



Federal Aviation Administration

Memorandum

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To: All Regions
Attn: Manager, Airports Division

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Subject: Engineering Brief No. 79, Determining RSA NAVAID Frangibility and Fixed-By-Function Requirements

Introduction

This Engineering Brief provides guidance for determining whether navigational aids (NAVAIDS) are fixed-by-function and whether they meet frangibility requirements if located inside the runway safety area (RSA). On February 4, 2009, the Office of the Associate Administrator for Airports (ARP) and the Senior Vice President of the Operations Business Unit signed a memorandum (attached) agreeing to work together to complete improvements to NAVAIDS that are needed to meet RSA standards. A key part of this effort is to determine the appropriate corrective action for more than 2,000 objects that are identified in the Runway Safety Area Inventory (RSAI) database as not meeting RSA standards. This guidance is based on the work of the joint ARP/Air Traffic Organization (ATO) team for NAVAIDS in RSAs.

Scope and Intended Audience

FAA and airport field inspectors should only use this Engineering Brief to determine whether NAVAIDS installed inside the RSA:

1. are fixed-by-function and required to remain inside the RSA, and
2. meet frangibility requirements

This Engineering Brief does not provide guidance or requirements for decisions, actions, or procedures for correcting NAVAID violations as described herein. Similarly, this Engineering Brief does not provide guidance for making determinations on the practicability of relocating NAVAID objects as well as decisions regarding the practicability of meeting frangibility requirements. For example, safety enhancement may be negligible for some massive structures even when frangible connections are provided. In the absence of additional guidance, engineering judgment may be required to maintain compatibility with the spirit of this guidance.

RSA NAVAID Requirements

NAVAIDS located inside the RSA meet standards if they are (1) fixed-by-function and (2) frangible to within 3 inches of grade. Non fixed-by-function NAVAIDS that remain inside the RSA must be subjected to a safety risk analysis¹ to determine whether leaving them inside the RSA presents an acceptable risk. Any NAVAID that remains inside the RSA, whether fixed-by-function or not, must meet frangibility requirements. Any NAVAID that remains inside the RSA where it is not practicable to meet frangibility standards must also be subjected to a safety risk analysis.

Fixed-By-Function

NAVAIDS that are fixed-by-function do not need a safety risk analysis to remain inside the RSA. For the purposes of improving NAVAIDS inside the RSA, use the following definition of fixed-by-function:

Fixed By Function NAVAID. Any component of a NAVAID where the standard siting criteria (distance from the runway) prevents the NAVAID from being located outside either the runway safety area (RSA) or runway object free area (ROFA) for the runway being served. A NAVAID where standard siting criteria does not allow it to be located outside the runway safety area (RSA) is fixed by function for the RSA. A NAVAID where standard siting criteria does not allow it to be located outside the runway object free area (ROFA) is fixed by function for the ROFA.

- a. Fixed-by-function NAVAIDs include: Runway End Identifier Lights (REIL); Precision Approach Path Indicator (PAPI); Visual Approach Slope Indicator (VASI); Inner Marker (IM), or Approach Light Systems – All types (ALS). A modification of standards is required to designate any other type of NAVAID as fixed-by-function.
- b. Service roads and safety-essential roadway signs to a fixed-by-function NAVAID are also considered to be fixed-by-function.
- c. Equipment shelters, junction boxes, transformers, power control units, and other appurtenances that support a fixed-by-function NAVAID are not fixed-by-function unless operational requirements require them to be located in close proximity to the NAVAID.
- d. Designation as fixed-by-function does not preclude requirements to coordinate proposed installations with FAA Order 7400.2. Specific location, construction plans, and frangibility requirements must be reviewed for each proposal to install any fixed-by-function as well as non fixed-by-function NAVAID.

Frangibility Requirements

Advisory Circular (AC) 150/5300-13, *Airport Design*, established frangibility requirements for NAVAID objects:

Objects higher than 3 inches (7.6 cm) above grade should be constructed, to the extent practicable, on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches (7.6 cm) above grade. Other objects, such as manholes, should be constructed at grade. In no case should their height exceed 3 inches (7.6 cm) above grade. (¶ 305(a)(4))

AC 150/5220-23, *Frangible Connections*, provides guidance for how to provide frangible connections to meet frangibility requirements. However, it does not provide guidance for meeting

¹ A safety risk analysis is expected to follow FAA Safety Risk Management (SRM) procedures and will result in either a Safety Risk Management Decision (SRMD) or a Safety Risk Management Decision Memorandum (SRMDM) in accordance with the ATO Safety Management System Manual. SRM procedures that result in a determination of unacceptable risk *may* result in the NAVAID being decommissioned and removed from the RSA.

the 3-inch requirement. In other words, a frangible connection would not meet standards if it were installed on a rigid structure exceeding 3 inches in height.

Determining the Frangible Point

The frangible point is measured from the grade to the point of frangibility on the connection. See Figure 1. Be sure to measure from a point on grade that is close to the pad foundation. For the most part, there are two types of frangible connections: Frangible Couplings and Frangible Bolts. Figure 2 provides details on how to locate the frangible point on these connections

Standard and Acceptable Installations

As Figures 1, 2, and 3 illustrate, the surrounding grade does not need to be flush with the top of the concrete foundation or pad to meet RSA requirements. However, it is always a good idea to provide gravel fill or a maintenance pad to eliminate any lip around the pad. This will minimize the impact of the object on overrunning aircraft and will account for unanticipated erosion. Figure 4 presents details for grading around the concrete foundation pad to meet standards. Use this detail as guidance for improving existing sub-standard installations and for new installations. Figure 5 shows some examples of standard installations and Figure 6 shows typical installations that are not acceptable.

Sometimes additional fill or grading is required to eliminate the lip at the edge of the pad and to meet the 3-inch requirement. However, there are situations where excessive fill can create an additional hazard that also needs to be eliminated. Fill or grading that creates a grade change exceeding 5% slope can create a significant hazard for aircraft overruns. Figure 7 shows typical installations that are not acceptable.

Non Standard RSA Construction

Runway safety areas need to be cleared and graded to meet standards. They must also be capable of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft. See AC 150/5300-13, paragraph 305. The RSA must be constructed to meet these standards before attempting to improve any NAVAID to meet frangibility requirements. Otherwise, any improvement to the NAVAID alone would not provide the desired safety enhancement. See Figure 8.

Fixed-By-Function

Most visual NAVAIDS are fixed-by-function and must be located inside the RSA. However, equipment that supports these installations in most cases can be located remotely from the actual light fixture and therefore are **not** fixed-by-function. Junction boxes, splice cans, and power/control units are typical equipment that are not fixed-by-function. It may be possible to locate some of this equipment underground. See Figure 9 for examples.

Figure 1. Measuring Frangibility of NAVAIDS in the RSA

Measuring Items in the Safety Area

3" maximum height is measured from grade to the point of Frangibility

- Not from ground to the top of the pad
- OVERALL height 3 inches

Point of Frangibility

Pad

Grade

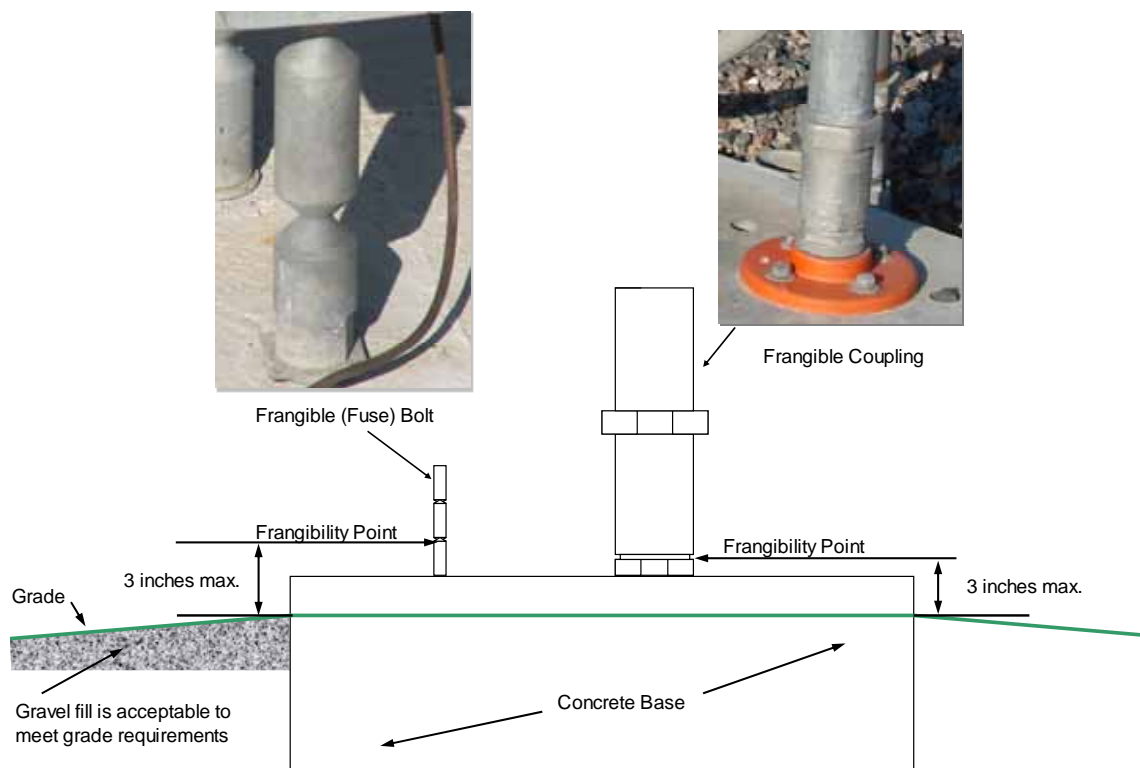
3 inch Max

Inspecting Runway & Taxiway Safety Areas
November 17, 2008

Federal Aviation
Administration

8

Figure 2 Typical Frangible Connections



Notes:

1. Frangible Bolts or Fuse Bolts are typically installed on:
 - Approach Light Systems (ALS) that use Low Impact Resistant (LIR) structures
 - Localizers
2. Frangible couplings are used with electrical metallic tubing (EMT) and are installed on
 - Approach Light Systems that are less than 6 feet high
 - PAPI
 - VASI
 - REIL
 - ALS Maintenance Stands
3. Frangible connections **do not** allow objects that are **not** fixed-by-function to meet RSA standards. These include above ground junction boxes, power control units and other appurtenances that are otherwise practicable to relocate outside the RSA/ROFA.
4. New installations should provide grading that is flush with the top of the concrete base. See Figure 4. This illustration is only to be used for evaluating existing installations for frangibility.

Figure 3. Field Measurement of Frangibility

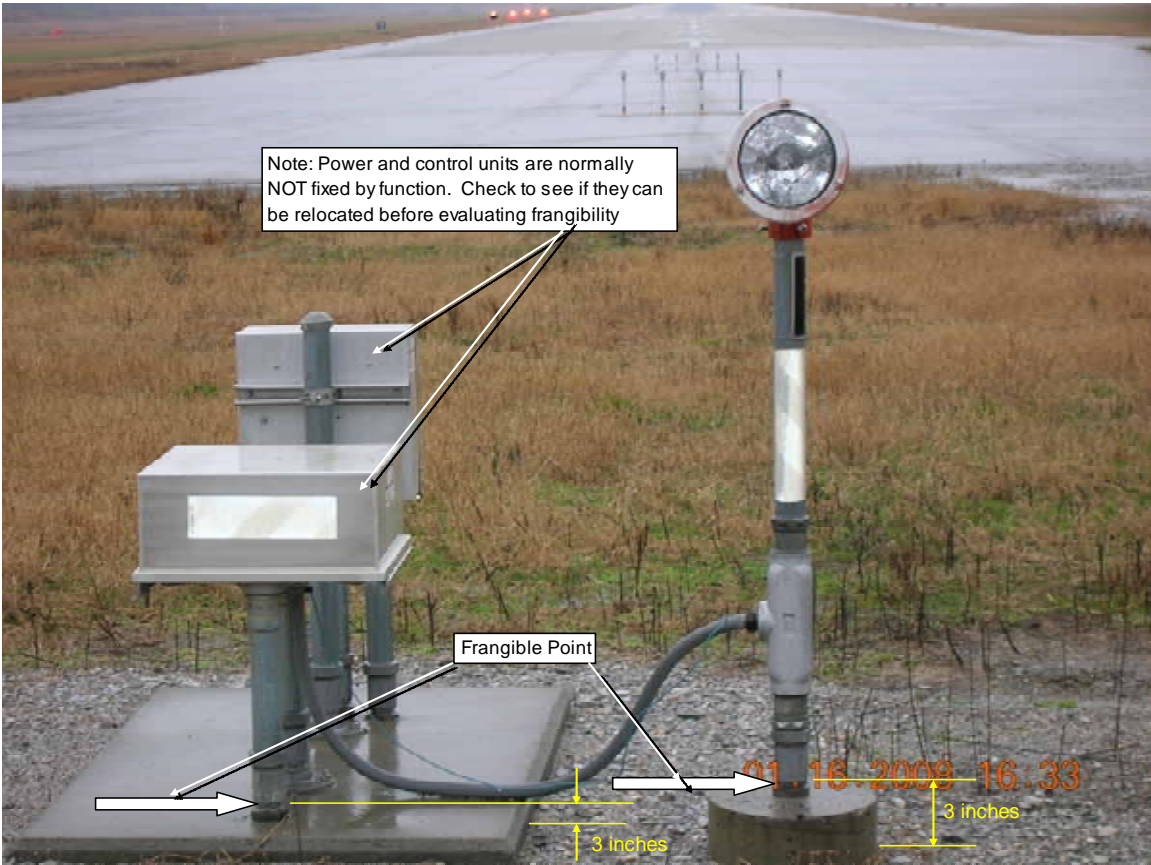
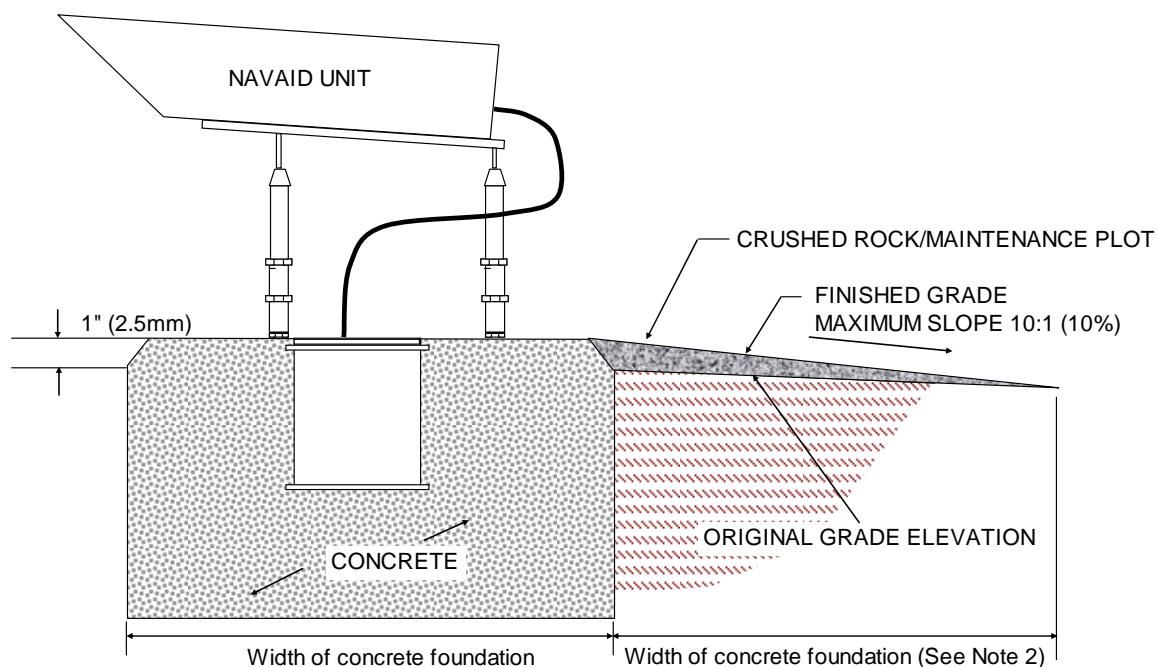


Figure 4. Typical Concrete Pad and Grading Detail



VISUAL NAVAID INSTALLATION DETAIL - TYPICAL

Notes:

1. Use this detail for finishing and grading around concrete pad foundations. This detail replaces the applicable portion of AC 150/5340-30D, Figure 90 and typical installation details provided with standard drawings.
2. If the concrete foundation is not constructed flush with the top of the surrounding grade, place and compact additional crushed rock to provide a maximum grade of 10% for the width of the foundation as shown. Any remaining fill should not exceed 5%.
3. Although the maximum grade normally allowable inside the RSA is 5%, grades surrounding the concrete foundation that are as large as 10% are permissible as shown here. Grades exceeding 10% for any distance or exceeding 5% for longer distances than shown here do not meet RSA requirements.
4. Provide for adequate drainage around the concrete foundation. The minimum grade away from the foundation should not be less than 3%. Note that a finished grade that is below the top of the slab does not provide adequate drainage.

Figure 5. Typical Standard ALS Installations

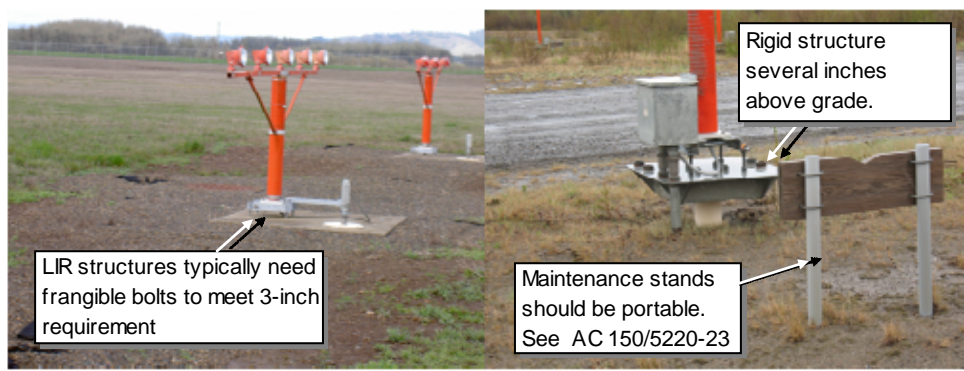


Standard Low Impact Resistant (LIR) structure installation with frangible bolts and flush gravel maintenance plot



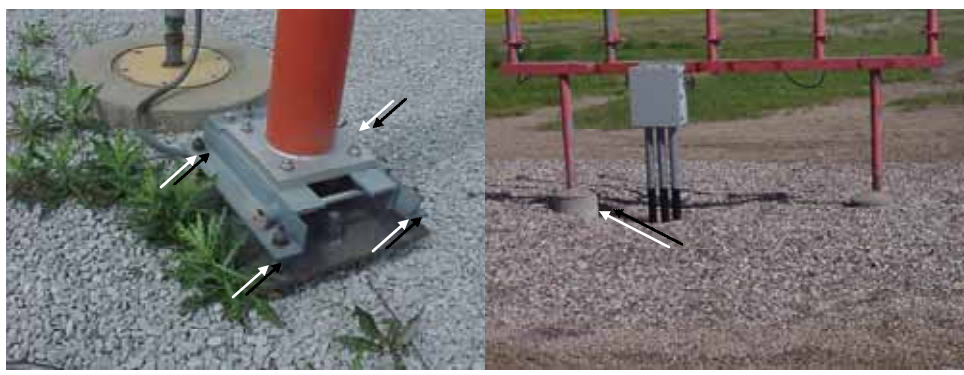
Standard ALS installation. Note electrical metallic tubing (EMT) with frangible couplings installed on light stations that are less than 6 feet high.

Figure 6. Non-Standard ALS Installations



LIR Structure- needs frangible bolts
Should use EMT if less than 6 feet high
(see Figure 5)

LIR Structure installed on a rigid
structure- frangible bolts alone are not
enough



LIR Structure- needs frangible bolts

Foundations appear to be too high

Figure 7. Unacceptable Grading Surrounding NAVAIDS



Excessive gravel fill creates a hazard



PAPI installation with excessive grade

Figure 8. Non-Standard RSA



Non-Frangible NAVAID installed in an RSA that does not meet standards.

Figure 9. Equipment Not Fixed-By-Function



Power/control units (PCU) and junction boxes that are not fixed-by-function