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 (airport name), 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 county, city or town acting individually or jointly 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 municipality while final responsibility for the airport still rests with the municipality which owns the airport. The municipality 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 statues that allow for the creation of an independent municipal or regional 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

Transition to Unleaded Aviation Gasoline

In October 2023, the Environmental Protection Agency (EPA) released a final endangerment finding regarding the lead emissions produced from piston engine aircraft. This finding created obligations for both the EPA and the Federal Aviation Administration (FAA).

Over the next 3-4 years, the EPA and FAA must create three separate rulemakings that will have an impact on airports in the NPIAS.

1. The EPA must develop lead emissions standards for aircraft engines
2. FAA must incorporate emissions standards into the engine certification process
3. FAA must regulate lead as a fuel component or additive to control or eliminate lead emissions

The FAA and others in the industry created the Eliminate Aviation Gasoline Lead Emissions (EAGLE) Initiative in March 2022 to work towards transitioning to lead free fuels for piston aircraft by the end of 2030. This initiative involves ensuring that supply chain and infrastructure is in place during the transition as well as creation of standards to authorize aircraft to begin using the newly developed fuel. This is imperative given that there are over 220,000 piston aircraft in the United States.

The EPA endangerment finding does not require airports to ban or restrict the use of 100LL. Therefore, airports will need to consider the space required to accommodate storage and dispensing of multiple types of fuel. Airports will also be responsible for choosing a supplier that can economically and reliably provide the fuel needed. Additionally, adequate training will need to be provided for airport users to ensure misfuelling does not occur.

There are currently four unleaded fuel alternatives available today: Autogas, UL91, Swift Fuels UL94, and GAMI G100UL. Aircraft owners can purchase Supplemental Type Certificates (STCs) in order to allow their aircraft to operate using the fuel alternatives. The two most common in the US right now include Autogas (for lower compression aircraft) and Swift Fuels UL94 (STC Approved Model List currently covers about 68% of certified aircraft). At this time, Swift Fuels UL94 is able to be intermixed with 100LL at any ratio, however the fuels cannot be stored together.

Airports should consider how they will begin to transition their fueling infrastructure to provide 100LL and an unleaded alternative until all certified aircraft can utilize the alternative. Part of this will involve conversations with based aircraft owners as well as transient users. For airports with multiple fuel storage tanks, this could involve utilizing one for the unleaded alternative.

Part of the EAGLE initiative involves advocating for policies that provide airports with funding to transition their fueling infrastructure to unleaded avgas. Currently there are several potential funding options to assist with the transition.

1. Airport Infrastructure Grant Program
2. Airport Improvement Program

See flyeagle.org for more information.

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.

Laurel Municipal Airport

The **Laurel Airport Authority 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 is managed by authority board members. **Laurel 406 Aero provides FBO services** at the airport.

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 49 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.

Nonhub: 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 **Nonhub 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.

Laurel Municipal Airport Classification

The Laurel Municipal Airport is classified as a **non-primary 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.

Laurel Municipal Airport is classified as a **Level 1 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
- 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.

Laurel Municipal Airport ASSET Classification

Laurel Municipal Airport is classified as a **Local 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 Laurel Municipal Airport (6S8).

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. The AIP is currently operating under an extension (H.R. 636) of the FAA Modernization and Reform Act of 2012 (Public Law 112-95). The Act extends the agency's authority and provides funding at current levels through September 2017.

- **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.

Supplemental Funding

Beginning in 2018, the Airport Improvement Program included an additional allocation of funds identified as Supplemental Appropriation. The money comes from the General Fund rather than the Airport and Airway Trust fund and the appropriation varies in size but is distributed similar to discretionary funds.

Bipartisan Infrastructure Law

On November 6, 2021, the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act) was passed. This included $ 1 trillion for improvements to highways, bridges, roads, passenger and freight rail, airports, water and wastewater treatment, internet access and modernizing the electric grid. The FAA awarded the $25 billion received from the law to 3,075 airports and divided it into three grant groups:

1. $5 billion for airport terminals to replace aging terminals, increase energy efficiency and accessibility.
2. $5 billion for air traffic facilities to update and upgrade equipment to improve safety, security and environmental standards and replace necessary facilities.
3. $15 billion for airport infrastructure for projects as defined under the existing Airport Improvement Grant and Passenger Facility Charge criteria including runways, taxiways, safety and sustainability projects, terminal, airport-transit, and roadway.

$145,000 was allocated from the Bipartisan Infrastructure Law to Laurel for 2023 for improvements.

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 Laurel

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. Laurel Municipal Airport **meets the definition for non-primary airport and receives non-primary entitlement funding** for eligible projects.

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. For this reason, the FAA has included in Grant Assurance Number 24 which states:

> "It [the airport sponsor] will maintain a fee and rental structure for the facilities and services at the airport which will make the airport as self-sustaining as possible under the circumstances existing at the particular airport, taking into account such factors as the volume of traffic and economy of collection."

For most small 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. For comparison, Montana DOT Aeronautics Division annually conducts a survey of rates and charges and posts those results on their website.

Rates and Charges Revenue

The primary category of income for airports comes from rates and charges that are established by the airport sponsor for the use of the airport. These include fees for services as well as rental income from the use of airport property.

Fuel Flowage Fees – The airport sponsor can charge a fee per gallon for fuel pumped at the airport. This should be for all fuel pumped at the airport whether it is from an FBO or a private company/individual with their own tanks. The fuel flowage provides an easy to calculate and collect user fee based on the aircraft use of the airport. Larger aircraft use more fuel and pay more. Higher frequency activity uses more fuel and pays more. Each of these correspond with higher use of the airport's facilities. It is important to note that this fuel flowage fee is to cover some of the expenses of operating the airport. The airport sponsor may also be leasing the fuel facility to an FBO or trying to cover maintenance of the fuel facility. Charges for leasing the fuel facility may be based on fuel flowage but should be over and above the standard fuel flowage fee for using the airport.

Landing Fees – The airport sponsor can charge a landing fee for the use of the airport. This is charged at most large airports and is calculated based on maximum gross weight. For most general aviation airports, the landing fee is not used because of the challenges in collecting the fee. Some airports however may have a landing fee for aircraft over a certain weight such as above 12,500 pounds. The landing fee for larger aircraft then becomes a means to cover the cost to the airport from higher usage from these larger aircraft.

Leases for Aeronautical Uses -- The primary means that a general aviation airport has to produce income is through property leases. Two common options for aeronautical leases are land leases for private hangar development or airport funded hangars leased for aircraft storage.

Land Lease is a common method for allowing hangar construction. This is where a tenant will lease a tract of airport land that is connected to the airfield and public access. The tenant will construct a facility at their own expense and pay a land lease rate to the airport through a term of the lease sufficient for the tenant to amortize their investment. An important element to consider is reversion of the improved property to the airport following the initial 'amortization' term of the lease. The reason to consider reversion is addressed in more detail in this section and would be instituted equally for any person and varies only based on the level of investment made into the facility.

A guideline for setting the initial 'amortization' lease term with reversion is to expect a level of investment of a certain dollar amount per square foot for every 10-years of lease. The lower rates would be given to those who are providing services at the airport and higher rates to those just storing personal/company aircraft but not providing aviation services. An amortization schedule for a facility can also be used to determine the proper term. These are not absolute rules but are tools to use to determine the lease term. Here is an example of the calculation of lease term using $35 per square foot investment being worth a 10-year lease.

$$\frac{\$400{,}000\ investment}{5{,}000\ sf\ hangar} = \$80\ per\ SF \qquad \frac{\$80\ per\ SF}{\$35\ per\ 10\ Years} = 22\ years$$

What Is Reversion?

Reversion occurs after a private improvement has been constructed on public property and that improvement has been fully amortized. Any improvement to real property becomes an integral part of the underlying land, and in this case, the improvement is to public property. The question is posed quite often about why reversion. Why should an airport expect a tenant to build a facility on the airport then revert ownership of that facility after the term of a lease expires? The underlying question is, **Does the airport owner have a compelling need to control the airport? .. Yes**

The primary issue that drives this discussion is that an airport and its associated facilities (runways, taxiways, aprons, etc.) are constructed on a finite piece of public property. With limited access and ability to expand, **Is it in the public's interest to allow tenants to control the use of that finite property into perpetuity? .. No**

Reversion solves this potential issue and maintains the public's ability to control the airport by allowing the airport to redevelop portions of the airport after a notable period of time (usually 20 – 40 years). An airport may choose to redevelop for a variety of reasons, including conformity with current design standards, repurposing areas for changing demands, or renovation or upgrading existing structures. Airports are quite unique in that even though there are large amounts of acreage for an airport, there are only certain areas that have the proper access to both the airside and landside to make a facility functional. Airports generally have broad impacts on communities including improved medical services and stimulation of economic development, and as a result millions of public dollars are invested to make these hangar areas as functional as possible for all airport users.

The general argument against reversion is that it stifles tenant's ability to maximize the value of their investment, and as such, may prevent the airport from getting development that will allow it to be as self-sustaining as possible. With a reasonable amortization time period and a fair ability to negotiate an improved property lease, these concerns are addressed.

These arguments have been greatly simplified for this discussion, but this decision is one that each airport sponsor should consider carefully to determine what is best for them to meet demand and comply with grant conditions and local, state, and federal laws.

Please note that a person constructing a facility will often be interested in leasing the improved property after the original lease term expires. This is done by negotiating a new rental rate commensurate with the improved value of the property. Assuring that individuals are paying the improved value of the property, puts the proper economic incentive in place so the airports finite property is used to the best of its ability.

Airport Funded Hangars is the other option for the airport to maintain control and provide facilities for aircraft storage. Providing airport funding depends first on whether the airport has the funds to construct a hangar and second on the confidence the airport has in being able to lease the facility at a sufficient rental rate. The FAA allows airports to use non-primary entitlements for revenue producing facilities, such as hangars, but only if all other airport needs for federal funding have been met and no other projects are foreseen in the next three years.

Table B-1 – Hangar Funding Options

	Land Lease
Pros	Only private funds at risk, No public funds at risk
Cons	Individual hangars use more space than group hangars
Typical Uses	Individual Hangars, Specialized Facilities, Large Investments, Businesses
	Airport Funding
Pros	Can use Non-Primary Entitlement funds Airport maintains control immediately
Cons	Requires up front public funds Public money is at risk if there are no tenants
Typical Uses	Small Hangars, Group Hangars such as T-Hangars

Source: KLJ Analysis

Ownership of Hangars - Whether the city chooses Land Lease or Airport funding to construct hangars, the hangars will still at some point become property of the airport as a result of reversion. When the hangar is not owned by the airport, the hangar is subject to property taxes as an improvement to the property. Since airports are public entities, the property and improvements owned by airports are not subject to property taxes. An advantage to the tenant of reversion is not paying property taxes on the building. An option is to revert the property immediately after construction, but the tenant continues to pay the land lease rate through the initial term. The tenant would still be responsible for minor/major maintenance for the facility.

Leasing for Non-Aeronautical Uses – The only other significant asset that the airport has is land that can be used for agricultural purposes. The primary purpose of the land that the airport has is to provide sufficient safety surfaces for aircraft landing and taking off from 6S8. Secondarily to that is to recover a reasonable amount of income while maintaining safety standards. The land is suitable for hay production and airports have received income by leasing the property for hay. Some airports do an annual cash lease for the property but others have found that a multi-year agreement based on shares of the crop mitigates the risk of changing market conditions and allows the airport to earn income reasonable to the market conditions at the time of the cutting rather than be based on a speculative bid very early in the production season.

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.

Airport Design Guidelines

Guidance on minimum FAA airport design standards is found in FAA AC 150/5300-13B, *Airport Design*. 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 150/5300-13B, 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 appropriate airport design standards for specific runway, taxiway, apron, or other facilities, as described in FAA AC 150/5300-13B.

- **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.

[1] FAA Advisory Circular 150/5300-13B, *Airport Design*

- **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.

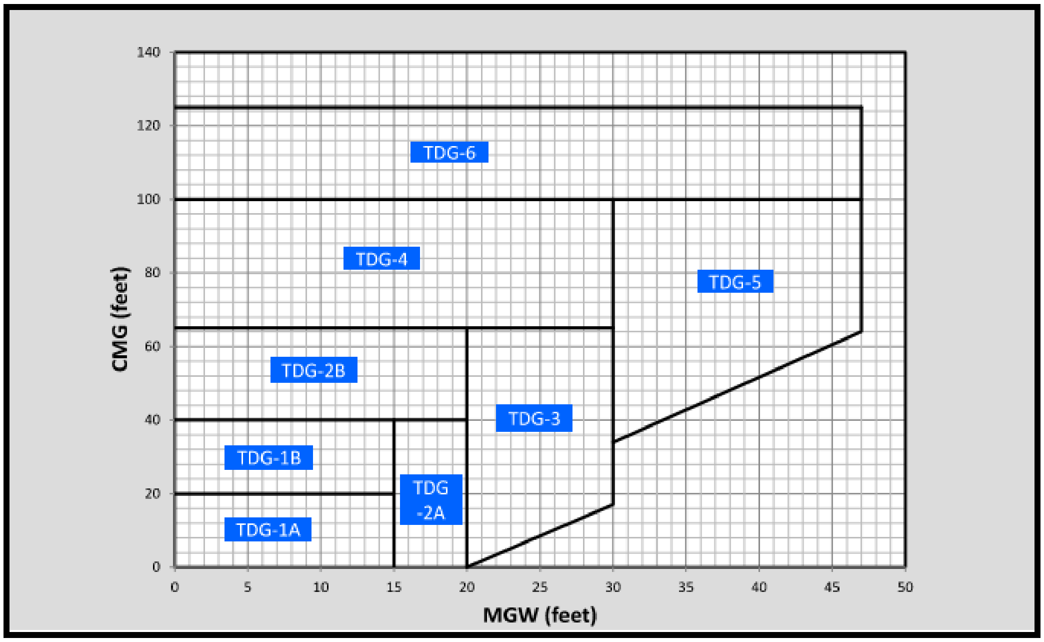
Figure B-1 – Airfield Classification Systems

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 150/5300-13B, 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 150/5300-13B, Airport Design



Note: Values in the graph are rounded to the nearest foot. 1 foot = 0.305 meters.

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 150/5300-13B, 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 150/5300-13B, 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

Table L-1. Approach Reference Code (APRC)

Visibility Minimums	Runway to Taxiway Separation (ft)										
	≥ 150	≥ 200	≥ 225	≥ 240	≥ 250	≥ 300	≥ 350	≥ 400	≥ 450	≥500	≥550
Not lower than 3/4 mile (1.2 km) [4000 RVR]	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/II/ 4000	D/IV/ 4000 D/V/ 4000 [1]	D/IV/ 4000 D/V/ 4000 [2]	D/V/ 4000 [3] D/VI/ 4000	D/IV/ 4000
Lower than 3/4 mile (1.2 km) but not lower than 1/2 mile (0.8 km) [2400 RVR]	N/A	B/I(S)/ 2400	B/I(S)/ 2400	B/I(S)/ 2400	B/I/ 2400	B/II/ 2400	B/III/ 2400	D/IV/ 2400 D/V/ 2400 [1]	D/IV/ 2400 D/V/ 2400 [2]	D/V/ 2400 [3] D/VI/ 2400	D/IV/ 2400
Lower than 1/2 mile (0.8 km) but not lower than 1/4 mile (0.4 km) [1600 RVR]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	D/IV/ 1600	D/IV/ 1600	D/V/ 1600	D/VI/ 1600
Lower than 1/4 mile (0.4 km) [1200 RVR]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	D/IV/ 1200	D/IV/ 1200	D/V/ 1200	D/VI/ 1200

Note 1: Airport elevation at or below 1,345 ft (410 m).
Note 2: Airport elevation between 1,345 ft (410 m) and 6,560 ft (2,000 m).
Note 3: Airport elevation above 6,560 ft (2,000 m).

General 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.
- For ADG-VI aircraft with tail heights of less than 66 feet (20.1 m), ADG-V separation standards apply.
- 1 ft = 0.305 m

Source: FAA AC 150/5300-13B, 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

Table L-2. Departure Reference Code (DPRC)

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	D/VI [1]

Note 1: Refer to Figure L-1. ADG-VI airplanes may depart with aircraft on the parallel taxiway where the runway to taxiway separation is as little as 400-feet (122 m) under these two scenarios:

a. No ADG-VI aircraft is occupying the parallel taxiway beyond 1,500 feet (457 m) of the point of the start of takeoff roll.

b. No aircraft, regardless of size, is occupying the parallel taxiway beyond 1,500 feet (457 m) of the point of the start of takeoff roll when there is snow, ice, or slush contamination on the runway.

General 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.
- 1 ft = 0.305 m

Source: FAA AC 150/5300-13B, 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

Figure 3-26. Runway Protection Zone (RPZ), Runway Object Free Area (ROFA), and Runway Safety Area (RSA)

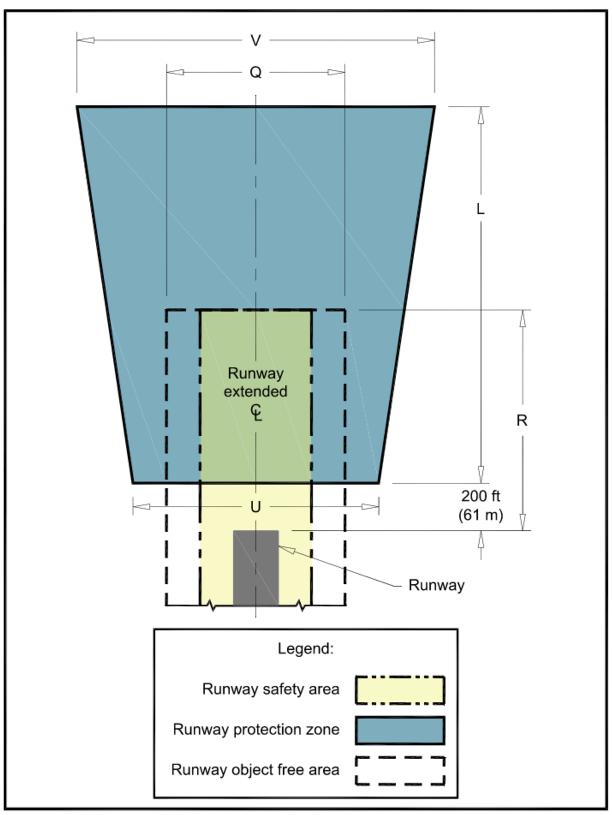
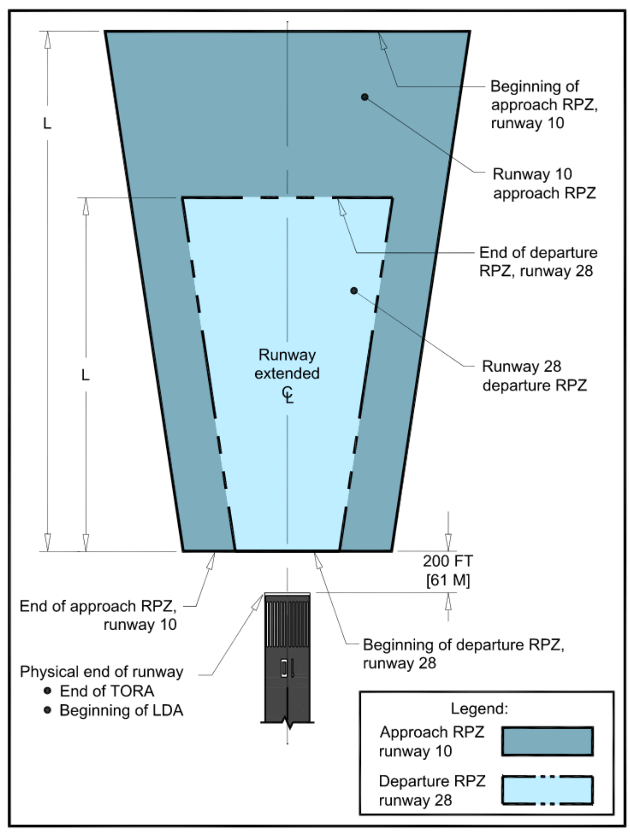


Figure 3-27. Runway with all Declared Distances Equal to the Runway Length



Source: FAA AC 150/5300-13B Figures 3-26 and 3-27

Figure B-6 – Runway Protection Zone Sizes

Runway Protection Zone Dimensions					
AAC	**ADG**	**Visibility Minimums**	**Length (L)**	**Inner Width (U)**	**Outer Width (V)**
A/B*	I, II	Visual, Not Lower than 1 mile	1,000	250	450
A/B	I, II, III, IV	Visual, Not Lower than 1 mile	1,000	500	700
A/B	I, II, III, IV	Not Lower than ¾ mile	1,700	1,000	1,510
C/D/E	I, II, III, IV, V, VI	Visual, Not Lower than 1 mile, Not Lower than ¾ mile	1,700	1,000	1,510
A/B, C/D/E	I, II, III, IV, V, VI	Lower than ¾ mile	2,500	1,000	1,750

*Source: FAA AC 150/5300-13B Appendix G; * Small (up to 12,500 lbs MTOW)*

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 approach surfaces are outlined in paragraph 3.6 of FAA AC 150/5300-13B and portrayed in Tables 3-2, 3-3 and 3-4 of the AC. The approach surface tables and respective figures are shown in **Figure B-7, B-8** and **B-9** as follows. 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. The departure surface is outlined in paragraph 3.6 of FAA AC 150/5300-13B and portrayed in Table 3-5 of the AC. The departure surface table and respective figure is shown in **Figure B-10**. The surface 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/marking, 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.

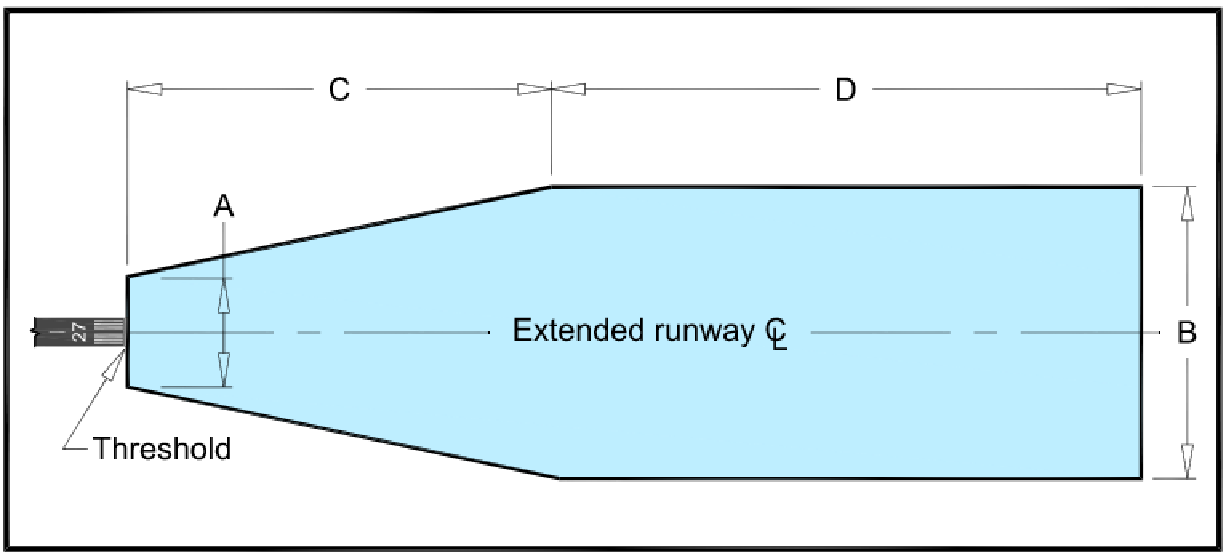
Figure B-7 – FAA Visual Approach Table 3-2

Table 3-2. Visual Approach Surfaces

Surface	Runway Type	A ft (m)	B ft (m)	C ft (m)	D ft (m)	Slope
Surface 1	Approach end of runways serving small airplanes with approach speeds less than 50 knots.	120 (37)	300 (91)	500 (152)	2,500 (762)	15:1
Surface 2	Approach end of runways serving small airplanes with approach speeds of 50 knots or more.	250 (76)	700 (213)	2,250 (686)	2,750 (838)	20:1
Surface 3	Approach end of runway serving large airplanes (>12,500 lbs (5,669 kg))	400 (122)	1,000 (305)	1,500 (457)	8,500 (2,591)	20:1

Note: Approach surface begins at the runway threshold.

Figure 3-5. Visual Approach Surfaces



Note 1: Refer to Table 3-2 for dimensional values.
Note 2: Surface slopes upward and away from starting point.

Source: FAA AC 150/5300-13B Table 3-2

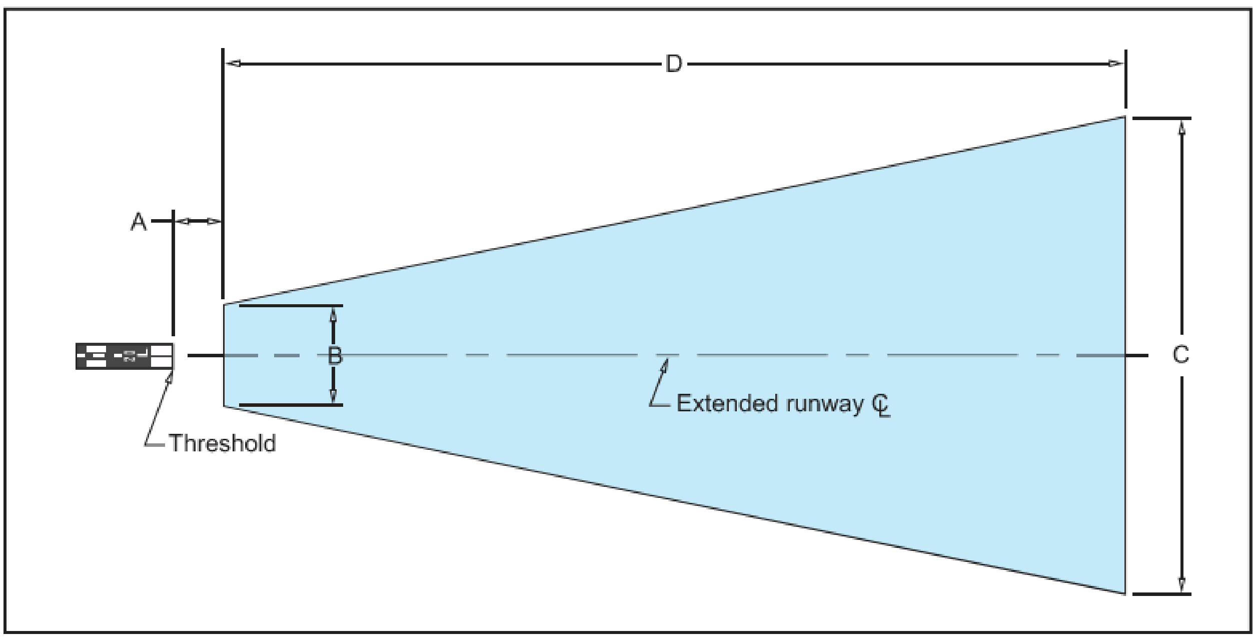
Figure B-8 – FAA NPI Approach Table 3-3

Table 3-3. Non-Precision and IFR Circling Approach Surfaces

Surface	Runway Type	Visibility minimums	A ft (m)	B ft (m)	C ft (m)	D ft (m)	Slope
Surface 4	Approach end of runways that supports IFR circling procedures and procedures only providing lateral guidance (VOR, NDB, LNAV, LP, and LOC).	≥ ¾ statute mile (1.2 km)	200 (61)	400 (122)	3,400 (1,036)	10,000 (3,048)	20:1
		< ¾ statute mile (1.2 km)	200 (61)	400 (122)	3,400 (1,036)	10,000 (3,048)	34:1

Note 1: Dimension A is relative to the runway threshold.
Note 2: Refer to the U.S Terminal Procedures Publication (TPP) to determine if circling minimums are available.
Note 3: Marking and lighting of obstacle penetrations to this surface or the use of a Visual Guidance Lighting System (VGLS) may mitigate displacement of the threshold. Contact the Flight Procedures Team if existing obstacles penetrate this surface.
Note 4: 10,000 feet (3,048 m) represents a nominal value for planning purposes. The length is dependent on the Visual Descent Point (VDP) location.

Figure 3-6. Non-Precision and IFR Circling Approach Surfaces



Note: Refer to Table 3-3 for dimensional values.

Source: FAA AC 150/5300-13B Table 3-3

Figure B-9 – FAA APV and PA Approach Table 3-4

Table 3-4. APV and PA Instrument Runway Approach Surfaces

Surface	Runway Type	Visibility minimums	A ft (m)	B ft (m)	C ft (m)	D [4] ft (m)	Slope
Surface 5	Approach end of runways providing ILS, MMLS, PAR, and landing distance available (LDA) with glidepath, LPV, LNAV/VNAV, RNP, or GLS.	≥ ¾ statute mile (1.2 km)	200 (61)	400 (122)	3,400 (1,036)	10,000 (3,048)	20:1
		< ¾ statute mile (1.2 km)	200 (61)	400 (122)	3,400 (1,036)	10,000 (3,048)	34:1
Surface 6	Approach end of runways providing ILS, MMLS, PAR, and LDA with glidepath, LPV, LNAV/VNAV, RNP, or GLS.	All	0	Runway Width + 200 (61)	1,520 (463)	10,200 (3,109)	30:1

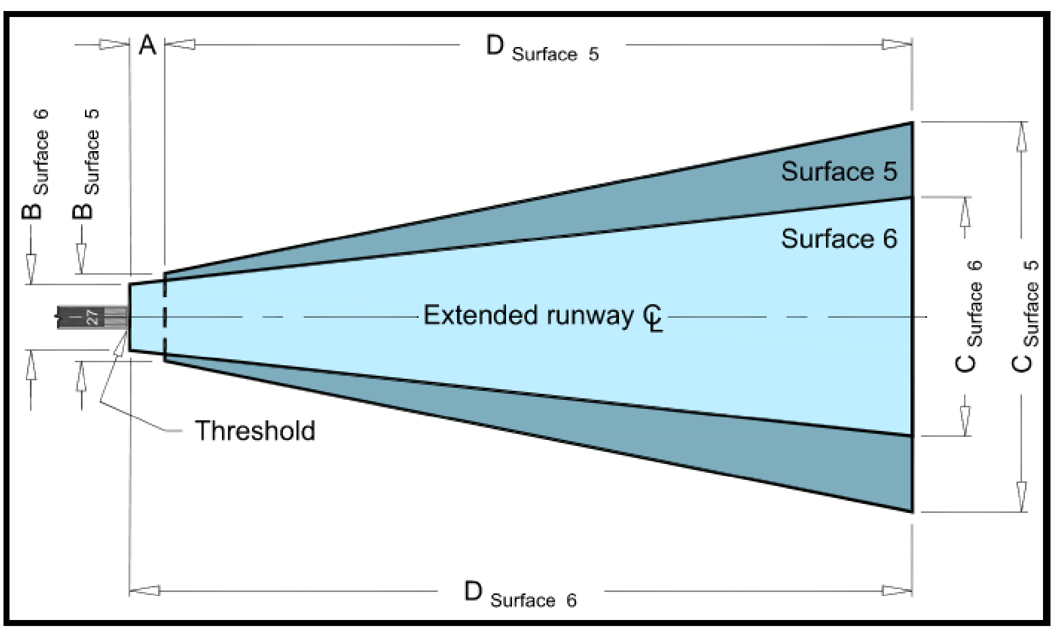
Note 1: Dimension A is relative to the runway threshold.

Note 2: Surface 5 represents the TERPS visual portion of the final approach segment. Surface 6 represents the TERPS Vertical Guidance Surface (VGS). Both surfaces apply for APV and PA procedures. Contact the Flight Procedures Team if existing obstacles penetrate this surface.

Note 3: The FAA assesses TERPS final approach segment criteria (e.g., W, X, Y surfaces) for all runway ends authorized for ILS, mobile microwave landing system (MMLS), precision approach radar (PAR), and LDA with glide slope, LPV, and GLS procedures. Refer to FAA Order 8260.3 for additional information on TERPS surfaces.

Note 4: Represents a nominal value for planning purposes. The actual length depends on the precision final approach fix.

Figure 3-7. Approach Procedure with Vertical Guidance (APV) and Precision Approach (PA) Instrument Runway Approach Surfaces



Note: Refer to Table 3-4 for dimensional values.

Source: FAA AC 150/5300-13B Table 3-4

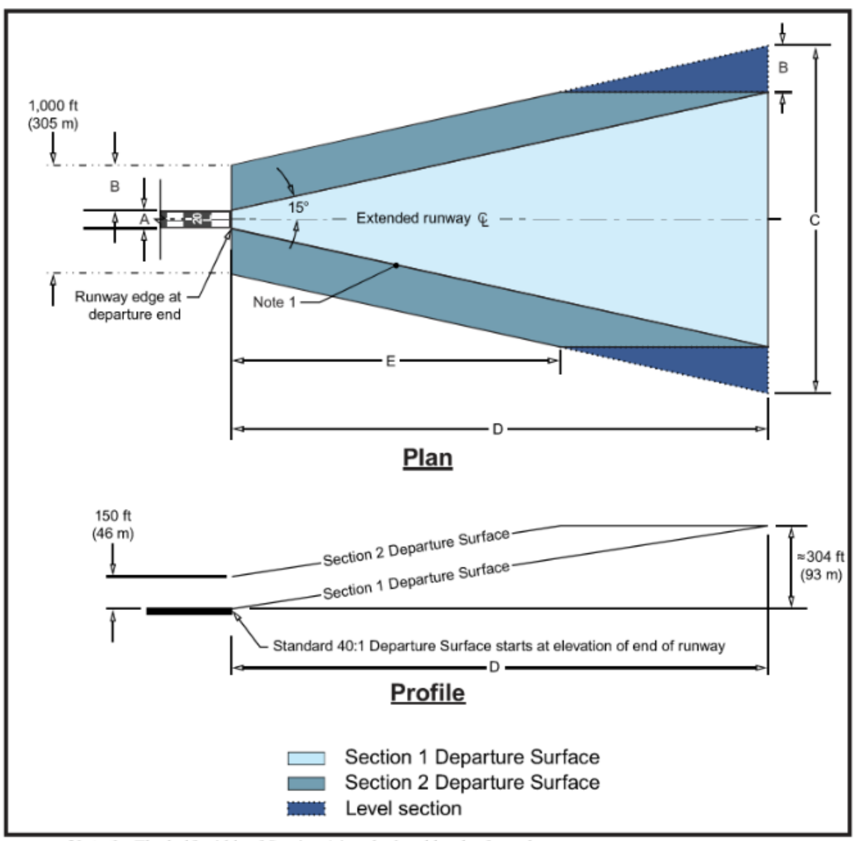
Figure B-10 – FAA Departure Table 3-5

Table 3-5. Instrument Departure Surface

Surface	Runway Type	A ft (m)	B ft (m)	C ft (m)	D [4] ft (m)	E ft (m)	Section 2 Angle θ [2]	Section 2 Transverse Slope m[2]
Surface 7	Runways providing instrument departure operations	60 (18.3)	470 (143)	7,512 (2,290)	12,152 (3,704)	6,152 (1,875)	17:7	3.13:1
		75 (22.9)	462.5 (141)				18.0	3.08:1
		100 (30.5)	450 (137)				18.4	3.00:1
		150 (46)	425 (130)				19.4	2.83:1
		200 (61)	400 (122)				20.6	2.67:1

Note 1: Section 1 of the departure surface starts at the DER elevation for the width of the runway and rises along the extended runway centerline at 40:1. Section 2 starts at an equal elevation to the adjoining Section 1. Section 2 continues until reaching 304 ft (93 m) and then levels off until reaching the line where Section 1 and Section 2 reach 304 ft (93 m) above DER elevation, then that part of Section 2 that leveled off continues at a 40:1 slope.
Note 2: See Figure 3-11 for a graphical depiction of these values.
Note 3: The start of the surface is relative to the departure end of the runway. For runways with published declared distances, the TODA indicates the beginning of the departure surface. See Figure 3-10.
Note 4: 12,152 feet (3,704 m) represents a 2 nm nominal value for planning purposes.
Note 5: For other runway width values, interpolation is required to determine the value of "B", the Section 2 angle, and the Section transverse slope.

Figure 3-9. Instrument Departure Surface



Note 1: The half-width of Section 1 is calculated by the formula:
Section $1_{\text{Half Width}}$ = (1/2 RWY Width) + (Tan 15° × X), where X = distance from the departure end of the runway.

Source: FAA AC 150/5300-13B Table 3-5

Instrument Procedures

Instrument approach procedures to a runway end are used by landing aircraft to navigate to the airport during instrument conditions when the cloud ceiling is less than 1,000 feet and/or visibility is less than 3 miles. Establishing approaches with the lowest possible weather minimums allow the airport to maximize its operational utility. Each approach type requires differing infrastructure and navigational aids. Types of approach procedures include non-precision approach (NPA), approach with vertical guidance (APV) and precision approach (PA). FAA airport design standards must be met as shown in **Figure B-11** and **Figure B-12**. Coordination with FAA Flight Procedures Office is recommended to review the feasibility of implementing any new approach procedure.

Figure B-11 – FAA Airport Design Standards for Instrument Approach Procedures

Table K-1. Criteria to Support Instrument Flight Procedure Development

Standards [1]	**Visibility Minimums** [1]			
	< 3/4 statute mile (1.2 km)	**3/4 (1.2 km) to < 1 statute mile (1.6 km)**	**≥ 1 statute mile (1.6 km) straight-in**	**Circling** [2] **≥ 1 statute mile (1.6 km)**
HAT [3]	≤ 250 ft	≥ 250 ft	≥ 250 ft	≥ 350 ft
POFZ (PA and APV only)	Required	Not Required	Not Required	Not Required
IT-OFZ	Required	Not Required	Not Required	Not Required
ALP [4]	Required	Required	Required	Required
Minimum Runway Length	4,200 ft	3,200 ft [5]	3,200 ft [5]	3,200 ft [5]
Paved Surface	Required	Recommended [6]	Recommended [6]	Recommended [6]
Runway Markings (See AC 150/5340-1)	Precision	Non-precision	Non-precision	Visual
Holding Position Signs and Markings (See AC 150/5340-1, AC 150/5340-18)	Required	Required	Required	Required [6]
Runway Edge Lights [7]	HIRL or MIRL	HIRL or MIRL	MIRL or LIRL	MIRL or LIRL (Required only for night minimums)
Parallel Taxiway [8]	Required	Required	Recommended	Recommended
Approach Lights [9]	Required	Recommended [10]	Recommended [10]	Not Required
VGSI [11]	Recommended	Recommended	Recommended	Recommended
Applicable Runway Design Standards, (Reference online Runway Design Standards Matrix Tool or Appendix G)	Lower than 3/4 mile (1.2 km) visibility minimums	Not lower than 3/4 mile (1.2 km) visibility minimums	Not lower than 1 mile (1.6 km) visibility minimums	Not lower than 1 mile (1.6 km) visibility minimums
Approach or Departure Surface to be Met (Reference paragraph 3.6.1)	See Table 3-3 or Table 3-4	See Table 3-3 or Table 3-4	See Table 3-3 or Table 3-4	Table 3-3
Optimum Survey Type [12]	VGS	VGS	NVGS	NVGS [13]

Note: 1 ft = 0.305 m

Source: FAA AC 150/5300-13B, Airport Design, Table K-1

Figure B-12 – FAA Airport Design Standards for Instrument Approach Procedures Notes

Numbered Notes for Table K-1:

Note 1: Visibility minimums and described standards are subject to the application of FAA Order 8260.3 (TERPS) and associated orders. For each level of visibility, meet or exceed the optimum conditions within the column.

Note 2: For runways authorized for circling, meet requirements for threshold siting (reference paragraph 3.5) and OFZ (reference paragraph 3.11).

Note 3: HAA for circling. The HAT/HAA indicated is for planning purposes; actual obtainable HAT/HAA is determined by TERPS and may be higher due to obstacles or other requirements.

Note 4: An ALP is only required for obligated airports in the NPIAS; it is recommended for all others.

Note 5: Runways less than 3,200 ft (975 m) are protected by 14 CFR Part 77 to a lesser extent. However, runways as short as 2,400 ft (732 m) could support an instrument approach provided the lowest HAT is based on clearing any 200-ft (61 m) obstacle within the final approach segment.

Note 6: Unpaved runways require case-by-case evaluation by the IFP Validation Team (IVT).

Note 7: Runway edge lighting is required for night approach minimums. High intensity lights and an RVR touchdown zone sensor are required for RVR-based minimums.

Note 8: A full-length parallel taxiway leading to and from the thresholds is advisable to achieve the lowest possible minimums, and minimizes the time aircraft are on the runway. Refer to the minimum visibility requirements on airport conditions in FAA Order 8260.3. Construction of a parallel taxiway, while advisable, is not a requirement for publication of an IFP with visibility minima ≥ 1 statute mile (1.6 km).

Note 9: Not applicable to Performance Based Navigation procedures. The following standards are applicable to conventional, ground-based procedures. A full approach light system (ALSF-1, ALSF-2, Simplified Short Approach Light System with Runway Alignment (SSALR), or MALSR) is required for visibility < 3/4 statute mile (1.2 km). Intermediate (MALSF, MALS, SSALF, SSALS, Short Approach Lighting System (SALS)/SALSF) or Basic (ODALs) systems will result in higher visibility minimums. An ALSF-1 or ALSF-2 is required for CAT II/III ILS. HAT < 250 ft (76 m) without MALSR, SSALR, or ALSF is permitted with visibility not less than 3/4 statute mile.

Note 10: ODALS, MALS, SSALS, and SALS are acceptable. Approach lights are recommended where a visibility minima improvement of at least 1/4 statute mile (0.4 km) can be achieved.

Note 11: To preclude a non-standard IFP, it is critical the instrument approach vertical descent angle (VDA) or glidepath angle (GPA) is coincident with the VGSI angle.

Note 12: See AC 150/5300-18 for VGS and non-Vertically Guided Survey (NVGS) requirements. When an AC 150/5300-18 VGS is not available, the equivalent legacy vertically guided (VG) surveys are area navigation approach precision vertical landing (ANAPV)/ localizer performance with vertical guidance (LPV)/PC, and PIR.

Note 13: Absence of a survey does not preclude authorization to establish circling to a runway but may result in the procedure being restricted to daytime only operations.

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 and 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 150/5300-13B) are described below. See **Figure B-13** 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-13 – Taxiway Design Standards Table 4-1 and 4-2

Table 4-1. Design Standards Based on Airplane Design Group (ADG)

Item	ADG					
	I	II	III	IV	V	VI
Taxiway and Taxilane Protection						
TSA (maximum ADG wingspan)	49 ft (14.9 m)	79 ft (24.1 m)	118 ft (36 m)	171 ft (52 m)	214 ft (65 m)	262 ft (80 m)
TOFA [2]	89 ft (27.1 m)	124 ft (38 m)	171 ft (52 m)	243 ft (74 m)	285 ft (87 m)	335 ft (102 m)
TLOFA [2]	79 ft (24.1 m)	110 ft (34 m)	158 ft (48 m)	224 ft (68 m)	270 ft (82 m)	322 ft (98 m)
Taxiway and Taxilane Separation						
Taxiway centerline to parallel taxiway centerline [1]	70 ft (21.3 m)	102 ft (31 m)	144 ft (44 m)	207 ft (63 m)	249 ft (76 m)	298 ft (91 m)
Taxiway centerline to fixed or movable object [2]	44.5 ft (13.6 m)	62 ft (18.9 m)	85.5 ft (26.1 m)	121.5 ft (37 m)	142.5 ft (43 m)	167.5 ft (51 m)
Taxilane centerline to parallel taxilane centerline [1]	64 ft (19.5 m)	94 ft (29 m)	138 ft (42 m)	198 ft (60 m)	242 ft (74 m)	292 ft (89 m)
Taxilane centerline to fixed or movable object [2]	39.5 ft (12.2 m)	55 ft (16.8 m)	79 ft (24.1 m)	112 ft (34 m)	135 ft (41 m)	161 ft (49 m)
Wingtip Clearance						
Taxiway wingtip clearance	20 ft (6.1 m)	23 ft (7 m)	27 ft (8.2 m)	36 ft (11 m)	36 ft (11 m)	36 ft (11 m)
Taxilane wingtip clearance	15 ft (4.6 m)	16 ft (4.9 m)	20 ft (6.1 m)	27 ft (8.2 m)	28 ft (8.5 m)	30 ft (9.1 m)

Note 1: See Figure 4-5.
Note 2: See Figure 4-6.
Note 3: See paragraphs 4.5.3.1 and 4.5.4.1 for TSA and TOFA standards at fillets.

Table 4-2. Design Standards Based on Taxiway Design Group (TDG)

Item	TDG							
	1A	1B	2A	2B	3	4	5	6
Taxiway/Taxilane Width [1]	25 ft (7.6 m)	25 ft (7.6 m)	35 ft (10.7 m)	35 ft (10.7 m)	50 ft (15.2 m)	50 ft (15.2 m)	75 ft (22.9 m)	75 ft (22.9 m)
Taxiway Edge Safety Margin [1]	5 ft (1.5 m)	5 ft (1.5 m)	7.5 ft (2.3 m)	7.5 ft (2.3 m)	10 ft (3 m)	10 ft (3 m)	14 ft (4.3 m)	14 ft (4.3 m)
Taxiway Shoulder Width [2]	10 ft (3 m)	10 ft (3 m)	15 ft (4.6 m)	15 ft (4.6 m)	20 ft (6.1 m)	20 ft (6.1 m)	30 ft (9.1 m)	30 ft (9.1 m)
Taxiway/Taxilane Centerline to Parallel Taxiway/Taxilane Centerline w/180 Degree Turn	See Table 4-6 and Table 4-7.							

Note 1: See Figure 4-4.
Note 2: When the most demanding aircraft has four engines and is ADG-VI, the standard taxiway shoulder width is 40 feet (12.2 m).

Source: FAA AC 150/5300-13B

Airspace Protection

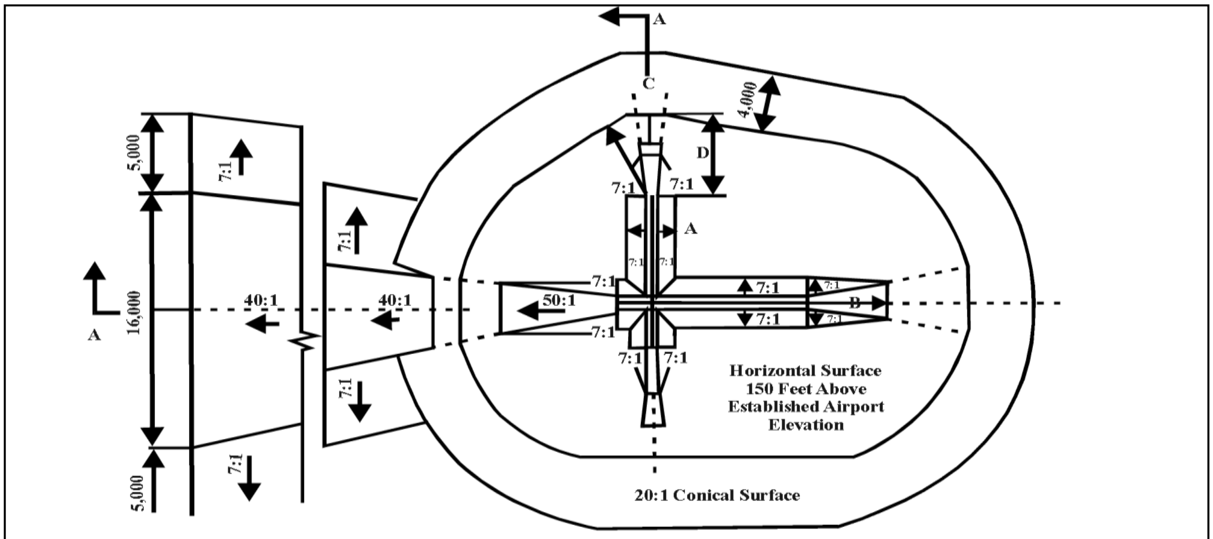
Airspace is an important resource around airports that is essential for safe flight operations. There are established standards to identify airspace obstructions around airports. FAA grant assurances (obligations) require the airport sponsor to take appropriate action to assure that airspace is adequately 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-14**.

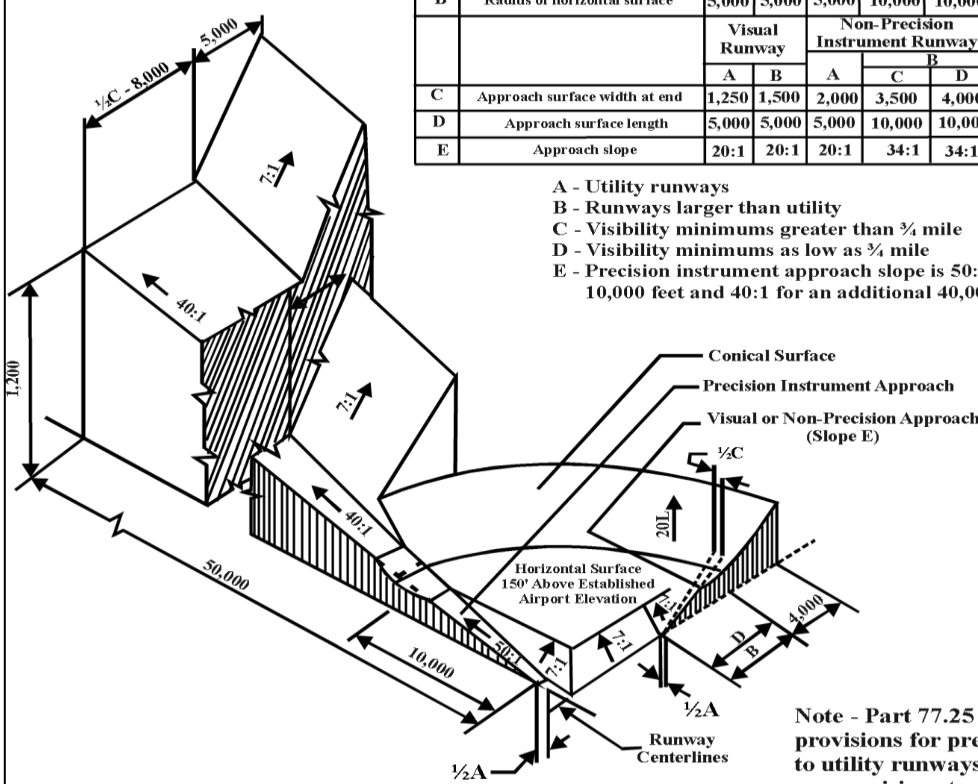
Of note are the primary surfaces which should be kept clear of non-essential objects above the runway centerline elevation. The approach surface extends upward and outward from the runway. A slope is defined as the horizontal distance traveled for each one vertical foot.

Figure B-14 – FAR Part 77



DIM	ITEM	Dimensional Standards (Feet)					
		Visual Runway		Non-Precision Instrument Runway			Precision Instrument Runway
		A	B	A	B: C	B: D	
A	Width of primary surface and approach surface width at inner end	250	500	500	500	1,000	1,000
B	Radius of horizontal surface	5,000	5,000	5,000	10,000	10,000	10,000
		Visual Runway		Non-Precision Instrument Runway			Precision Instrument Runway
		A	B	A	B: C	B: D	
C	Approach surface width at end	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	*

A - Utility runways
B - Runways larger than utility
C - Visibility minimums greater than ¾ mile
D - Visibility minimums as low as ¾ mile
E - Precision instrument approach slope is 50:1 for inner 10,000 feet and 40:1 for an additional 40,000 feet



Note - Part 77.25 does not make provisions for precision approaches to utility runways. In these situations, use precision standards for other than utility runways to develop the primary, approach, and transition surfaces.

Source: FAA