

FAA Airport Protection Standards

Presented to: ICAO – Colombia Webinar

By: Michael Ferry, P.E., Senior Civil Engineer

Date: August 6, 2020



**Federal Aviation
Administration**

We are
Airports

Overview

- **Airport Design Standards**
 - Focus on Minimum Runway Standards
- **Airspace Protection**
- **Challenging Situations**



Airport Design Standards

- **Guidelines for a safe, efficient and economic airport system**
- **AC 150/5300-13, Airport Design**
 - *Standards and recommendations for the geometric layout and engineering design of runways, taxiways, aprons, and other facilities at civil airports.*
- **Part 139 requires some of these standards to be met (i.e. RSA)**



Standards

- Critical for safety
- How do FAA airports meet standards?
 - FAA pays for majority of airside projects
 - **FAA can only pay if grant applications meet standards**
 - Starts with Planning!



Focus Today: FAA Minimum Runway Design Standards

k. **Runway design standards.** As a minimum, runway design and runway extensions must evaluate the following design elements:

- **Eight minimum standards**

- Found in 5300-13

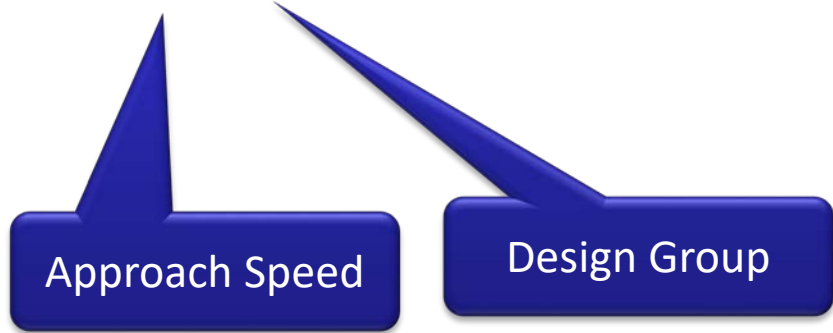
- 5 & 8 roughly equivalent

- (1) RSA, paragraph 307.
- (2) OFZ, paragraph 308.
- (3) Runway Object Free Area (ROFA), paragraph 309.
- (4) Runway Protection Zone (RPZ), paragraph 310.
- (5) Approach and Departure Surfaces, paragraphs 303.b and 303.c.
- (6) Runway to taxiway separation standards, interactive Table 3-5.
- (7) Runway visibility zone, Figure 3-7.
- (8) Threshold siting standards, Table 3-2.



Aircraft Design Group (ADG)

- Similar to ICAO
- Example: 737-800
 - D-III



41-feet, 2-inches



112-feet, 7-inches

$$\text{Speed}_{\text{Approach}} = 142 \text{ kts}$$

5300-13 Table 3-5

- Provides design dimensions for most critical design aspects
 - Example: Most 737s are C-IIIs

Table 3-5. Runway design standards matrix

| ITEM | | C – III | | | |
|---|---|---------------------------------|-----------------------|-------------------------|---------------------|
| | | Visual | Not Lower than 1 mile | Not Lower than 3/4 mile | Lower than 3/4 mile |
| Runway Design | | | | | |
| | Runway Length | Refer to paragraphs 302 and 304 | | | |
| | Runway Width ¹² | 150 ft | 150 ft | 150 ft | 150 ft |
| | Shoulder Width ¹² | 25 ft | 25 ft | 25 ft | 25 ft |
| | Blast Pad Width ¹² | 200 ft | 200 ft | 200 ft | 200 ft |
| | Blast Pad Length | 200 ft | 200 ft | 200 ft | 200 ft |
| | Crosswind Component | 16 knots | 16 knots | 16 knots | 16 knots |
| Runway Protection | | | | | |
| Runway Safety Area (RSA) | | | | | |
| | Length beyond departure end ^{9,10} | 1000 ft | 1000 ft | 1000 ft | 1000 ft |
| | Length prior to threshold ¹¹ | 600 ft | 600 ft | 600 ft | 600 ft |
| | Width | 500 ft | 500 ft | 500 ft | 500 ft |
| Runway Object Free Area (ROFA) | | | | | |
| | Length beyond runway end | 1000 ft | 1000 ft | 1000 ft | 1000 ft |
| | Length prior to threshold ¹¹ | 600 ft | 600 ft | 600 ft | 600 ft |
| | Width | 800 ft | 800 ft | 800 ft | 800 ft |
| Runway Obstacle Free Zone (ROFZ) | | | | | |
| | Length | Refer to paragraph 308 | | | |
| | Width | Refer to paragraph 308 | | | |
| Precision Obstacle Free Zone (POFZ) | | | | | |
| | Length | N/A | N/A | N/A | 200 ft |
| | Width | N/A | N/A | N/A | 800 ft |
| Approach Runway Protection Zone (RPZ) | | | | | |
| | Length | 1700 ft | 1700 ft | 1700 ft | 2500 ft |
| | Inner Width | 500 ft | 500 ft | 1000 ft | 1000 ft |
| | Outer Width | 1010 ft | 1010 ft | 1510 ft | 1750 ft |
| | Acres | 29.465 | 29.465 | 48.978 | 78.914 |
| Departure Runway Protection Zone (RPZ) | | | | | |
| | Length | 1700 ft | 1700 ft | 1700 ft | 1700 ft |
| | Inner Width | 500 ft | 500 ft | 500 ft | 500 ft |
| | Outer Width | 1010 ft | 1010 ft | 1010 ft | 1010 ft |
| | Acres | 29.465 | 29.465 | 29.465 | 29.465 |
| Runway Separation | | | | | |
| <i>Runway centerline to:</i> | | | | | |
| | Parallel runway centerline | Refer to paragraph 316 | | | |
| | Holding position ⁸ | 250 ft | 250 ft | 250 ft | 250 ft |
| | Parallel Taxiway/Taxilane centerline ² | 400 ft | 400 ft | 400 ft | 400 ft |
| | Aircraft parking area | 500 ft | 500 ft | 500 ft | 500 ft |
| | Helicopter touchdown pad | Refer to AC 150/5390-2 | | | |

Notes:

- Appendix 7 contains non-interactive tables for all RDCs.
- Values in the table are rounded to the nearest foot. 1 foot = 0.305 meters.



Federal Aviation Administration

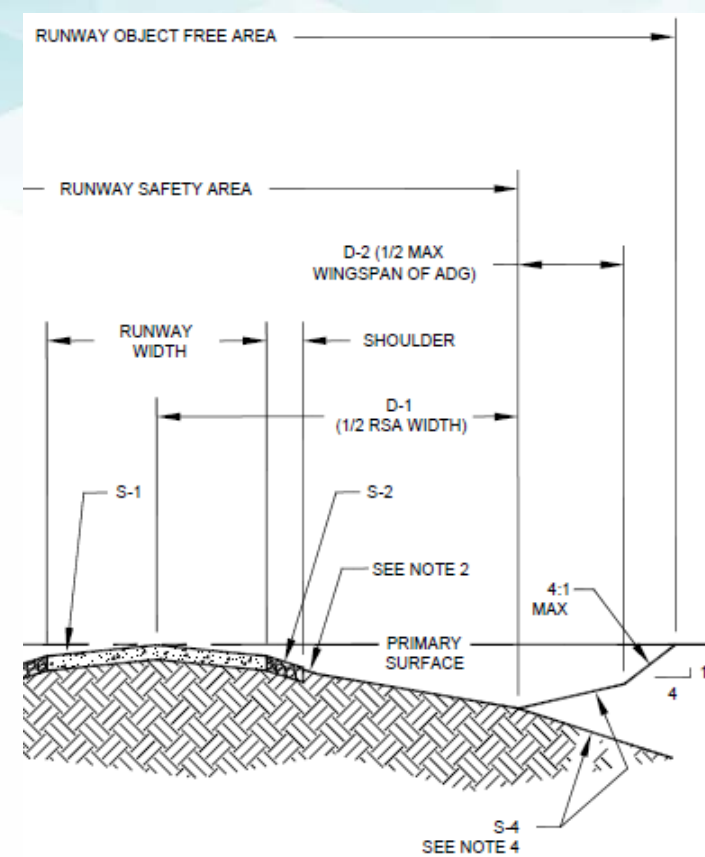
Runway Safety Area (RSA)

- **Safety of airplanes undershoot, overrun, or veer off the runway**
- **Accessibility for firefighting and rescue equipment**
- **Typical dimensions are 1,000 ft. in length by 500 ft. in width**



RSA Requirements

- No hazardous humps / ruts
- Clear except 3" or frangible
 - NavAids
- Support ARFF when dry
- Drained (grading or inlets)
- Isn't subject to a Modification of Standard (MOS)



| APPROACH CATEGORY | A & B | C, D, AND E |
|-------------------|--------------|--------------|
| S-1 | 1.0% TO 2.0% | 1.0% TO 1.5% |
| S-2 (≥S-1) | 1.5% TO 5.0% | 1.5% TO 5.0% |
| S-3 | 1.5% TO 5.0% | 1.5% TO 3.0% |

| ADG | I | II | III | IV | V | VI |
|---------------|---|----|------|----|------|-----|
| D-1 | D-1 IS 1/2 OF C (RUNWAY SAFETY AREA WIDTH). SEE INTERACTIVE TABLE 3-5. | | | | | |
| D-2 | 25 | 40 | 59 | 86 | 107 | 131 |
| S-4 (MAXIMUM) | 8:1 | | 10:1 | | 16:1 | |

Fixed-by-function designation for NAVAIDs

| NAVAID | Fixed-By-Function | | |
|----------------|-------------------|-------------------|----------------------|
| | In RSA | In ROFA | Associated Equipment |
| Airport Beacon | No | No | N/A |
| ALS | Yes | Yes | No ¹ |
| ASDE-X | No | No | N/A |
| ASOS, AWOS | No | No | N/A |
| ASR | No | No | N/A |
| ATCT | No | No | N/A |
| DME | No | No | No |
| GS | No ² | No ^{2,3} | No |
| IM | Yes | Yes | Yes |
| LDIN | Yes | Yes | No ¹ |
| LOC | No | No | No |
| LLWAS | No | No | No |
| MM | No | No | No |
| NDB | No | No | N/A |
| OM | No | No | No |

| | | | |
|--------------------------|-----|-----|-----------------|
| PRM | No | No | No |
| REIL | Yes | Yes | No ¹ |
| Runway Lights and Signs | Yes | Yes | No |
| RTR | No | No | No |
| RVR | No | Yes | Yes |
| RWSL | Yes | Yes | No |
| Taxiway Lights and Signs | Yes | Yes | No |
| VOR/TACAN/VORTAC | No | No | N/A |
| PAPI & VASI | Yes | Yes | No |
| WAAS | No | No | No |
| WCAM | No | No | No |
| WEF | No | No | No |
| Wind Cone | No | No | No |

Notes:

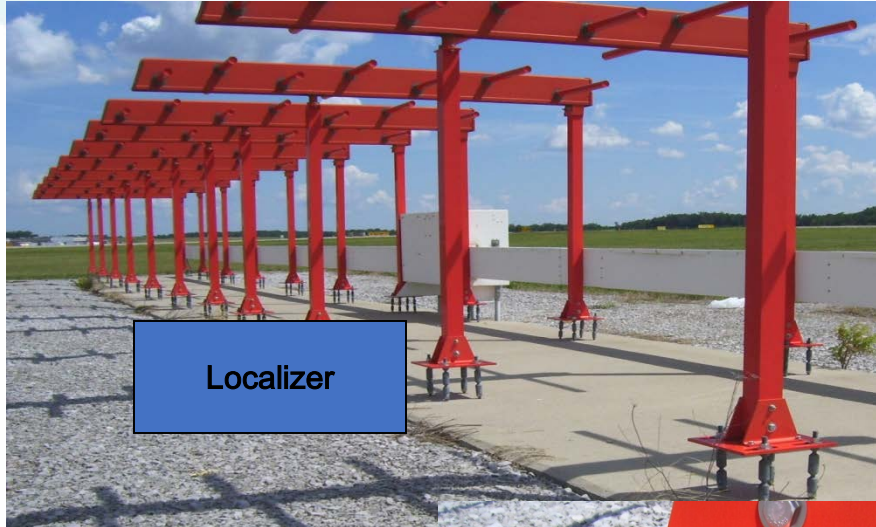
1. Flasher light power units (Individual Control Cabinets) are fixed-by-function.
2. End Fire glideslopes are fixed-by-function in the RSA/ROFA.
3. Allowing a GS within ROFA due to a physical constraint should be evaluated on a case-by-case basis.



Navigational Aids and Equipment



Low Impact Resistant Pole



Localizer



ALSF-2 Approach Lighting System



Precision Approach Path Indicator

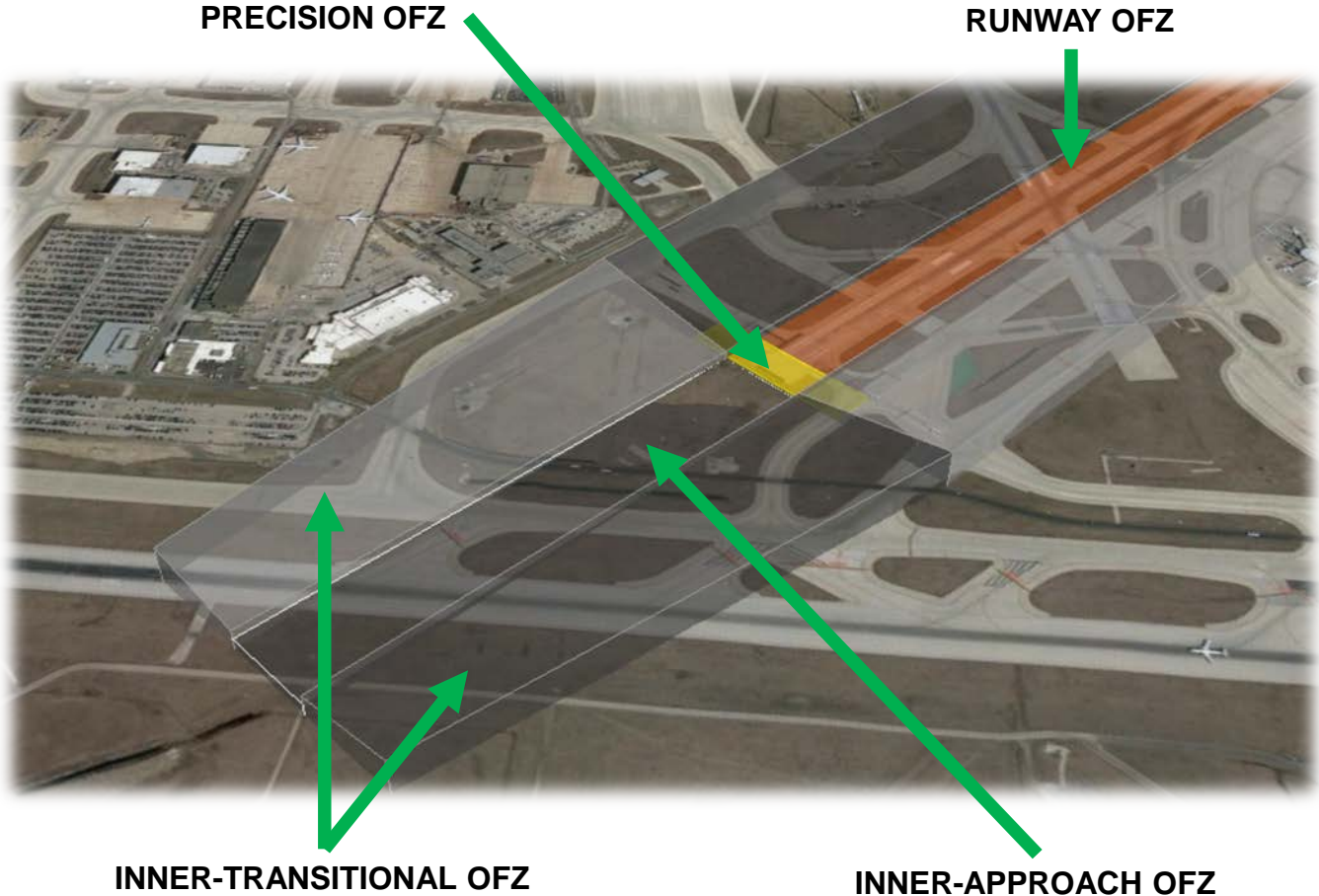


Frangible Bolts



Runway End Identifier Lights

Runway Obstacle Free Zone (OFZ)



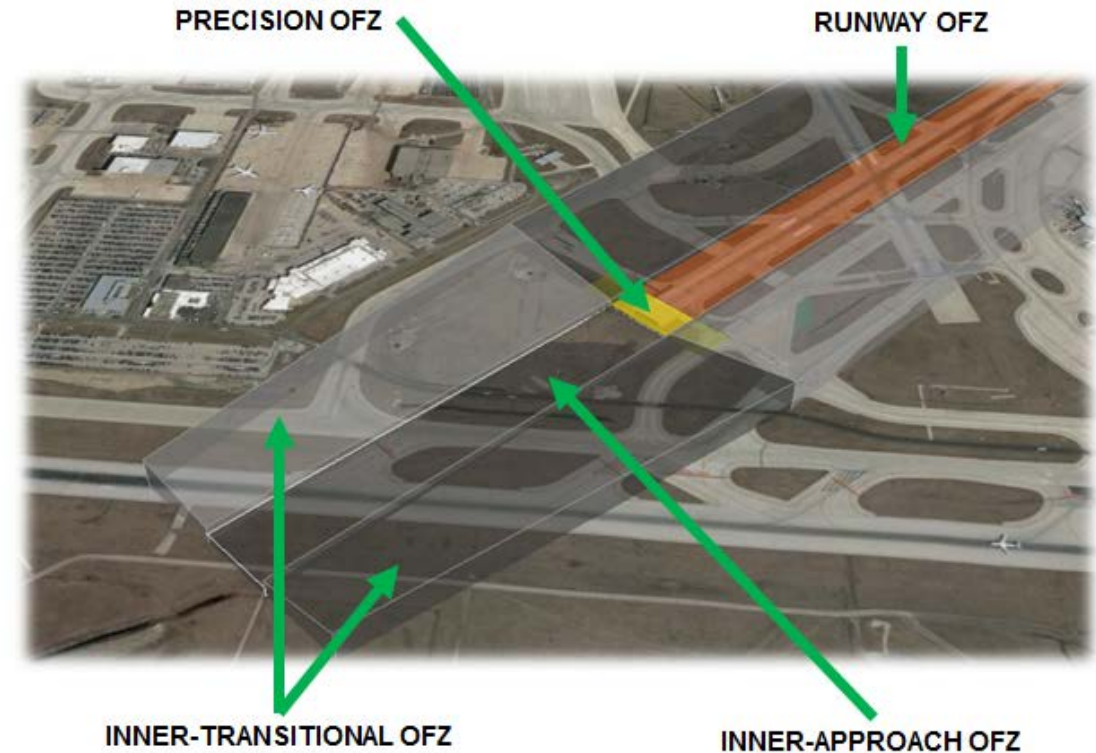
Key Facts:

- Only frangible NAVAIDs that need to be inside OFZ because of function is permitted to penetrate the OFZ.
- OFZ must be kept clear during operations.
- Shape is dependent on the approach minimums and the aircraft on approach



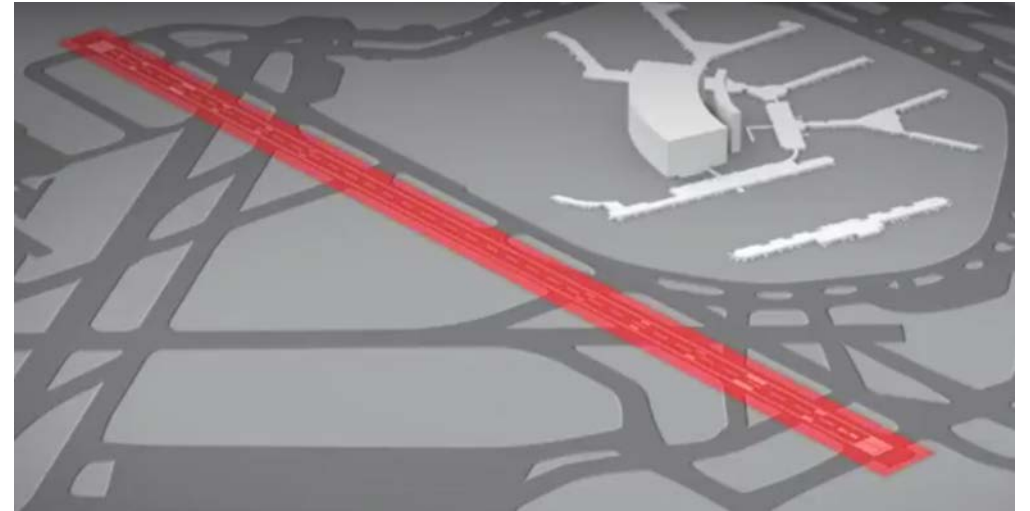
Obstacle Free Zone (OFZ)

- **Four distinct surfaces:**
 - Runway Obstacle Free Zone (ROFZ)
 - Inner-Transitional Obstacle Free Zone
 - Inner-Approach Obstacle Free Zone
 - Precision Obstacle Free Zone (POFZ)



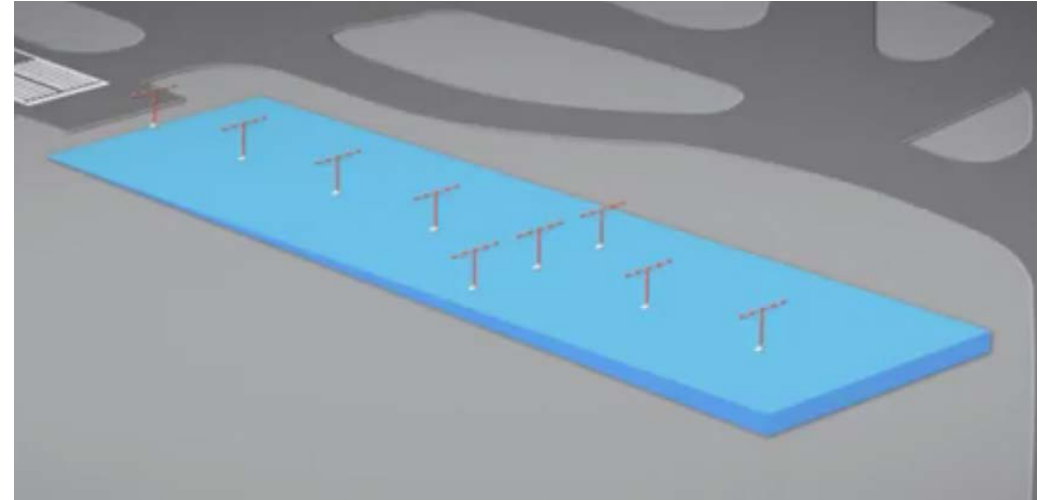
Runway OFZ

- **Extends 200 feet beyond each end of runway**
- **400 feet for operations by large aircraft**
- **For operations by small aircraft:**
 - 300 ft for lower than 3/4 statute mile approach visibility minimums
 - 250 ft for operations by small aircraft with approach speeds of 50 knots or more
 - 120 ft for operations by small aircraft with approach speeds of less than 50 knots



Inner-Approach OFZ

- Applies only to runways with an ALS
- Surface begins 200 ft from runway threshold
- Extends 200 ft beyond last light unit in the ALS
- Same width as ROFZ and has a 50 (horizontal) to 1 (vertical) slope



Inner-Transitional OFZ

- **Operations by small aircraft:**

- Slopes 3 (horizontal) to 1 (vertical) to a height of 150 feet above the airport elevation

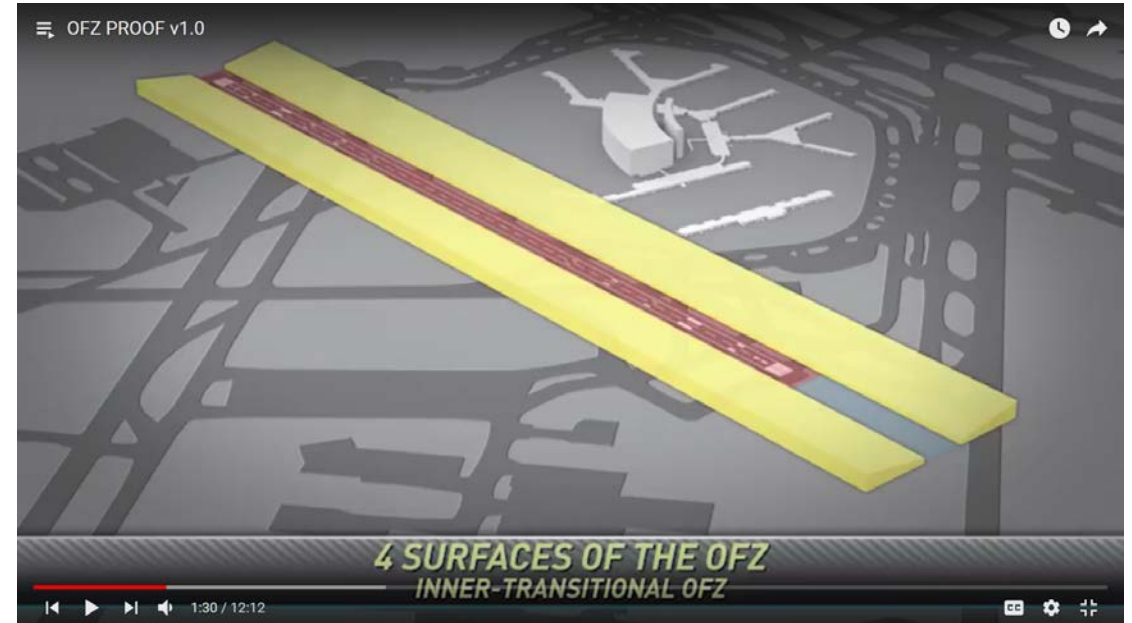
- **Operations by large aircraft:**

- CAT I Operations

- Rises vertically, then slopes 6 to 1 to a height of 150 feet above the airport elevation

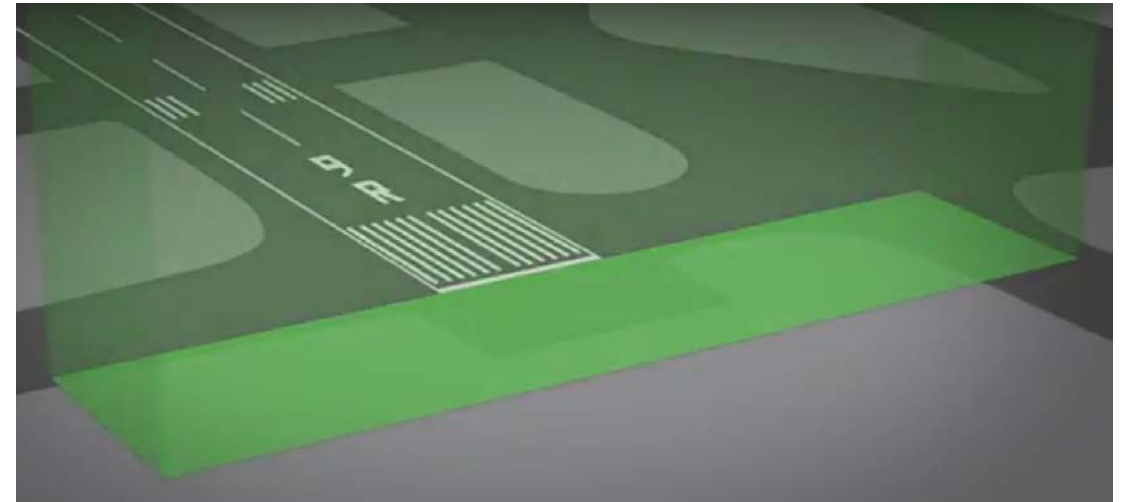
- CAT II/III Operations

- Rises vertically, then slopes 5 to 1 to a distance “Y” from runway centerline, and then slopes 6 to 1 out to a height of 150 feet above the airport elevation



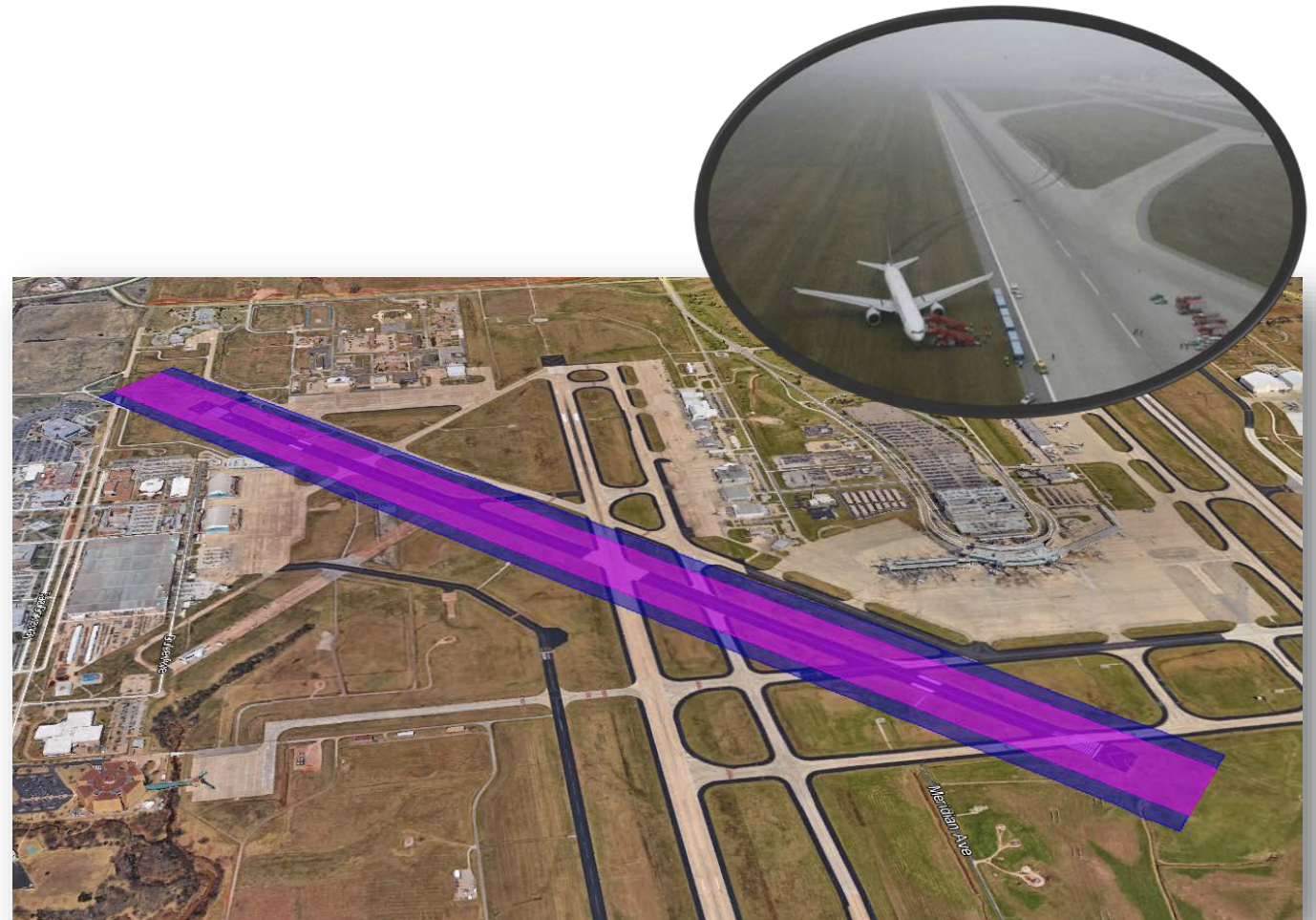
Precision Obstacle Free Zone (POFZ)

- Wing of aircraft on a taxiway may penetrate
- Fuselage and tail may not penetrate
- Vehicles up to 10 ft permitted if necessary for maintenance
- The surface is only in effect when:
 - The approach includes vertical guidance
 - The reported ceiling is below 250-feet or visibility is less than 3/4 statute mile
 - An aircraft is on final approach within 2 miles of the runway threshold



Runway Object Free Area (ROFA)

- Protects the wings of an aircraft that enters the RSA
- 2-dimensional area centered on the runway centerline
- Objects in the ROFA should be frangible to 3 inches



Runway Protection Zone (RPZ)

- Enhance the protection of people and property on the ground.
- Airport owners should own the property to the limits of the RPZ
- Clear of all above-ground objects
- As a minimum, should remain clear of all incompatible facilities

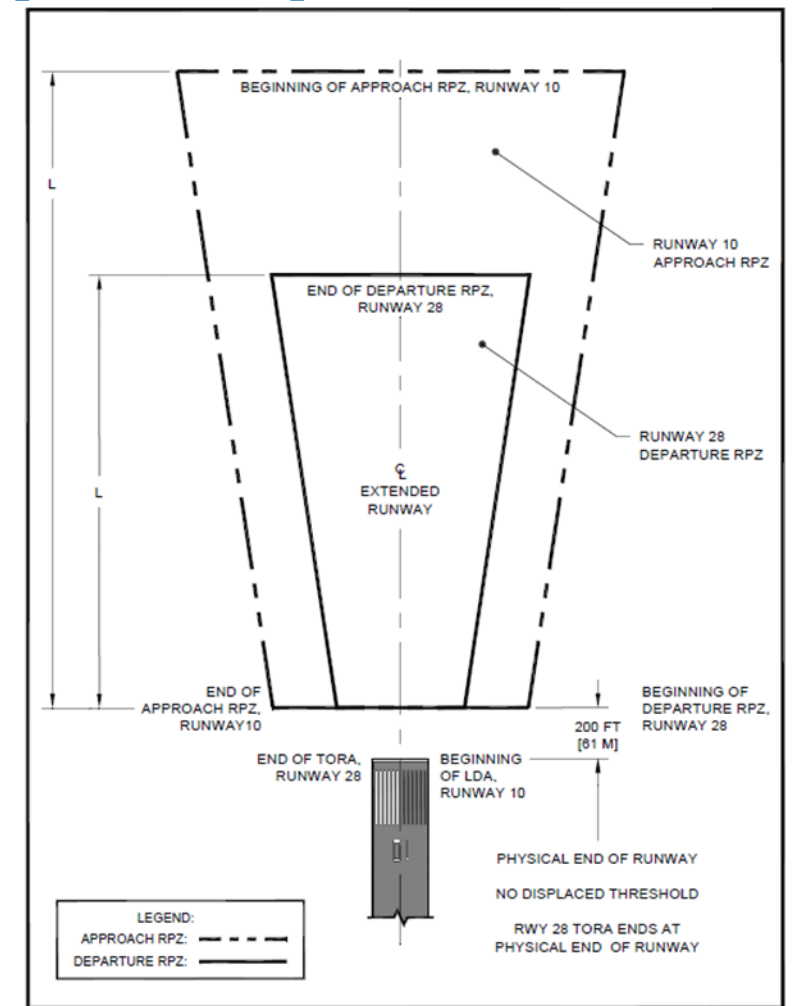


Figure 3-17. Runway with all declared distances equal to the runway length



Approach Surface

- **Protects arriving aircraft during VFR and IFR conditions**
- **Surface depends on what aircraft utilizes the runway and on visibility minimums**
- **Penetrations to surface may result in:**
 - Higher instrument landing minimums
 - Higher than normal glide path angles
 - Non-standard threshold crossing heights
 - Final approach offset



Approach / Departure Surfaces

- ▶ An evaluation surface that defines the minimum required obstruction clearance for approach or departure procedures
- ▶ Based on planned visibility minimums (TERPs determines actual published minimums)

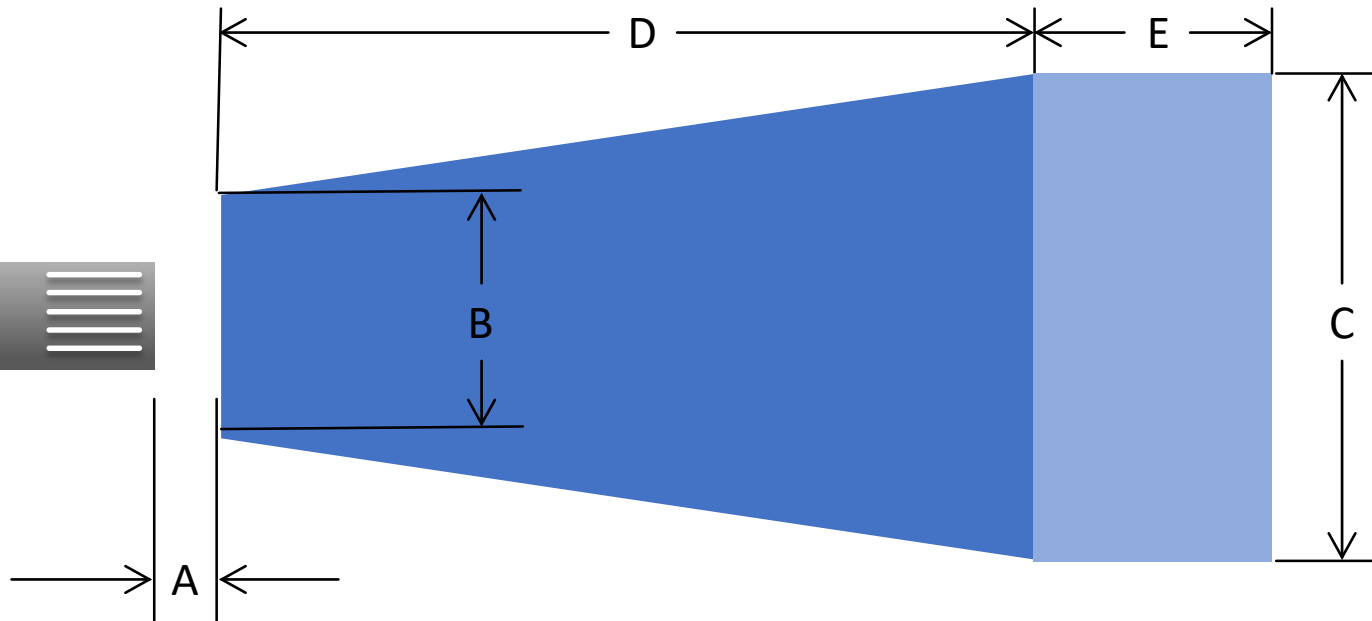


Table 3-2. Approach and Departure Standards Table ^{1,2}

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

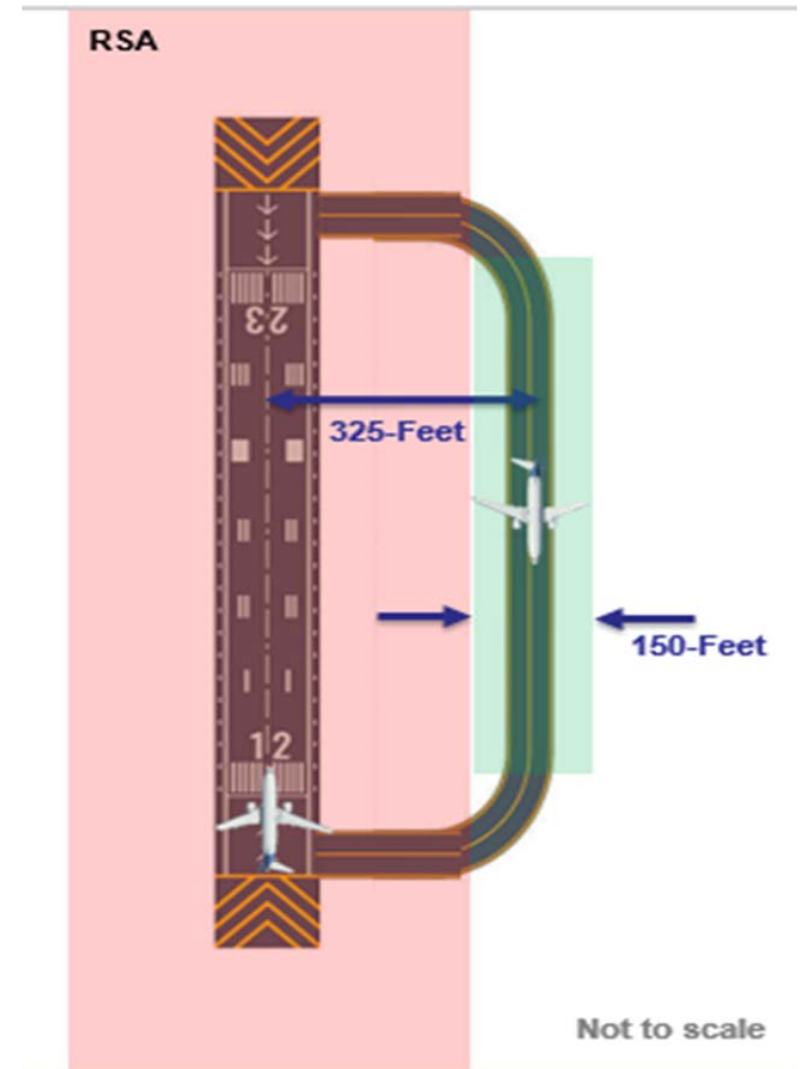
* The letters are keyed to those shown in Figure 3-2 of AC 150/5300-13A.

General Notes:

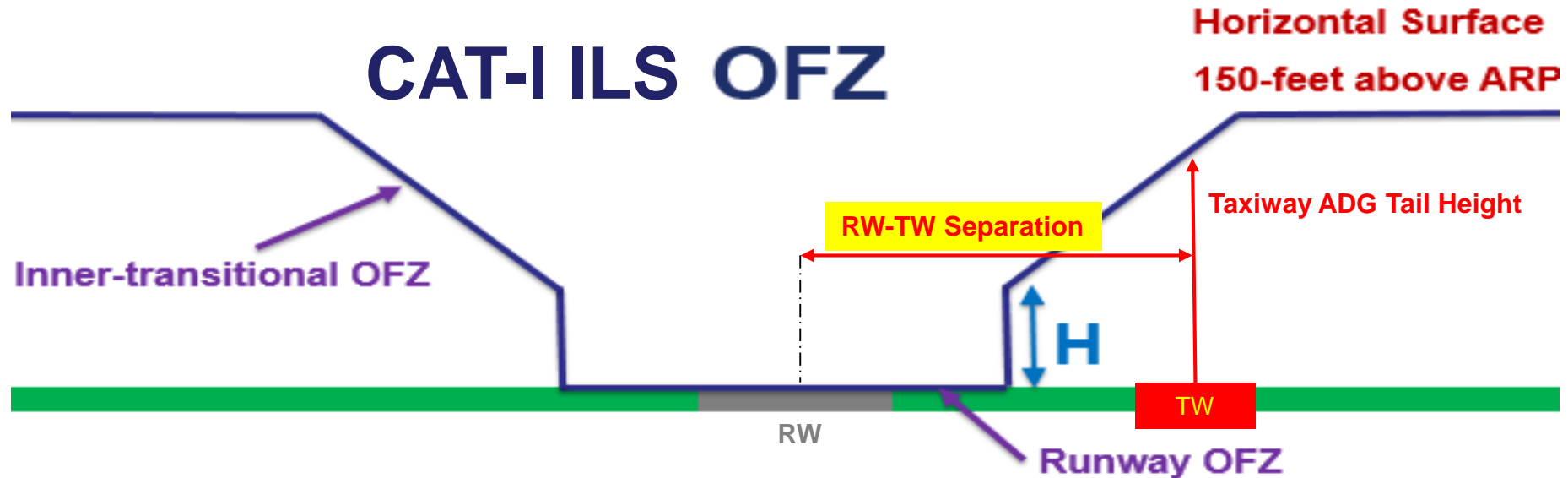
1. This table presents the dimensional standards applicable to varying runway types based on normal conditions (e.g. standard 3-degree glidepath angle). Meeting the requirements of this table will protect the use of the runway in both visual and instrument meteorological conditions near the airport while ensuring maximum runway utility. Final published visibility minimums are determined, in part, by applying the criteria described in FAA Order 8260.3.
2. For planning purposes, objects must remain clear of the surfaces provided in this table. The FAA Flight Procedures Team must mitigate existing obstacles that penetrate instrument procedures that cannot be removed, relocated, or lowered. A modification of standards is not issued for the surfaces described in this table, in accordance with FAA Order 5300.1.

Runway to Taxiway Separation

- **Minimum distance between a runway and it's parallel taxiway**
 - Assumes same design group
 - High speed exits that allow reverse direction may require additional distance
 - Dimensions from Table 3-5
- **Protects the RSA and Inner transitional OFZ from taxiing aircraft**
 - Use largest ADG using the TW



Runway to Taxiway Separation Example



Runway OFZ Width = 400'

Inner-Transitional OFZ Slope = 6:1

$H = 61 - 0.094S - .003E$

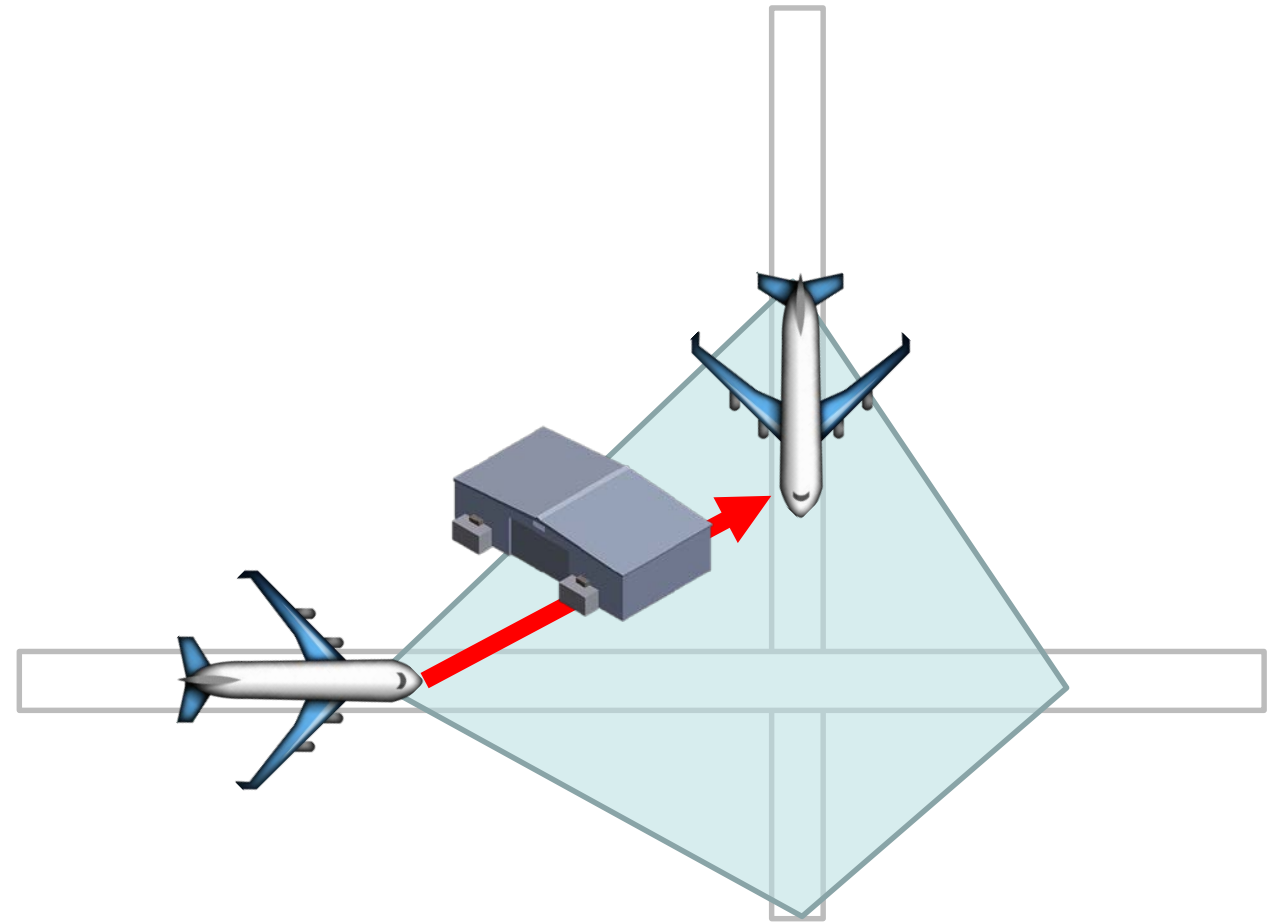
S = Wingspan of aircraft

E = Runway threshold elevation (MSL)



Runway Visibility Zone (RVZ)

- Maintaining a clear RVZ allows departing and arriving aircraft to verify the location and actions of other aircraft and vehicles on the ground that could create a conflict.



Airspace Protection

- *The navigable airspace is a limited national resource that Congress has charged the FAA to administer in the public interest as necessary to ensure the safety of aircraft and its efficient use.*



Airspace Authority

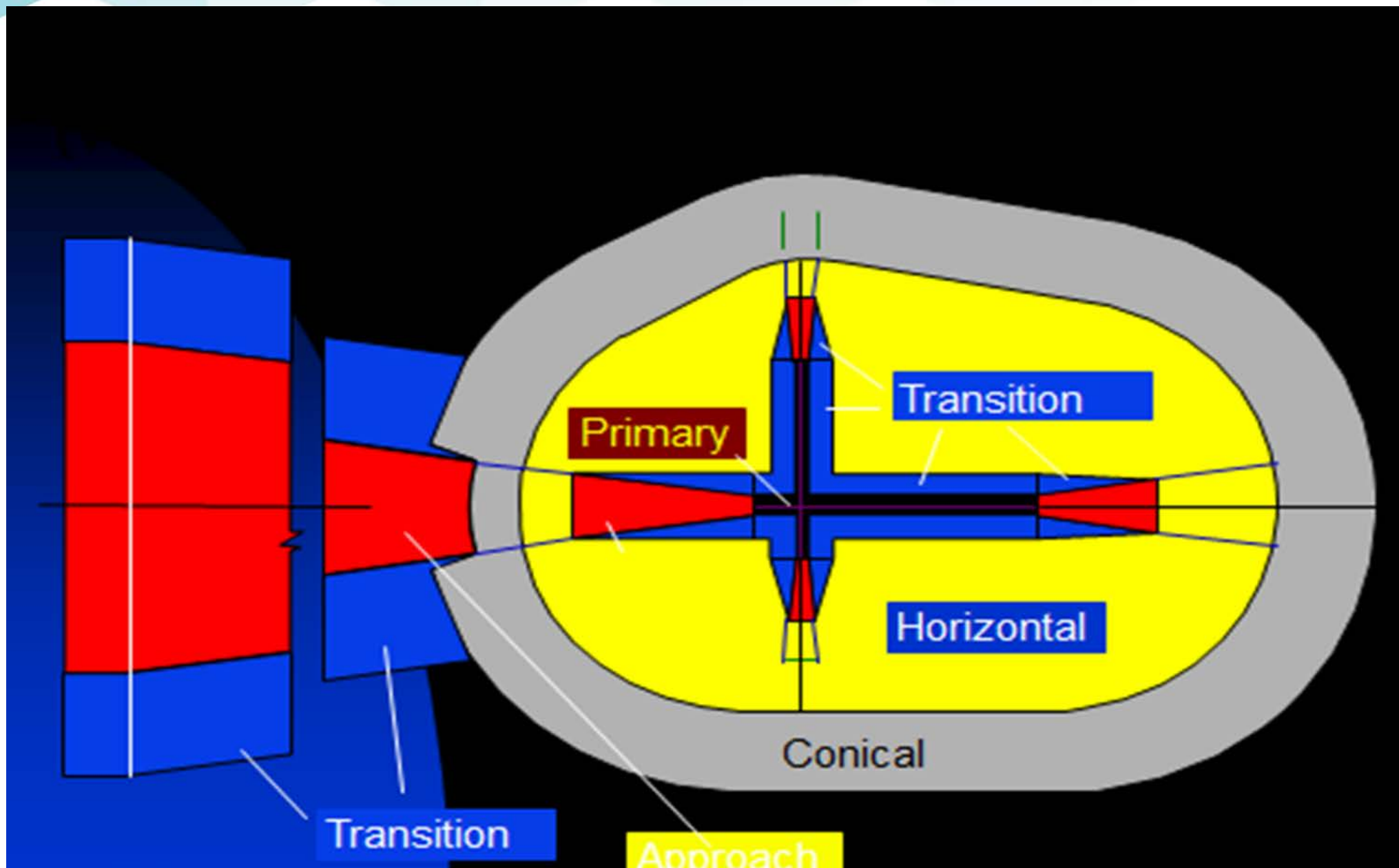
- **Title 14 CFR Part 77 (Regulation versus Standard)**
 - Safe, Efficient Use, & Preservation of the Navigable Airspace
- **Title 14 CFR Part 157**
 - Notice for Construction, Alteration and Deactivation of Airports

Regardless of Federal Funding Participation

- Notice requirements under Part 77 (similar to ICAO Annex 14 Chapter 4) does not consider federal funding participation or limited to federally obligated airports.

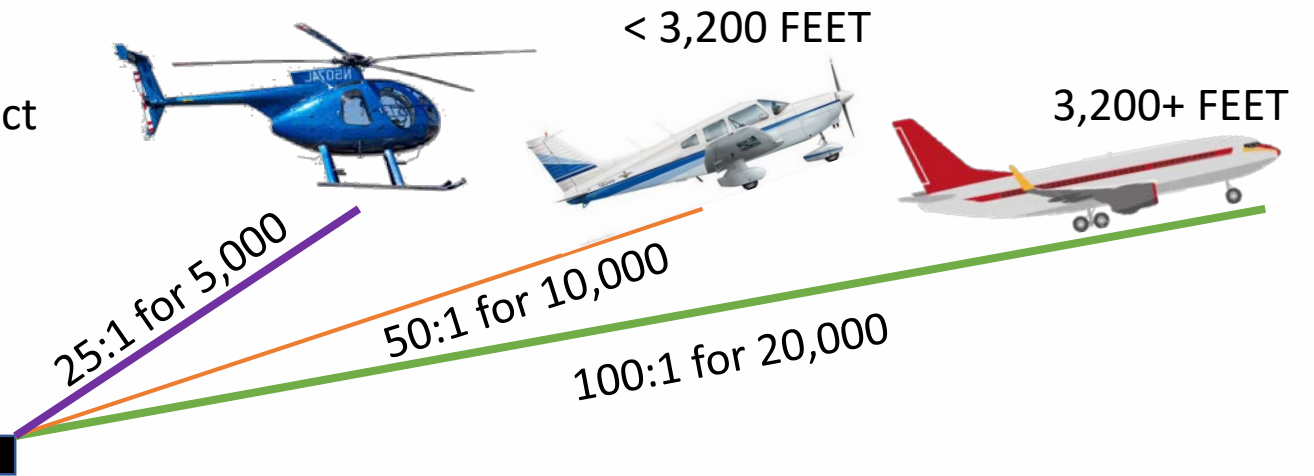


Part 77 Overall View



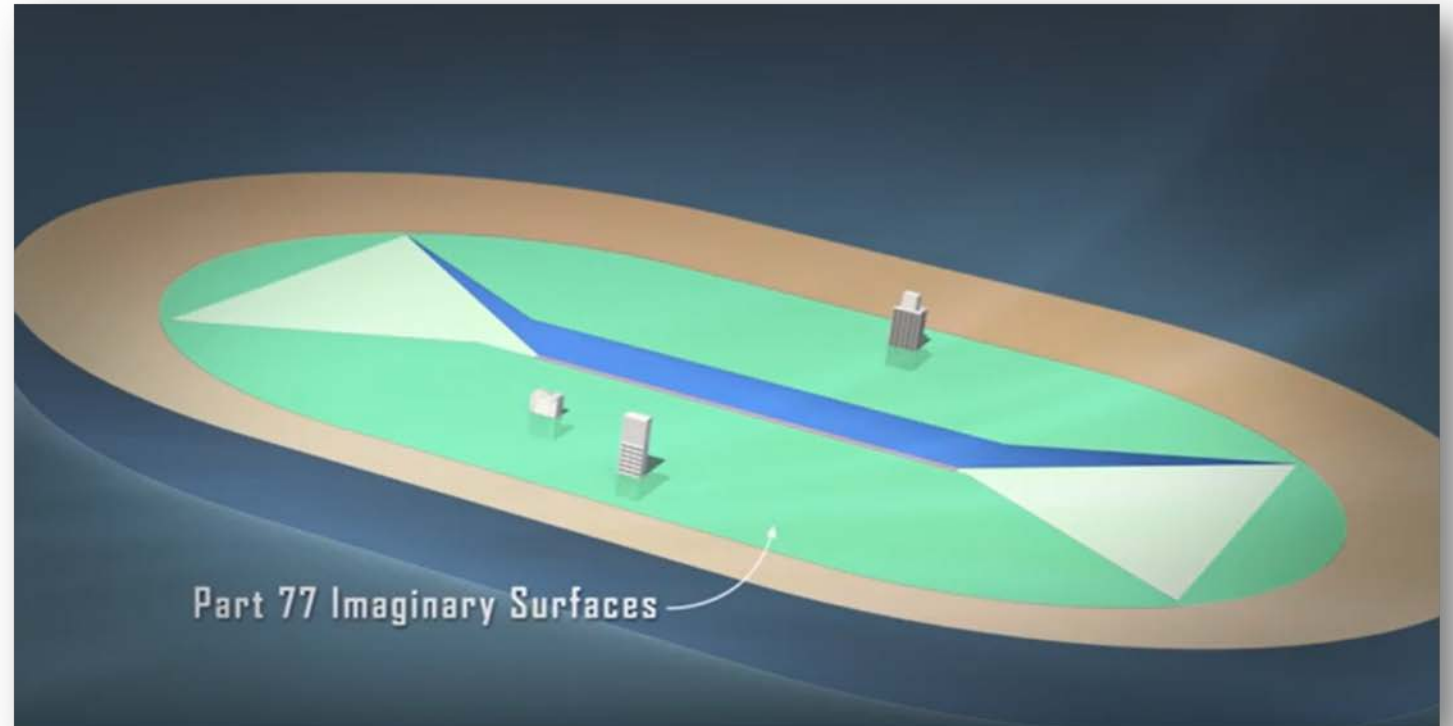
- Greater height than imaginary surface on specified slopes

- Traverse ways of a height which if adjusted upward
 - 17 feet for Interstate Highways
 - 15 feet for any other public roadways
 - 10 feet for private roads
 - 23 feet for railroads
 - Waterway to height of highest mobile object to normally traverse



Airspace Obstruction Standards

- Obstructions to air navigation affecting airspace safety
 - Existing and proposed manmade objects
 - Objects of natural growth
 - Terrain



Form and Time of Notice

- FAA form 7460-1
 - “Notice of Proposed Construction or Alteration”
- Preferred filing method via internet
- Notice must be submitted at least 45 calendar days before:
 - Start date of proposed construction or alteration
 - or*
 - Filing date for construction permit application

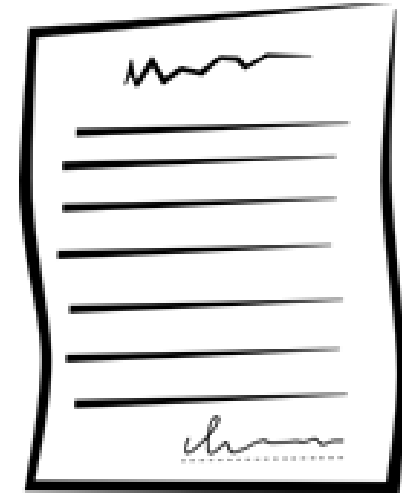
FAA Form 7460-1 (2-12) Supersedes Previous Edition

An FAA Determination issued under this part will be one of the following:

(1) **No objection.**

(2) **Conditional.** A conditional determination will identify the objectionable aspects of a project or action and specify the conditions which must be met and sustained to preclude an objectionable determination.

(3) **Objectionable.** An objectionable determination will specify the FAA's reasons for issuing such a determination.



Limitations of FAA Authority

- The FAA cannot
 - Limit structure height
 - Prohibit construction
 - **Require** structures to be marked and/or lighted (we **recommend** to prevent objecting)
- FAA will object and issue Determination of Hazard
 - This prevents structures for communication (which require Federal license)



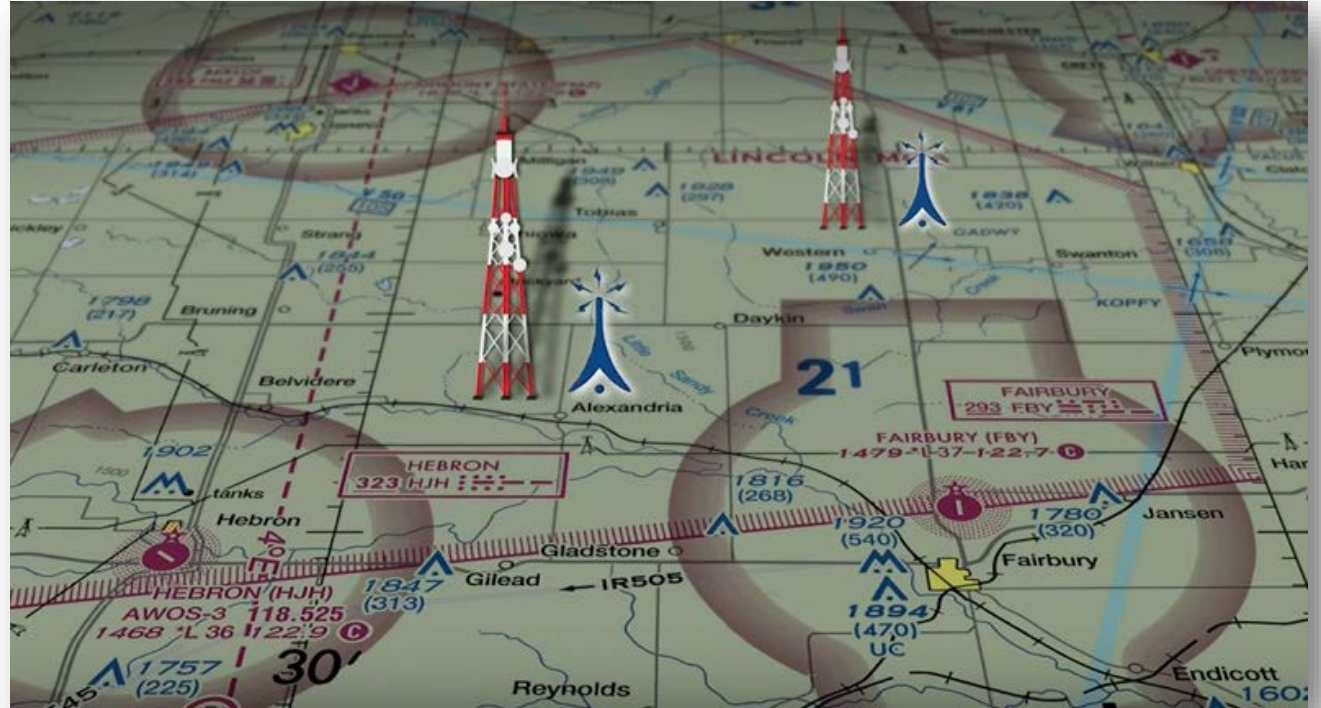
Structures seldom get built against an unfavorable FAA determination due to implied liability, zoning permits, insurance, state laws.



Limitations of the FAA's Authority

We assess obstructions to:

- Determine the impact the proposed object will have to airspace.
- Work with the Proponent to eliminate any hazard to navigation.
- The FAA needs to know of its existence so it can be charted.



FAA Wide Protection

- Example: Flight Procedures responsible to ensure published information for IFR procedures is safe
 - **Will alter published minimums from planned minimums to reflect actual conditions**
 - Additionally, assesses beyond just design group aircraft

TRAVERSE CITY, MI
CHERRY CAPITAL (TVC)
TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES
AMDT 12 07DEC17 (17341) (FAA)

TAKEOFF MINIMUMS:
Rwy 10, 400-3 w/min. climb of 220' per NM to 1200 or std. w/min. climb of 280' per NM to 1100, or 1300-3 for VCOA.
Rwy 18, 400-2¾ w/min. climb of 205' per NM to 1400 or std. w/min. climb of 222' per NM to 1100, or alternatively, with std. takeoff minimums and a normal 200' per NM climb gradient, takeoff must occur no later than 2000' prior to DER, or 1300-3 for VCOA.
Rwy 28, std. w/ min. climb of 340' per NM to 2000, or 1300-3 for VCOA.
Rwy 36, 400-2½ or std. w/ min. climb of 203' per NM to 1000 or alternatively, with std. takeoff minimums and normal 200' per NM climb gradient, takeoff must occur no later than 1200' prior to DER.

DEPARTURE PROCEDURE:
Rwy 10, climb heading 099° to 1100' before turning right.
Rwy 18, climb heading 185° to 1100' before turning.
Rwy 36, climb heading 005° to 1300' before turning left.

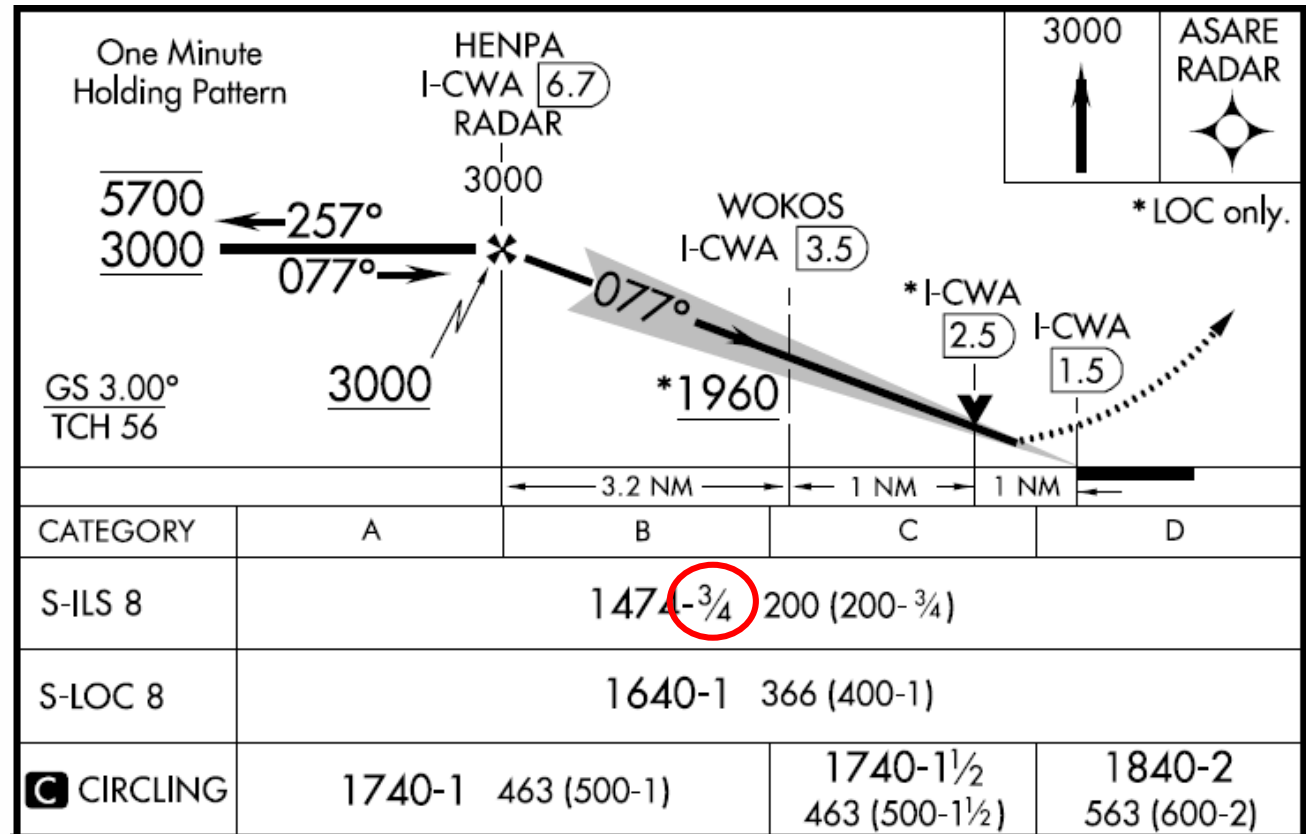
VCOA:
Obtain ATC approval for VCOA when requesting IFR clearance. Climb in visual conditions to cross Cherry Capital Airport at or above 1800 before proceeding on course.

TAKEOFF OBSTACLE NOTES:
Rwy 10, tree 1284' from DER, 739' left of centerline, 662' MSL.
Trees beginning 1524' from DER, 821' left of centerline, up to 663' MSL.
Trees beginning 1822' from DER, 916' right of centerline, up to 669' MSL.
Tree 2242' from DER, 963' right of centerline, 671' MSL.
Trees beginning 2341' from DER, 941' right of centerline, up to 672' MSL.
Tree 2570' from DER, 1169' right of centerline, 679' MSL.

16 JUL 2020 to 13 AUG 2020

Flight Procedures Protection

- Example: Visibility increased due to non-standard conditions



Challenging Situations



Engineered Material Arrest System (EMAS)

- 116 EMAS installations at 69 airports
- 15 successful arrestments, saving a total of 406 lives on board



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns

Date: 9/27/2012

AC No: 150/5220-22B

Initiated by: AAS-100

Change:

1. PURPOSE. This advisory circular (AC) contains standards for the planning, design, installation, and maintenance of Engineered Materials Arresting Systems (EMAS) in runway safety areas (RSA). Engineered Materials means high energy absorbing materials of selected strength, which will reliably and predictably deform under the weight of an aircraft.

overrunning aircraft within the runway safety area would have prevented major damage to aircraft and/or injuries to passengers.

Recognizing the difficulties associated with achieving a standard safety area at all airports, the FAA undertook research programs on the use of various materials for aircraft arresting systems.

EMAS INSTALLATION

Charleston Yeager Airport



EMAS AIRCRAFT ARRESTMENT

US Airways Flight 2495, Charleston Yeager Airport, January 19, 2010



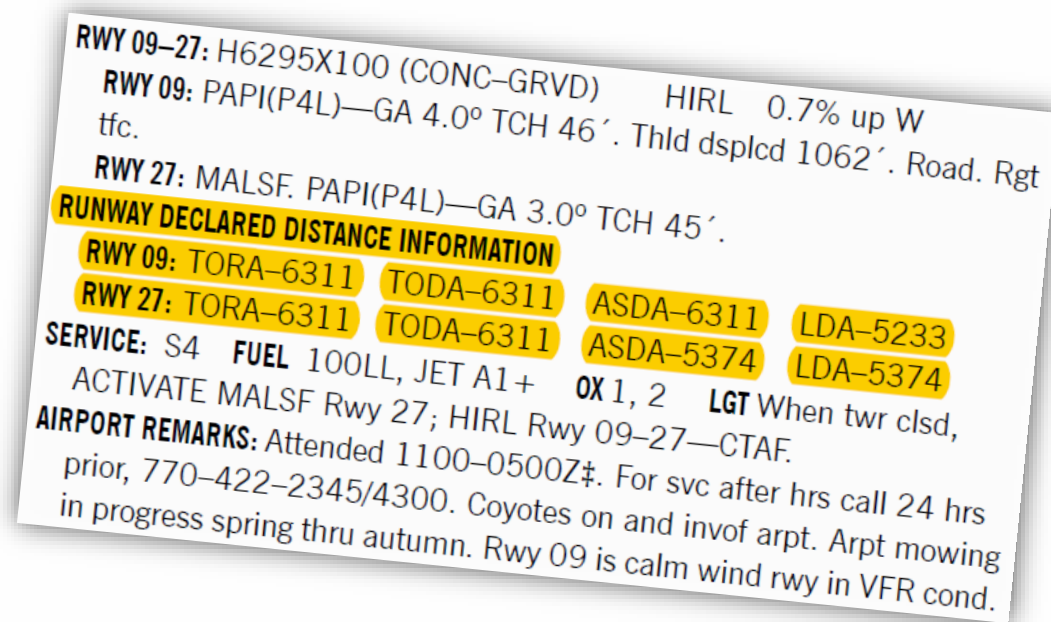
Modification of Standards

- Discussed in next couple of presentations
- Allows unique solutions for unique situations that maintain safety

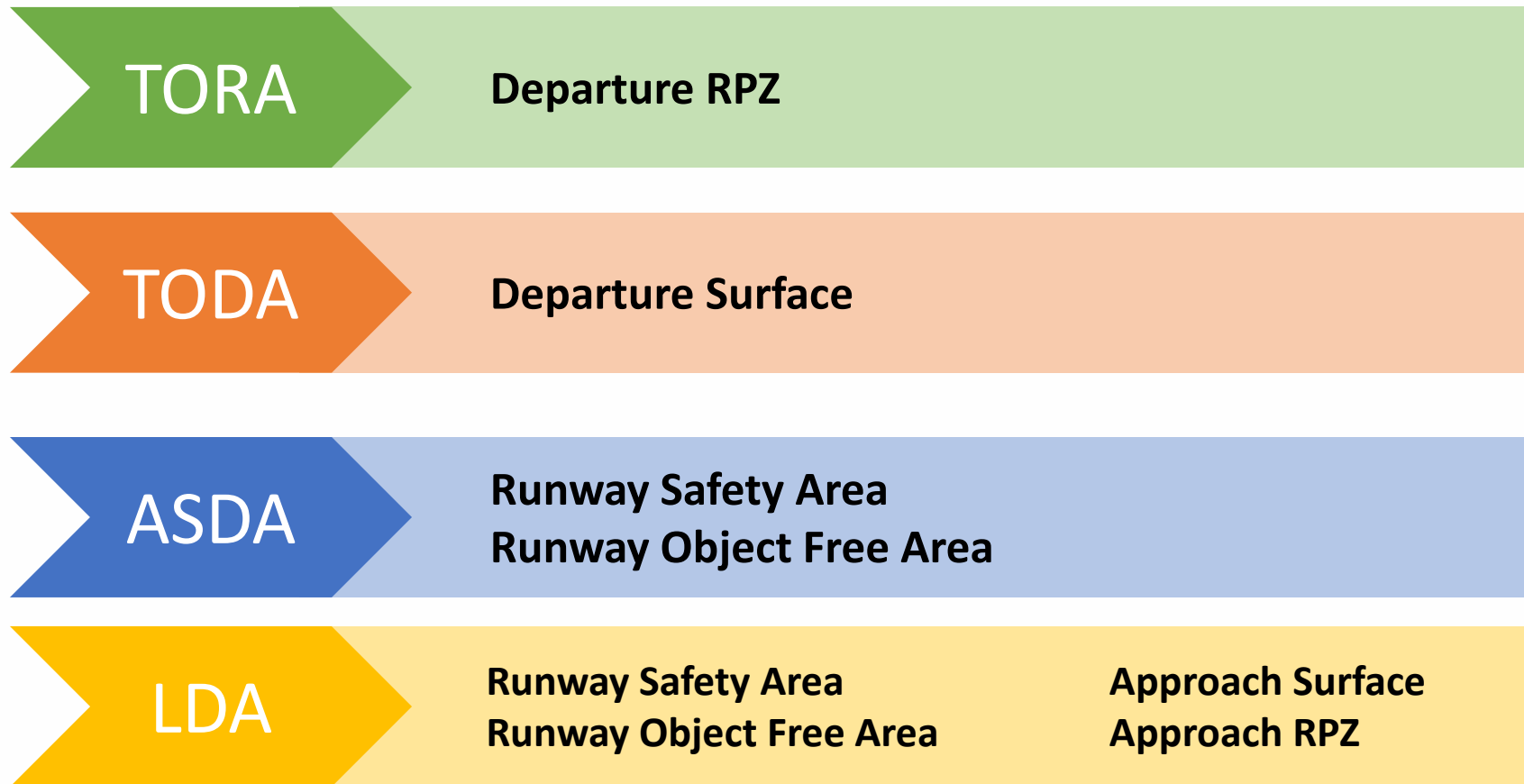


Declared Distances

- Represents the maximum distances for takeoff, rejected takeoff, and landing distances performance requirements
- Declared distances is based on the operational direction and published for each runway end.
- Published in:
 - Chart Supplement
 - Airport Master Record
 - NOTAMs



Obtaining Airport Design Standards Through the Use of Declared Distances



Declared Distances

Consists of:

- Takeoff Runway Available (TORA)
- Takeoff Distance Available (TODA)
- Accelerate Stop Distance Available (ASDA)

DEPARTURE OPERATIONS



← Start of TORA, TODA, & ASDA



← Start of TORA, TODA, & ASDA

- Landing Distance Available (LDA)

ARRIVAL OPERATIONS

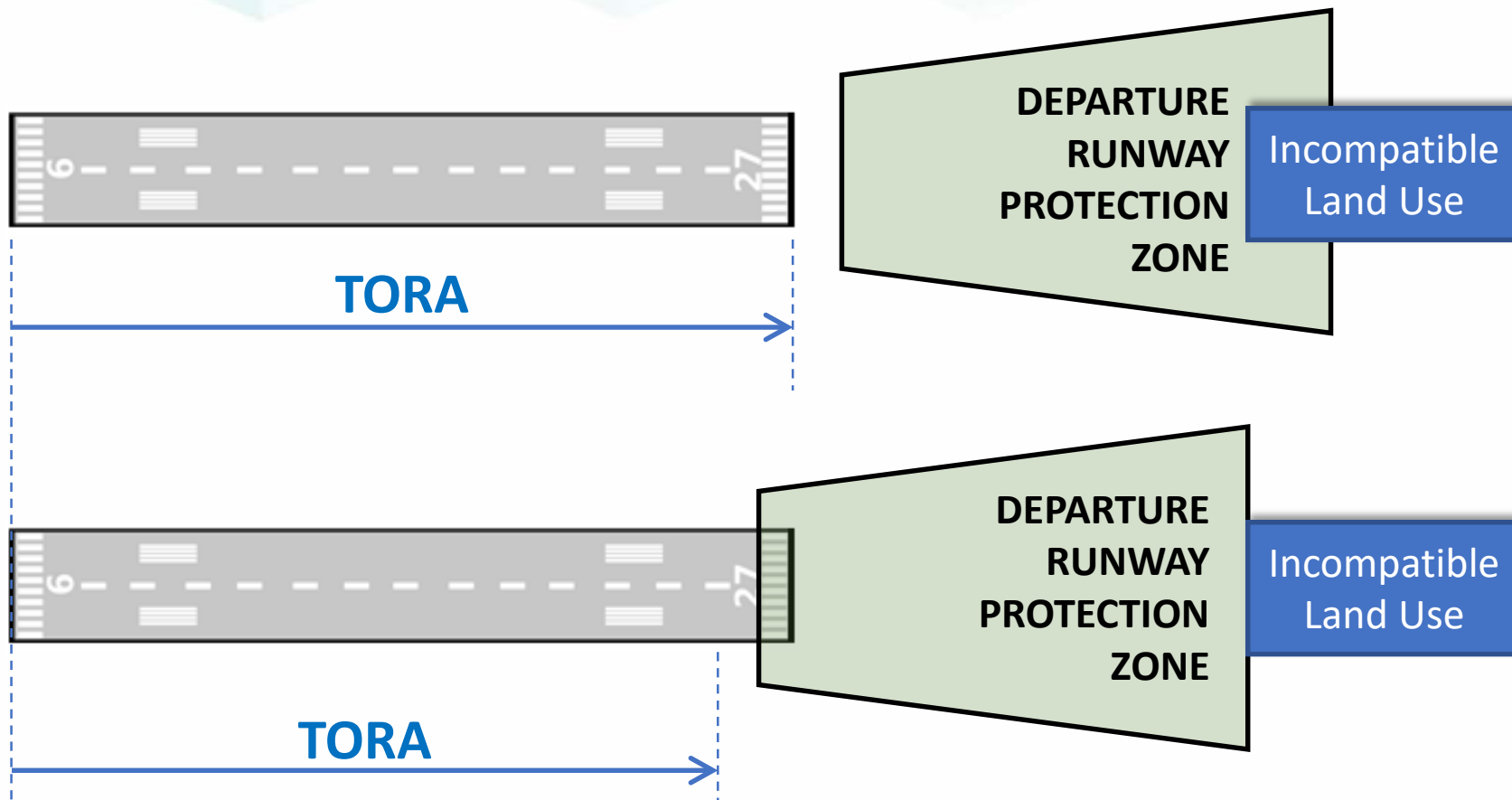


← Start of LDA



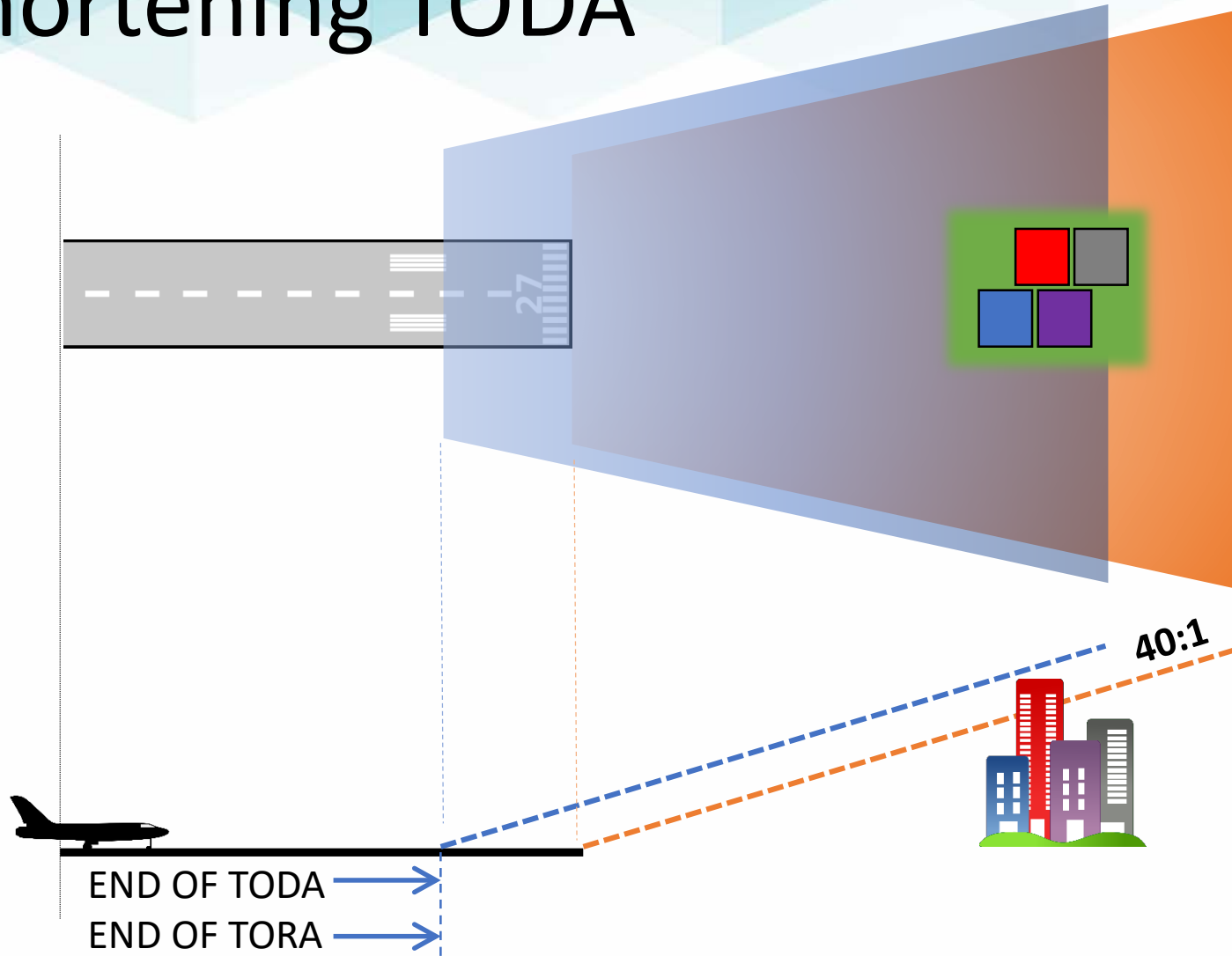
← Start of LDA

Shortening TORA



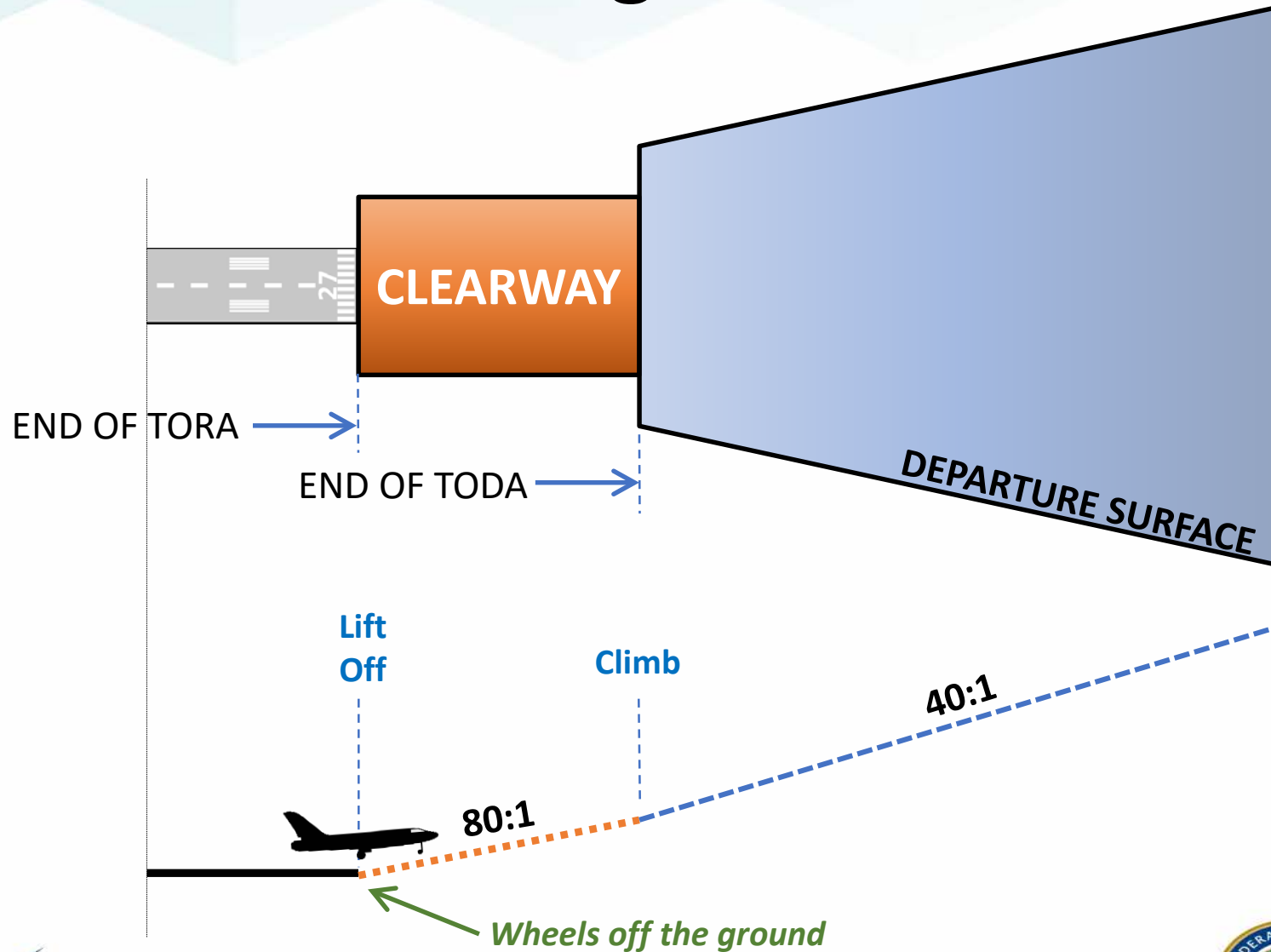
NOT TO SCALE

Shortening TODA



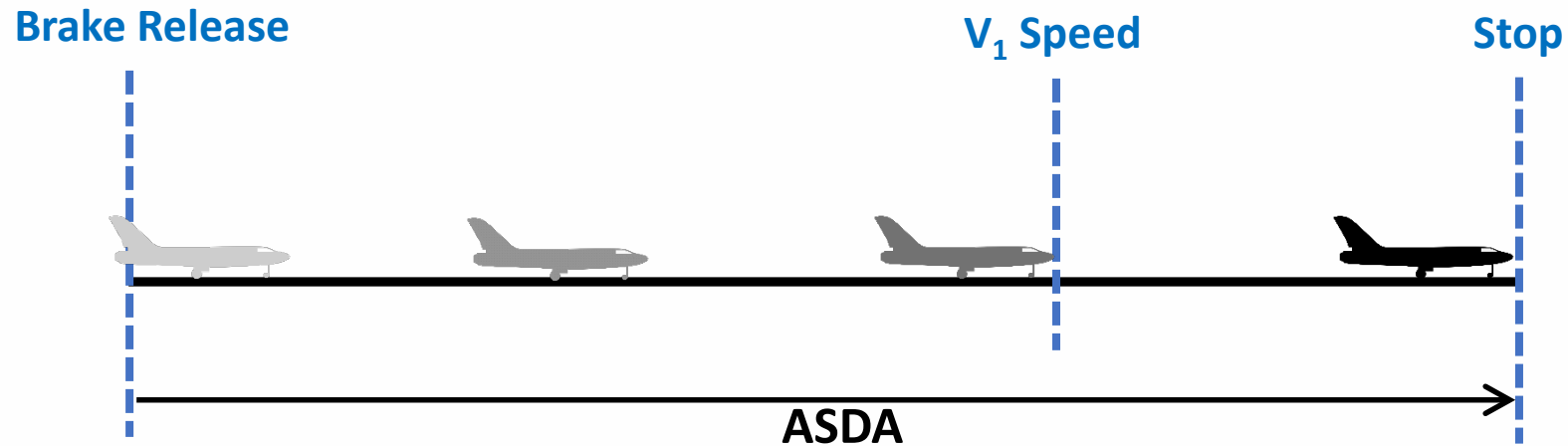
NOT TO SCALE

Extending TODA



Accelerate Stop Distance Available (ASDA)

Distance to accelerate from brake release to V_1 and then decelerate to a stop.



NOT TO SCALE

TYPICAL ASDA



RUNWAY SAFETY AREA

ASDA

EXTENDED ASDA



STOPWAY

RUNWAY SAFETY AREA

ASDA

SHORTENED ASDA



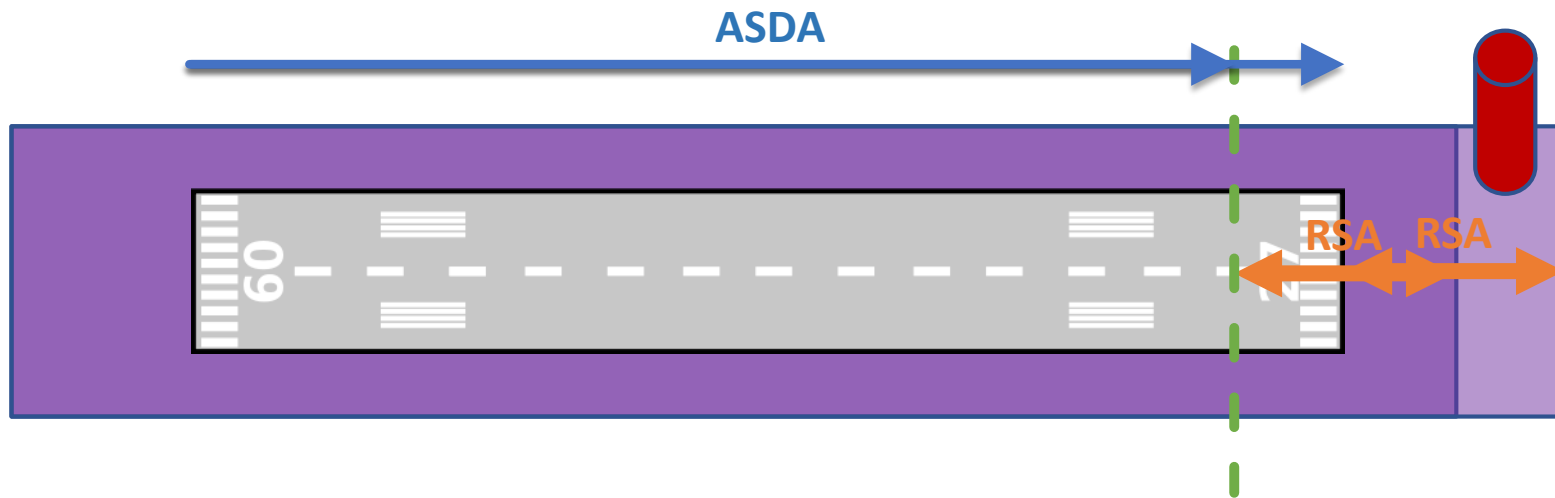
RUNWAY SAFETY AREA

ASDA

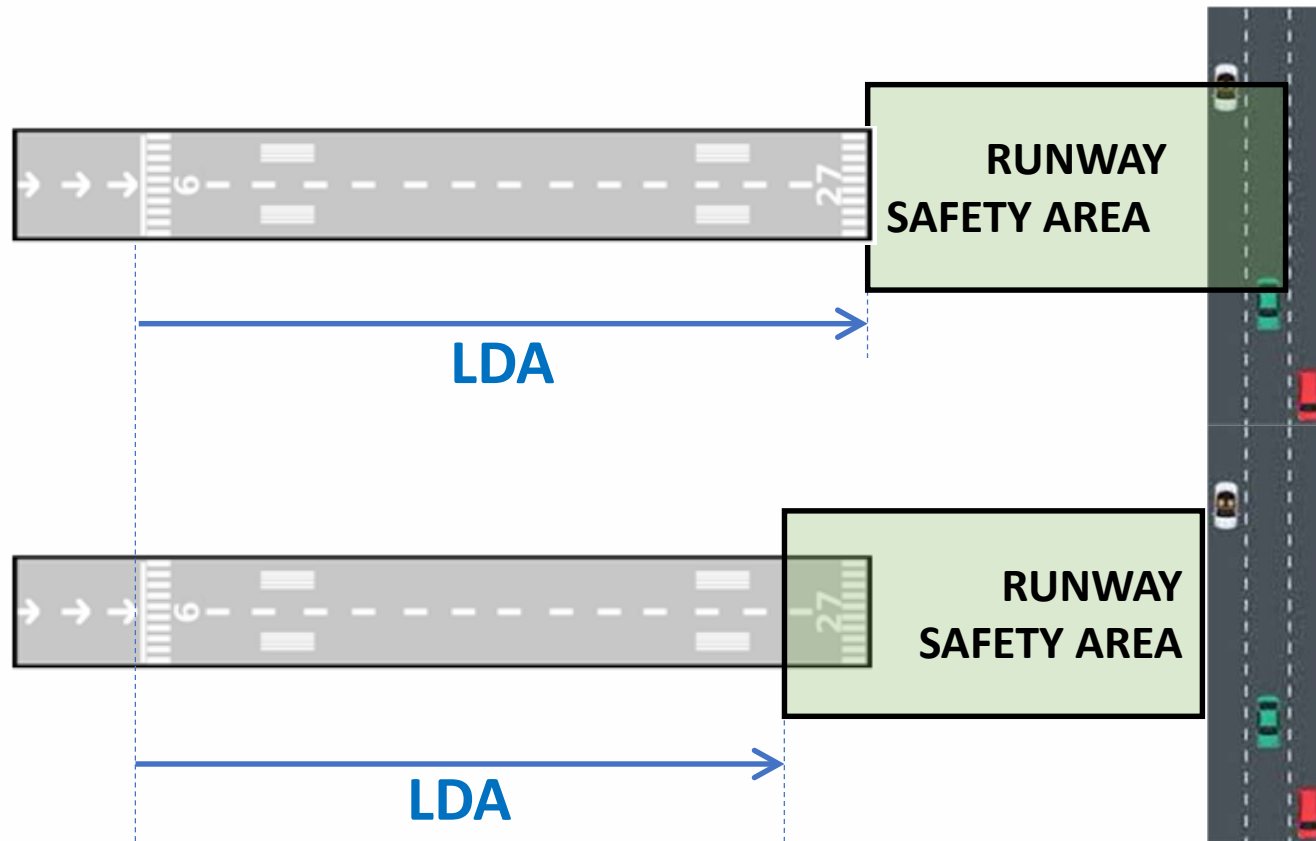


Accelerate Stop Distance Available (ASDA)

- ▶ Published accelerate–stop distance requirements for a rejected takeoff (allows incorporating a stopway)
- ▶ RSA clearance may be obtained beyond the runway by reducing the ASDA



Shortening LDA (with displaced threshold)



NOT TO SCALE

Questions



Michael Ferry, P.E.

Senior Civil Engineer, Great Lakes Region

Federal Aviation Administration

Airports Division - Safety & Standards Branch, AGL-620



2300 East Devon Avenue, Des Plaines, IL 60018



847.294.7531



Michael.Ferry@faa.gov



FAA
Office of Airports