Technical Supplement to CASP 2020

Airspace Protection: FAA Airport Design Standards and Federal Regulations

This technical supplement contains enhanced descriptions and details about airport design standards.

Federal regulations focusing on airspace safety include Parts 77, 95, and 97 of Title 14 of the Code of Federal Regulations. Part 77 covers the "Safe, Efficient Use and Preservation of the Navigable Airspace" (14 CFR Part 77). Part 95 covers "IFR Altitudes" (14 CFR Part 95) and Part 97 covers "Standard Instrument Procedures" (14 CFR Part 97). In Part 77, navigable airspace is defined as the airspace at or above the minimum altitudes of flight that are needed to ensure safety in the takeoff and landing of aircraft, and where potential hazards require identification and mitigation:

- Any object of natural growth, terrain, or permanent or temporary construction or alteration

- The alteration of any permanent or temporary existing structure by a change in its height, including appurtenances or lateral dimensions, including equipment or material used therein. (14 CFR Part 77.13)

FAA Order series 8260.3, *United States Standard for Terminal Instrument Procedures (TERPS)*, prescribes standardized methods for designing and evaluating instrument flight procedures (IFPs) prescribed under 14 CFR Part 95 and 14 CFR Part 97. It also contains design guidance related to other IFPs and Air Traffic Control (ATC) charts not specified under Parts 95 or 97.

TERPS specifies the minimum measure of obstacle clearance considered by the FAA to supply a satisfactory level of vertical protection. The validity of the protection is dependent, in part, on assumed aircraft performance. In the case of TERPS, it is assumed that aircraft will perform within certification requirements. These criteria are predicated on normal aircraft operations for considering obstacle clearance requirements. Normal aircraft operation means all aircraft systems are functioning normally, all required navigation systems are performing within flight inspection parameters, and the pilot is conducting instrument operations utilizing IFPs based on the TERPS standard to provide required obstacle clearance. While the application of TERPS criteria indirectly addresses issues of flyability and efficient use of navigation systems, the major safety contribution is the provision of obstacle clearance standards. This facet of TERPS allows aeronautical navigation in instrument meteorological conditions (i.e., low visibility weather) without fear of collision with unseen obstacles. Required obstacle clearance is provided through application of level and sloping obstacle clearance surface (OCS).

In addition to airport design guidance (see above), FAA Advisory Circular (AC) series 150/5300-13, *Airport Design* (Airport Design Standards), accounts for the portions of the sloping obstacle clearance surface within two nautical miles of airports, when aircraft are landing (approach) or taking off (departure).

Airport Design Standards incorporate visibility minimums associated with published instrument flight procedures, which are derived from TERPS. Airport Design Standards include approach surfaces different (i.e., more defined) than those covered by Part 77.

In addition, Airport Design Standards also include a departure surface whereas Part 77 has no departure surface. The approach surfaces in Airport Design Standards also account for visual (fair weather) flight procedures/rules to protect airspace for all types of airport and/or runway environments. There is no departure surface for visual runways.

FAA uses all the above when reviewing potential obstructions such as buildings, towers, antennas, trees, etc. Part 77 acts as a baseline or first step. If a potential obstruction does not penetrate any of the Part 77 surfaces, then FAA will determine that its construction/installation would not present a hazard to air navigation. If a potential obstruction does penetrate a Part 77 surface, then that does not necessarily mean FAA will deem it a hazard. Instead, FAA will determine whether the potential obstruction penetrates any of the Airport Design Standards, inclusive of obstacle clearance surfaces such as approach and departure surfaces. This is like a second step. If a potential obstruction does penetrate Airport Design Standards, then FAA will determine that its construction/installation would present a hazard to air navigation and indicate the maximum height allowed that would not present a hazard. The third/final step only comes into play when an obstruction penetrating Airport Design Standards is built despite a hazard determination from FAA or without consulting FAA in advance. Such a penetration can result in the need to displace the runway threshold, decreasing the available landing distance. Sometimes, FAA can change an existing or planned minimum flight altitude, a published or special instrument procedure, or an instrument flight departure procedure to mitigate the obstruction depending upon the severity of the penetration and its geographic location. (Obstructions along the extended runway centerline are much more difficult to mitigate than obstructions offset from the extended runway centerline.)

FAA's Airport Design Standards also include on-airport or near-airport surfaces, called zones. These zones are applied to runways and taxiways based on aircraft performance and dimensions. Potential obstructions are evaluated in relation to proposed runway lengths and taxiway widths (whether new or existing) such that designs can be implemented or adjusted to maintain safety for aircraft of intended use. Airport Design zones in the immediate vicinity of runways and taxiways include:

- **Object Free Zone** (OFZ). The clearing standard precludes aircraft and other object penetrations, except for frangible guidance equipment required in the OFZ because of its function (such as visual lighting aids).

- **Runway Obstacle Free Zone** (ROFZ). The ROFZ is a defined volume of airspace centered above the runway centerline, above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The ROFZ extends 200 feet (61 m) beyond each end of the runway and has various widths based on aircraft approach speeds.
- **Inner-approach OFZ.** The inner-approach OFZ is a defined volume of airspace centered on the approach area. It applies only to runways with an airport lighting system associated with instrument landing equipment. The OFZ begins 200 feet from the runway threshold, at the same elevation as the runway threshold, and extends 200 feet beyond the last light unit in the lighting system.
- **Inner-transitional OFZ.** The inner-transitional OFZ is a defined volume of airspace along the sides of the ROFZ and inner-approach OFZ. It applies only to runways with lower than 3/4 statute mile approach visibility minimums associated with instrument landing approaches. (AC 150/5300-13A)

As a complement to FAA airspace protection, airspace conflicts can be addressed through local land use and zoning controls, avigation easements, and land acquisition. Conflicts are also identified through the FAA Airspace Review Process, which is initiated through the submission of the FAA Form 7460-1 through the Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) web portal. The FAA Airspace Review Process is inclusive of Part 77, Part 95, Part 97, TERPS, and Airport Design Standards.

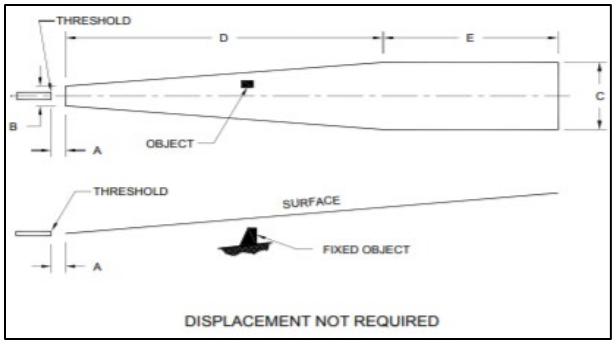
In addition to decreasing available landing distance and/or instrument flight procedure/rule changes, obstructions can also restrict the clear view of runways, helipads, taxiways, or traffic patterns from the airport traffic control tower cab and impede airport capacity/efficiency.

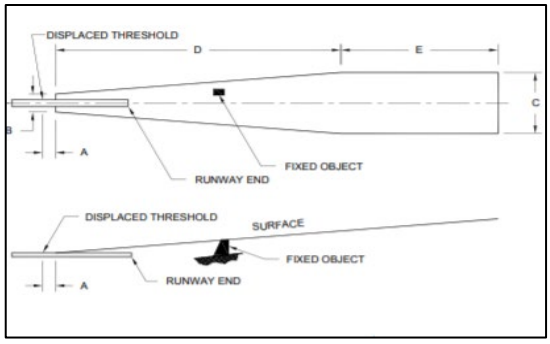
Airport Design Standards in AC 150/5300 13 complement Part 77 by allowing adjustments to airspace not available in Part 77 for obstruction clearance, and by identifying areas such as RSAs and RPZs that should remain free of structures. Used together, Part 77 and Airport Design Standards assist planning efforts to make the most of airport use and safety.

Airport Design Standards and Guidance

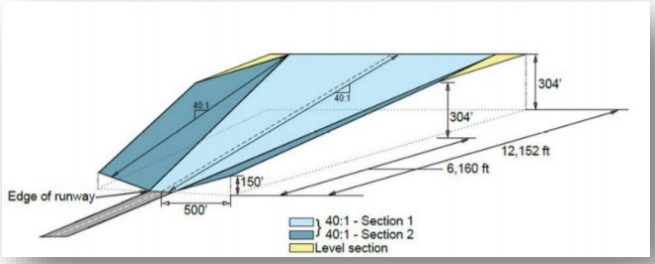
When an obstruction penetrating Airport Design Standards is built despite a hazard determination from FAA or without consulting FAA in advance, such a penetration can result in the need to displace the runway threshold, decreasing the usable runway length.

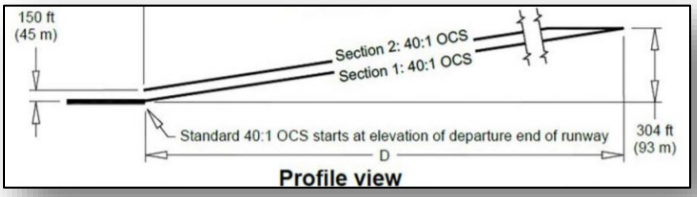
In the illustrations below, the Airport Design Standards address how a potential obstruction (i.e., a fixed object) governs the need for a displaced (approach) threshold for the runway:





Source: FAA AC 150/5300-13A





Displaced thresholds allow aircraft to clear obstructions and operate safely. However, in some cases, the utilization of the runway (and the airport itself) may be compromised for certain aircraft. The presence of a displaced threshold only affects runway operations in the direction of the obstruction. For example, in the graphic at right above, only westbound (to the left) approaches/landings would be impacted. Eastbound (to the right) approaches/landings could use the entire runway length, assuming there is not a displaced threshold on the other/west runway end (not shown). Similar standards apply for departures. The illustrations below depict the departure surface included with Airport Design Standards. In many cases, this departure surface will be more controlling (i.e., lowest to the ground) than any other surface, inclusive of Airport Design Standards and Part 77.

Instrument Departure Runway Obstacle Clearance Surface Source:
FAA Engineering Brief No. 99A

Part 77 vs. Airport Design Standards

While the surfaces prescribed under Part 77 are tied to the airport and runway ends, the surfaces prescribed under Airport Design Standards are tied to runway ends as well as to obstructions. Surfaces associated with Part 77 only move when a runway end moves such as when an airport extends a runway. However, surfaces associated with Airport Design Standards only move when a lack of obstructions allows, regardless of when a runway end moves. In other words, a runway extension will result in little, or no, additional usable length if an existing or proposed obstruction penetrates a surface in the Airport Design Standards due to the requirement to displace thresholds.

As discussed in CASP Chapter 3, the reason Airport Design Standards include approach surfaces different (i.e., more defined) than those covered by Part 77 is that Airport Design Standards incorporate visibility minimums associated with published instrument flight procedures, which are derived from TERPS, which focuses on providing a satisfactory level of vertical protection (i.e., obstacle clearance), whereas Part 77 focuses on airport/runway characteristics and infrastructure, regardless of available vertical protection. For example, the approach surfaces under Part 77 are always applied to the runway ends, regardless of an obstruction penetrating. However, the presence of an obstruction penetrating an approach (or departure) surface under Airport Design Standards dictates the usable runway ends, known as displaced thresholds, and possible implementation of declared distances.

FAA uses both Part 77 surfaces as well as Airport Design Standards when reviewing potential obstructions such as buildings, towers, antennas, trees, etc. Part 77 acts as a baseline or first step. If a potential obstruction does not penetrate any of the Part 77 surfaces, then FAA will determine that its construction/installation would not present a hazard to air navigation. If a potential obstruction does penetrate a Part 77 surface, then that does not necessarily mean FAA will deem it a hazard. Instead, FAA will determine whether the potential obstruction penetrates any of the Airport Design Standards, inclusive of obstacle clearance surfaces such as approach and departure surfaces. This is like a second step. If a potential obstruction does penetrate Airport Design Standards, then FAA will determine that its construction/installation would present a hazard to air navigation and indicate the maximum height allowed that would not present a hazard. The third/final step only comes into play when an obstruction penetrating Airport Design Standards is built despite a hazard determination from FAA or without consulting FAA in advance.

Such a penetration can result in the need to displace the runway threshold, decreasing the available landing distance. Sometimes, FAA can change an existing or planned minimum flight altitude, a published or special instrument procedure, or an instrument flight departure procedure to mitigate the obstruction depending upon the severity of the penetration and its geographic location. (Obstructions along the extended runway

centerline are much more difficult to mitigate than obstructions offset from the extended runway centerline.)

FAA has an interest in states, counties, municipalities, or any other unit of government with land use authority also applying Airport Design Standards together with Part 77 for a more comprehensive means to address land use compatibility. Where Part 77 provides a baseline to determine if an obstruction should be removed, lowered or lighted, Airport Design Standards become the "next level" up in safety by considering how best to preserve the airspace. But, avoiding less than optimal runway and airport utilization, effective land use compatibility extends beyond the regulatory framework with coordinated efforts among airport and municipal planners.