THE FAA REIMBURSABLE

THE WHO WHAT WHEN WHERE AND WHY!

FAA REIMBURSABLE

- What is a Reimbursable agreement with FAA?
- What will trigger a reimbursable?
- How the reimbursable works
- The FAA groups that you will be working with
- Types of systems that you will encounter
- Design Criteria and Specifications for these systems


Inc.


CASE
carhartt

RECENT REIMBURSABLES

- SFO – Airport was upgrading its safety by shortening RW and installing EMAS. Navaids adjusted to new RW length.
- DFW – End Around TW Project. Localizer Shelter and ALSF-2 in the way.
- FSM – Extending RW for new Aircraft class. NAVAIDs adjusted to new RW length.
- JAC - Complete RW rebuild. NAVAIDs updated with RW.
- Little Rock VORTAC – Moving for more real-estate
- Corona VORTAC – In the way of new wind farm.

WHAT DO I MEAN BY REIMBURSABLE?

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Washington Headquarters National Policy

ORDER 2500.35D

Effective Date:
8/30/07

SUBJ: Reimbursable Agreements Covering Goods and Services Provided by the FAA

1. **Purpose of This Order.** This order sets policy related to the preparation, approval, and management of reimbursable agreements in which the FAA provides goods or services and where the recipient or project sponsor pays the associated costs. The standard operating procedures related to the reimbursable agreements can be found in the FAA Financial Manual – Volume 4: Accounting, Chapter 6: Reimbursable Agreements: https://employees.faa.gov/org/staffoffices/aba/financial_manual/vol_4/

2. **Audience.** This order is for all FAA headquarters, regions, centers, service areas, and field office personnel.

3. **Where Can I Find This Order.** FAA Orders and Notices website: https://employees.faa.gov/tools_resources/orders_notices/

WHERE DO YOU START?
WHO IS THE FAA?

Flight Standards Service Organizational Chart

Flight Standards Service
Lawrence Fields (A) AFX-1 Executive Director
Admin: Nicole Stankosky

Deputy Executive Directors
Wesley L. Mooty (A) (AFX-2A) — Caitlin Locke (A)(AFX-2B)
Admin: Jamie J. McLaughlin

Office of Air Carrier Safety Assurance
Director, Dennis J. Hill (A) (AFC-1)
Admin: Sheryl CTR Opperman
Deputy Directors
Hugh Thomas (AFC-2A) — Brittany Richardson (A) (AFC-2B)
Admin: Alexis CTR Woods

- Air Carrier Division A (AFC-100) George W. Wadsworth IV — Admin: Kelly Sampson
- Air Carrier Division B (AFC-200) Thomas F. Malone — Admin: Stacey Seeley
- Air Carrier Division C (AFC-300) Steven J. Rogers — Admin: Kelly Sampson
- Air Carrier Division D (AFC-400) Scott Chance (A) — Admin: Serina Volore
- Air Carrier Division E (AFC-500) Michael Drew — Admin: Serina Volore
- Air Carrier Division F (AFC-600) Calvin D. Tillman (A) — Admin: Stacey Seeley

Office of General Aviation Safety Assurance
Director, Hardie H. DeGuzman (AFG-1)
Admin: Julia CTR Scott
Deputy Directors
Rolandos Lazaris (A) (AFG-2A) — Thomas A. Winston (AFG-2B)
Admin: Jacquelyn Davenport

- General Aviation Division A 135 10 or More (AFG-100) Erik F. Anderson (A) — Admin: Randi CTR Sargent-Bragg
- General Aviation Division B 135 9 or Less (AFG-200) Victor L. Goodell — Admin: Stephanie CTR Groves
- General Aviation Division C 135 9 or Less (AFG-300) Karen D. Gattis — Admin: Michele CTR Raye
- General Aviation Division D 135 9 or Less (AFG-400) William J. McGowan (A) — Admin: Stephanie CTR Groves
- General Aviation Division E 135 9 or Less (AFG-500) Wayne Fry — Admin: La Tasha CTR Maddox
- General Aviation Division F Air Agency (AFG-600) Mark E. Kramer — Admin: La Tasha CTR Maddox
- General Aviation Division G Air Agency (AFG-700) Jerald L. Eichelberger

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Director, Robert M. Ruiz (AFS-1)
Admin: Kecia CTR Brown
Deputy Directors
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Admin: Stacy CTR Carr

- International Program Division (AFS-50) Jackie Black (A) — Admin: Santresa L. CTR Glass
- Aircraft Evaluation Division (AFS-100) Jeffrey Phipps — Admin: Debbie Allen
- Air Transportation Division (AFS-200) Robert Reckert — Admin: Kim Y. CTR Henderson
- Aircraft Maintenance Division (AFS-300) Rebecca Hoover (A) — Admin: Annette CTR Skaggs
- Flight Technologies & Procedures Division (AFS-400) Christopher J. Hope — Admin: Angela CTR Williams
- Regulatory Support Division (AFS-600) Karen Lucke (A) — Admin: Santresa L. CTR Glass
- General Aviation & Commercial Division (AFS-800) Brad Palmer — Admin: Debbie Allen

Office of Foundational Business
Director, Jill Brown (AFB-1)
Admin: Cheryl CTR Bruce
Deputy Directors
Murrell "Tip" Stinnette (AFB-2A) — Mark Hopkins (A) (AFB-2B)
Admin: Elizabeth CTR Todd

- Mission Services Division (AFB-100) Charles A. Davis (A) — Admin: Annette CTR Skaggs
- Strategic Planning & Financial Services Division (AFB-200) Augusto Casado — Admin: Monica CTR Wallace
- Workforce Services Division (AFB-300) Vincent Chirasello — Admin: Morgan Day
- Safety Risk Management Division (AFB-400) Cody Schnaufer (A) — Admin: Morgan Day
- Workforce Development Division (AFB-500) Bobby M. Hedlund — Admin: La Tasha CTR Maddox
- Civil Aviation Registry Division (AFB-700) Gerald A. Boots — Admin: Sandi D. CTR Gardner

(A) - Acting

FAA Services Hierarchy

FAA Services

As of 11/7/2023

1. Air Traffic Management
1. Flight Planning
2. Air Traffic Control - Separation Assurance
3. Air Traffic Control - Advisory
4. Traffic Management - Synchronization
5. Traffic Management - Strategic Flow
6. Emergency and Alerting
7. Navigation
8. Airspace Design and Management
9. Government/ Agency Support

2. Airport Management
1. Grants Management
2. Airport Safety Certification and Compliance
3. Airport Planning and Development

3. Security
1. Facilities Security
2. Information Security
3. Personnel Security
4. Emergency & Disaster Planning & Response

4. Safety
1. Aviation Safety
2. Facilities Safety
3. Hazardous Materials Management

5. Enterprise Management
1. FAA Strategies, Planning, and Concepts
2. Acquisitions
3. Regional Administration
4. FAA Facilities
5. FAA Sustainment
6. Training
7. Spectrum Management
8. FAA Technology and Infrastructure
9. FAA Data and Information Management
10. Workforce Planning and Development (Human Resources)
11. Budget and Financial Management
12. Enterprise Policy and Guidance Development
13. Legal
14. Public Affairs, Information, and Outreach

6. Certification
1. Risk-Based Decision Making
2. Aircraft Certification
3. Flight Standards
4. Rulemaking
5. Accident Investigation
6. Aviation Medicine

7. Environment and Energy
1. Science and Tools
2. Technology
3. Alternative Fuels
4. Policy Development

8. Commercial Space Transportation
1. CST Licensing and Permits
2. CST Safety
3. CST Rulemaking
4. CST Infrastructure
5. CST Research
6. CST Grants

FAA
Office of NextGen

WHAT IS A COMMON ISSUE THAT ARISES FROM THESE PROJECTS?

- The first is that NPT **(FAA NAS Planning Team)** is often informed late about a project's potential impact to an FAA facility. We have little to no visibility on upcoming airport sponsored projects unless the sponsor tells us directly. We don't see 7460s in the engineering group and our operations group that reviews 7460s often can overlook impacts to facilities. Quite commonly, we'll be informed about a project in the early Fall of the year prior to construction. This is typically the time where the Sponsor's engineer has just started design work but this is already way too late for us to incorporate the work into our work plan. We really need to know about the work at least **18 months in advance** of construction start and ideally even further out than that. It is much easier for us to stand down from a project that is determined to have no impacts than it is for us to start late.

Austin Mixell, Lead Engineer NAVAIDs Engineering

- Ideally you want to contact the NAS Planning Team.
- I also recommend contacting the local SSC at that specific airport.
- Do not depend on SSC to drive the ship. They are busy with their normal activites and you will need to be lead in moving things along.
- 18 months in advance is ideal!!!!

NAS PLANNING TEAM

GEOGRAPHICAL ASSIGNMENTS

Eastern Service Center

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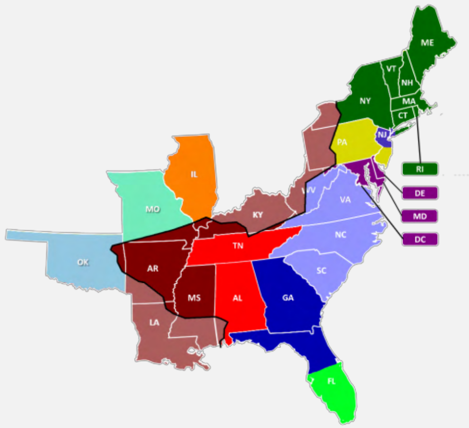

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CSC	**Brad Urey** | 817.222.4029 | brad.urey@faa.gov	IL

CSC Functional Directory

All Items AJV-C001 **AJV-C330** ··· Find an item

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HERE ARE SOME CONTACTS FOR NPT

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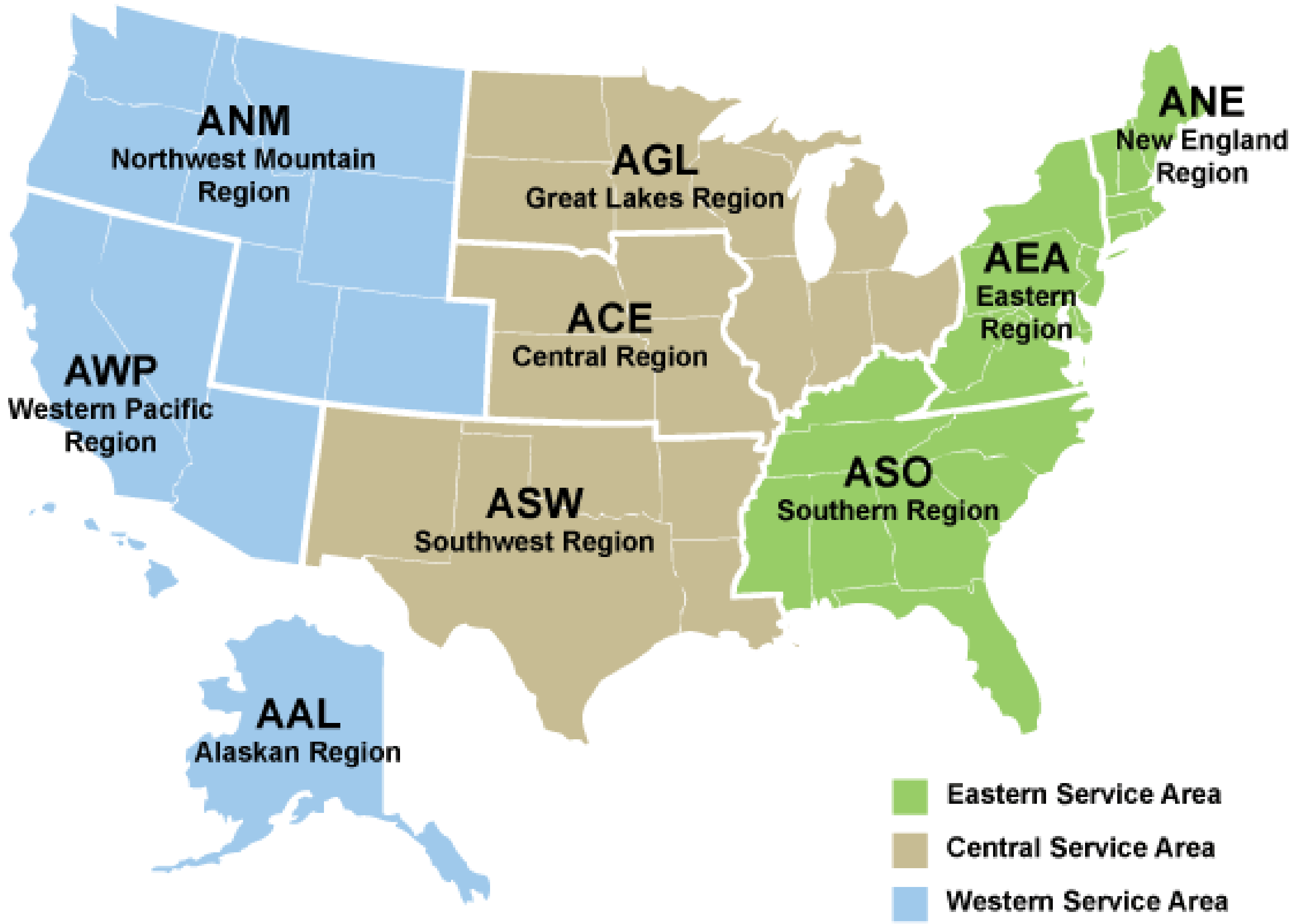
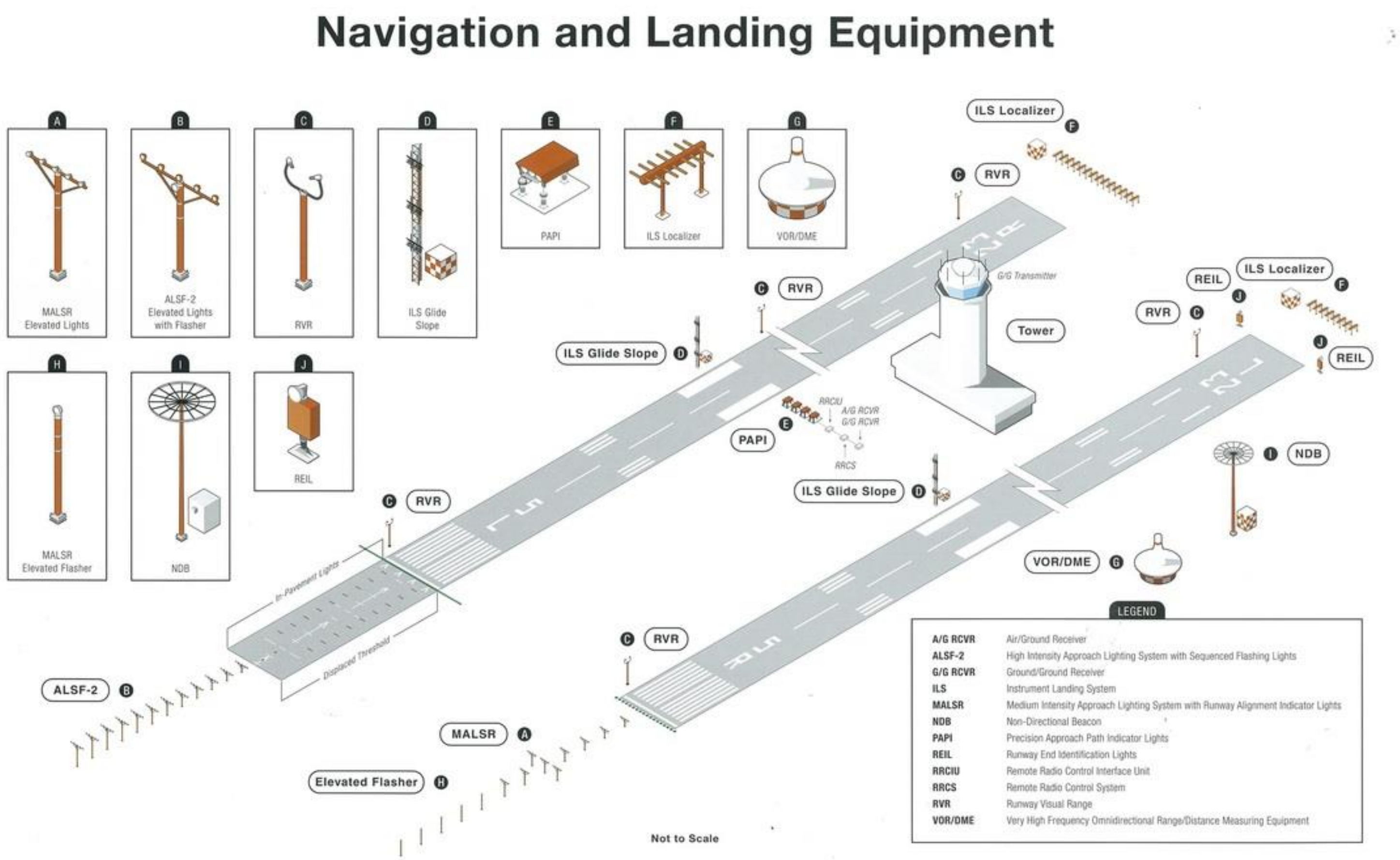
NAVAIDS ENGINEERING



FAA SYSTEMS



Navigation and Landing Equipment
MALSR Elevated Lights
ALSF-2 Elevated Lights with Flasher
RVR
ILS Glide Slope
PAPI
ILS Localizer
VOR/DME
MALSR Elevated Flasher
NDB
REIL
ILS Localizer
RVR
G/G Transmitter
Tower
REIL
ILS Glide Slope
PAPI
RRCIU
A/G RCVR
G/G RCVR
RRCS
NDB
VOR/DME
In-Pavement Lights
Displaced Threshold
ALSF-2
MALSR
Elevated Flasher
Not to Scale
LEGEND
A/G RCVR Air/Ground Receiver
ALSF-2 High Intensity Approach Lighting System with Sequenced Flashing Lights
G/G RCVR Ground/Ground Receiver
ILS Instrument Landing System
MALSR Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
NDB Non-Directional Beacon
PAPI Precision Approach Path Indicator Lights
REIL Runway End Identification Lights
RRCIU Remote Radio Control Interface Unit
RRCS Remote Radio Control System
RVR Runway Visual Range
VOR/DME Very High Frequency Omnidirectional Range/Distance Measuring Equipment

HALF TIME??

SITING CRITERIA

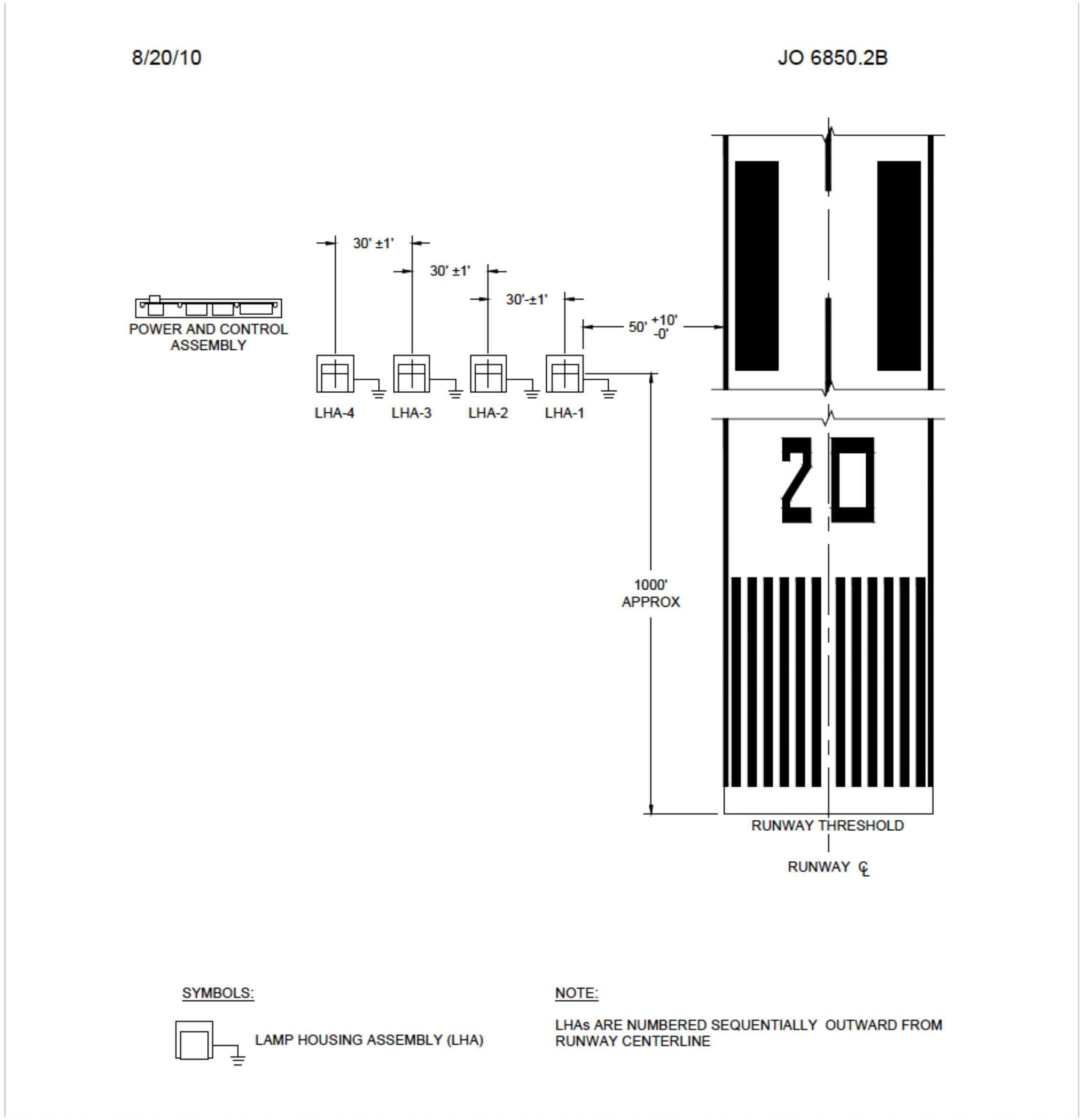
OR

INSTALLATION CRITERIA

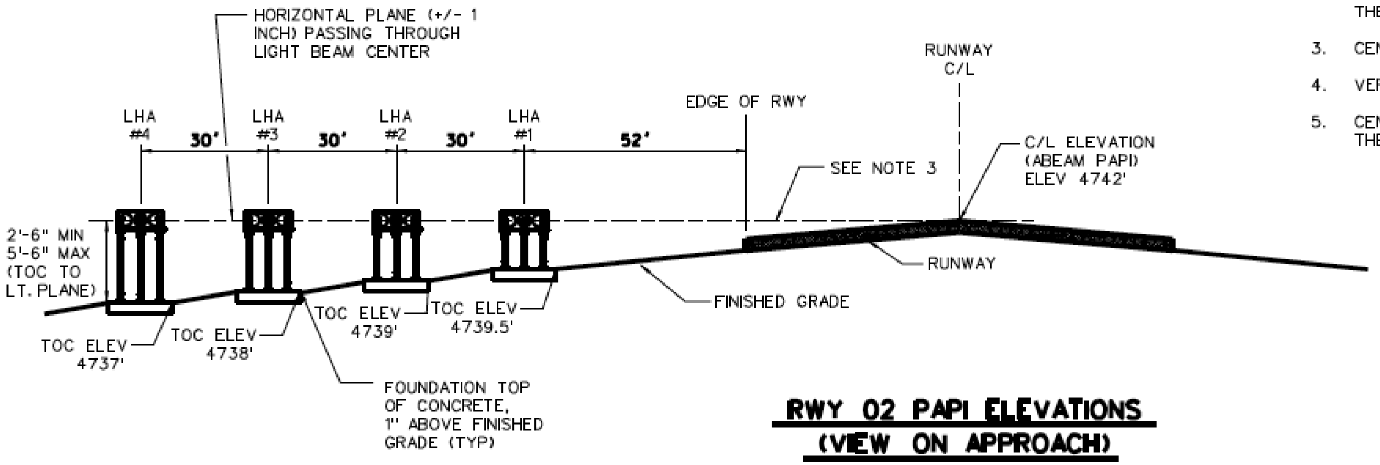
- FAA Job Orders tell you how to site your system. There are a bunch of them!
- Approach Lighting – Job Order 6850.2
  - PAPI
  - MALSR
  - ALSF I or II
- Ground Based Navigation – JO6750.16
  - Glide Slope
  - FFM
  - Localizer
  - Inner Marker / Outer Marker
  - VOR / TAC / DME (JO 6820.10)
- Remote Comm. Facilities – JO 6850.6
  - RTR, RCAG, Air To Ground, BUEC

6850.2 – COMMON MISTAKES

- The PAPI can move along runway.
- Must be in line with Glide Slope if it exist.
- Edge of RW Clearance. Must Be 50’
- Legs must not be longer than 6 feet.
- Watch your Part 139 Slopes and beware of the concrete sidewalk.



PAPI EDGE DISTANCE AND HEIGHT



RWY 02 PAPI ELEVATIONS
(VIEW ON APPROACH)
NOT TO SCALE

NOTES:

1. INSTALLATION TOLERANCES FOR SEPARATION BETWEEN LHA'S AND DISTANCE BETWEEN LHA #1 AND EDGE OF RUNWAY IS ± 2 INCHES.
2. THE FRONT FACE OF EACH LHA IS IN A LINE PERPENDICULAR TO THE RUNWAY CENTERLINE, ± 1 INCH.
3. CENTER OF LHA LIGHT BEAM IS LEVEL WITH PAPI ABEAM CENTERLINE ± 1 INCH.
4. VERIFY LHA HEIGHTS WITH THE RESIDENT ENGINEER BEFORE CUTTING EMT LEGS.
5. CENTER OF LHA LIGHT BEAM SHALL BE 1' ABOVE THE INTERCEPT OF THE VISUAL GLIDE PATH AT THE RUNWAY CENTERLINE WITHIN + 1'.

GLIDE PATH: 3.0°
TCH: 50'

LHA	AIMING ANGLE
#1	3° 30' 00"
#2	3° 10' 00"
#3	2° 50' 00"
#4	2° 30' 00"

PART 139

- If you are required to have sidewalk pay attention to grade.
- Legs have min and max height.
- Part 139 requires specific slopes.

6850.2 – COMMON MISTAKES

- Max spacing of threshold bar is 10 from declared threshold.
- Line up side row bars with TDZ Lights!!!
- The first 9 stations will most likely be in pavement.
- PAR 38 Lamps for MALSR are currently out of stock in the USA. So don't throw anything away until your flight checked and published.

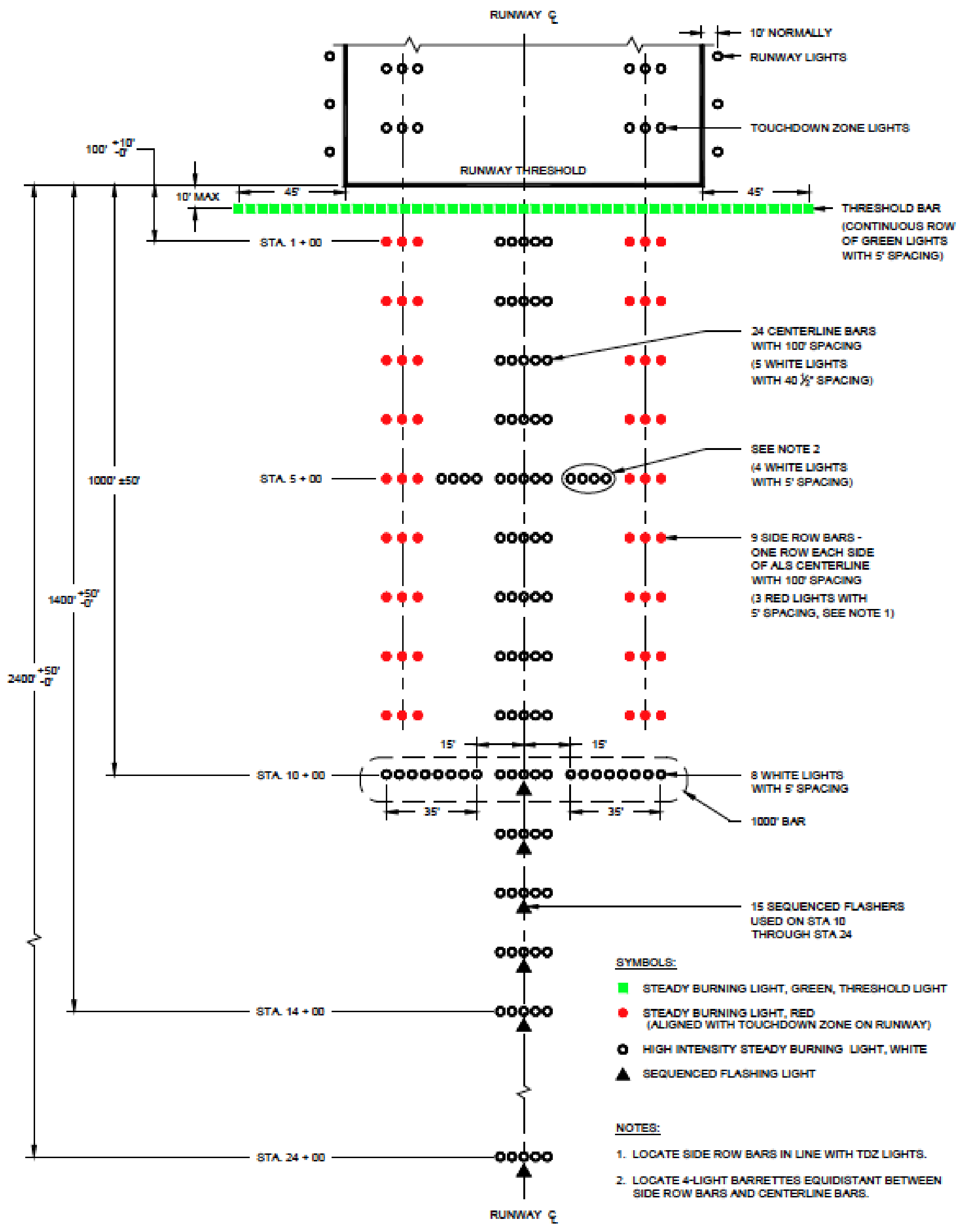


FIGURE 2-1. ALSF-2 CONFIGURATION

DON'T FORGET SPECIFICATION

6750.16 – COMMON MISTAKES

- Know your ILS Types!!!
- Some ILS equipment is obsolete. So If you break it then you buy a new version.
- If you move ILS and new location wont work with that type then you need different type. FAA should guide you on this. Don't Assume
- Who Will tune ILS when its done being moved? Does FAA have personnel available for your schedule?

ILS will provide. Siting within restricted areas should only be considered when standard installations are not practical.

d. Back-Course Coverage Considerations. Current localizer antenna systems utilize unidirectional antennas and will not provide a useable back-course. If an instrument approach is required for the opposing approach, a facing localizer on the opposite end of the runway is necessary. New localizer establishments using bi-directional antenna arrays are no longer authorized.

e. Equipment Type and Configuration Considerations. Equipment type and configuration used in ILS establishments should be carefully chosen for the environment in which it is installed. Consideration should be given not only to siting ILS equipment to account for current terrain, obstructions, etc., but also for future airport expansion and other development around the airport environment. Type and configuration include single versus dual frequency equipment, narrow versus wide aperture antenna arrays, capture-effect versus null-reference, etc. An example is the airport where a single frequency, narrow aperture, localizer will function satisfactorily, but the airport plans indicate a large hangar construction project. In this example, the siting engineer should consider siting a more complex localizer system to protect future facility performance. The glide slope example can be more demanding. If a null-reference glide slope is sited and subsequent changes to the airport environment require change to a capture-effect configuration, the modification to capture-effect would involve more than simply reconfiguring the transmitting equipment. Since a capture-effect configuration requires an additional antenna and mast height, the modification could actually require moving the glide slope site to allow adequate clearance of the Obstacle-Free Zone (OFZ). In this example, major issues in the future can be avoided with prudent siting. New ILS equipment consists primarily of dual frequency localizer and capture effect glide slope systems in dual equipment configurations. Redeployment of existing systems, particularly Mark I series single frequency localizers with eight or fourteen element narrow aperture antenna arrays, may result in unacceptable signal-in-space performance. The discussion in paragraph 2-7b(4) regarding the limitations of single frequency narrow aperture localizer antenna arrays is particularly germane.

11. ILS Components as Obstructions. The siting engineer considers the effects of the ILS components themselves as obstructions. These considerations should include guidance given in FAA Order 8260.3, 14 CFR Part 77, and applicable Advisory Circulars such as AC 150/5300-13, 70/7460-1. Both the Airport division office and Flight Procedures Team should be consulted and provide approval and/or waiver for any penetrations as part of the required airspace review. Failure to obtain approval or a waiver will preclude installation of that component.

6750.16 – COMMON MISTAKES

- Terrain matters.
- If you move it then you need to see what the terrain is going to look like.
- If you don't move one but you destroy the terrain in front of one, then you may have some issues. So even if you don't have a reason to move ILS you may still need to discuss plans with FAA.

monitoring are discussed in detail in Chapter 5.

(3) Connectivity. ILS systems have inputs and outputs that may require telecommunication circuits which must be established prior to commissioning. In addition to FAA owned and maintained multi-pair copper cable, connectivity options include fiber optics, multiplexing networks, and connectivity through airport or commercially provided cabling or systems. These telecommunication input/outputs provide connectivity to ancillary aids and other ILS components that provide identification, signaling, and status to and from the ILS.

14. Siting Effects on ILS Operations. The ability of each ILS subsystem to provide reliable and accurate guidance information depends primarily upon the proper formation of its respective radiation patterns. The greatest detriment to the formation of the desirable patterns is the presence of reflecting objects such as uneven terrain, power lines, buildings, dense vegetation, ground vehicles, water, snow and/or ice conditions, and aircraft moving in the vicinity of the sites. The following siting requirements for each type of facility should enable the responsible engineer to choose the optimum site. Math modeling techniques can be employed to predict the probable location, magnitude, and duration of ILS disturbances caused by multipath conditions,

whether from structures or from aircraft of various sizes and orientation at different locations. Issues involved with these techniques are outlined below.

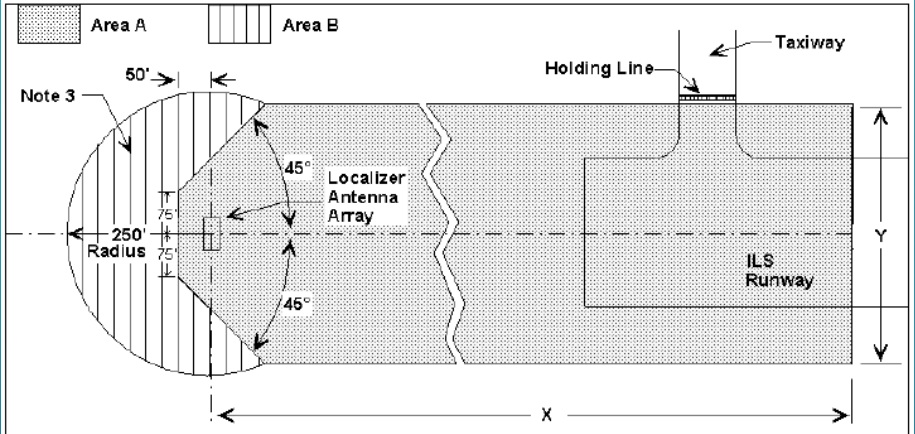
a. Computerized Math Models. Computerized math models are widely available and usable by personnel with a wide variety of experience levels; however, engineering knowledge of and judgment about the appropriate assumptions and limitations of the various models are required when applying such models to specific multipath environments. It should be noted that modeling results do not consider other operational issues such as snow banks, aircraft or vehicular movement, aircraft hold areas, or increase to aircraft taxi times due to ILS critical areas. Additionally, the modeling tends to simplify the topography and surrounding environment.

WHAT IS THE MOST MISUNDERSTOOD DESIGN PORTION FOR AN FAA SYSTEM?

- Hands down the most misunderstood item I see over and over again is the application of critical areas for LOC, GS, VOR, and ASOS/AWOS. VORs and ASOS/AWOS or other weather equipment do not have critical areas. They have areas that need to be protected from development but there is no such thing as a VOR critical area. Excavations and stockpiling within the VOR "protection area" need to be avoided with the system still in service, but haul routes (provided they are not immediately adjacent to the VOR) are perfectly fine. Aircraft taxi through VOR protection areas all the time and are not controlled in any way. Similarly ASOS and AWOS do not have "critical areas". They do have a protected zone in which equipment needs to be kept lower than the wind speed instrument and dust needs to be kept down for visibility readings but you could park twenty scrapers right next to a ASOS and it wouldn't do anything to the reliability of the system.

- Most engineers understand the application of the critical area for the LOC and GS well enough, but one thing that often gets overlooked is that we need to be concerned with grading and site development work which occurs outside of the critical area as well. I can't tell you how many times I've had an engineer say oh we're not doing any grading in the GS critical area so we are okay when they are building a huge swale 1400' from the antenna. There is expansive grading criteria given in 6750.16E for Glide Slopes that extend well beyond just the critical area.

Austin Mixell, Lead Engineer NAVAIDs Engineering

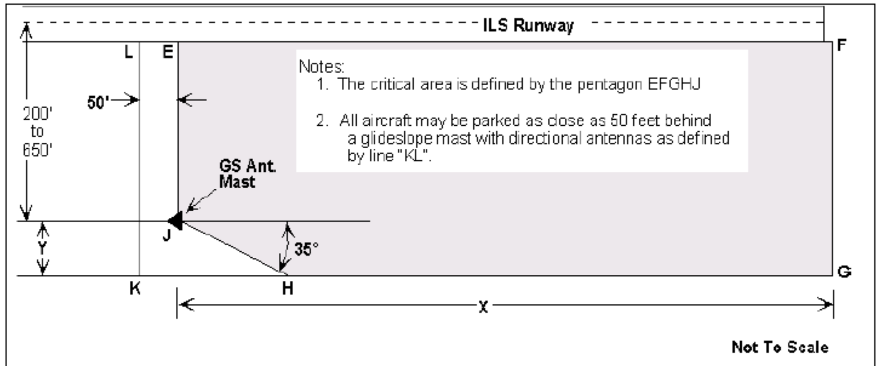


	X	Y	
Category I	2000	400	Note 4
Category I/II/III	2000	400	Note 5
Category II	4000	500	
Category III	7000	500	

Notes:

1. Critical area is indicated by shaded zones.
2. Hold line/signs indicate the position beyond which aircraft/vehicles will require ATCT authorization before proceeding on or across runway.
3. Area B is deleted from the critical area when a unidirectional localizer antenna is installed. The standard log-periodic dipole antenna array is in this category.
4. For 8-element localizer array with course widths less than 4 degrees and runways which operate B-747-size and larger aircraft, the Y dimension shall be 600 feet.
5. These dimensions apply where aircraft size is equal to or less than 135 feet in length or 42 feet in height; e.g., B-727.
6. Critical areas for LDA, SDF, and Offset Localizer facilities are the same as for Category I, but are centered about the course line.

Figure 1-2. Category I, II, & III Localizer Critical Area



FACILITY TYPE	CATEGORY I X	CATEGORY I Y	CATEGORY II/III X	CATEGORY II/III Y
ALL IMAGE GLIDE SLOPES				
Small Aircraft 2/	800	100	800	100
NULL REFERENCE				
Medium Aircraft 3/	2000	200	2500	200
Large Aircraft 4/	3100	200	3200	200
SIDEBAND REFERENCE & CAPTURE EFFECT				
Medium and Large Aircraft 3/ 4/	1300	200	1300	200

Notes:

1. All distances are in feet and represent the minimum allowable distances from the nearest point on the aircraft longitudinal axis (line from nose to tail) to the glide slope antenna, as defined in figure 1-3.
2. Small aircraft are defined as aircraft with dimensions less than 60' in length and 20' in height; i.e., Kingair. This includes all surface vehicles and helicopters.
3. Medium aircraft are defined as aircraft with dimensions less than 160' in length and 38' in tail height; i.e., B-727, MD-80.
4. Large aircraft are defined as all aircraft greater than 160' in length or greater than 38' tail height.
5. The small, medium and large aircraft sizes are based upon the dimension used in computer modeling of critical areas and apply to this document only.

Figure 1-3. Image Glide Slope Critical Area

GLIDE SLOPE GRADE

- The grade in front of Glide Slope matters.
- Watch out what grading you do in front of Glide Slope.

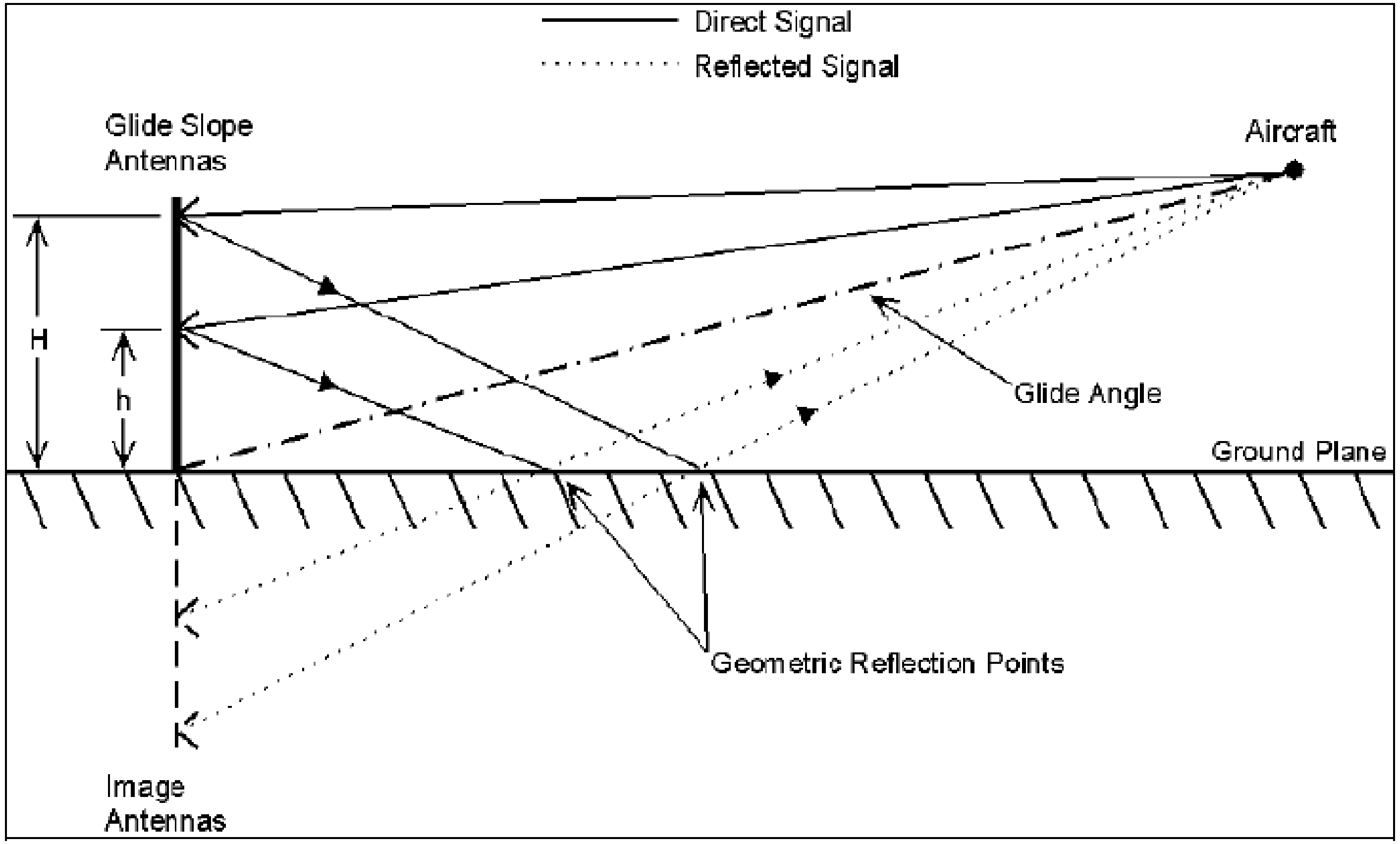


Figure 3-1. Image Antenna Concept

GLIDE SLOPE LOCATION

- Since Terrain Matters put it where it makes the best sense.
- Remember that PAPIs usually get power from Glide Slope so if GS is on one side of RW and PAPIs on other. You will need a bore the RW or bring commercial power to that site.

d. Glide Slope Location. The glide slope may be located on either side of the runway; therefore, all other siting factors (terrain, accessibility, etc.) being equal, the glide slope should be located on that side of the runway which is free of taxiways, runways, helicopter pads, and other potential sources of traffic interference (see Paragraph 1-15). To preclude relocations necessitated by new construction, future airport expansion plans should also be considered when determining the site selection.

e. Exclusion. If the siting conditions offer no satisfactory alternatives, exclusion of the glide slope and the establishment of a partial ILS should be considered. Every effort, however, should be made to site a glide slope because the presence of the vertical guidance provides a stabilized descent. The partial ILS consisting of a localizer and outer marker beacon may provide sufficient improvement in the landing minimums or the safety factor to justify omission of the vertical guidance information provided by the glide slope.

5. Reserved.

c. Elevation. The elevation of the array must be considered in conjunction with the distance requirement. Although a ground-mounted array is usually adequate at most facilities, at some locations an elevated array may be necessary to provide the required minimum signal coverage and performance. This may occur where runway discontinuities exist (humps, elevation changes, or runway safety area grading) or the presence of hills, trees, buildings, or other obstructions in the vicinity cause a shadow effect. As an elevated antenna structure on the extended runway centerline is quite massive, other options should be considered to include placing the antenna on additional fill or moving the antenna array to a higher elevation within the runway safety area.

(1) Antenna Height. The array should be mounted so that the antenna-radiating element is in line of sight with threshold crossing height (TCH) at the approach end of the runway. With the lower minimums and more stringent tolerances associated with Category II/III sites it is more essential to satisfy these criteria. In addition, Category III approaches must provide rollout guidance in ILS Zones 4 and 5. Rollout guidance can be compromised if the runway profile has a low spot in the middle and aircraft drop below the line of sight, reducing Course energy and possibly allowing reflected Clearance energy to capture the receiver. Siting of Category III localizers must provide adequate Course signal strength during rollout. Options available to improve line of sight coverage include use of a more highly focused antenna array or installation of the antenna array on a berm or an elevated platform. At those locations where future upgrading to Category II/III is not programmed or considered feasible, i.e., runway length/width, presence of obstructions, annual instrument approaches, etc., the array may be mounted to

HEIGHT OF THE LOCALIZER

- CAT 1 – Can be on the ground.
- CAT 2&3 – Need to have line of sight to TCH.

FAA SPECIFICATION – WHAT TO KNOW

FAA-STD-019f, Chg 2
August 23, 2019

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
STANDARD

LIGHTNING AND SURGE PROTECTION, GROUNDING, BONDING, AND SHIELDING REQUIREMENTS FOR FACILITIES AND ELECTRONIC EQUIPMENT

FAA-C-1217H
November 5, 2018

SUPERSEDING
FAA-C-1217G
April 24, 2018

U.S. Department of Transportation Federal Aviation Administration

U.S. Department of Transportation

Federal Aviation Administration

Construction Specification

ELECTRICAL WORK, PREMISES WIRING

FAA-C-1391d

FAA-C-1391d
September 2014
SUPERSEDING
FAA-C-1391c
May 2012

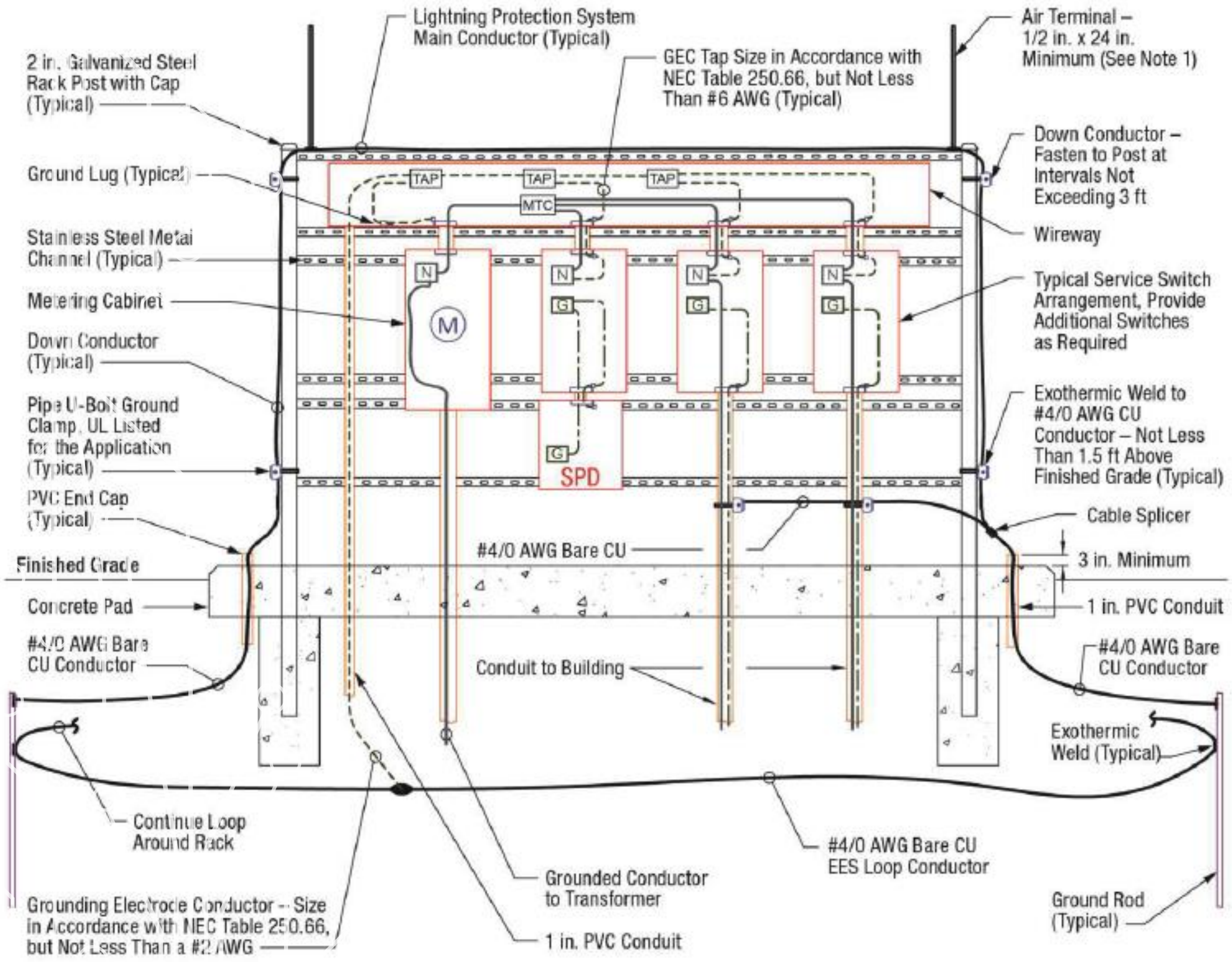
DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION
SPECIFICATION

INSTALLATION, TERMINATION, SPLICING, AND TRANSIENT/SURGE PROTECTION OF UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM POWER CABLES

This specification is approved for use by all Departments of the Federal Aviation Administration (FAA)

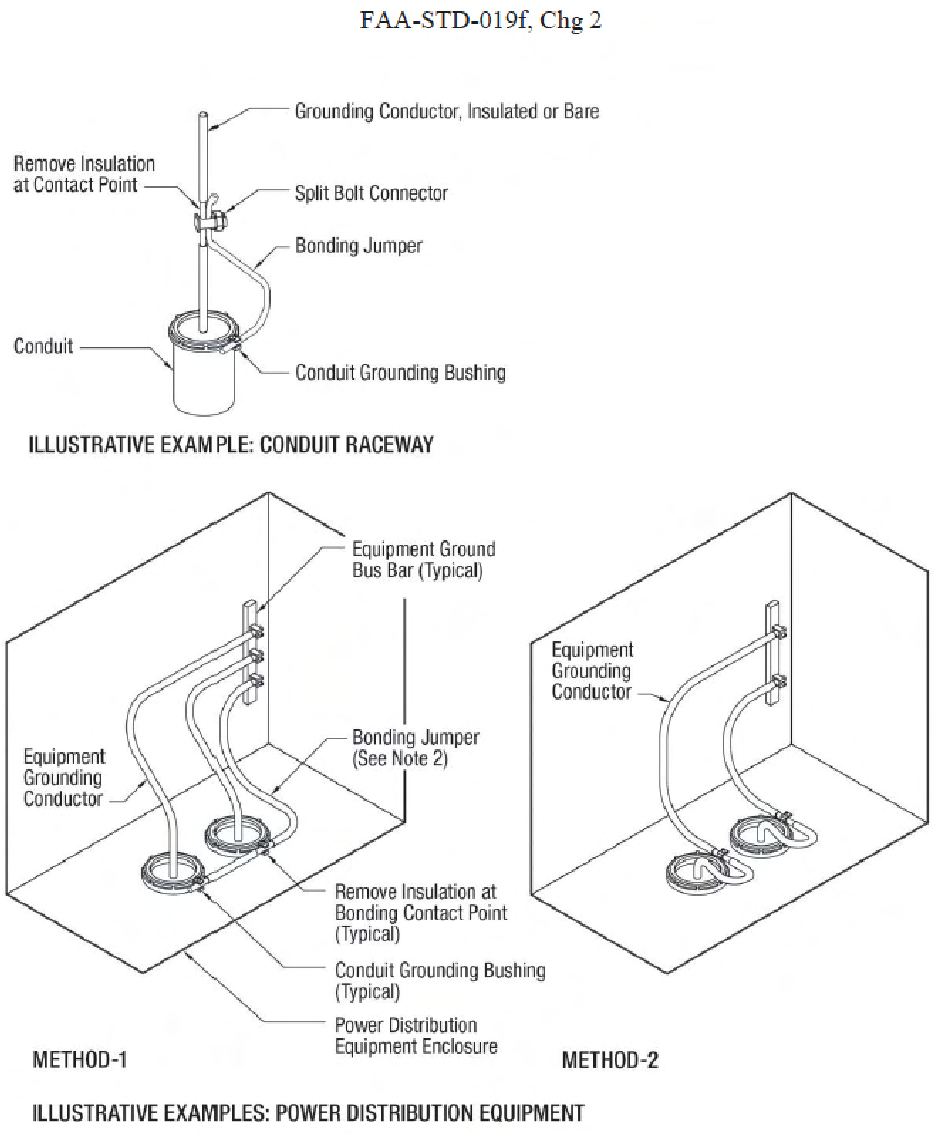
racks illustrated in Figure 4, an alternative EES design consisting of a minimum of two ground rods with a 4/0 AWG interconnecting ground wire is permitted.



19F – QUICK START

- 4/0 Bare Copper Counterpoise.
- #2 Green Ground to every enclosure.
- #2 Green Ground to every metallic conduit.
- 28R Lighting protection halo.
- Ground Metallic conduit when it crosses counterpoise.
- This will cost more than normal.

CABINET GROUNDS



SURGE PROTECTION

- Basic rule is
- If its an outside circuit, then it will need SPD.
- If several inside circuits, they can share SPD.

4.6.1 General

SPDs shall be provided at locations where electrical power systems are susceptible to conducted power line surges. SPD equipment functional performance requirements are detailed in section 5.7. Selection of appropriate SPD depends on location and application. The SPDs and transient suppression provided at electronic equipment power line entrances shall be coordinated as required herein and paragraph 5.6.4.

4.6.2 SPD for Power Distribution System

SPDs shall be provided at the following locations:

a. Service Disconnecting Means. Provide SPD on the load side of the SDM.

b. Facility Entrance Point. Provide SPD on the load side of a facility entrance point. For example, if the facility entrance point is within a NAS electronic equipment room, the SPD is required at the first distribution panelboard that supplies the branch panelboards within the room.

c. Transfer Switch, Switchboard, or Panelboard. Provide SPD either on the load side of an engine generator transfer switch, or on the first switchboard or distribution panelboard located downstream of the transfer switch.

d. Panelboards Feeding Building Exterior Loads. Provide SPDs at panelboards that supply branch circuit wiring exiting the building to serve exterior equipment.

e. Secondary Transformer. Provide SPD at separately derived power source that feeds NAS electronic equipment.

A lightning arrester shall be installed on the primary side of FAA-owned distribution transformers. Lightning arresters and SPDs shall be approved by the OPR.

4.6.2.1 SPD for Facility Entrance Equipment

SPDs shall be provided at the SDM, at all facility entrance penetrations, and at feeder and branch panelboards as specified in paragraph 4.6.2.2. Additional SPDs shall be provided at the power line entrances to operational electronic equipment.

4.6.2.2 SPD for Power Distribution Feeders and Panelboards

SPDs shall be installed on switchgear, panelboards, and disconnect switches providing service to NAS operational equipment or supplying exterior circuits.

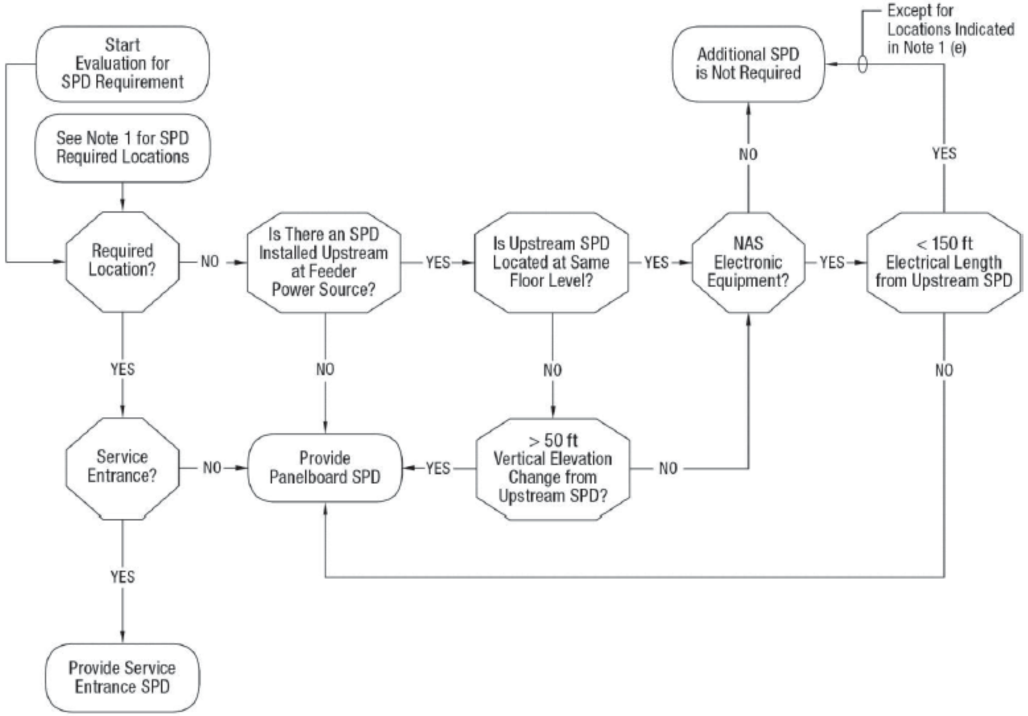
Examples of exterior circuits include obstruction lights, convenience outlets, guard houses, security systems, electric gates, and feeds to other facilities.

Where feeder and branch panelboards are located close together and their panelboards do not serve exterior circuits, use the SPD location decision tree diagram, Figure 8, to determine if an SPD is required for branch panelboards. SPDs for panelboards that provide service to exterior circuits shall meet requirements of paragraphs 5.7.2.1.1, 5.7.2.1.2, and 5.7.2.1.3 for facility entrance SPDs.

SPD FLOW CHART

- This chart might help.

FAA-STD-019f, Chg 2



Notes:

1. Provide SPDs in accordance with paragraph 4.6.2 and for the following locations.
   a. Power service disconnecting means (SDM).
   b. Load side of automatic transfer switch (ATS).
   c. Transformer, secondary of separately derived power source.
   d. Panelboards with branch circuits that feed building exterior loads.
   e. Power feeder that supplies the panelboards for NAS electronic equipment room. SPD is required at the first panelboard located within the room.

FACILITY GROUNDING

- Dedicated #2 taps from 4/0 counterpoise to each box.
- Ground plates are required. Only one for less than 200SF.

FAA-STD-019f, Chg 2

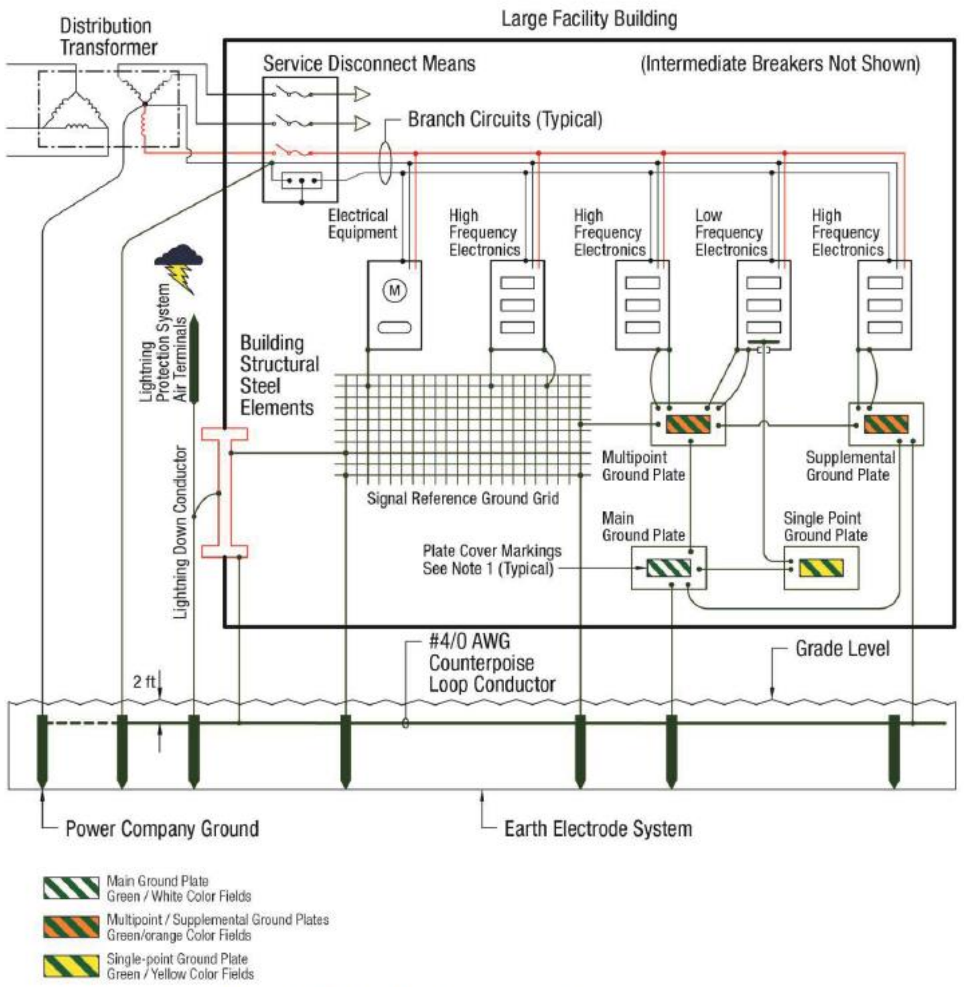


Figure 9. Typical Facility Grounding System

FENCE GROUNDING

- Do this every 100 feet and all corners and gates.

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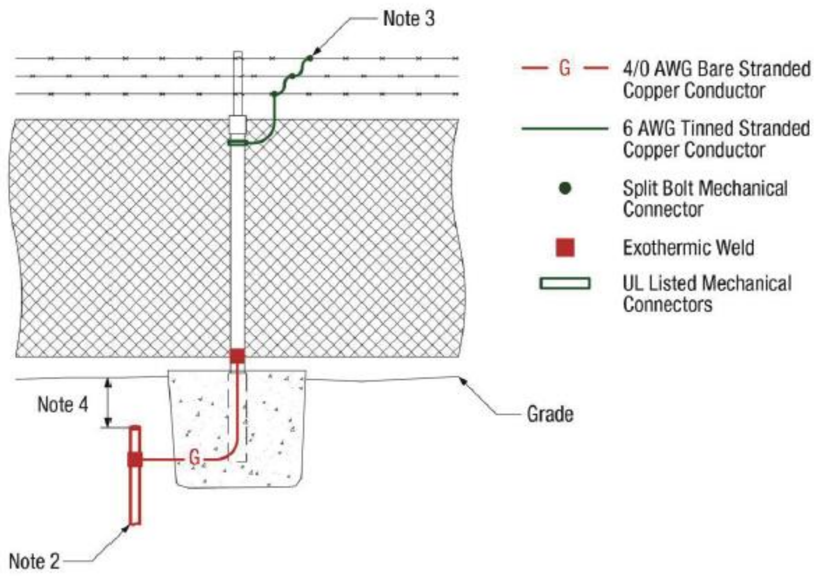


Illustrative Example: Chain Link Fence

Notes:

1. Diagram depicts elemental parts of a typical fencing grounding and bonding installation. Other architectural style fence configurations are possible.
2. Install 10 ft long by 3/4 in. diameter copper clad ground rods at all corners, gate posts, and at intervals not to exceed 100 feet. Exothermically weld each ground rod to the post.
3. Mechnically bond each strand of security wire to the fence post at all corners, gate posts, and at intervals not to exceed 100 feet.
4. 12 in. minimum below grade, but not less than frost depth.

Figure 18. Fence Grounding

GROUND METALLIC CONDUIT

- FAA requires conduit that enters a facility to be grounded.
- All below grade connections must be exothermic welds.
- If conduit enters building underground then it will be grounded with #2 exothermic weld at counterpoise.

5.4.3 Electromagnetic Shielding for Lines, Conductors, and Cables

5.4.3.1 Facility Entrance Conduit

Direct routed conductors and cables, both buried or above ground, shall enter the facility through a minimum of 10-ft ferrous RGS conduit at the exterior face of the building. For above-ground conditions, provide a minimum 10-ft ferrous RGS conduit on the exterior face of the facility at the entrance point. Entrance conduits shall be bonded to the EES with a bare copper stranded conductor, 2 AWG minimum. This entrance conduit, if buried, shall extend a minimum of 5 ft beyond the EES. Entrance conduits can be bonded below or above grade.

Exception. *Power feeders maintained by and installed to the requirements of the electric utility provider are exempt from the facility entrance RGS requirement.*

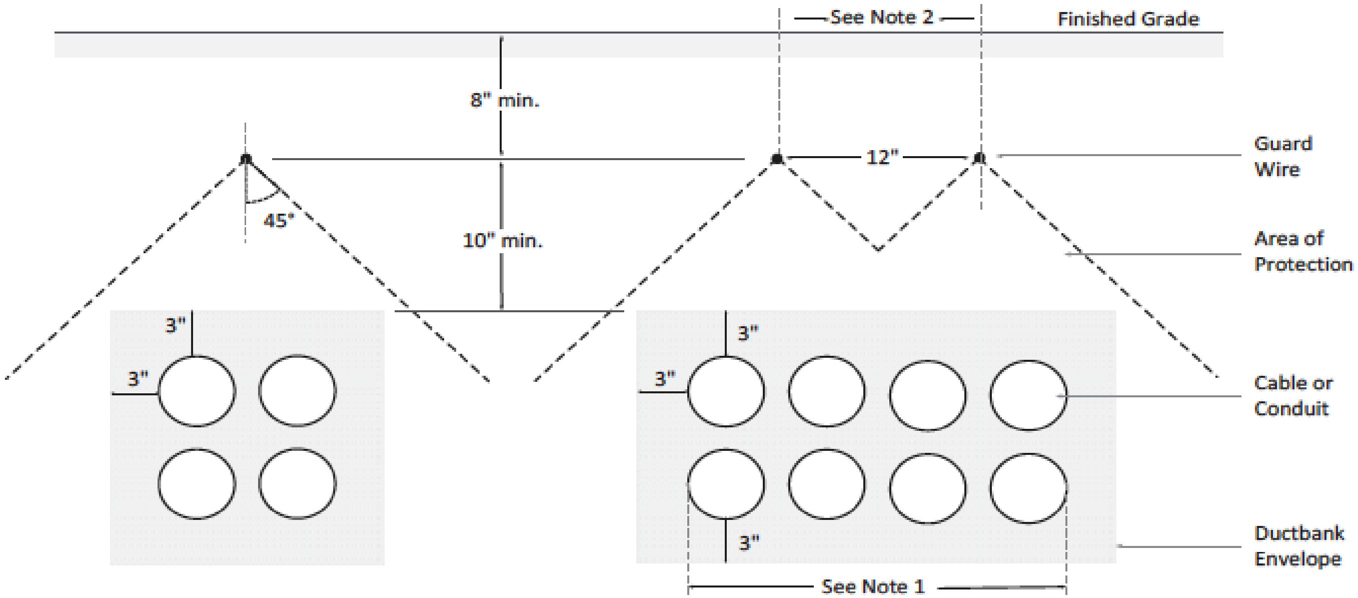
5.4.3.1.1 Above-Ground Conduit Entrance to Facility

At the conduit entrance point, a bonding connection shall be made either to the EES or to a bulkhead connector plate that is bonded to the EES in accordance with paragraph 5.4.3.2. If neither of these bonds is feasible, the bond shall be made to the main or supplemental multipoint ground plate. Provide a minimum 2 AWG stranded copper conductor using exothermic welds or UL-listed pressure connectors for this connection.

DUCT BANKS

- Requires 1/0 bare copper guard wire over trench.
- Ground Rod every 90 feet tied to 1/0 guard wire.

FAA-STD-019f, Chg 2



Notes:

1. Provide additional parallel guard wire runs for cables or cable ductbanks wider than 3 ft.
2. The spacing intervals between the center lines of the guard wires should not exceed twice the height distance between the guard wire and ductbank.

Figure 19. Buried Guard Wire Detail for Underground Cables or Cable Ductbanks

19F – WHAT IT LOOKS LIKE

1391 – QUICK START

- PVC Coated Rigid conduit within Counterpoise. Then transition to sand encased SCH 80 PVC.
- H20 or AC rated handholes every 500LF.
- Ground Bars in Handholes
- Detectable Warning tape
- Cable Tags
- No Splices !!!!

WHAT IT LOOKS LIKE

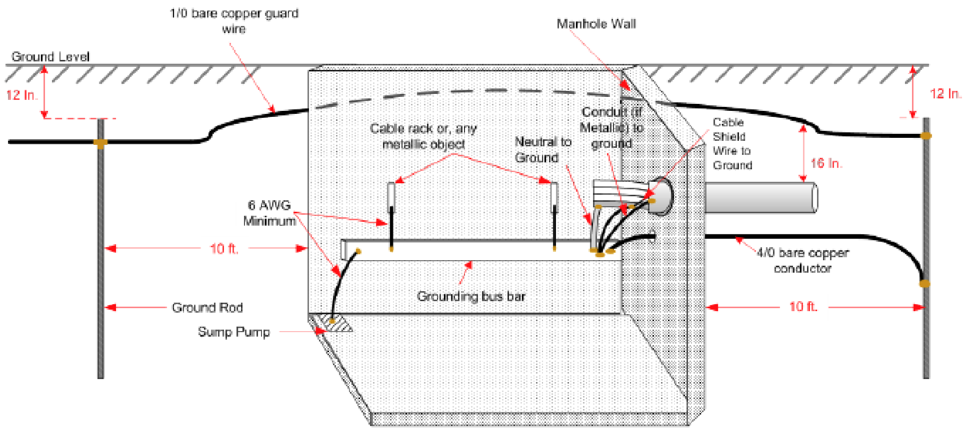


FIGURE 5.11.3-1. Grounding and guard wire installation detail at a manhole.

1217 – WHAT IT LOOKS LIKE

SUMMARY

- Moving or disturbing and FAA system will require a reimbursable agreement.
- FAA NAS Planning Team should be notified right away.
- Read applicable Siting criteria for your system.
- Know the FAA specifications front to back.
- Questions?