HANDOUT

WELCOME TO Graham Airpark

South Dakota Aeronautics Commission -

It is with great honor and dignity that on May 19th, 2022, a date that I will remember for the rest of my life, I am announcing from Pierre South Dakota, our Great State Capital, that the Graham Airpark Development has achieved a once in a lifetime feat that will change the demographic of the State of South Dakota forever. The Graham Airport is the 2nd airport in the history of our state, Clyde Ice in Spearfish, SD was the 1st airport in the State of South Dakota, with Graham being the 1st airport in our state's history with a paved runway.

This project is a legacy that continued with the belief in my leadership from Dr. M. Frances Graham that I would be able to carry the "baton" and bring the Graham airport into the next century as a world class airport. Bringing the 1400-acre planned development to life has exceeded all our expectations. It is humbling to be a part of this new adventure along with a great team and support from the community that continues to help make it all possible.

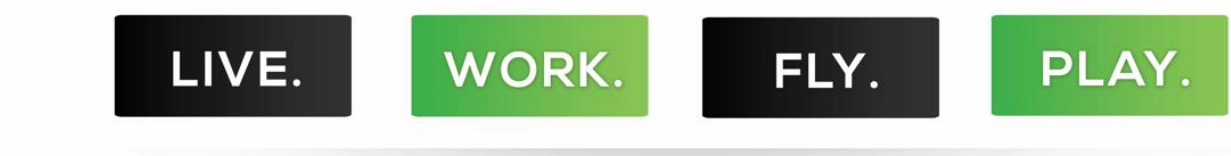
I am very proud to announce that the historical Graham Field is ready to proceed with the largest land sale within the City of North Sioux City history, and the largest funded Governor's office Economic development's land sale in the State of South Dakota's history. The entire development has been designed around a runway expansion project to allow the Graham Airpark to have a Design Group III runway to allow "big jets" to come in and out of our community. It has been a disruptive idea and turbulent along the way. But we made it! We are here and we aren't going anywhere.

In partnership with the State of South Dakota and with KLJ Engineering as the lead project engineer, I am pleased to present our preliminary Airport Layout Plan for the Graham Airpark Development Project's runway in Southeast South Dakota. I am also announcing today that we will be proceeding forward with all stakeholders to bring a monumental opportunity for economic development to South Dakota. The Graham Airpark Development will forever change the capabilities of 7K7 Graham Field and will bring economic impact of over 300 million dollars to the Great State of South Dakota over the next coming decades.

The Graham Airpark runway will have 7400'x75' of paved runway surface and will be a tremendous transportation project. Through public private partnership and the State of South Dakota, this opportunity is made possible. This mixed-use development project, that is ready to proceed, has 90-acres committed to workforce housing and 330+ acres of "certified ready" sites that have the ability for direct runway access. KLJ has given us the assurances that our airspace is protected. It truly is an unprecedented opportunity for the State of South Dakota and the Southeastern South Dakota communities.

For opportunities visit: www.grahamairpark.com

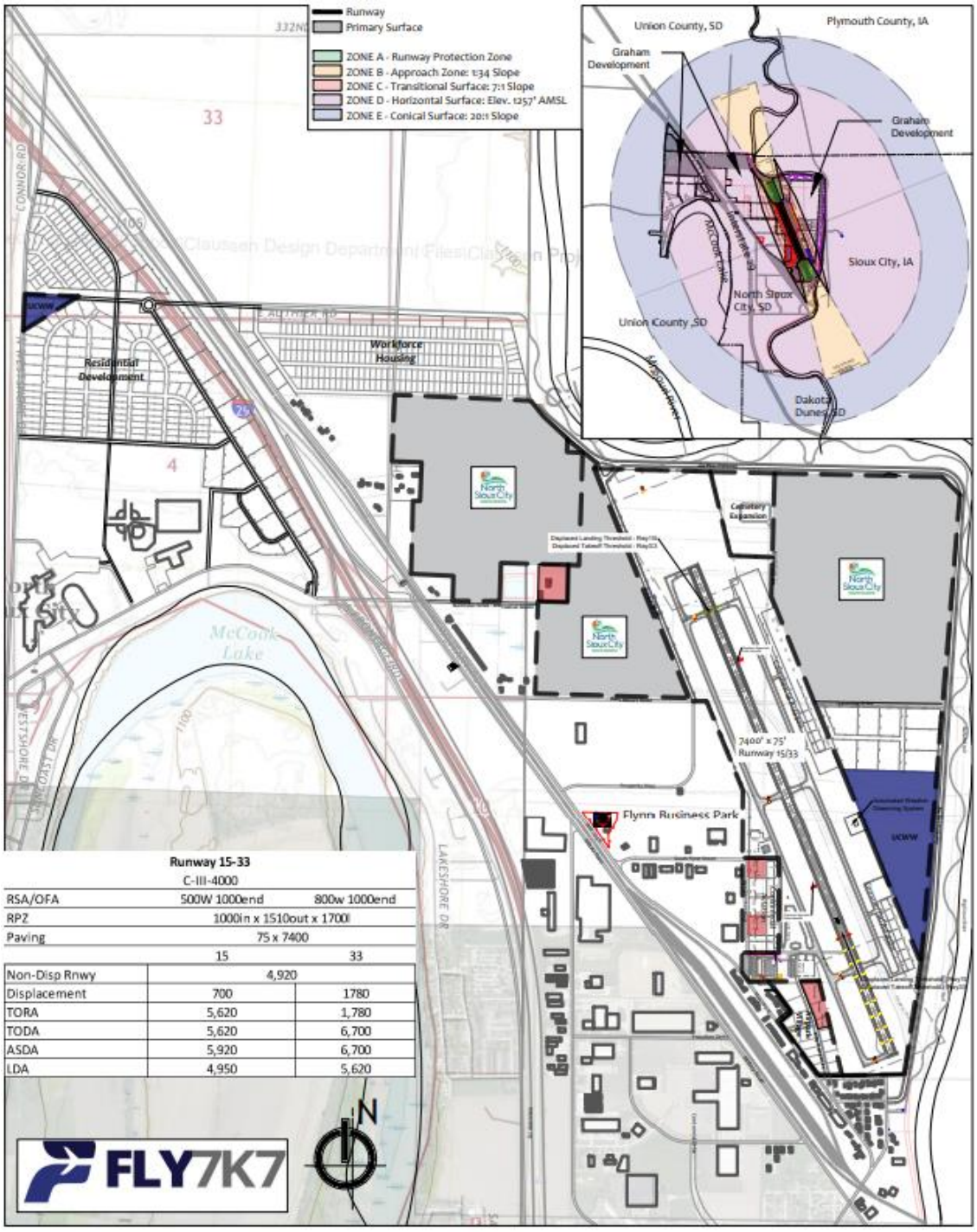
Stephen F. Jones | **Graham Airpark Developer**
The Claussen Group
Per Aspera Ad Astra – "Our aspirations take us to the stars"



HANDOUT

WELCOME TO

Graham Airpark



Runway 15-33

C-III-4000

RSA/OFA	500W 1000end	800w 1000end
RPZ	1000in x 1510out x 1700	
Paving	75 x 7400	
	15	33
Non-Disp Rnwy	4,920	
Displacement	700	1780
TORA	5,620	1,780
TODA	5,620	6,700
ASDA	5,920	6,700
LDA	4,950	5,620

LIVE. WORK. FLY. PLAY.

Graham Development Master Plan

Version Release Date

1-20-22

Graham Development Master Plan

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: No Scale

N

0" 1"

Cover Sheet

G-1

Big Sioux River

Joe Foss Parkway

UNDER CONTRACT

Graham Development

100' Clear

75' Clear

Lycoming Drive

UCWW

10' Clear

15' Clear

Displaced Threshold

Runway End

Reserved

Airpark Village

Graham Airfield

8690' x 100'
Runway 33/15

Cemetery Expansion

50' Clear

Rickenbacher Road

HWY. 105

Military Road

Prosperity Way

Flynn Business Park

Freedom Drive

Waters Road

North Derby Lane

Interstate 29

Big Sioux River

Approach Surface

Joe Foss Parkway

Rivers Landing

Graham Development

Sold

Country Vista

Union Park

Shamrock Road

Northshore Drive

McCook Lake

Reserved

Lakeside Estates

UCWW

Horizontal Surface

Conical Surface

North Sioux City
SOUTH DAKOTA

CLAUSSEN
Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations Airpark Features, in relation to proposed North Sioux City Master Plan.

Drawn by: Scott Musselman
Issue date: 1.20.2022

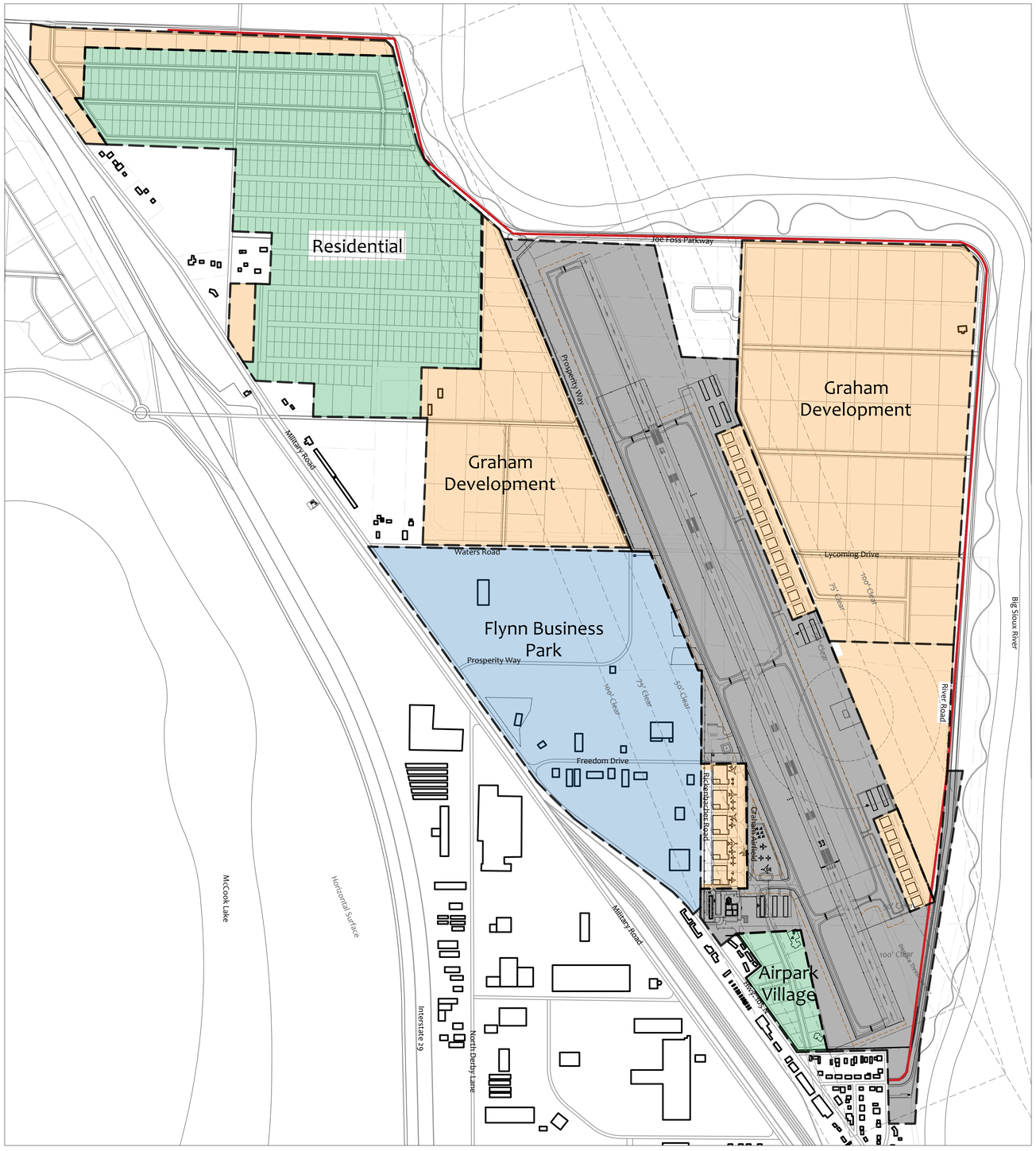
Scale: 1" = 600'-0"

N

0" 1"

Master Site Plan

G-2



- Airport Area
- Airport Business Park
- Residential Area
- Flynn Business Park

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee See Notes. Zone X
	Area with Flood Risk due to Levee Zone D
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard Zone X
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Service Center (MSC) toll free number at 1-800-358-9616 (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided by U.S. Department of Agriculture, dated 2011 and 2016; Service Center Agencies, dated 2011; U.S. Census Bureau, dated 2015 and 2017; South Dakota Department of Transportation, dated 2015; and Natural Resources Conservation Service, dated 2016. For information about base maps, refer to Section 6.2 "Base Map" in this FIS Report.

SCALE

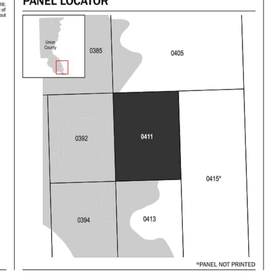
Map Projection: Universal Transverse Mercator Zone 14N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD88

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR



FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP
UNION COUNTY, SOUTH DAKOTA and Incorporated Areas
PANEL 411 OF 475

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH SIOUX CITY, CITY OF	460087	0411	E
UNION COUNTY	460242	0411	E

PRELIMINARY 1/10/2019

VERSION NUMBER 2.4.3.0

MAP NUMBER 46127C0411E

EFFECTIVE DATE

North Sioux City SOUTH DAKOTA

CLAUSSEN Est. 1945

Graham Airpark Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Airpark Features, in relation to proposed site flood conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 600'-0"

N

0" 1"

Site Context Plan

G-3

Nature Trail
Big Sioux River
Nature Trail
Nature Trail
Joe Foss Parkway
Joe Foss Parkway
Joe Foss Parkway
Joe Foss Parkway
Nature Trail
UNDER CONTRACT
Graham Development
See x-2
Oldfield Court
Wishart Road
Lycoming Drive
UCWW
Commercial Aviation
See G-10
Displace Threshold 33'
Runway End
Trailhead
N. Main Street
Automated Weather Observing System
Displaced Landing Threshold - Rwy33
Displaced Takeoff Threshold - Rwy15
33
Verna Street
Delier Street
Leneve St.
Hwy. 105 N
Precision Approach Path Indicator
Reserved
Reserved
Reserved
Kitty Hawk Drive
Commercial Aviation
See G-11
8690' x 100'
Runway 15/33
General Aviation
Airpark Village
See G-6
Visitor Aviation Parking
Lycoming Drive
Cemetery Expansion
Commercial Aviation
See G-9
Helipad
Reserved
Reserved
Hwy. 105 N
Rickenbacher Road
Military Road
Precision Approach Path Indicator
Displaced Landing Threshold - Rwy15
Displaced Takeoff Threshold - Rwy33
15
Joe Foss Parkway
Nature Trail
Prosperity Way
UNDER CONTRACT
Graham Development
See x-2
Lone Eagle Road
West Waters Road
Northshor Drive - Alternative Access
Joe Foss Parkway
UNDER CONTRACT
SOLD
Residential
See G-7
Flynn Business Park
Prosperity Way
South Flynn Street
Freedom Drive
Hwy. 105 N
Military Road
Centennial Drive
N. Derby Lane
Interstate 29

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations Airport Features & Airpark, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 200'-0"

N

0" 1"

Airport Layout Plan

G-4

North Sioux City SOUTH DAKOTA

CLAUSSEN Est. 1945

Runway
Primary Surface

ZONE A - Runway Protection Zone
ZONE B - Approach Zone: 1:34 Slope
ZONE C - Transitional Surface: 7:1 Slope
ZONE D - Horizontal Surface: Elev. 1257' AMSL
ZONE E - Conical Surface: 20:1 Slope

Plymouth County, IA

Sioux City, IA

Sioux City, IA

Displaced Threshold:
42-32-15.28 N
96-29-01.3 W
Elev: 1107' (AMSL)

Displaced Threshold Approach Path

Big Sioux River

Graham Development

Runway End:
42-33-18.11 N
96-29-37.12 W
Elev: 1107' (AMSL)

Flynn Business Park

North Sioux City, SD

Interstate 29

Dakota Dunes, SD

Graham Development

Interstate 29

McCook Lake

Union County, SD

Graham Development

Union County ,SD

Interstate 29

Missouri River

North Sioux City
SOUTH DAKOTA

CLAUSSEN Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations Air Space, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 1500'-0"

N

0" 1"

Airport Protection

G-5

8960' x 100'
Runway 15/33

Runway Safety Area

Taxi E

Taxi C

Taxiway Object Free Area

Runway Protection Zone

20 ' Buffer Wall

Vegetation Buffer

Gate

Reserved

Runway Access 1
1.77 Acres

Reserved

Runway Access 2
1.43 Acres

Reserved

Runway Access 3
.79 Acres

Runway Access 4
.65 Acres

Runway Access 5
.65 Acres

Runway Access 6
.65 Acres

Runway Access 7
.65 Acres

70' Wide ROW

Kitty Hawk Drive

Runway Access 19
.32 Acres

Runway Access 18
.39 Acres

Runway Access 17
.52 Acres

Runway Access 16
.65 Acres

Runway Access 13
.41 Acres

Runway Access 14
.41 Acres

Runway Access 15
.35 Acres

Runway Access 10
.42 Acres

Runway Access 11
.42 Acres

Runway Access 12
.43 Acres

Runway Access 9
.97 Acres

Runway Access 8
1.47 Acres

Beechcraft Court

Highway 105 N.

20 ' Buffer Wall

New "T" Hangars

New "T" Hangars

Taxi T

Taxi A

Taxi T

Taxi B

Commercial Lots:
- 64 West Airport
- 50 East Airport

Commercial Aviation Lots:
- 26 Commercial Hanger lots

Residential Lots:
- 540 Neighborhood Residential Lots
- 19 Airpark Village Runway Access Lots

2 Airpark Village

Scale: 1" = 60'-0"

North Sioux City SOUTH DAKOTA

CLAUSSEN Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Airport Features, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 60'-0"

N

0" 1"

Site Plan

G-6

8960' x 100'
Runway 15/33

PAPI

RPZ

Runway Safety Area

Taxiway Object Free Area

Taxi E

Taxi C

Taxi T

Taxi A

General Aviation
Hangars

Lindberg Lane

Visitor Aircraft Parking

Taxiway Object Free Area

Wind
Cone

Taxi T

Taxi T

Fuel Station

Taxi B

Commercaial Parking & Taxi

Mechanic &
Historic
Hangars

Helipad

Emergency Access Road

Commercial
Hangar Site 5:
FBO & Medevac Hospitality

150'

Commercial
Hangar Site 4

Commercial
Hangar Site 3

Commercial
Hangar Site 2

Commercial
Hangar Site 1

G.A.
Gates

Control & Security
House

200'

General Aviation
Hangars

Private Commercial Entrance

Fuel Tanks

Richenbacker Road

North Sioux City
SOUTH DAKOTA

CLAUSSEN
Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Airport Features, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 100'-0"

N

0" 1"

Site Plan

G-7

UNDER CONTRACT

Graham Development

UNDER CONTRACT

Wishart Road

Lycoming Drive

Airport Security Fence

Parking

General Aviation Hangars

Commercial Hangar Site 13

Commercial Hangar Site 14

Commercial Hangar Site 15

Commercial Hangar Site 16

Commercial Hangar Site 17

Commercial Hangar Site 18

Commercial Hangar Site 19

Commercial Hangar Site 20

Commercial Hangar Site 21

Commercial Hangar Site 22

Commercial Hangar Site 23

Commercial Hangar Site 24

Commercial Hangar Site 25

Commercial Hangar Site 26

Taxi I

Taxi K

Taxiway Object Free Zone

Apron

Taxi M

G.A. Gates

Parking

Lycoming Drive

Airport Security Fence

100'

100'

General Aviation Hangars

Runway Safety Area

8960' x 100'
Runway 15/33

PAPI

Taxi C

RPZ

Taxi H

Runway Safety Area

15

Taxiway Object Free Zone

Airport Security Fence

FLyn Business Park

North Sioux City
SOUTH DAKOTA

CLAUSSEN
Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Airport Features & Building Site, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 100'-0"

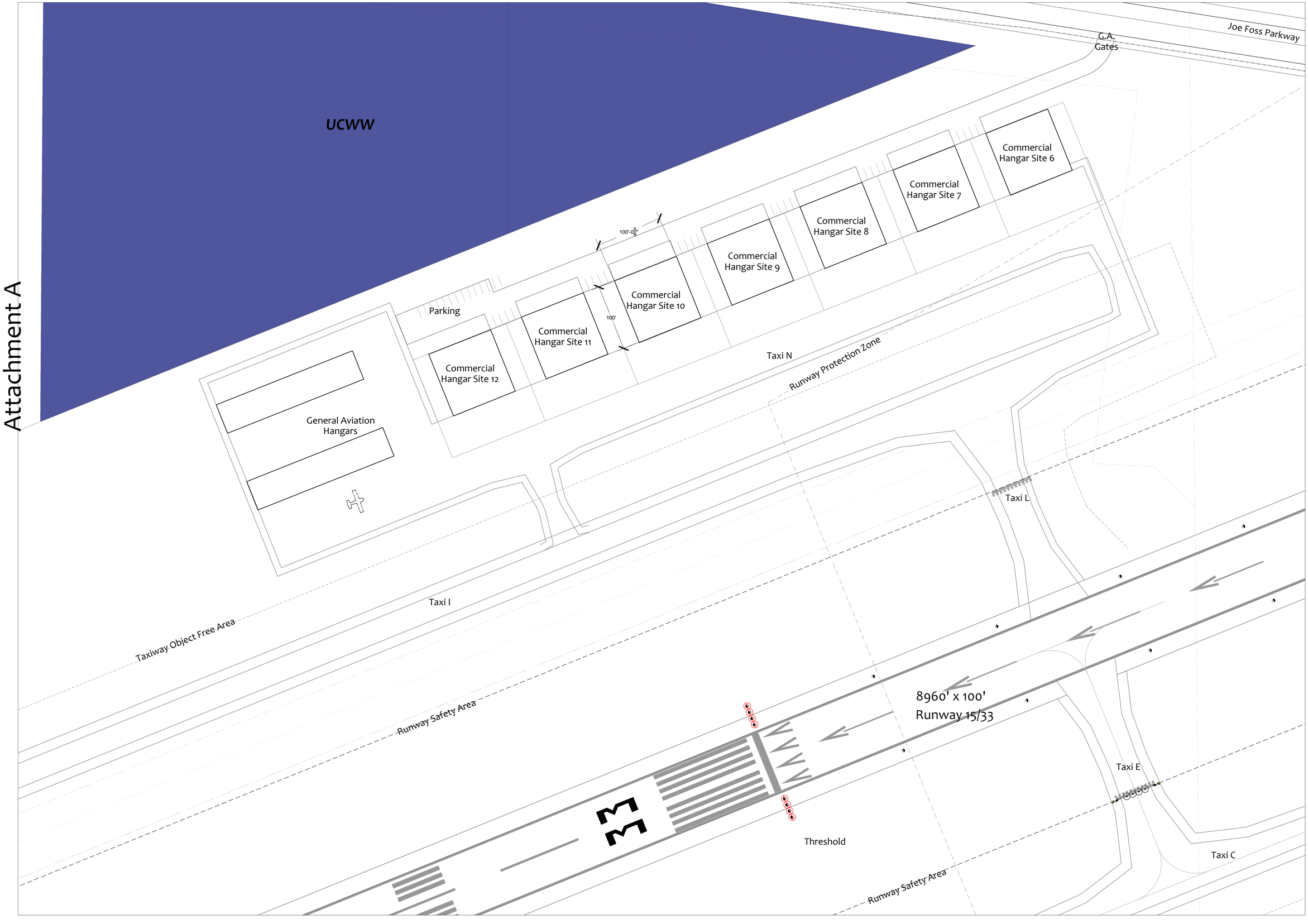
N

0" 1"

Site Plan

G-8

Attachment A



Graham Development Master Plan

FLY7K7

CLAUSSEN Est. 1945

North Sioux City SOUTH DAKOTA

Drawing Contents:

Site Plan showing the locations of Airport Features, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 60'-0"

0" 1"

Site Plan

G-9

Proposed Exit 5

East Authier Road

Joe Foss Parkway

Commercial

Mixed Use:
Commercial & Multi-family

Union Park Lots 1 - 20

Clyde Ice Avenue

Union Park Lots 21 - 40

Union Park

Union Park Lots 41 - 60

Typical Lot
.29 Acres

Earhart Drive

.54 acres Union Park Lots 61 - 78

.41 acres Union Park Lots 79 - 95

Wright Avenue

Hughes Court

Hwy. 105 N

Shamrock Road

Rivers Landing Lots 1 - 25

.46 acres

.79 acres

Clyde Ice Avenue

Rivers Landing Lots 24 - 41

.33 acres

.33 acres

.33 acres

Rivers Landing

Rivers Landing Lots 42 - 59

.55 acres

Earhart Drive

Rivers Landing Lots 60 - 78

Lot 79 Lot 80 .34 ac 81

Rivers Landing Lots 82 - 100

Lot 101 Lot 102 .51 ac 103

Clyde Ice Avenue

Wright Avenue

Joe Foss Parkway

Big Sioux River

Nature Trail

Big Sioux River

UNDER CONTRACT

Country Vista

Northpark Village

Shamrock Road

Kitzmiller Court

Mixed Use:
Commercial &
Multi-family

UNDER CONTRACT

Depression Area

SOLD

Graham Development

Prosperity Way

Graham Airfield

Interstate 29

Hwy. 105 N

Exit 4

Northshore Drive

Northshore Drive

Commercial Lots:

Commercial Aviation Lots:

Residential Lots:

Mixed Use : Commercial & Multi-family Residential

North Sioux City
SOUTH DAKOTA

CLAUSSEN
Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Residential Site, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 200'-0"

N

0" 1"

Site Plan

G-7

Commercial Lots:

Commercial Aviation Lots:

Residential Lots:

Mixed Use : Commercial & Multi-family Residential

Joe Foss Parkway
Clyde Ice Avenue
Earhart Drive
Wright Avenue
Wright Avenue
Hwy 105 N.
Reserved
Lakeside Drive
Commercial
Soverign Court
Northshore Drive
McCook Lake
EXIT 5
Mixed Use: Commercial & Multi-family
Lakeside Drive
Valley Passage
Soccer Complex
Dakota Valley Elementary
Duessenberg Avenue
De Havilland Drive
De Havilland Drive
Duessenberg Avenue
Duessenberg Avenue
Northshore Drive
Baseball Complex
De Havilland Drive
Cessna Ct.
Citation Drive
Bombardier Lane
Multi-family Residential
Panther Way
Panther Way
Stearman Lane
Lockheed Lane
Panther Way
Sikorski Avenue
Utility Easement
Joe Foss Parkway
Embraer Ct.
Lakeside Estates : Residential
Blériot Circle
Duessenberg Drive
Football Field
Boeing Drive
Stearman Lane
Dassault Drive
Blériot Circle
Blériot Circle
UCWW
Valley Passage
Dakota Valley Highschool
Westshore Drive

North Sioux City SOUTH DAKOTA

CLAUSSEN Est. 1945

Graham Development Master Plan

FLY7K7

Drawing Contents:

Site Plan showing the locations of Airport Features, in relation to proposed site and existing conditions.

Drawn by: Scott Musselman
Issue date: 1.20.2022

Scale: 1" = 200'-0"

N

0" 1"

Site Plan

G-8

GRAHAM FIELD AIRPORT STUDY

Purpose and Scope

The information presented in this report represents the study findings for the Graham Field Planning Study prepared for McCook Industries, the airport owner. This study for Graham Field (7K7) will serve as a guide identifying future development necessary to accommodate existing and future aviation demands.

The airport sponsor and KLJ developed the scope for the project to include work tasks to document existing facilities and portray development alternatives in accordance with best practices established by the Federal Aviation Administration (FAA).

Airport Overview

7K7 is located in North Sioux City, South Dakota in an area primarily identified for economic development for the region. The area is accessible by interstate (I-29), rail, and navigable waterways. As a privately owned, public use airport, 7K7 has a wide range of flexibility to lease and provide services and facilities to tenants beyond the limitations mostly encountered by public entities.

Airport Role & Design

7K7 is a general aviation airport and is one of four public use airports serving the Sioux City Metropolitan Statistical Area. The airport currently has limited facilities with 36' x 2,230' of paving for a 100' x 5,300' runway. The airport does not currently have any instrument approach capabilities and has 10 based aircraft. Public use airports near 7K7 are listed in **Table 1-1** for perspective on surrounding airports

Table 1-1 – Surrounding Public Airports

Airport Name / City	FAA ID	Location from Airport	Based Aircraft	Instrument Approach	Longest Runway
Graham Field/North Sioux City SD	7K7	-	10		
Martin Field/South Sioux City NE	7K8	5 S	36	visual	3323'
Sioux Gateway/Sioux City IA	SUX	9 SSE	73	200' ½ m	9002'
Le Mars Municipal/Le Mars IA	LRJ	19 NE	13	300' 1 m	5056'
Harold Davidson Field/Vermillion SD	VMR	24 NW	18	400' 1 m	4105'
Pender Municipal/Pender NE	0C4	27 SW	14	300' 1 m	3600'
Wayne Municipal/Wayne NE	LCG	28 SW	17	300' 1 m	4201'
Sioux County Regional/Orange City IA	SXK	32 NE	42	200' ½ m	5500'

Source: AIRNAV

Meteorological Considerations

Meteorological conditions affect the facility requirements of an airport. Temperature affects runway length, wind direction and speed affect runway orientation, and visibility and cloud ceiling conditions determine the need for runway navigational aids and lighting. The average maximum temperature for the Sioux City, Iowa area is 85.0 degrees Fahrenheit (July) which affects runway length.

Hourly metrological data was reviewed data from the Sioux Gateway Automated Surface Observation System (ASOS) facility available from the National Climatic Data Center (NCDC). Periodic "special" weather observations within each hour were removed. This method provides the true average weather trends at an airport without skewing conditions toward IFR where multiple observations may be taken each hour due to changing conditions.

METEOROLOGICAL DATA

Local weather conditions are a significant factor in the design and development of airport facilities since they affect aircraft performance.

Prevailing winds are from the northwest and are generally aligned with the airport's runway configuration. Crosswind or tailwind conditions can be hazardous to aircraft operations if they exceed the operational capabilities of the airplane or flight crew. The smallest aircraft are typically the most affected operationally by crosswinds.

A runway's wind coverage is determined by an aircraft's ability to operate with a "direct" crosswind, which is defined as 90 degrees to the direction of travel. For planning purposes, FAA has defined the maximum direct crosswind for small aircraft at 10.5 knots (12 mph). For increasingly larger aircraft, 13 knots, then 16 knots, then 20 knots for the largest aircraft. Aircraft can operate safely in progressively higher wind speeds as the crosswind angle decreases and the wind direction aligns more closely with the direction of flight. Ideally, an aircraft will take off and land directly into the wind or with a light crosswind. The FAA recommends that primary runways accommodate at least 95 percent of local wind conditions. **Table 1-2** provides the calculated all-weather wind coverage for the airport.

Table 1-2 – All-Weather Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 15-33	95.32%	98.09%	99.34%

Source: KSUX ASOS (2012-2021, Hourly) from National Climactic Data Center, 86,803 Total Observations

Wind coverage and weather conditions are further evaluated based on the two different flight rules, visual (VFR) and instrument (IFR). Visual Meteorological Conditions (VMC) are encountered when the visibility is 3 nautical miles or greater, and the cloud ceiling height is 1,000 feet or greater. Conditions less than these weather minimums are considered Instrument Meteorological Conditions (IMC) requiring all flights to be operated under IFR requirements.

Wind coverage during VMC is evaluated to determine the ideal alignment for runways used during visual operations, such as VFR flight training (see **Table 1-3 VMC Wind Coverage**). Wind coverage during IMC is evaluated to determine the ideal alignment for instrument approaches to an airport's runway see **Table 1-4 IMC Wind Coverage**).

Table 1-3 – VMC Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 15-33	95.46%	98.19%	99.39%

Source: KSUX ASOS (2012-2021, Hourly) from National Climactic Data Center, 81,015 Total Observations

Table 1-4 – IMC Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 15-33	93.33%	96.79%	98.57%

Source: KSUX ASOS (2012-2021, Hourly) from National Climactic Data Center, 5,788 Total Observations

Based on true hourly weather data the airport experiences IMC weather conditions 6.67 percent of the time. When considering an instrument approach weather minimum of 400-foot cloud ceiling and 1-mile visibility, the airport has weather conditions below this criterion 5.6 days per year where the airport is not usable. Improving to a 250-foot cloud ceiling and ¾-mile visibility will only add 1.5 more days per year leaving 4.1 days still below minimums. **It is recommended to improve the approach to 400' ceiling and 1 mile visibility which will improve accessibility to 98.48% or 359.4 days per year.**

Table 1-5 – Meteorological Analysis

Weather Condition	Percentage	Days per Year	Hours per Year
VMC	93.33%	340.7	8,176
IMC to 400' Ceiling 1 mile Visibility	5.15%	18.7	451
IMC to 250' Ceiling ¾ mile Visibility	0.43%	1.5	37
Below Weather Minimums	1.09%	4.1	96
Total	***100.0%***	*365.0*	***8,760***

Source: KSUX ASOS (2012-2021, Hourly) from National Climactic Data Center, 86,803 Total Observations

Critical Design Aircraft

The critical design aircraft types must be identified to determine the appropriate airport design standards to incorporate into airport planning. The existing and future critical design aircraft characteristics at Graham Field (7K7) are summarized as follows. The future design aircraft is an ARC B-II, TDG-2A turbojet airplane. The heaviest aircraft would be 39,700 pounds (dual wheel). The ultimate design aircraft is an ARC C-III, TDG-2A turbojet airplane. The heaviest aircraft would be 73,000 pounds (dual wheel).

Table 1-6 – Airfield Design Aircraft Summary

Design Characteristics	Future	Ultimate
Aircraft Make/Model	Dassault Falcon 50	Dassault Falcon 8X
Airplane Approach Category	B	C
Airplane Design Group	II	III
Taxiway Design Group	2A	2A
Wingspan	61’ 11”	86’ 3”
Length	60’ 9”	80’ 3”
Height	22’ 11”	25’ 7”
Cockpit to Main Gear	26’ 11”	35’ 9”
Main Gear Width	15’ 3”	16’ 8”
Approach Speed (1.3 x Stall)	100 knots	106 knots
Maximum Takeoff Weight	39,700 pounds	73,000 pounds
Landing Gear Configuration	Dual Wheel	Dual Wheel

Source: Dassault Aviation, KLJ Analysis

RUNWAY APPROACH/DEPARTURE SURFACES

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for safety for landing aircraft. These surfaces are identified in Paragraph 3.6 of FAA AC 150/5300-13B. The departure surface applies to runways with instrument departures available. It begins at the end of the takeoff distance available and extends upward and outward at a 40:1 slope. No new penetrations are allowed unless an FAA study has been completed and a determination of no hazard has been issued. The applicable approach/departure surface standards are identified in **Table 1-7**.

Table 1-7 – Approach/Departure Surface Requirements

Runway End(s)	Par. 3.6 Surface	Description	Slope
Existing			
15, 33	2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more (visual, day/night)	20:1
Future & Ultimate			
15, 33	5	Approach end of runways expected to accommodate instrument approaches having visibility minimums greater than or equal to ¾ mile	20:1
15, 33	6	Approach end of runways expected to accommodate instrument approaches with vertical guidance	30:1
15, 33	7	Departure runway ends used for any instrument operations	40:1

Source: FAA AC 150/5300-13B, KLJ Analysis

Based on the Critical Design Aircraft and the planned approach minimums, the design standards for Runway 15/33 are provided in detail in **Table 1-8 Runway 15/33 Design Standard Matrix**.

Table 1-8 – Runway 15/33 Design Standard Matrix

Design Standard	Facility Requirement or Recommendation		
	Existing	Future	Ultimate
Runway Identification	15/33	15/33	15/33
Runway Classification	Utility	Other-Than-Utility	Other-Than-Utility
Runway Design Code (RDC)	A-I-Vis	B-II-5000	C-III-5000
Approach Reference Code (APRC)	-	D-IV-5000	D-IV-5000
Departure Reference Code (DPRC)	-	D-IV	D-IV
Pavement Strength (Wheel Loading)	12,500 (SW)	40,000 (DW)	80,000 (DW)
Runway Width	36’	75’	75’
Runway Length	2,230’	’	’
Displaced Threshold	0’	0’	0’
Take Off Run Available (TORA)	2,230’	’	’
Take Off Distance Available (TODA)	2,230’	’	’
Accelerate Stop Distance (ASDA)	2,230’	’	’
Landing Distance Available (LDA)	2,230’	’	’
Runway Safety Area (RSA)			
RSA Width	120’	150’	500’
RSA Length Past Departure End	240’	300’	1,000’
RSA Length Prior to Threshold	240’	300’	1,000’
Runway Object Free Area (ROFA)			
ROFA Width	250’	500’	800’
ROFA Length Past Departure End	240’	300’	1,000’
ROFA Length Prior to Threshold	240’	300’	600’
Runway Object Free Zone (ROFZ)			
ROFZ Width	120’	400’	400’
ROFZ Prior/Past Threshold	200’	200’	200’
Runway Protection Zone (RPZ)			
RPZ Start from Runway	200’	200’	200’
RPZ Length	1,000’	1,000’	1,700’
RPZ Inner Width	250’	500’	1,000’
RPZ Outer Width	450’	700’	1,510’
Parallel Taxiway Centerline	150’	240’	400’
Hold Position	125’	200’	250’
Aircraft Parking Area	125’	250’	500’
Runway Lighting Type	-	MIRL	MIRL
Runway Marking Type	-	Non-Precision	Non-Precision
14 CFR Part 77 Approach Category	20:1	34:1	34:1
Approach Type	Visual	NPI	NPI
Visibility Minimums	Visual	1 mile	¾ mile

Source: FAA AC 150/5300-13B, KLJ Analysis

AREA AIRSPACE

7K7 is within the Class D airspace of Sioux Gateway (SUX) airport. This airspace is considered sufficient to instrument approach procedures for 7K7.

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 "imaginary" three-dimensional airspace surfaces and are obstructions. **Table 1-9** depicts the existing, future, and ultimate approach airspace surfaces for 7K7:

Table 1-9 – Part 77 Approach Airspace Requirements

Runway End	Approach Standards	Part 77 Code	Inner Width*	Outer Width	Length	Slope
Existing						
15, 33	Visual Utility	A	250'	1,250'	5,000'	20:1
Future						
15, 33	Non-Precision Other-Than-Utility No lower than ¾ mile	C	500'	3,500'	10,000'	34:1
Ultimate						
15, 33	Non-Precision Other - Than-Utility As low as ¾ mile	D	1,000'	4,000	10,000'	20:1

*Source: Title 14 CFR Part 77, KLJ Analysis *Inner width is also the Primary Surface width driven by the most demanding approach to a runway.* ***Bold*** *indicates change from existing standard.*

Any existing, future, or ultimate Part 77 obstructions located around 7K7 will be identified on the ALP for further action.

APPENDIX A: GLOSSARY OF TERMS

Introduction

Combining the extremely technical language of airports and aviation with the bureaucratic language of government organizations can create a myriad of unusual words and term. The combination of technical language and "governmentese" often results in many short-hand phrases or acronyms. This appendix presents many of the terms and acronyms used throughout the master plan.

Glossary of Terms

ABOVE GROUND LEVEL (AGL): The elevation of a point or surface above the ground.
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.
ADVISORY CIRCULAR: Publications issued by the FAA providing recommendations relative to policy, guidance, and information on specific aviation subject. The recommendations in these publications are considered mandatory requirements for airports that have received federal grants.
AIR CARRIER: An operator that: (1) performs at least five round trips per week between two or more points and publishes flight schedules specifying the times, days of the week, and places between which such flights are performed; or (2) transports mail by air under a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.
AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.
AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on airport property designed to protect all aspects of aircraft operations.
AIRCRAFT OWNERS AND PILOTS ASSOCIATION (AOPA): A private organization serving the interests and needs of general aviation pilots and aircraft owners.
AIRCRAFT APPROACH CATEGORY (AAC): A grouping of aircraft based on 1.3 times their stall speed in landing configuration at their maximum certificated landing weight. The AAC categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF): An airport service and facility that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.
AIRFIELD: The portion of an airport that contains facilities necessary for aircraft operations.
AIRLINE HUB: A category of commercial service airports or group of commercial service airports in a metropolitan or urban area based on the percentage of annual national enplanements at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. The categories form the basis for the apportionment of entitlement funds.

AIRPLANE CLASSIFICATION NUMBER (ACN): An international method that expresses the effect of an individual aircraft on different pavements with a unique number that varies according aircraft weight and configuration, pavement type, and subgrade strength.
AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based on wingspan. The groups are:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.
AIRPORT BEACON: A navigational aid located at an airport that displays a rotating light beam to identify the type of airport.
AIRPORT CAPITAL IMPROVEMENT PLAN (ACIP): The Federal Aviation Administration planning program that identifies, prioritizes, and distributes airport development funds required to meet the needs of the National Airspace System as specified by national goals and objectives.
AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).
AIRPORT IMPROVEMENT PROGRAM (AIP): A program created under the Airport and Airway Improvement Act of 1982 to provide funding for airport planning and development.
AIRPORT LAYOUT PLAN (ALP): The airport drawing showing boundaries and proposed additions to all areas owned or controlled by the sponsor for airport purposes, including the location and nature of existing and proposed airport facilities and structures, and the location on the airport of existing and proposed non-aviation areas and improvements.
AIRPORT MASTER PLAN: A long-range plan for airport development, including descriptions of the data and analyses on which the plan is based.
AIRPOR T OBSTRUCTION CHAR T: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, with representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads, and other airport vicinity details.
AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) and physical characteristics (Airplane Design Group) of the most demanding airplanes projected to operate at an airport.
AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.
AIRPORT REFERENCE TEMPERATURE: The mean maximum temperature of the hottest month.
AIRPORT SPONSOR: The entity legally responsible for the management and operation of an airport, including the fulfillment of the requirements of applicable laws and regulations.
AIRPORT SURFACE DETECTION EQUIPMENT (ASDE): A radar system providing air traffic controllers with a visual representation of aircraft and other vehicles ground movements on the airfield.
AIRPORT SURVEILLANCE RADAR (ASR): The primary radar located at an airport or in an air traffic control terminal area that depicts the location of aircraft in the air. The signal only provides the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument flight rule (IFR) room if radar equipped, using air to ground communications and/or radar, visual signaling and other methods to provide safe and expeditious movement of terminal air traffic.

AIRPORTS GEOGRAPHIC INFORMATION SYSTEM (AIRPORTS GIS or AGIS): Used by the FAA to collect airport and aeronautical data to support the FAA's next generation (NextGen) aviation system. AGIS provides standards for surveying and data collection to assist the FAA in the development of instrument approaches and provides the basis for electronic ALPs (eALP).

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the enroute phase of flight.

AIRSIDE: The portion of an airport containing the facilities necessary for the operation of aircraft. This normally includes, runways, taxiways, aprons, and hangar areas.

AIRSPACE: The volume of space above the surface of the ground provided for the safe operation of aircraft.

AIR TAXI: An air carrier certificated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide on demand, public transportation of persons and property by aircraft. Generally, operates small aircraft "for hire" for specific trips.

AIR TRAFFIC CONTROL (ATC): A service operated by an appropriate FAA designated organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR TRANSPORT ASSOCIATION OF AMERICA (ATA): An organization that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. The ATA promotes air transportation safety by coordinating industry and governmental safety programs and serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level or above ground level.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility that provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: See Part 77.

APRON: A specified portion of the air field used for passenger, cargo, or freight loading and unloading, aircraft parking, and the refueling, maintenance, and servicing of aircraft.

AREA NAVIGATION (RNAV): The air navigation procedure that provides the capability to establish and maintain a flight path on an arbitrary course.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATED WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record and relay weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B): A major component of the FAA's NextGen system, where aircraft equipped with GPS receivers can transmit their location and altitude to other nearby aircraft and to air traffic control.

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system that senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or property interest in land over which the unobstructed right of flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

BASE LEG: See "traffic pattern."

BASED AIRCRAFT: The total number of active general aviation aircraft that use or may be expected to use a specific airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface beyond the end of a runway for the purpose of eliminating ground surface erosion caused by the wind generated by aircraft engines at the initiation of a takeoff.

BUILDING RESTRICTION LINE (BRL): A theoretical line on an airport layout plan beyond which airport buildings must not be located in order to maintain safe aircraft operations.

CAPITAL IMPROVEMENT PLAN (CIP): A program for the design and construction of airport improvements needed to accommodate the operational and passenger activity at an airport.

CEILING: The cloud height above the ground surface, which is reported as either broken or overcast.

CIRCLING APPROACH: A pilot maneuver to align the aircraft with the runway for landing when flying a predetermined circling instrument approach procedure under IFR.

CLASS A, B, C, D, E, G AIRSPACE: See Controlled Airspace

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY (CTAF): A radio frequency designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: See Part 77.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including flight level FL600 (60,000 feet). All pilots must operate their aircraft under IFR.

- **CLASS B**: Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The configuration of Class B airspace is unique to each airport, but typically consists of two or more layers of airspace and is designed to contain all published instrument approach procedures to the airport. An air traffic control clearance is required for all aircraft operating in the area.
- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (reported as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a five nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.
- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the airport elevation (reported as MSL) surrounding airports that have an operational control tower. Class D airspace is individually tailored and configured to encompass published instrument approach procedures. Unless otherwise authorized, all pilots must establish two-way radio communication.
- **CLASS E**: Generally, controlled airspace that is not classified as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.
- **CLASS G**: Generally, that airspace not classified as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace
CROSSWIND: A wind that is not parallel to a runway centerline or to the intended flight path of an aircraft.
CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.
CROSSWIND LEG: See "traffic pattern."
DECIBEL: A unit of noise representing a level relative to logarithmic scale.
DECISION HEIGHT: The height above the runway surface at which a decision must be made to either continue the approach or execute a missed approach.
DECLARED DISTANCES: The distances declared available for an airplane's: takeoff runway; takeoff distance; accelerate-stop distance; and landing distance requirements as defined below:

- **TAKEOFF RUNWAY AVAILABLE (TORA)**: The runway length declared available and suitable for the ground run of an airplane taking off;
- **TAKEOFF DISTANCE AVAILABLE (TODA)**: The TORA plus the length of any remaining runway and/or clearway beyond the far end of the TORA;
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)**: The runway plus stopway length declared available for the deceleration of an aircraft aborting a takeoff; and

- **LANDING DISTANCE AVAILABLE (LDA)**: The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION (DOT): The federal government organization including the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.
DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport as designation by the Secretary of Transportation or Congress to meet a specified national priority such as enhancing capacity, safety, and security, or mitigating noise.
DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the physical beginning of the runway.
DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground-based) used to measure in nautical miles, the slant range distance of an aircraft from the DME navigational aid.
DNL: (Day/Night Level) The 24-hour A-weighted average aircraft sound level between 10 PM and 7 AM as averaged over a span of one year. It is the FAA standard metric for deter mining the cumulative exposure of individuals to noise.
DOWNWIND LEG: see "traffic pattern."
EASEMENT: The agreed upon legal right of one party to use a portion of the real estate rights of another party as specified in the easement document.
ELEVATION: The vertical distance measured in feet above mean sea level.
ENROUTE: The portion of a flight between departure and arrival terminal areas.
ENPLANED PASSENGERS: The total number of revenue passengers boarding air craft, including originating, stop-over, and transfer passengers, in scheduled and non-scheduled services.
ENPLANEMENT: The loading of passengers, cargo, freight, or mail on an aircraft.
ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based on its annual passenger enplanements.
ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed in accordance with the National Environmental Policy Act (NEPA) to determine whether an action would significantly affect the environment and thus require a more detailed environmental impact statement.
ENVIRONMENTAL AUDIT: An assessment of a party's compliance with the applicable environmental requirements of an authority's environmental compliance policies, practices, and controls.
ENVIRONMENTAL IMPACT STATEMENT (EIS): A NEPA document required of federal agencies for major projects or legislative proposals affecting the environment. The EIS is a decision-making tool describing the positive and negative effects of a proposed action.
ESSENTIAL AIR SERVICE (EAS): A federal program that guarantees air carrier service to selected small communities by providing subsidies as needed to prevent these cities from losing such service.
FEDERAL AVIATION REGULATIONS (FAR): The rules established by the executive departments and agencies of the Federal Government for aviation. FAR's are the aviation subset of the Code of Federal Regulations.
FINAL APPROACH: See "traffic pattern."
FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a significant effect on the environment and for which an environmental impact statement will not be prepared.
FIXED BASE OPERATOR (FBO): A provider of services to airport users. Such services include, but are not limited to: aircraft storage; fueling; flight training; repair; and maintenance.

FLIGHT LEVEL: An altitude designation within controlled airspace.
FLIGHT SERVICE STATION (FSS): An operations facility in the national flight advisory system that uses data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data. An FSS provides pre-flight and in-flight advisory services to pilots through air and ground based communication facilities.
FRANGIBLE NAVAID: A navigational aid that retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.
GENERAL AVIATION: That portion of civil aviation that encompasses all facets of aviation except commercial or military aircraft.
GLIDESLOPE (GS): The electronic component of an ILS system that emits signals providing vertical guidance using airborne instruments during instrument approaches during approach and landing.
GLOBAL POSITIONING SYSTEM (GPS): A system of satellites that enables navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.
GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo freight, and airport services.
HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.
HIGH INTENSITY RUNWAY LIGHTS (HIRL): The highest intensity or brightness of lights that delineate the lateral boundaries of a runway.
HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircraft movement off runways after landing (at speeds up to 60 knots), thus reducing runway occupancy time.
HORIZONTAL SURFACE: See 'Part 77'
INSTRUMENT APPROACH: An approach to an airport with the intent to land by an aircraft in accordance with an IFR flight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.
INSTRUMENT APPROACH PROCEDURE (IAP): A series of predetermined maneuvers under instrument flight conditions for a landing, or to a point from which a landing may be made visually.
INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight plan under which an air craft operates.
INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system that normally consists of the following electronic components and visual aids:

1. Localizer;
2. Glide Slope;
3. Outer Marker;
4. Middle Marker;
5. Approach lights.

INSTRUMENT METEOROLOGICAL CONDITIONS (IMC): Specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.
ITINERANT OPERATIONS: Arrivals and departures by aircraft to or from a location greater than 20 miles from the airport.

KNOTS: A unit of speed used in navigation that is equivalent to the number of nautical miles traveled in one hour.

LAND AND HOLD SHORT OPERATIONS (LAHSO): An air traffic control procedure intended to increase airport capacity without compromising safety that allows pilots to land and hold short of an intersecting runway, an intersecting taxiway, or some other designated point on a runway.

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM (LAAS): A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy, integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft based at the airport and operating in the local traffic pattern or within sight of the airport, including aircraft known to be departing for or arriving from flights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch-and-go training operations.

LOCALIZER (LOC): The component of an ILS that provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but not part of a complete ILS and not aligned with the runway.

LOCALIZER PERFORMANCE WITH VERTICAL GUIDANCE (LPV): A Global Positioning System (GPS) runway instrument approach procedure providing horizontal and vertical guidance. Accuracy levels are 16 meters horizontally and 20 meters vertically.

LOW INTENSITY RUNWAY LIGHTS (LIRL): The lowest intensity or brightness of lights designated for use in delineating the sides of a runway.

MEDIUM INTENSITY RUNWAY LIGHTS MIRL: The middle intensity or brightness of lights designated for use in delineating the sides of a runway.

MILITARY OPERATIONS: Aircraft operations performed by military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace.

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight route to be followed if, after an instrument approach, a landing is not completed. Missed approaches normally occur:

1. When an aircraft has descended to the decision height but has not established visual confirmation of the runway; or
2. When directed by air traffic control to pull up or to go around.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport used for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At airports with an airport traffic control tower, air traffic control clearance is required for entry onto the movement area.

NATIONAL AIRSPACE SYSTEM (NAS): The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS (NPIAS): The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.
NATIONAL TRANSPORTATION SAFETY BOARD (NTSB): A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certificates or licenses issued by the Secretary of Transportation.
NAUTICAL MILE: A unit of distance used in navigation that is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equal to approximately 1.15 statute mile.
NAVIGATIONAL AID (NAVAID): A term used to describe lights, signs, and associated supporting electronic equipment (e.g., PAPI, VASI, ILS, etc.) to aid in aircraft navigation.
NEXT GENERATION AIR TRANSPORTATION SYSTEM (NextGen): An umbrella term for the FAA's ongoing upgrade to the National Airspace System from a ground-based system of air traffic control to a satellite-based system of air traffic management.
NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.
NON-DIRECTIONAL BEACON (NDB): A radio beacon transmitting electronic signals in a 360-degree pattern. Pilot of an aircraft equipped with direction finding equipment can determine their bearing to/from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the ILS marker, it is normally called a Compass Locator.
NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure using horizontal but no vertical course guidance, such as VOR, TACAN, NDB, or LOC.
NOTICE TO AIRMEN (NOTAM): A time sensitive notice to pilots containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System that is considered essential to flight operations personnel.
OBJECT FREE AREA (OFA): An area on the ground free of objects, except those required for air navigation or aircraft ground maneuvering purposes, centered on a runway, taxiway, or taxilane to enhance the safety of aircraft operations.
OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that provides clearance for aircraft landing or taking off from the runway, and for missed approaches. The OFZ is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function.
OPERATION: A take-off or a landing.
OUTER MARKER (OM): An ILS navigation facility located four to seven miles from the runway threshold on the extended centerline, indicating the pilot is passing over the facility and can begin final approach.
PART 77: Federal laws under Title 14 of the Code of Federal Regulations identifying standards for the Safe, Efficient Use and Preservation of the Navigable Airspace. Several different imaginary airspace surfaces are defined for airports purposes of identifying an obstruction to air navigation:

- **PRIMARY SURFACE:** An imaginary surface defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific dimensions of this surface are a function of the type of approaches existing or planned for the runway.
- **APPROACH SURFACE:** An imaginary surface defined in FAR Part 77 that is longitudinally centered on an extended runway centerline and extends outward and upward from the primary

surface at each runway end at a designated slope and distance based on the type of available or planned approach by aircraft to a runway.

- **TRANSITIONAL SURFACE:** An imaginary surface extending outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.
- **HORIZONTAL SURFACE:** An imaginary airspace surface with the horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs.
- **CONICAL SURFACE:** An imaginary surface defined in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

PAVEMENT CONDITION INDEX (PCI): A numerical index between 0 and 100 which is used to indicate the general condition of a pavement. Surveying processes and calculation methods are standardized for airport pavements.

PAVEMENT CLASSIFICATION NUMBER (PCN): An international method of expressing the load-carrying capacity of a pavement as a single unique number, without specifying a particular aircraft or detailed information about the pavement structure.

PILOT CONTROLLED LIGHTING: Airport runway lighting systems controlled by pilots activating their microphone on a specified radio frequency.

PRECISION APPROACH: A standard instrument approach procedure that provides runway alignment and descent (glide slope) information. Precision approaches are categorized as:

- **CATEGORY I (CAT I):** A precision approach providing a decision height of not less than 200 feet and visibility of not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II):** A precision approach that provides a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III):** A precision approach that provides approaches with a decision height and visibility lower than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR (PAR): A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the final approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending beyond the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard that requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible N AVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: See Part 77.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.
RADIAL: A radio signal generated by a Very High Frequency Omni-directional Range (VOR) station that is defined as an azimuth from the station.
REGRESSION ANALYSIS: A statistical technique used to identify and quantify the relationships between forecast factors.
REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve flight service stations (FSSs)and are established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering enroute clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times.
REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ATCTs.
RELIEVER AIRPORT: An airport serving general aviation aircraft that might otherwise use a congested air-carrier airport.
REQUIRED NAVIGATION PERFORMANCE (RNP): A type of performance-based navigation that enables aircraft with required on-board navigation performance monitoring and alerting equipment to fly a specific path between defined points, fundamentally similar to RNAV.
RESTRICTED AREA: See special-use airspace.
RNAV: Area navigation: airborne equipment that permits flights over determined tracks within prescribed accuracy tolerances without the need to over-fly ground-based navigation facilities. Used enroute and for approaches to an airport.
RUNWAY: A defined rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 degrees would be designated Runway 18. The heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360 degrees). Aircraft can takeoff or land from either end of a runway, depending on wind direction.
RUNWAY ALIGNMENT INDICATOR LIGHT (RAIL): A series of high intensity, sequentially flashing lights installed on the extended runway centerline, usually in conjunction with an approach lighting system.
RUNWAY END IDENTIFIER LIGHTS (REIL): Two synchronized flashing lights, one on each side of the runway threshold, that provide rapid and positive identification of the approach end of a particular runway.
RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.
RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape with dimensions determined by the aircraft approach speed and runway approach type and minima.
RUNWAY SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.
RUNWAY VISIBILITY ZONE (RVZ): A specified area on the airport to be kept clear of permanent objects that provides an unobstructed line-of-site from any point five feet above the runway centerline to any point five feet above an intersecting runway centerline within the specified area.
RUNWAY VISUAL RANGE (RVR): An electronically-derived value in feet, representing the horizontal distance a pilot can see down the runway.

SPECIALIZED AVIATION SERVICE OPERATOR (SASO): Sometime known as single-service providers or special FBOs, a SASO is a commercial service provider on an airport typically providing a single specialized aeronautical service that does not meet the minimum standards of a full service fixed based operator (FBO).
SCOPE: The document that identifies and defines the tasks, emphasis, and level of effort associated with a project or study.
SEGMENTED CIRCLE: Visual indicators designed to provide traffic patter n Information at airports without operating control towers.
SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface that supports aircraft running off the pavement; provides enhanced drainage; and blast protection.
SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.
SMALL AIRPLANE: An airplane that has a maximum certified takeoff weight of up to 12,500 pounds.
SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area where activities must be confined because of their nature and/or where limitations may be imposed on aircraft operations that are not a part of those activities. Special-use airspace classifications include:

- **ALERT AREA**: Airspace that may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA**: Airspace where activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which aircraft flight is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, where the flight of aircraft, while not wholly prohibited, is subject to restrictions. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA**: Airspace that may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned IFR departure routing, preprinted for pilot use in graphic and textual form.
STANDARD TERMINAL ARRIVAL (STAR): A pre-planned IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.
STOP-AND-GO: Procedures wherein an aircraft will land, make a complete stop on the runway, and then takeoff. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.
STOPWAY: An area beyond the end of a takeoff runway designed to support aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing of aircraft.
STRAIGHT-IN LANDING/APPROACH: A landing aligned within 30 degrees of the final approach course following completion of an instrument approach.

TACTICAL AIR NAVIGATION (TACAN): An ultra-high frequency electronic air navigation aid providing suitably equipped aircraft with a continuous indication of bearing and distance to the TACAN station.
TAKEOFF RUNWAY AVAILABLE (TORA): See declared distances.
TAKEOFF DISTANCE AVAILABLE (TODA): See declared distances.
TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.
TAXIWAY: A defined path established for the taxiing of aircraft from one part of an airport to another.
TAXIWAY SAFETY AREA (TSA): A defined surface on each side of the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.
TERMINAL INSTRUMENT PROCEDURES: Published flight procedures for conducting instrument approaches to runways under instrument meteorological conditions
TERMINAL RADAR APPROACH CONTROL (TRACON): An element of the air traffic control system responsible for monitoring the enroute and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.
TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.
THRESHOLD: The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.
TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.
TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.
TOUCHDOWN ZONE (TDZ): The first 3,000 feet of the runway beginning at the threshold.
TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.
TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100-foot intervals. The basic system extends 3,000 feet along the runway.
TRAFFIC PATTERN: The traffic flow prescribed for aircraft landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and final approach, described as follows:

- **UPWIND LEG**: A flight path parallel to the landing runway in the direction of landing.
- **CROSSWIND LEG**: A flight path at right angles to the landing runway off its upwind end.
- **DOWNWIND LEG**: A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
- **BASE LEG**: The flight path at right angles to the landing runway off its approach end. The base leg normally extends from the down-wind leg to the intersection of the extended runway centerline.
- **FINAL APPROACH**: A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway.

UNCONTROLLED AIRPORT: An airport without an airport traffic control tower where Visual Flight Rules traffic is performed.
UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM): A non-government airport communications facility that may provide airport information. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

UPWIND LEG: See "traffic pattern."

VECTOR: A heading issued to an aircraft to provide radar navigational guidance.

VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION (VOR): A ground-based electronic navigation aid transmitting very high frequency radio signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION/ TACTICAL AIR NAVIGATION (VORTAC): A navigation aid providing co-located VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME).

VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, whose centerline is defined by radio navigation aids.

VISUAL APPROACH: An aircraft approach conducted in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport approach aid providing visual approach slope guidance to aircraft during a landing approach. The VASI emits a directional pattern of high intensity red and white focused light beams that indicate to the pilot they are on path when seeing red/white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's that provide two visual glide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, pilots and controllers use VFR to indicate the type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM (WAAS): An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of flight.

Acronyms and Abbreviations

AC:	advisory circular
ACN:	aircraft classification number
ADF:	automatic direction finder
ADG:	airplane design group
ADS-B:	automatic dependent surveillance - broadcast
AFSS:	automated flight service station
AGL:	above ground level
AGIS:	Airports Geographic Information System
AIP:	Airport Improvement Program
AIR-21:	Wendell H. Ford Aviation Investment and Reform Act for the 21st Century
ALS:	approach lighting system
ALSF-1:	standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT I configuration)
ALSF-2:	standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)
APV:	instrument approach procedure with vertical guidance
ARC:	airport reference code
ARFF:	aircraft rescue and firefighting
ARP:	airport reference point
ARTCC:	air route traffic control center
ASDA:	accelerate-stop distance available
ASR:	airport surveillance radar
ASOS:	automated surface observation station
ATCT:	airport traffic control tower
ATIS:	automated terminal information service
AVGAS:	aviation gasoline - typically 100 low lead (100LL)
AWOS:	automated weather observation station
BRL:	building restriction line
CFR:	Code of Federal Regulations
CIP:	capital improvement program
DME:	distance measuring equipment
DNL:	day-night noise level
DWL:	runway weight bearing capacity for aircraft with dual-wheel type landing gear
DTWL:	runway weight bearing capacity of aircraft with dual-tandem type landing gear
FAA:	Federal Aviation Administration
FAR:	Federal Aviation Regulation
FBO:	fixed base operator
FY:	fiscal year
GPS:	global positioning system
GS:	glide slope
HIRL:	high intensity runway edge lighting

IFR: instrument flight rules (FAR Part 91)
ILS: instrument landing system
IM: inner marker
LAAS: local area augmentation system
LAHSO: land and hold short operations
LDA: localizer type directional aid
LDA: landing distance available
LIRL: low intensity runway edge lighting
LMM: compass locator at middle marker
LOC: ILS localizer
LOM: compass locator at ILS outer marker
LPV: localizer performance with vertical guidance
MALS: medium intensity approach lighting system
MALSR: medium intensity approach lighting system with runway alignment indicator lights
MIRL: medium intensity runway edge lighting
MITL: medium intensity taxiway edge lighting
MLS: microwave landing system
MM: middle marker
MOA: military operations area
MSL: mean sea level
NAVAID: navigational aid
NDB: nondirectional radio beacon
NextGen: next generation air transportation system
NM: nautical mile (6,076 .1 feet)
NPES: National Pollutant Discharge Elimination System
NPIAS: National Plan of Integrated Airport Systems
NPRM: notice of proposed rulemaking
ODALS: omnidirectional approach lighting system
OFA: object free area
OFZ: obstacle free zone
OM: outer marker
PAC: planning advisory committee
PAPI: precision approach path indicator
PCN: pavement classification number
PFC: porous friction course
PFC: passenger facility charge
PCL: pilot-controlled lighting
PIW: public information workshop
PLASI: pulsating visual approach slope indicator
POFA: precision object free area
PVASI: pulsating/steady visual approach slope indicator
PVC: Poor visibility and ceiling.
RCO: remote communications outlet
REIL: runway end identifier lighting

RNAV: area navigation
RNP: required navigation performance
RPZ: runway protection zone
RSA: runway safety area
RTR: remote transmitter/receiver
RVR: runway visibility range
RVZ: runway visibility zone
SALS: short approach lighting system
SASO: specialized aviation service operator
SASP: state aviation system plan
SEL: sound exposure level
SID: standard instrument departure
SM: statute mile (5,280 feet)
SRE: snow removal equipment
SSALF: simplified short approach lighting system with sequenced flashers
SSALR: simplified short approach lighting system with runway alignment indicator lights
STAR: standard terminal arrival route
SWL: runway weight bearing capacity for aircraft with single-wheel type landing gear
STWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear
TACAN: tactical air navigational aid
TDZ: touchdown zone
TDZE: touchdown zone elevation
TAF: Federal Aviation Administration (FAA) Terminal Area Forecast
TODA: takeoff distance available
TORA: takeoff runway available
TRACON: terminal radar approach control
VASI: visual approach slope indicator
VFR: visual flight rules (FAR Part 91)
VHF: very high frequency
VOR: very high frequency omni-directional range
VORTAC: VOR and TACAN collocated
WAAS: wide area augmentation system

APPENDIX B: GENERAL AVIATION AIRPORTS 101

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.

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

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

Figure B-1 – Airfield Classification Systems

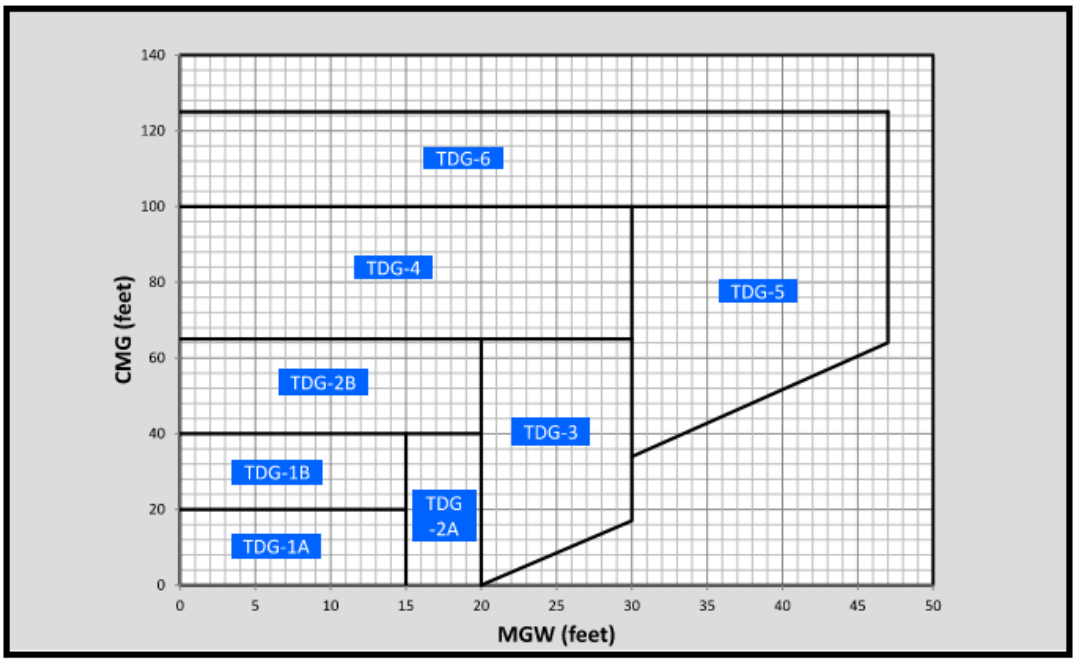
Aircraft Approach Category (AAC)		
AAC	**Approach Speed**	
A	Approach speed less than 91 knots	
B	Approach speed 91 knots or more but less than 121 knots	
C	Approach speed 121 knots or more but less than 141 knots	
D	Approach speed 141 knots or more but less than 166 knots	
E	Approach speed 166 knots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

*Source: FAA AC 150/5300-13B; *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 Figure 1-1

Figure 1-1. Taxiway Design Groups (TDGs)



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

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 Figure L-1

Departure Reference Code (DPRC)

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

Figure B-4 – Departure Reference Code

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

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 and **Figure B-6** provides the dimensions.

Figure B-5 – FAA Runway Protection Zone

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

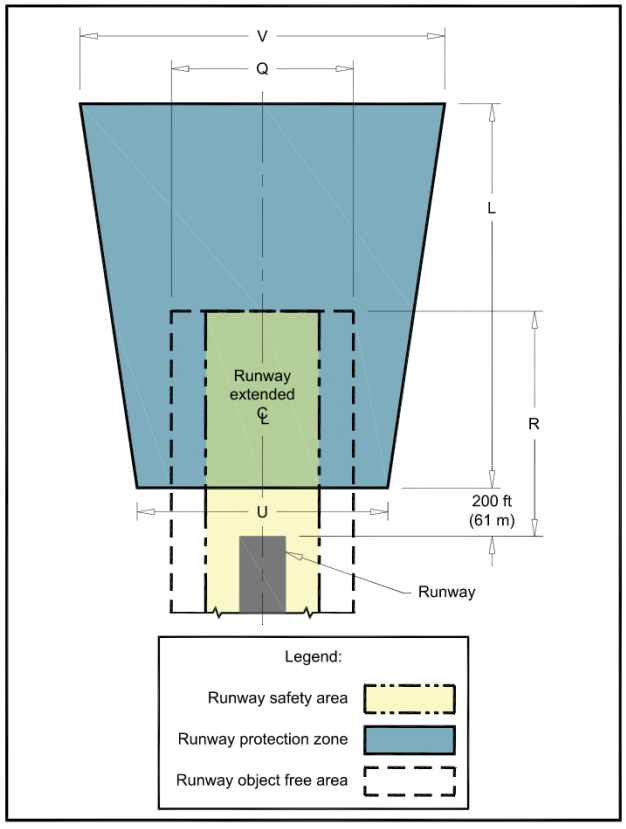
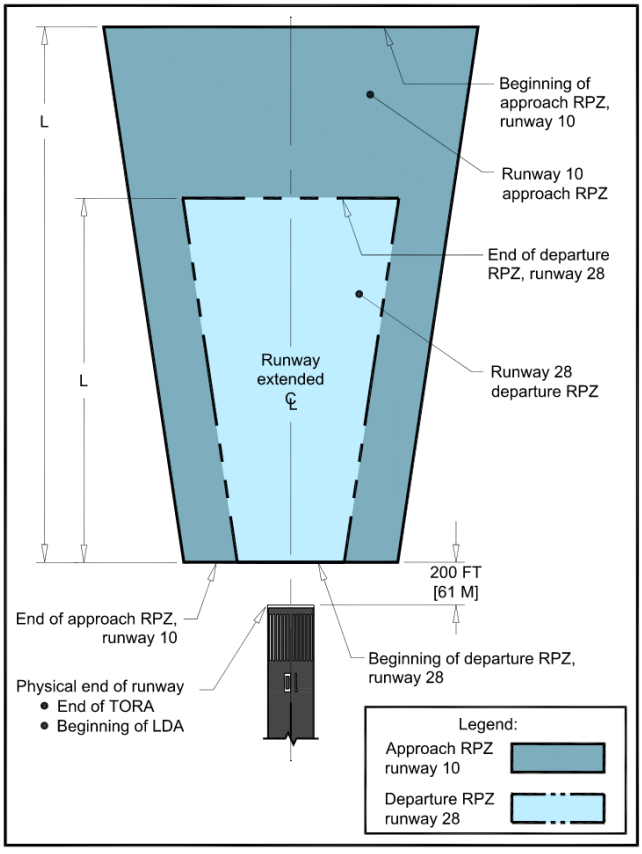


Figure 3-27. Runway with all Declared Distances Equal to the Runway Length



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. These departure surface is outlined in paragraph 3.6 of FAA AC 150/5300-13B and portrayed in Tables 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.

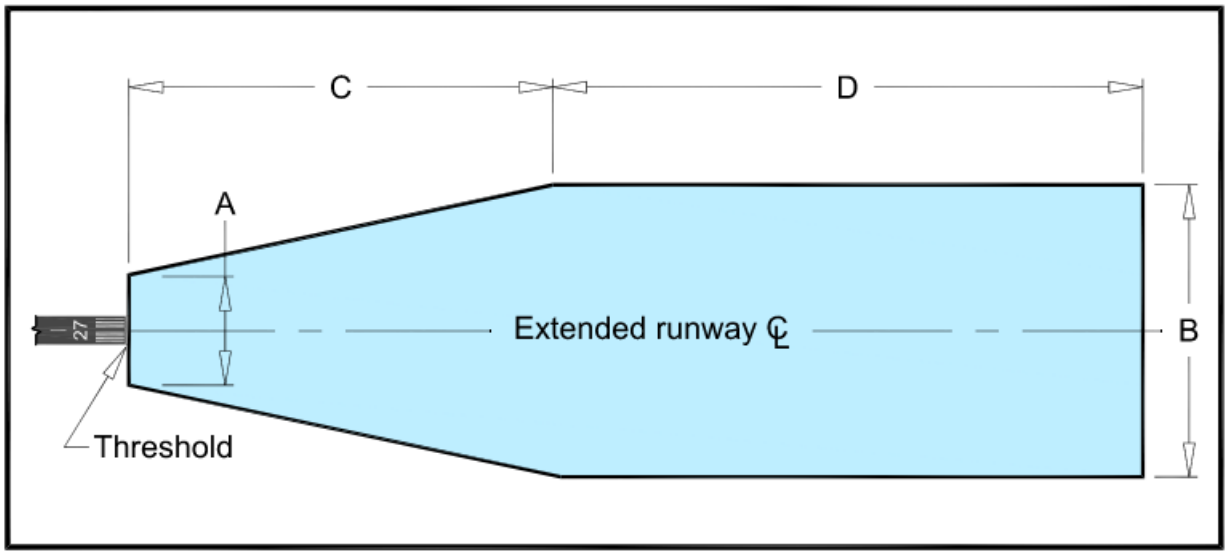
Figure B-7 – FAA Visual Approach Table 3-2

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

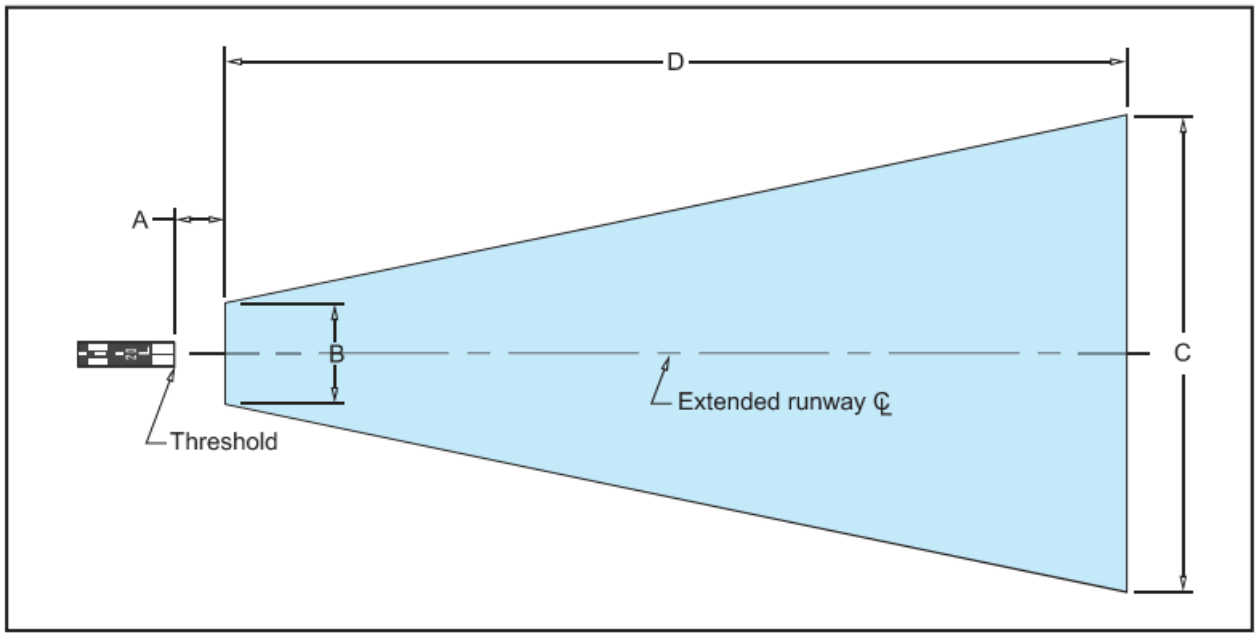
Figure B-8 – FAA NPI Approach Table 3-3

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

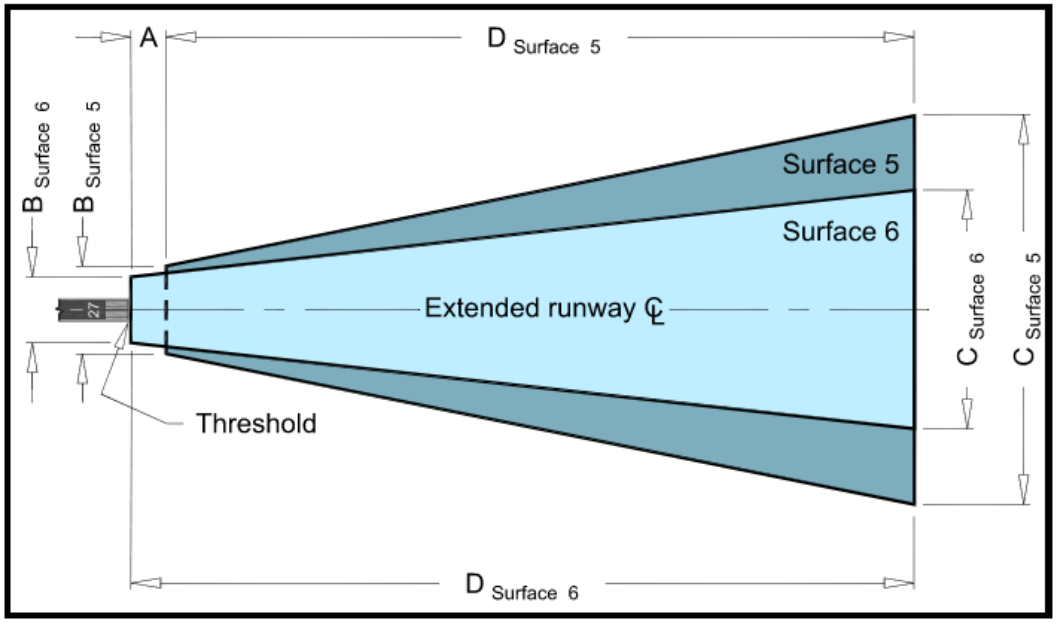
Note 1: Dimension A is relative to the runway threshold.

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

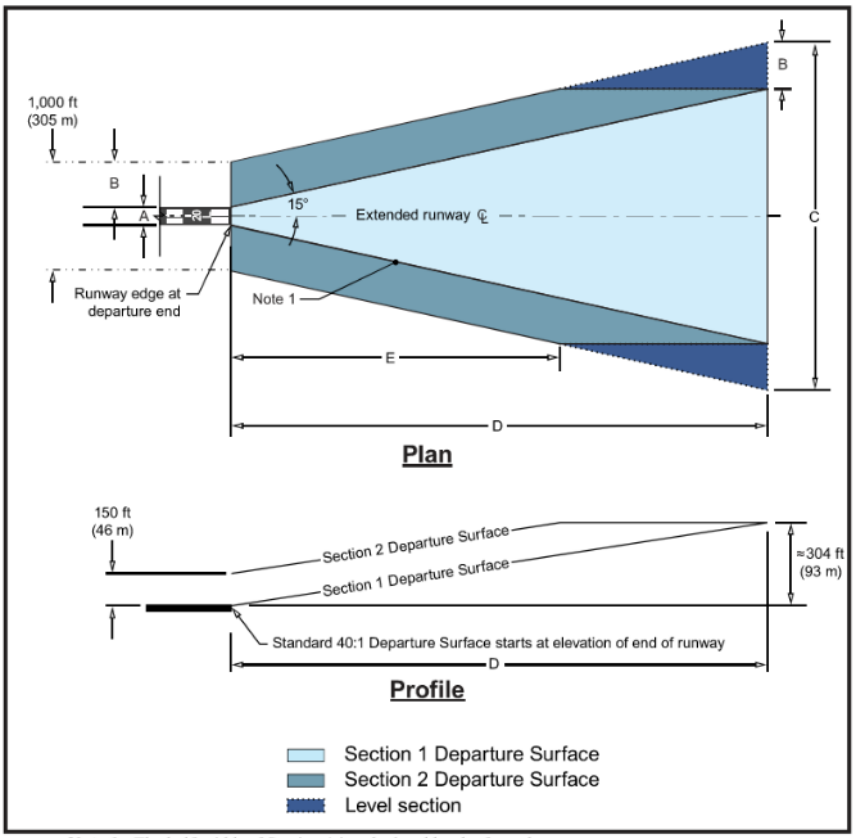
Figure B-10 – FAA Departure Table 3-5

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 Tables 4-1 and 4-2

Airspace Protection

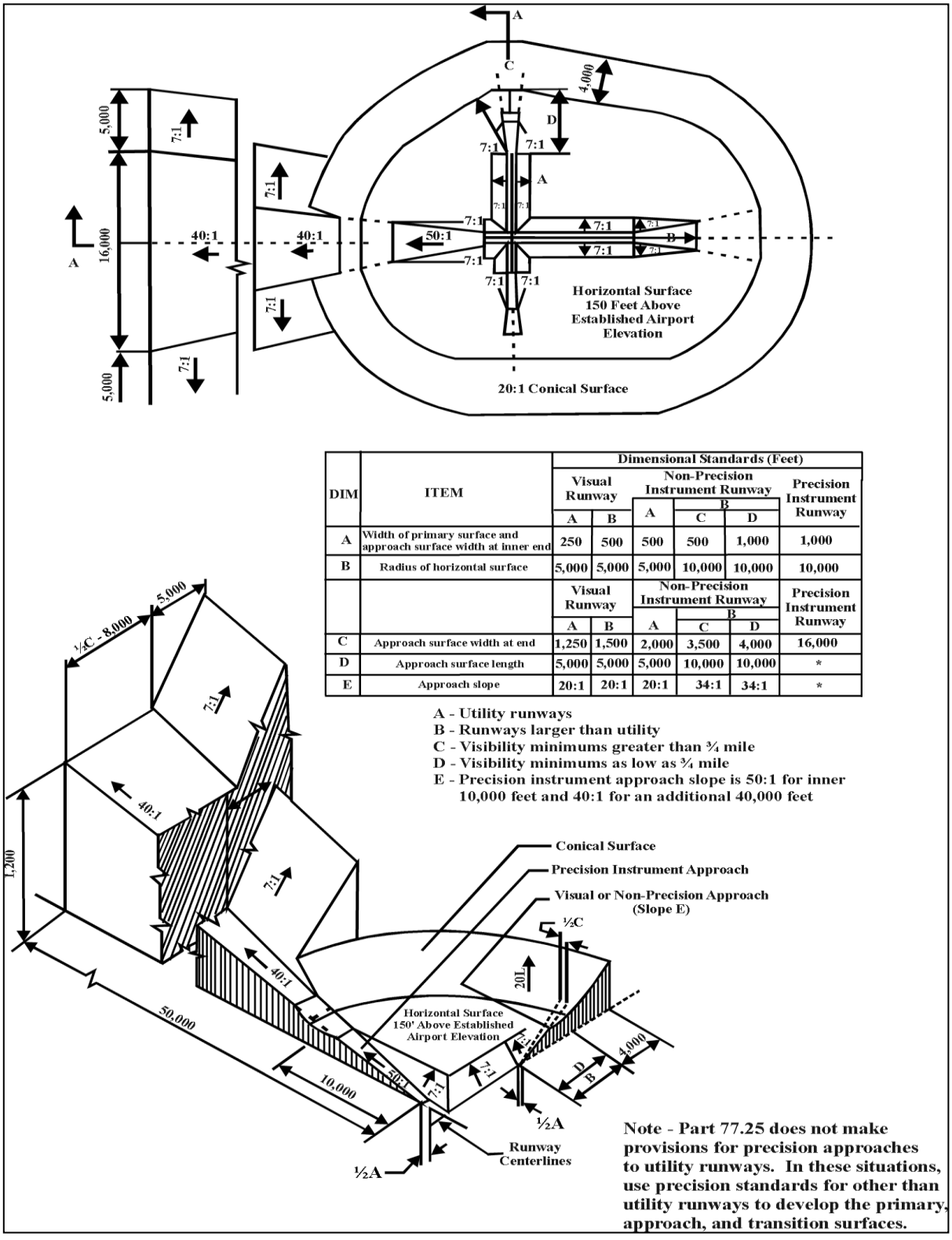
Airspace is an important resource around airports that is essential for safe flight operations. There are established standards to identify airspace obstructions around airports. FAA grant assurances (obligations) require the airport sponsor to take appropriate action to assure that airspace is adequately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

Gmail **Stephen Jones <sfjones@fly7k7.com>**

7K7 Preliminary Cost Estimates

1 message

Jake Braunagel <jake.braunagel@kljeng.com> Tue, May 10, 2022 at 5:57 PM
To: "Stephen Jones (sfjones@fly7k7.com)" <sfjones@fly7k7.com>

Stephen,

Below are some very rough preliminary cost estimates with 20% contingencies factored in due to unknowns:

- Runway 15-33 (8” Concrete – 75’ x 7,400’) with Runway Edge Lights, Lighted Signs, Beacon, Windcone, Segmented Circle, Prefabricated Electrical Vault Building, PAPIs, REILs - $18 million
- Parallel Taxiway & Connectors (8” Concrete – 35’ x 7,400’) with Taxiway Edge Lights and Lighted Signs - $10 million
- West Aprons and Taxilanes (8” Concrete) without Apron Edge Lights - $10 million
- Perimeter Fence - $1 million
- AWOS III - $0.5 million
- West Airpark Residential Taxilanes (4” Asphalt) - $1 million

TOTALS = $40.5 million

Some notable items not included in the above estimates: Terminal Building, Airport Owned Hangars, Instrument Landing System (ILS).

Thanks,

Jake Braunagel, PE

Aviation Department Manager

Registered (SD, MN, ND, NE, IA)

KLJ

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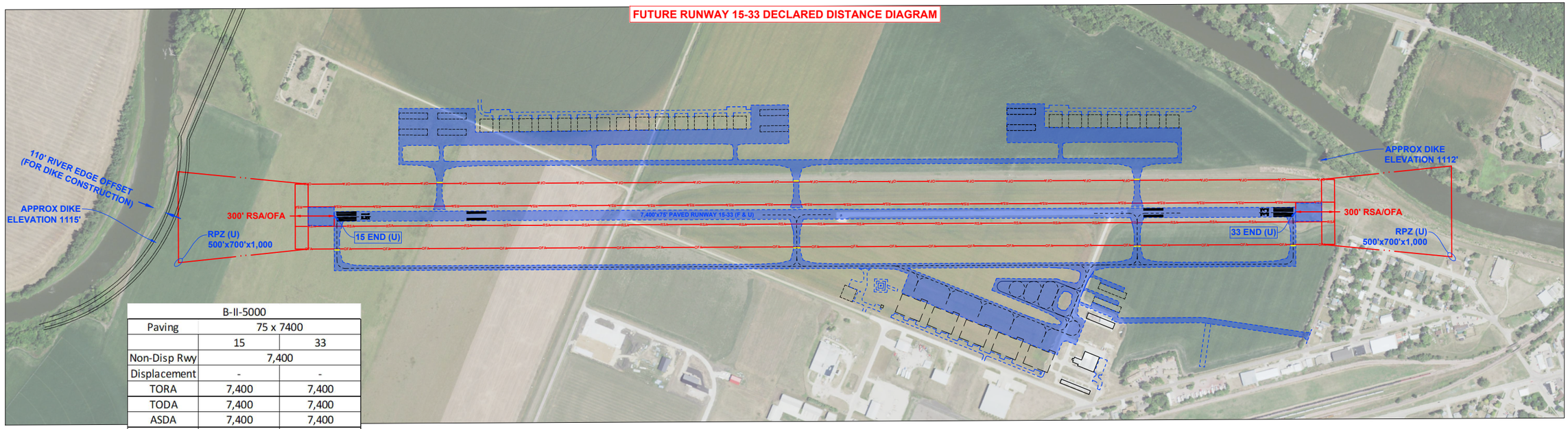
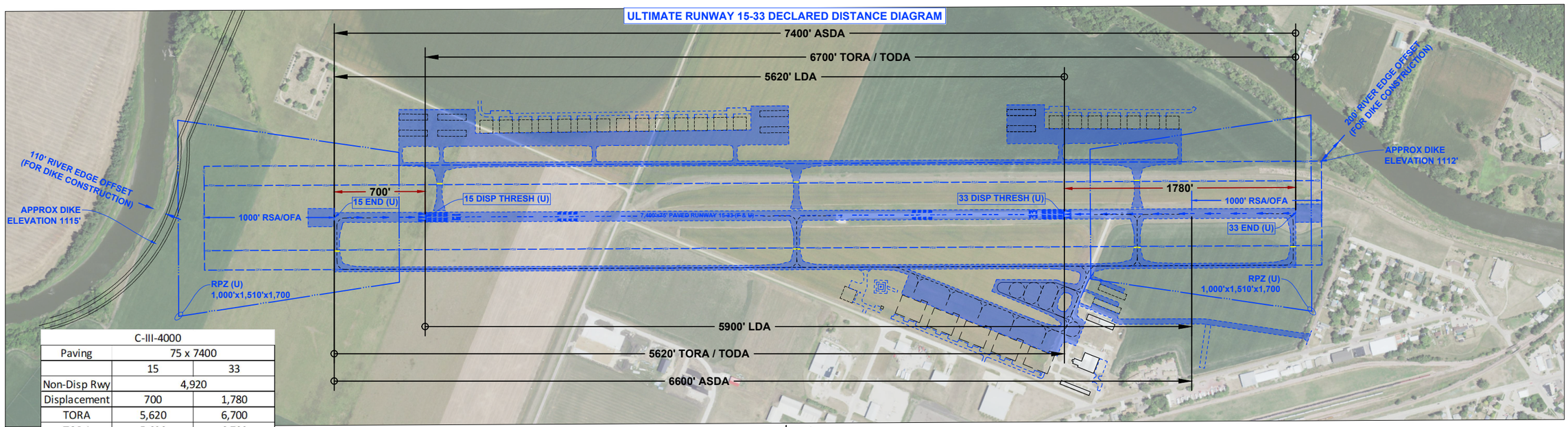
701-290-9218 Cell
5110 East 57th Street
Sioux Falls, SD 57108-8627
kljeng.com

FUTURE RUNWAY 15-33 DECLARED DISTANCE DIAGRAM

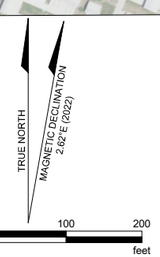


B-II-5000		
Paving	75 x 7400	
	15	33
Non-Disp Rwy	7,400	
Displacement	-	-
TORA	7,400	7,400
TODA	7,400	7,400
ASDA	7,400	7,400
LDA	7,400	7,400

ULTIMATE RUNWAY 15-33 DECLARED DISTANCE DIAGRAM



C-III-4000		
Paving	75 x 7400	
	15	33
Non-Disp Rwy	4,920	
Displacement	700	1,780
TORA	5,620	6,700
TODA	5,620	6,700
ASDA	5,920	7,400
LDA	4,950	5,620



100 0 100 200
scale feet

GRAHAM FIELD AIRPORT

GRAHAM AVIATION LLC (OWNER)

NORTH SIOUX CITY, SOUTH DAKOTA

TO BE USED AS A COMPLETE DRAWING SET FOR PLANNING PURPOSES ONLY, NOT FOR CONSTRUCTION

Airfield Capabilities Overview (Future & Ultimate)

DRAFTED MTK
REVIEWED KLP
PROJECT NUMBER 2205-00316

SHEET 3