



# Federal Aviation Administration

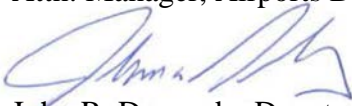
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## Memorandum

Date: January 21, 2016

To: All Regions  
Attn: Manager, Airports Division

From:   
John R. Dermody, Deputy Director, Office of Airport Safety and Standards,  
AAS-2

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

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### 1. Introduction

This Engineering Brief provides guidance for determining whether navigational aids (NAVAIDs) and associated equipment are fixed by function and whether they meet, or could be made to meet, frangibility standards 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 FAA 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.

### 2. Scope and Intended Audience

FAA and airport field inspectors should use this Engineering Brief to determine whether existing or future NAVAIDs, and associated facilities, installed inside the RSA:

- are fixed by function and thus required to remain inside the RSA, and
- meet frangibility standards.

This Engineering Brief **does not provide:**

- guidance on or requirements for decisions, actions, or procedures for correcting NAVAID violations, or
- guidance on making determinations on the practicability of relocating NAVAID objects or the practicability of meeting frangibility standards. For example, safety enhancement may be negligible for some massive structures even when frangible connections are provided.

In the absence of additional guidance, use engineering judgment to ensure NAVAID-related decisions comply with the spirit of this Engineering Brief.

### 3. RSA and Runway Object Free Area (ROFA) NAVAID Standards

NAVAIDs located inside the RSA meet standards if they are (1) fixed by function and (2) frangible to within 3 inches of grade. If it is not practicable for a fixed-by-function NAVAID inside the RSA to meet frangibility standards, it must be assessed in a practicability determination done by the responsible line of business.

Non-fixed-by-function NAVAIDs that remain inside the RSA must also be subjected to a practicability determination by the responsible line of business to determine whether leaving them inside the RSA presents an acceptable risk. If they are also not made frangible to within 3 inches of grade, they must be assessed as part of the RSA determination process.

If a NAVAID is within the ROFA but outside of the RSA and either (1) not fixed by function and/or (2) not made frangible to within 3 inches of grade, it must be subjected to a safety risk analysis<sup>1</sup>, as it would be excluded from the RSA determination process. The FAA line of business responsible for the relocation or installation leads the safety risk analysis.

### 4. Fixed-By-Function NAVAIDs and Objects

NAVAIDs that are fixed by function do not need a safety risk analysis to remain inside the RSA as long as they meet frangibility requirements.

When considering NAVAIDs inside the RSA, use the following definition of fixed by function:

**Fixed-By-Function NAVAID.** Any component of a NAVAID, as described in Paragraphs 604 and 605 of AC 150/5300-13A, *Airport Design*, where the standard siting criteria (distance from the runway) prevents the NAVAID from being located outside either the RSA or ROFA for the runway being served. A NAVAID where standard siting criteria does not allow it to be located outside the RSA is fixed by function for the RSA. A NAVAID where standard siting criteria does not allow it to be located outside the 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), End-Fire Glide Slope (EFGS), or Approach Light Systems – All types (ALS). The FAA and the manufacturer must agree to designate any other type of

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<sup>1</sup> 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.

- NAVAID as fixed-by-function. For more information, please refer to Table 6-1 in AC 150/5300-13A.
- b. **Service roads** to a fixed-by-function NAVAID are considered fixed by function. Service roads to NAVAIDs and associated equipment that are not fixed by function and located near or within the RSA, due to siting constraints, may be deemed as practicable to provide access to the facility for servicing. All roads within the RSA must be controlled with signage (see the current version of AC 150/5340-18, *Standards for Airport Sign Systems*) or by coordination with the air traffic control tower (ATCT) prior to entering. Access requirements and restrictions to RSAs at controlled airfields should be described in letters of agreement between the airport operator and the ATCT. At non-controlled airports, signage should still be installed to provide situational awareness. Service roads must also be graded in accordance with the current version of AC 150/5300-13 while encroaching as little into the RSA as possible. It is always preferred to access NAVAIDs from airport perimeter roads outside of the RSA to prevent or minimize vehicular movement inside the RSA. Access roads from taxiways are preferred over accessing a facility from the runway. Service roads within the ROFA are acceptable.
  - c. **Safety-essential roadway signs** to a fixed-by-function NAVAID are considered fixed by function and must meet the frangibility standards described in the current version of AC 150/5220-23, *Frangible Connections*. These standards must also be adhered to for any signs to a non-fixed-by-function NAVAID that has been approved to reside in the RSA.
  - d. **Equipment shelters, junction boxes, transformers, power control units, and other appurtenances that support fixed-by-function NAVAIDs** are not fixed by function unless operational specifications require them to be located in close proximity to the NAVAID. When practicable, these should also meet frangibility standards if their proximity to the NAVAID requires them to be placed within the RSA. The April 23, 2010, memorandum, *Amendment to Engineering Clarification for Navigational Aids Runway Safety Area Improvements*, and the December 8, 2011, memorandum, *Precision Approach Path Indicator (PAPI) Power Control Assembly (PCA) and Power and Control Unit (PCU) Siting Clarification*, provide additional guidance for determining whether specific NAVAIDs and associated equipment are fixed by function or not. ARP and ATO jointly signed both memorandums.
  - e. **Jet blast deflectors** are not fixed-by-function. However metal blast deflectors that are placed too close to a localizer may interfere with its navigation signal to aircraft and may have to be placed within the RSA. Non-metallic blast deflectors, such as those made of fiberglass or other plastic polymers, do not interfere with localizer signals. Additionally, fiberglass and plastic blast deflectors provide greater frangibility than metal deflectors. Therefore, any jet blast deflectors placed within the RSA must be entirely made of fiberglass or low mass plastic, including the frangible bolts at the base of the deflector. The point of frangibility must be made no higher than 3 inches above grade, subject to its determination process.

- f. **Engineered Materials Arresting Systems (EMAS) beds** are fixed by function and frangible as defined by the current version of AC 150/5220-22, *Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns*.

Regardless of fixed-by-function designation, proposed installations must comply with the current version of FAA Order 7400.2, *Procedures for Handling Airspace Matters*. Specific location, construction plans, and frangibility specifications must be reviewed for each proposal to install any fixed-by-function or non-fixed-by-function NAVAID.

## 5. Frangibility Standards

Refer to the current versions of the following ACs for frangibility guidance:

- **AC 150/5300-13A** establishes frangibility standards for NAVAID objects:  
Objects higher than 3 inches (76 mm) above grade must be constructed, to the extent practical, on frangible mounted structures of the lowest practical height with the frangible point no higher than 3 inches (76 mm) above grade. Other objects, such as manholes, should be constructed at grade and capable of supporting the loads noted above. In no case should their height exceed 3 inches (76 mm) above grade. (§ 307(b)(4))
- **AC 150/5220-23, *Frangible Connections***, explains how to provide frangible connections to meet frangibility standards. However, it does not provide guidance for meeting the 3-inch requirement. In other words, a frangible connection exceeding 3 inches in height above grade does not meet standards if it is installed on a structure that does not have low impact resistance (LIR). Rigid structures that are considered to be fixed by function, must be constructed at grade. The same frangibility practices apply to the ROFA as to the RSA.
- **AC 150/5345-46D, *Specification for Runway and Taxiway Light Fixtures***, provides guidance for lighting fixtures along the runway. L-804 elevated light fixtures must have a point of frangibility that is no greater than 1.5 inches above grade.
- **AC 150/5345-45C, *Low-Impact Resistant (LIR) Structures***, provides additional frangibility specifications for LIR structures.

## 6. Identifying and 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 the point on grade that is closest to the frangible point.

The two most common types of frangible connections are frangible couplings and frangible bolts. Figure 2 provides details on how to locate the frangible point on these connections. A third, less common type of frangibility configuration uses the process of drilling pressure-treated wooden support structures. This practice is only acceptable for existing structures and cannot be used for future installations.

## 7. 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 standards. 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. The gravel should be treated with porous cement or bound with wire mesh to protect from jet blast.

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 unacceptable installations.

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, excessive fill can create an additional hazard that needs to be eliminated. Fill or grading that creates a grade change exceeding a 5-percent slope, except over a foundation width distance as shown in Figure 4, can create a significant hazard for aircraft overruns. Figure 7 shows examples of unacceptable grading.

#### 8. NAVAIDs within a Non-Standard RSA

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 150/5300-13A, paragraph 307.

The RSA must be constructed to meet these standards before attempting to improve any NAVAID to meet fragility standards. Otherwise, any improvement to the NAVAID alone would not provide the desired safety enhancement. See Figure 8.

#### 9. Associated Equipment that is not Fixed-By-Function

Most visual NAVAIDs are fixed by function and must be located inside the RSA. However, equipment that supports these installations usually can be located apart from the actual light fixture and therefore would **not** be fixed by function. Junction boxes, splice cans, and power/control units are often typical equipment that are not fixed by function and must be relocated outside of the RSA, if practicable. If relocation out of the RSA is not practicable, the option of burial underground must be explored before allowing the facility to remain in place.

## Figures

Figure 1. Measuring Frangibility of NAVAIDs in the RSA

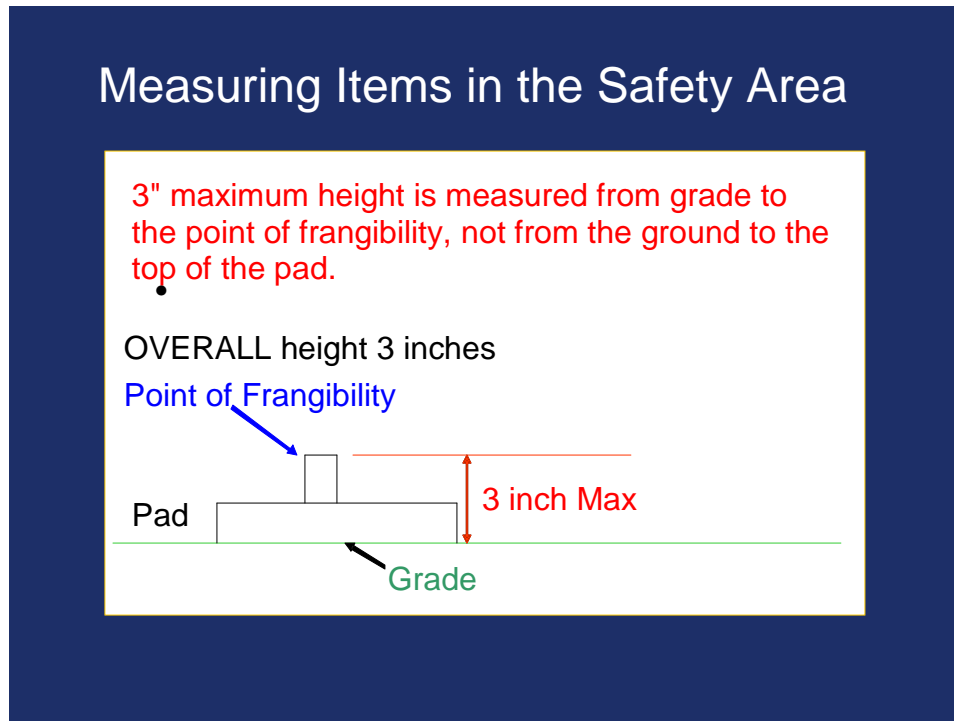
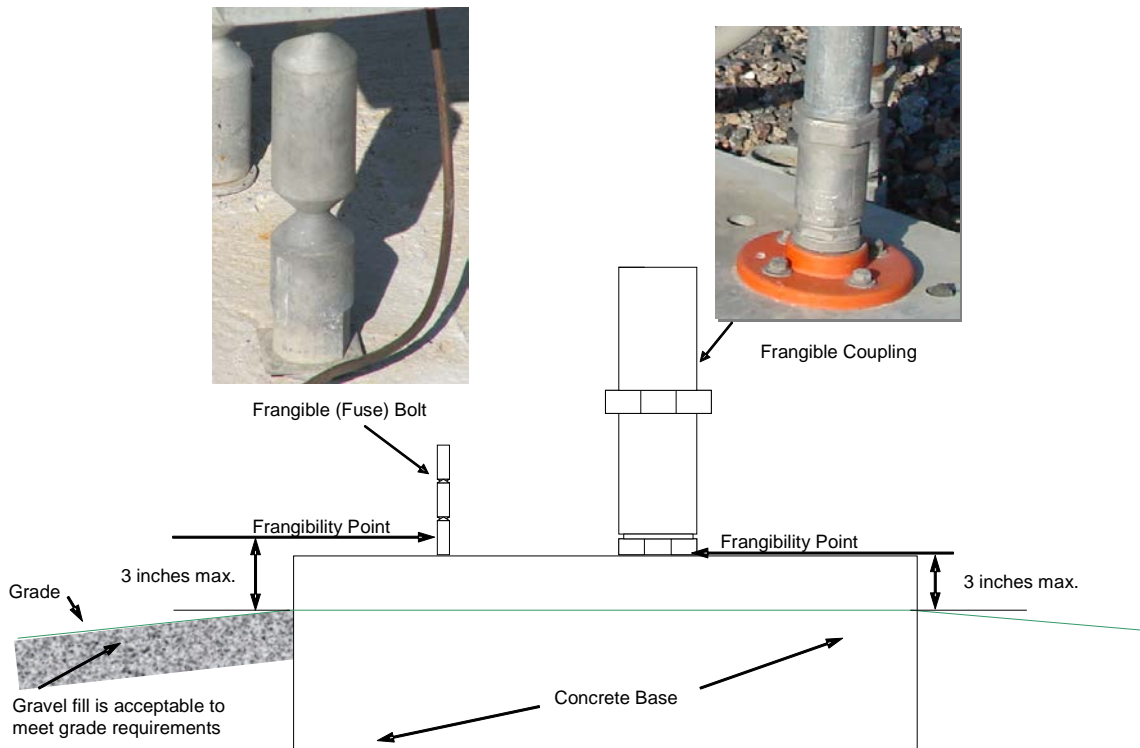


Figure 2. Typical Frangible Connections



## 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. Objects that are not fixed by function must be removed from the RSA to the best extent practicable, regardless of the lowest point of frangibility. These include above ground junction boxes, power control units and 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

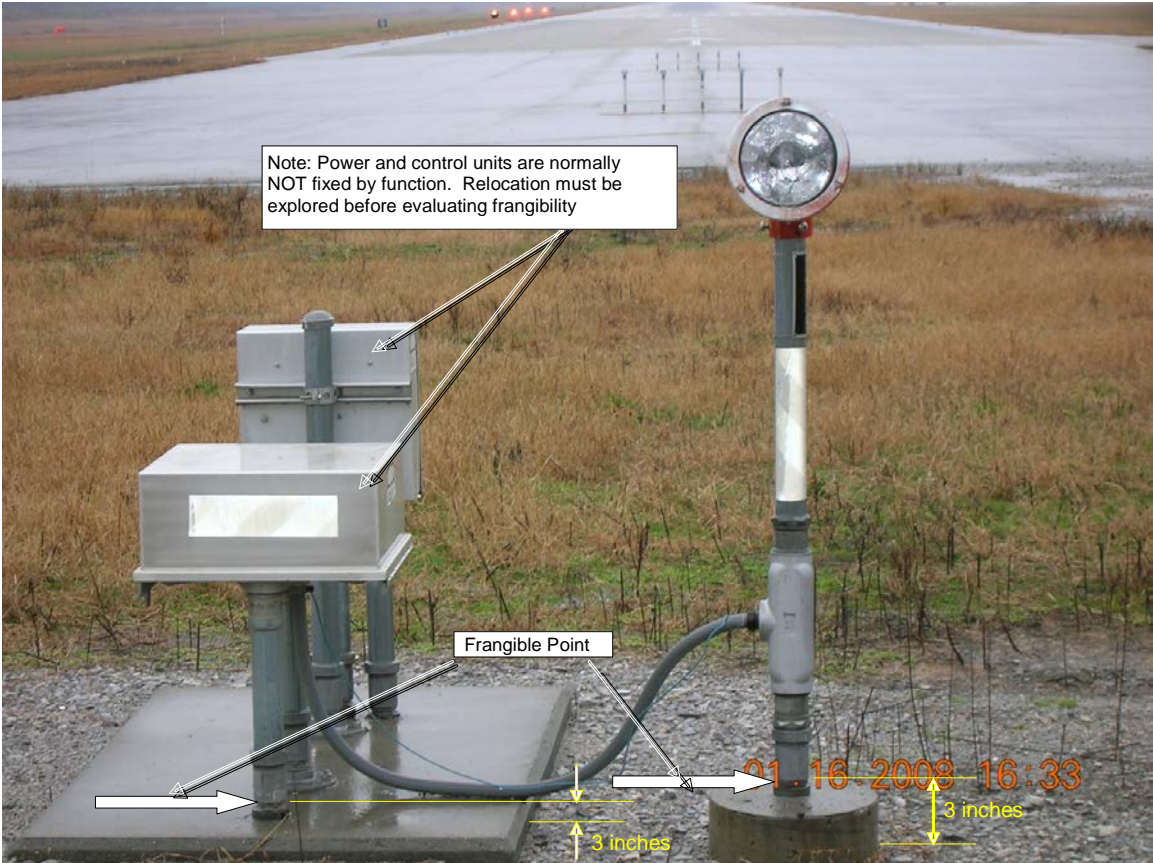
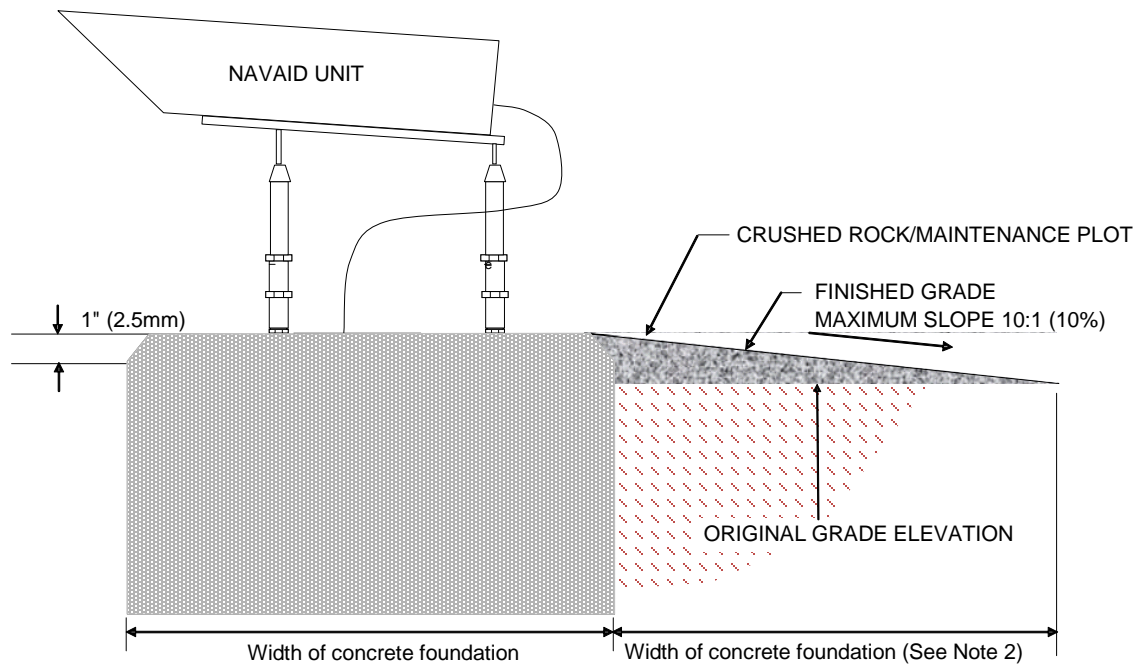




Figure 4. Typical Concrete Pad and Grading Detail

VISUAL NAVAID INSTALLATION DETAIL - TYPICAL

## Notes:

1. Use this detail for finishing and grading around concrete pad foundations.
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% or more than 10%. Note that a finished grade that is below the top of the slab does not provide adequate drainage.
5. Crushed rock should be treated with cement binder or contained with wire mesh in areas exposed to jet blast.

Figure 5. Typical Standard ALS Installations

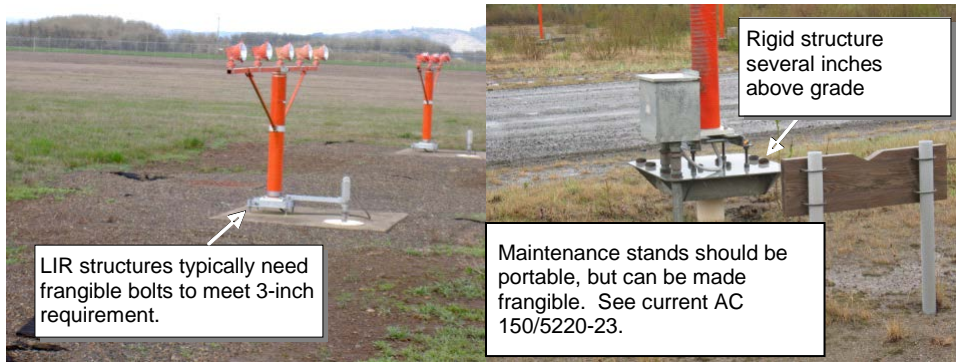


Standard Low Impact Resistant (LIR) structure installation with frangible bolts and flush gravel maintenance plot



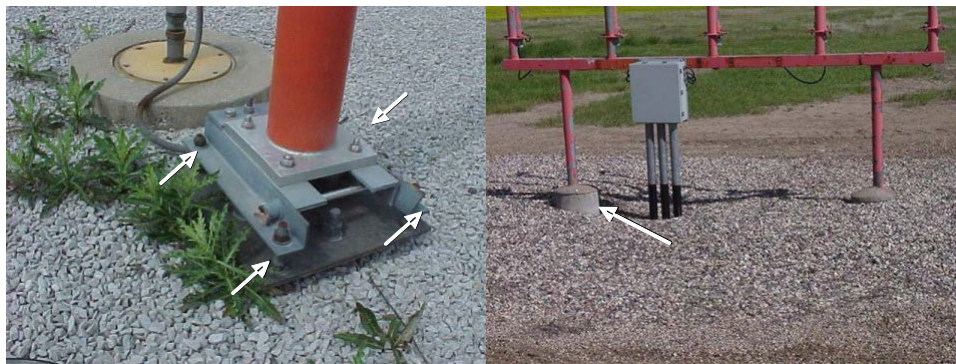
Standard ALS installation. Note electrical metallic tubing (EMT) with frangible couplings installed on light stations that are less than 6 feet high.

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



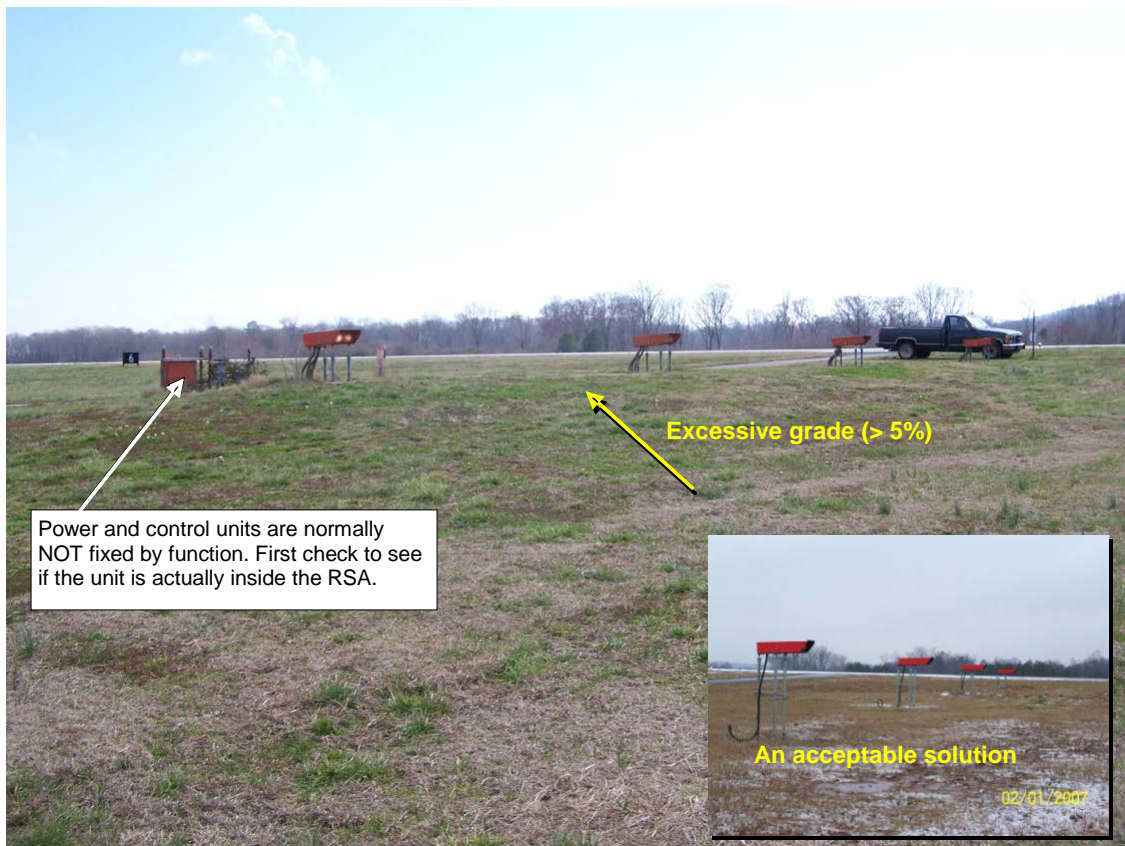
LIR structure - needs frangible bolts

Foundations appear to exceed 3 inches above grade

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 (PCUs) and junction boxes are fixed-by-function if they meet the standards of AC 150/5300-13 or either of the memorandums referenced in Paragraph 4.