge.
- **Taxiway Shoulder Width:** Taxiway shoulders provide stabilized or paved surfaces to reduce the possibility of blast erosion and engine ingestion problems associated with jet engines which overhang the edge of the taxiway pavement.
- **Taxiway/Taxilane Safety Area (TSA):** The TSA is located on the taxiway centerline and shall be cleared and graded, properly drained, and capable, under dry conditions, of supporting snow removal equipment, ARFF equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.
- **Taxiway Edge Safety Margin (TESM):** The minimum acceptable distance between the outside of the airplane wheels and the pavement edge.

- **Taxiway/Taxilane Object Free Area (TOFA):** The TOFA is centered on the taxiway centerline and prohibits service vehicle roads, parked airplanes, and above ground objects, except for objects that need to be in the TOFA for air navigation or aircraft ground maneuvering purposes.
- **Taxiway Separation Standards:** Separation standards between the taxiways and other airport facilities are established to ensure operational safety of the airport and are as follows:
 - Taxiway centerline to parallel taxiway/taxilane centerline
 - Taxiway centerline to fixed or moveable object

Other design standards include taxiway shoulder width to prevent jet blast soil erosion or debris ingestion for jet engines and required separation distances to other taxiways/taxilanes.

Figure B-7 – Taxiway Design Standards Table 4-1 and 4-2

Table 4-1. Design standards based on Airplane Design Group (ADG)

ITEM	DIM (See Figure 3-26)	ADG					
		I	II	III	IV	V	VI
TAXIWAY PROTECTION							
TSA	E	49 ft (15 m)	79 ft (24 m)	118 ft (36 m)	171 ft (52 m)	214 ft (65 m)	262 ft (80 m)
Taxiway OFA		89 ft (27 m)	131 ft (40 m)	186 ft (57 m)	259 ft (79 m)	320 ft (98 m)	386 ft (118 m)
Taxilane OFA		79 ft (24 m)	115 ft (35 m)	162 ft (49 m)	225 ft (69 m)	276 ft (84 m)	334 ft (102 m)
TAXIWAY SEPARATION							
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline ¹	J	70 ft (21 m)	105 ft (32 m)	152 ft (46.5 m)	215 ft (65.5 m)	267 ft (81 m)	324 ft (99 m)
Taxiway Centerline to Fixed or Movable Object	K	44.5 ft (13.5 m)	65.5 ft (20 m)	93 ft (28.5 m)	129.5 ft (39.5 m)	160 ft (48.5 m)	193 ft (59 m)
Taxilane Centerline to Parallel Taxiway/Taxilane Centerline ¹		64 ft (19.5 m)	97 ft (29.5 m)	140 ft (42.5 m)	198 ft (60 m)	245 ft (74.5 m)	298 ft (91 m)
Taxilane Centerline to Fixed or Movable Object		39.5 ft (12 m)	57.5 ft (17.5 m)	81 ft (24.5 m)	112.5 ft (34 m)	138 ft (42 m)	167 ft (51 m)
WINGTIP CLEARANCE							
Taxiway Wingtip Clearance		20 ft (6 m)	26 ft (8 m)	34 ft (10.5 m)	44 ft (13.5 m)	53 ft (16 m)	62 ft (19 m)
Taxilane Wingtip Clearance		15 ft (4.5 m)	18 ft (5.5 m)	27 ft (8.5 m)	27 ft (8 m)	31 ft (9.5 m)	36 ft (11 m)

Note: 1. These values are based on wingtip clearances. If direction reversal between parallel taxiways is needed, use this dimension or the dimension specified in Table 4-14 or Table 4-15, whichever is largest.

Table 4-2. Design standards based on Taxiway Design Group (TDG)

ITEM	DIM (See Figure 4-6)	TDG							
		1A	1B	2	3	4	5	6	7
Taxiway Width	W	25 ft (7.5 m)	25 ft (7.5 m)	35 ft (10.5 m)	50 ft (15 m)	50 ft (15 m)	75 ft (23 m)	75 ft (23 m)	82 ft (25 m)
Taxiway Edge Safety Margin	TESM	5 ft (1.5 m)	5 ft (1.5 m)	7.5 ft (2 m)	10 ft (3 m)	10 ft (3 m)	15 ft (4.6m)	15 ft (4.6m)	15 ft (4.6m)
Taxiway Shoulder Width		10 ft (3 m)	10 ft (3 m)	15 ft (3 m)	20 ft (6 m)	20 ft (6 m)	30 ft (9 m)	30 ft (9 m)	40 ft (12 m)
Taxiway/Taxilane Centerline to Parallel Taxiway/Taxilane Centerline w/ 180 Degree Turn	J	See Table 4-14							
TAXIWAY FILLET DIMENSIONS		Table 4-3	Table 4-4	Table 4-5	Table 4-6	Table 4-7	Table 4-8	Table 4-9	Table 4-10

Source: FAA AC 150/5300-13A, Change 1 (Airport Design)

Airspace Protection

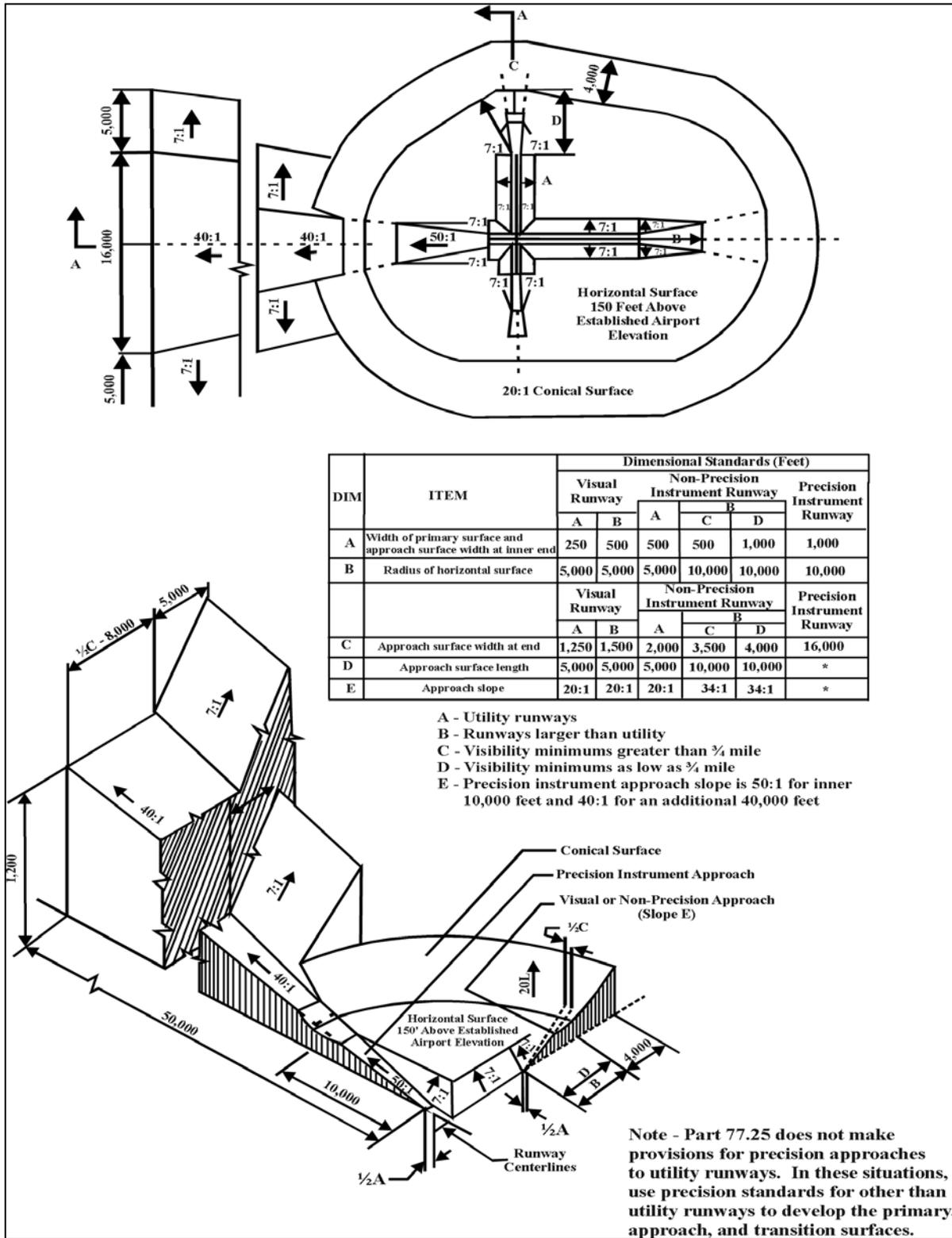
Airspace is an important resource around airports that is essential for safe flight operations. There are established standards to identify airspace obstructions around airports. FAA grant assurances (obligations) require the airport sponsor to take appropriate action to assure that airspace is adequately cleared to protect instrument and visual flight operations by removing, lowering, relocating, marking or lighting, or otherwise mitigating existing airport hazards and preventing the establishment or creating of future airport hazards. Examples of obstructions include trees, buildings, poles, towers, terrain, mobile objects, and aircraft tails. Sufficiently clear airspace near the approach and departure runway ends are vitally important for safe airport operations. An FAA aeronautical study should be completed to determine the operational impacts and necessary mitigation of obstructions (i.e. lowering, lighting, marking, publish operational restrictions).

Part 77 Civil Airport Imaginary Surfaces

Title 14 CFR (Code of Federal Regulations) Part 77 *Safe, Efficient Use, and Preservation of the Navigable Airspace* is used to determine whether man-made or natural objects penetrate these “imaginary” three-dimensional airspace surfaces and become obstructions. Federal Aviation Regulation (FAR) Part 77 surfaces are the protective surfaces most often used to provide height restriction zoning protection around an airport. Sufficiently clear airspace is necessary for the safe and efficient use of aircraft arriving and departing an airport. The most demanding approach to a runway defines the Part 77 airspace standards for that runway. These airspace surfaces include the primary, approach, transitional, horizontal, and conical surfaces each with different standards. The slope of an airspace surface is defined as the horizontal distance traveled for each one vertical foot (i.e. 50:1). Part 77 standards are shown in **Figure B-8**.

Of note are the primary surfaces which should be kept clear of non-essential objects above the runway centerline elevation. The approach surface extends upward and outward from the runway. A slope is defined as the horizontal distance traveled for each one vertical foot.

Figure B-8 – FAR Part 77



Source: FAA