

UNIFIED FACILITIES CRITERIA (UFC)

AIRFIELD AND HELIPORT MARKING



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AIRFIELD AND HELIPORT MARKING

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER CENTER (Preparing Activity)

Record of Changes (changes are indicated by \1\ ... /1/)

Change No.	Date	Location

This UFC supersedes Air Force ETL 04-2, *Standard Airfield Pavement Marking Schemes*, 19 July 2004; Army TM 5-823-4 C1, *Marking of Army Airfield-Heliport Operational and Maintenance Facilities*, July 1987; UFC 3-260-05A, *Marking of Army Airfield Heliport Operational and Maintenance Facilities*, 16 January 2004; Army Engineering and Construction Bulletin, *Marking of Army Airfields and Heliports*, 1 October 2012; and Army ETL 1110-3-512, *Army Airfield and Heliport Markings*, 30 September 2015.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD \(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and, in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

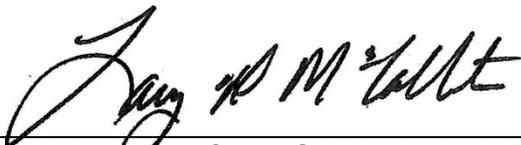
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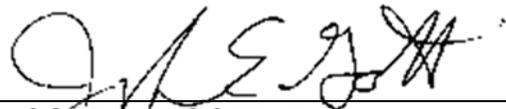
- Whole Building Design Guide web site <http://dod.wbdg.org/>.

Refer to UFC 1-200-01, *DoD Building Code (General Building Requirements)*, for implementation of new issuances on projects.

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**UNIFIED FACILITIES CRITERIA (UFC)
NEW DOCUMENT SUMMARY SHEET**

Document: UFC 3-260-04, *Airfield and Heliport Marking*

Superseding: Air Force Engineering Technical Letter (ETL) 04-2, *Standard Airfield Pavement Marking Schemes*, 19 July 2004; Army TM 5-823-4 C1, *Marking of Army Airfield-Heliport Operational and Maintenance Facilities*, July 1987; UFC 3-260-05A, *Marking of Army Airfield Heliport Operational and Maintenance Facilities*, 16 January 2004; and Army Engineering and Construction Bulletin, *Marking of Army Airfields and Heliports*, 1 October 2012, and Army ETL 1110-3-512, *Army Airfield and Heliport Markings*, 30 September 2015

Description: The purpose of this document is to provide standard dimensions, colors, retro-reflectivity requirements, layout, placement, and orientation standards for marking airfield pavements. It gives the minimum level of marking necessary for paved surfaces of fixed and rotary wing runways, taxiways, helipads, and landing lanes. It also provides authority to mark hazards to air navigation as obstructions in accordance with national standards or military agreements within host countries. See TM 3-34.48-2, *Theater of Operations: Roads, Airfields, and Heliports – Airfield and Heliport Design*, Volume II, for landing zone marking requirements. This document applies to all Department of Defense (DoD) activities except those operating at airports owned and controlled by an authority other than the DoD. For airports under Federal Aviation Administration (FAA) jurisdiction, use FAA Advisory Circular (AC) 150/5340-1, *Standards for Airport Markings*. For DoD facilities overseas, if a written agreement exists between the host nation and DoD that requires application of North Atlantic Treaty Organization (NATO), International Civil Aviation Organization (ICAO), or FAA standards, those standards apply as stipulated within the agreement. For cases where a Status of Forces Agreement (SOFA) specifically requires international standards, use ICAO Annex 14, Volume I, *Aerodromes* (for fixed wing runways), or Annex 14, Volume II, *Heliports* (for rotary wing helipads and runways), as appropriate. Air Force tenant organizations on civil airports use these standards on the military portion of the airfield to the maximum extent practicable.

Reasons for Document: This document combines and consolidates standards for the Services to ensure uniformity in visual guidance aids on DoD airfields.

Impact: Impacts of implementing these updated standards have been minimized by allowing existing markings to remain pending a need to remark pavement due to age or normal wear.

Unification Issues: Naval Air Systems Command (NAVAIR) is the Office of Primary Responsibility for airfield marking on U.S. Navy facilities. The NAVAIR standard is NAVAIR 51-50AAA-2, *General Requirements for Shore Based Airfield Marking and Lighting*. Additionally, the NAVAIR publication includes airfield lighting standards which are not unified with UFC 3-535-01, *Visual Air Navigation Facilities*. The Pavements Discipline Working Group (DWG) continues to work with NAVAIR to unify airfield marking standards across DoD. Waiver processing differs among the Services due to differences in organizational structure.

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CHAPTER 1 BACKGROUND AND GENERAL INFORMATION

1-1 BACKGROUND.

These criteria are a compilation of U.S. and international standards, adopted from the International Civil Aviation Organization (ICAO) standards, North Atlantic Treaty Organization (NATO) agreements, and Federal Aviation Administration (FAA) standards, as well as individual Service- or aircraft-specific technical orders. Prior to publication of this UFC, each Service component promulgated independent airfield marking standards based upon mission needs and operational doctrine, none of which fully complied with NATO, ICAO, or FAA criteria. Because DoD Service components operate worldwide, it is desirable and necessary that visual aids be commonly recognized and universally accepted by all DoD personnel and our allies.

1-2 GENERAL INFORMATION.

Pavement markings are provided to enable and enhance safe and informed aircraft and vehicle operation on the airfield and roadways. They are required to be prominent and of uniform configuration so they are clearly understood. Do not place locally devised non-standard markings without authorization from the appropriate authority. Such markings confuse aviators and ground personnel and cause runway incursions and accidents.

1-3 PURPOSE AND SCOPE.

This UFC provides standards for marking DoD airfields and heliports. This UFC also requires use of the Federal Highway Administration's (FHWA) *Manual of Uniform Traffic Control Devices* (MUTCD) for marking roadways, vehicular traffic routes on airfields, and airfield service roads maintained and operated by the designated authority. It gives the minimum level of markings necessary for paved surfaces of fixed and rotary wing runways, taxiways, helipads, and landing lanes as well as unique apron or hard stand markings necessary for maintenance or calibration of aircraft. It refers to FAA or ICAO standards for marking the surfaces of obstructions when deemed necessary by the designated authority. For additional airfield facility types, such as the F-35 vertical landing (VL) pad, landing helicopter deck (LHD) simulated deck facilities, and other fixed-wing short takeoff and vertical landing (STOVL) facilities, see UFC 3-260-01.

1-4 APPLICABILITY.

These criteria apply to all DoD activities except those operating at airports owned and controlled by an authority other than DoD. U.S. Navy and Marine Corps pavement marking details for shore-based installations are provided in NAVAIR 51-50AAA-2, *General Requirements for Shore Based Airfield Marking and Lighting*. Download a copy at <http://www.wbdg.org/ffc/dod/supplemental-technical-criteria> (designated TSEWG NAVAIR 51-50111-2, *General Requirements for Shorebased Airfield Marking and Lighting*) or contact the management authority for NAVAIR 51-50-AAA-2 at: Commanding Officer Naval Air Warfare Center Aircraft Division, Lakehurst Logistics, Code 6.8.5.1, Lakehurst, NJ, 08733, phone (732) 323-5073.

Base the marking criteria used upon ownership of the facility or official agreements with the host nation or host aviation authority. For example, DoD-owned and -controlled facilities are marked in accordance with DoD criteria and municipally owned airfields and airports are marked in accordance with FAA or ICAO criteria, as applicable.

It is recommended that noncompliant markings be updated to comply with this UFC at the next painting cycle. However, existing markings are not required to be changed to comply with the updated criteria in this UFC until it is appropriate and economically feasible to remove and replace all noncompliant markings on a significant feature of the airfield. An entire runway, the taxiway system, or an individual apron are examples of significant features of an airfield for the purpose of complying with this UFC.

1-5 JOINT USE FACILITIES.

1-5.1 Within the Continental United States (CONUS).

A joint use facility is one where a written agreement between the U.S. military and a government agency authorizes use of the military runways for public transportation. For airports operated under FAA jurisdiction, use FAA AC 150/5340-1.

1-5.2 Outside the Continental United States (OCONUS).

For DoD facilities overseas, if a written agreement exists between the host nation and DoD that requires application of NATO or ICAO standards, those standards apply as stipulated within the agreement. For cases where a Status of Forces Agreement (SOFA) specifically requires international standards, use ICAO Annex 14, Volume I, *Aerodromes* (for fixed wing runways), or Annex 14, Volume II, *Heliports* (for rotary wing helipads and runways), as appropriate. DoD tenant organizations on civil airports use these standards on the military portion of the airfield to the maximum extent practicable.

1-6 GENERAL BUILDING REQUIREMENTS.

UFC 1-200-01 provides applicability of model building codes and government-unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, sustainability, and safety. Use this UFC in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

1-7 REFERENCES.

Appendix A contains a list of references. The publication date of the code or standard is not included in this UFC. In general, the latest available issuance of the reference is used.

1-8 SUMMARY OF BEST PRACTICES IN APPENDIX B.

1-8.1 Airfield Marking Handbook.

Appendix B-1 contains best practices for installation and maintenance of airfield and heliport markings documented by the Innovative Pavement Research Foundation (IPRF) in Project 05-1.

1-8.2 Maintenance of Marking Patterns from Previous Standards.

Appendix B-2 contains the layout and dimension details for airfield markings previously used on Air Force and Army installations prior to publication of this UFC. Details for Navy and Marine Corps pavement marking details for shore-based installations are provided in NAVAIR 51-50AAA-2. The details and reference information provided facilitates maintenance of existing markings.

1-8.3 Use of Metrics for Markings.

Appendix B-3 is a matrix of dimensional equivalencies for various line segments, markings, and distances to or from specific geographic or feature reference points identified or referenced in this UFC.

1-9 GLOSSARY.

Appendix C contains acronyms, abbreviations, and terms.

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CHAPTER 2 WAIVERS

2-1 REQUIREMENTS AND PROCEDURES.

Do not design, specify, provide, construct, or apply any airfield marking that does not comply with this UFC without first requesting and obtaining a waiver in accordance with Military Standard (MIL-STD) 3007 and agency, DoD, and Service department airfield waiver procedures. However, design markings to the extent needed to determine if a waiver is required and to prepare the waiver. Prepare and obtain separate waivers from the senior airfield authority and airfield manager if they are not included in the current agency waiver procedure. Refer to the current agency airfield markings waiver procedures in Tri-Service Pavements Working Group (TSPWG) Manual 3-260-04.18-02, *Airfield Marking Waiver Procedures*.

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CHAPTER 3 TOLERANCES, MATERIALS, APPLICATION RATES, AND COLORS

3-1 PATTERN SIZE ALLOWANCES.

3-1.1 Tolerances for New Markings and Remarking.

Apply all markings in the standard dimensions provided in the drawings. New markings are allowed to deviate a maximum of 10 percent larger than the standard dimension. The maximum deviation allowed when painting over an old marking is up to 20 percent larger than the standard dimension. Do not use less than standard dimensions.

3-1.2 Paint.

Mark flexible and rigid pavements with lead-free pavement-marking paints, available under Federal Specification TT-P-1952. Select Type I for use under normal conditions, Type II for use under adverse conditions, or Type III for increased durability. See the latest revision of Federal Specification TT-P-1952 for additional information on applications. Apply glass beads to the paint immediately after application of paint to incorporate retro-reflective properties into the markings.

3-1.2.1 Permanent Painted Markings.

Apply markings at 12 to 14 mils (0.310 to 0.360 millimeters) wet-film thickness for coverage of 121 (± 6) square feet per gallon (2.970 square meters [± 165 square millimeters] per liter). Apply beads to permanent painted markings at the rate recommended for the type beads used. (The wet film thickness of the paint is increased when the larger diameter Type IV beads are used. See paragraph 3-3.3 for details.) It is undesirable for painted markings to build up beyond a total thickness of approximately 40 mils (1.02 millimeters). This occurs after about five marking cycles unless surface abrasion (e.g., caused by snow-removal equipment) reduces this buildup. Repeated over-painting increases stresses at the initial bond with the pavement and eventually causes the marking to crack and peel.

3-1.2.2 Temporary Painted Markings.

Apply markings at 4 to 6 mils (0.100 to 0.150 millimeter) wet-film thickness in cases where new pavements need to be opened early or for temporarily displaced thresholds. Apply beads to temporary painted markings at half the normal rate; this provides markings of sufficient prominence to allow operations. Touch up the marking in case of bleeding and remark the pavement at the normal application rate after the pavement is at least 30 days old. For temporary markings, first apply a pavement-curing compound; this makes the markings easier to remove. A lime and water solution or sea-marker dyes are also used for temporary markings; however, these materials are best suited to dirt surfaces or snow-covered pavements. Temporary marking tape is also used for temporary taxi routes or for temporarily displaced threshold markings if the pre-threshold area is only planned for operation at normal taxiing speeds. High-speed operations, turning traffic, rotor-wash, or jet blast might dislodge these materials, creating a potential for foreign object damage (FOD) to jet engines. Do not use these materials on runways for this reason.

3-1.3 Alternate Marking Materials.

Thermoplastics or preformed materials such as tape are allowed for use on taxiways and aprons, but these type materials are not used on runways or helipads because of the potential FOD to aircraft if they delaminate from the pavement. Apply these materials in accordance with the manufacturer's recommendations. Pre-mix glass beads with thermoplastic materials and post-apply beads to the surface of the marking at the same application rate as noted above to provide initial retro-reflectivity. The beads are uniformly suspended throughout the material to ensure continuing retro-reflectivity as the marking wears from the effects of traffic. Add beads at a rate equivalent to that noted above for each 10 mils (0.250 millimeter) of overall application thickness.

3-1.4 Alternate Visual Aids.

When appropriate, lighted barricades, traffic cones, or portable edge markers are used instead of pavement markings during short periods of construction if addressed in the construction waiver and the construction phasing plan (see Appendix B of UFC 3-260-01). Use edge markers for daytime use or expedient airfield markings such as are used on a minimum operating strip (MOS) or a landing zone (LZ). Lighted visual aids are used for night operations or instrument flight rule (IFR) operations. Fasten or weight down all such devices to prevent them from becoming dislodged by jet blast or prop wash. Use frangible markers designed and constructed of materials that collapse if struck by an aircraft. They are colored to present a sharp contrast with the surrounding terrain.

3-1.5 Contrasting Markings to Increase Conspicuity.

If needed, use a non-reflectorized black border to outline markings on light-colored pavements (portland cement concrete [PCC] or oxidized asphaltic concrete [AC]). This makes the markings more prominent. The border is uniformly 6 inches (152 millimeters) wide (no variation in width beyond standard tolerances) and borders all edges of the marking

3-1.6 Obliteration of Extraneous Markings.

Use black paint, or a color blend of black and white to match pavement color, to temporarily hide extraneous markings rather than risk damaging the pavement during paint removal. **Note:** This method is only used temporarily because the underlying paint shows through when illuminated at night after the black paint begins to wear off the top of the previously applied glass beads. For effective guidance, remove the old paint completely by hydro-blast, grinding, or some other method, or pave over the old marking to eliminate potential confusion from obsolesced or extraneous surface markings. Take care when obliterating old markings so the resulting pattern no longer presents the appearance of a usable marking. This requires additional scarifying or overpainting for effective obfuscation of the pattern.

3-2 COLORS FOR PAVEMENT AND OBSTRUCTION MARKINGS.

3-2.1 Airfields and Roadways.

For airfield pavement applications, use the following color chip numbers from SAE-AMS-STD-595 when ordering or specifying paint. See the specific layout schemes in Chapters 5 through 8 for the specific color and retro-reflective requirements for the applicable marking.

3-2.1.1 White – 37925.

Generally, retro-reflective white is used for all runway, helipad, towway, and rotary wing runway or landing lane markings. However, there are some exceptions, such as for aircraft arresting system (AAS) warning markings, runway shoulder markings, hold short runway hold position markings, taxiway lead-in and lead-out lines, and hospital helipad markings.

3-2.1.2 Yellow – 33538.

Generally, retro-reflective yellow is used for all taxiway and apron markings, as well as displaced threshold areas used only as a taxiway and for the arrowheads and chevrons when the displacement is temporary. Exceptions: Restricted area markings and legends on some surface painted taxiway and apron signs are marked in other colors. Non-reflective yellow is used in overruns and for shoulder markings.

3-2.1.3 Red – 31136.

Red is normally used to mark restricted area boundaries and some of the legend on the restricted area signs required by AFI 31-101.

3-2.1.4 Black – 37038.

Black is used as a border to increase the conspicuity of markings on light-colored pavements. It is also mixed with white (to better match pavement surface color) and used to obliterate extraneous markings. **Note:** Covering obsolete or extraneous markings with paint is a temporary solution. The only means for permanent obliteration is to grind, scarify, burn, or hydro-blast the pavement surface or place a new surface material over the old markings.

3-2.1.5 Green – 34108.

Green is used to identify obstacle clearance boundaries at U.S. Army facilities.

3-2.2 Colors for Marking Obstructions.

For obstruction marking applications, use the following color chip numbers from SAE-AMS-STD-595 when ordering or specifying paint to mark obstructions.

- White – 17875
- Orange – 12197

3-3 RETRO-REFLECTIVE PAVEMENT MARKINGS.

3-3.1 Painted Pavement Markings.

Painted pavement markings are very difficult to see at night or during rain if they have no retro-reflective properties. Markings without beads also have a lower coefficient of friction. For these reasons, use of glass beads is encouraged for all surface painted markings. Do not place beads on black borders. Other less-expensive materials are available to improve the coefficient of friction on black painted pavement surfaces.

Note: Because thermoplastic materials are applied at a greater film thickness, these materials also have spherical beads premixed into the colored binder prior to application.

3-3.2 Post Applied Retro-Reflective Media.

Post-apply retro-reflective media (glass beads) specified under Federal Specification TT-B-1325D (or later revision) to make surface painted markings retro-reflective. Retro-reflective runway, taxiway, and apron markings are identified in the layout scheme descriptions in Chapters 5 through 8.

3-3.3 Material Selection.

Select the most appropriate material manufactured in accordance with the most current version of Federal Specification TT-B-1325D, as follows:

- Type I, Gradation A, Drop-On, Low Index of Refraction, for use on any airfield or roadway marking pattern applied with paint procured to comply with Federal Specification TT-P-1952E. Apply a minimum of 7 pounds per gallon (0.85 kilogram per liter) of paint. In accordance with the National Defense Authorization Act (NDAA) for Fiscal Year 2018, complete a life-cycle cost analysis of the beads which appropriately considers local site conditions, life-cycle cost maintenance, environmental impact, operational requirements, and the safety of flight before specifying or using beads with a refractive index of 1.6 or less, including Type I beads.
- Type II has been deleted and is no longer specified or used.
- Type III, Gradation A, Drop-On, High Index of Refraction, intended for applications where increased retro-reflectivity is needed. Apply a minimum of 10 pounds per gallon (1.2 kilograms per liter) of paint.

- Type IV Gradation A – Large coarse, direct-melt, low-index glass beads for drop-on applications are intended for highways and all airfield markings applied with paint procured to comply with Federal Specification TT-P-1952E, Type III. Apply a minimum of 8 pounds per gallon (1 kilogram per liter) of paint. A wet film paint thickness of 18 to 25 mils (0.457 to 0.635 millimeter) is specified when Type IV gradation A beads are used.
- Type IV Gradation B – Medium coarse, direct-melt, low-index glass beads for drop-on applications are intended for highways and all airfield markings applied with paint procured to comply with Federal Specification TT-P-1952E, Type III. Apply a minimum of 8 pounds per gallon (1 kilogram per liter) of paint. A wet film paint thickness of 15 to 18 mils (0.381 to 0.457 millimeter) wet film paint thickness is specified when Type IV gradation B beads are used.

3-3.4 Lifecycle Cost Analysis

In accordance with the NDAA of 2016, perform a lifecycle cost analysis at every individual location to determine what type of reflective media (glass bead) to use at the installation. This is reiterated in Unified Facilities Guide Specification (UFGS) 32 17 23. In accordance with the NDAA for fiscal year (FY) 2018, complete a lifecycle cost analysis of the beads which appropriately considers local site conditions, lifecycle cost maintenance, environmental impact, operational requirements, and the safety of flight before specifying or using beads with a refractive index of 1.6 or less, including Type I beads. TSPWG Manual 3-260-04.18-01, *Life-Cycle Cost Analysis of Retroreflective Glass Beads*, provides guidance on how to accomplish a lifecycle cost analysis (LCCA) comparing Type I to Type III retroreflective glass beads in accordance with NDAA FY 2018, Section 2872(b).

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CHAPTER 4 UNIQUE MARKING PRACTICES

4-1 PRACTICES FOR SPECIAL CIRCUMSTANCES.

Striated markings are substituted for any solid marking pattern that is 3 feet (0.9 meter) wide or wider to reduce the effects of frost heave or improve surface friction characteristics. Do not striate markings on runways intended to support operations in instrument categories II and III. Striated markings are created by painting multiple longitudinal stripes 6 inches (152 millimeters) wide with gaps from 4 to 6 inches (102 to 152 millimeters) wide.

4-2 OPEN GRADED WEARING SURFACES AND CLEANING EXISTING MARKINGS.

4-2.1 Painting Porous Pavements.

On porous friction surfaces or other open aggregate wearing surfaces, it is desirable, or in some cases necessary, to apply painted markings twice, approaching the area to be marked from opposite directions. Glass beads, necessary to add retro-reflective characteristics to the markings, are applied during each pass.

4-2.2 Cleaning Markings.

When contaminated by fuel, oil, dirt, or other impurities, clean pavement markings using high-pressure water or a combination of applying an environmentally friendly soap and sweeping with a truck- or tractor-mounted sweeper, followed by a clear-water rinse. Sweeping new markings immediately after the paint cures also improves retro-reflectivity by abrading the overspray deposited on adjacent surface-exposed beads during subsequent paint applications.

4-3 MAXIMUM PAINT THICKNESS.

Each time a surface is over-painted, the initial stress at the bond between the paint binder and the pavement increases. For this reason, remove painted markings before they build up more than about 40 mils (1 millimeter) total thickness. This occurs after about five marking cycles with Type I or Type II paints, and even more rapidly with the more heavily applied Type III (high-build) paints unless surface abrasion such as that caused by heavy accelerating, stopping, or turning traffic, or snow removal operations with plows and/or brooms, reduces the buildup by abrasion. Over-painting to excessive thickness also eventually causes the marking to prematurely crack and peel.

4-4 OBSTRUCTION MARKING.

Obstacles or obstructions defined by UFC 3-260-01, Federal Aviation Regulations (FAR) Part 77, or ICAO Annex 14, Volume I and Volume II, as applicable, are marked according to the following guidance:

- For installations in CONUS or its territories, use FAA AC 70/7460-1.

- For OCONUS installations, use the current edition of ICAO Annex 14, or the standard defined by the SOFA, Host Nation Funded Construction Agreement (HNFA), or Bilateral Infrastructure Agreement (BIA).

4-5 ROADWAY MARKING.

Markings and signs of roadways are configured in accordance with UFC 3-201-01, SDDCTEA Pamphlet 55-17, SDDCTEA Pamphlet 55-14, and the FHWA MUTCD.

CHAPTER 5 RUNWAY MARKINGS

5-1 GENERAL INFORMATION.

All markings of any color on light-colored pavement are optionally highlighted by marking a black, non-reflectorized 6-inch (152-millimeter) border (see paragraph 3-1.5).

5-2 RUNWAY MARKING SCHEMES.

5-2.1 Runway Marking Elements Based on Highest Intended Use.

There are three marking patterns for manned, fixed-wing runways; visual flight rules (VFR), non-precision instrument approach, and precision instrument approach. These are shown in Figure 5-1. Unmanned aircraft systems (UAS) are marked differently if constructed to support UAS-only operations. Determine the extent of runway markings based on the level of operations planned during day, night, and instrument meteorological conditions (IMC). Also consider available electronic navigation and visual approach lighting aids. Closed runways are marked to reflect their non-operational status. Engineers consult with the airfield managers to determine what markings are needed for each runway.

5-2.2 Additional Markings.

Installation/garrison commanders authorize additional standard markings. Non-standard markings are approved by the USAF Major Command Director of Operations (MAJCOM/A3) or U.S. Army Aeronautical Services Agency (USAASA), publicized in the DoD Flight Information Publication (FLIP). Interference with standard runway markings is not allowable. Non-standard markings are those not defined within any USAF or other DoD Service standard, Department of Transportation (FAA and FHWA), ICAO, Air Standardization Coordinating Committee (ASCC), or NATO standard appropriate for application at the given installation.

5-2.3 Unmanned Aircraft System (UAS) Runways.

For UAS-only runways, mark runway designation, centerline marking, and the letters "UAS" (without black borders), threshold bar, and runway edge stripes in retroreflective white, all centered on the runway width. These type runways are identified with the letters "UAS" on each end of the runway as shown in Figure 5-5.

5-2.3.1 Shadow (RQ-7A/B) -only runways are only marked with "UAS" without a designation number and centerline marking.

5-2.3.2 Global Hawk, Predator, and Reaper UAS-only runways are marked based on standard Class B airfield marking schemes and precedence (VFR, non-precision, or precision instrument; see Figure 5-1) and the standards provided herein.

5-2.4 Basic Visual Flight Rule (VFR) Runway.

For a VFR runway intended for use only during visual meteorological conditions (VMC), provide the following minimum markings (see Figures 5-1, 5-2, and 5-7):

- Centerline stripes
- Designation numbers (and letters, if appropriate)
- AAS warning markings (Runway only; do not mark these for emergency arresting systems located in overruns.)
- Runway/runway hold positions (if the runway intersects another runway and is used as a taxiway or is approved for simultaneous land and hold short operations [LAHSO] with the intersecting runway)
- Overrun chevrons
- Fixed distance (aiming point) marking (if the runway is 4,000 feet [1,200 meters] or longer and potentially used by jet aircraft)
- Add side stripes to all non-precision instrument runways and basic VFR runways where the shoulder pavement is the same as the full-strength runway pavement. On airfields where the width of the runway was reduced, creating a full-strength shoulder, the use of edge stripes is optional except that they must be used to mark the location of any non-full-strength pavement such as the shoulders of the previously wider runway.

5-2.5 Non-Precision Instrument Runways.

For an instrument, non-precision approach runway, also mark threshold bars and expand the centerline width to 3 feet (0.9 meter). See Figures 5-1 and 5-3 for examples.

Figure 5-1 Runway Marking Schemes

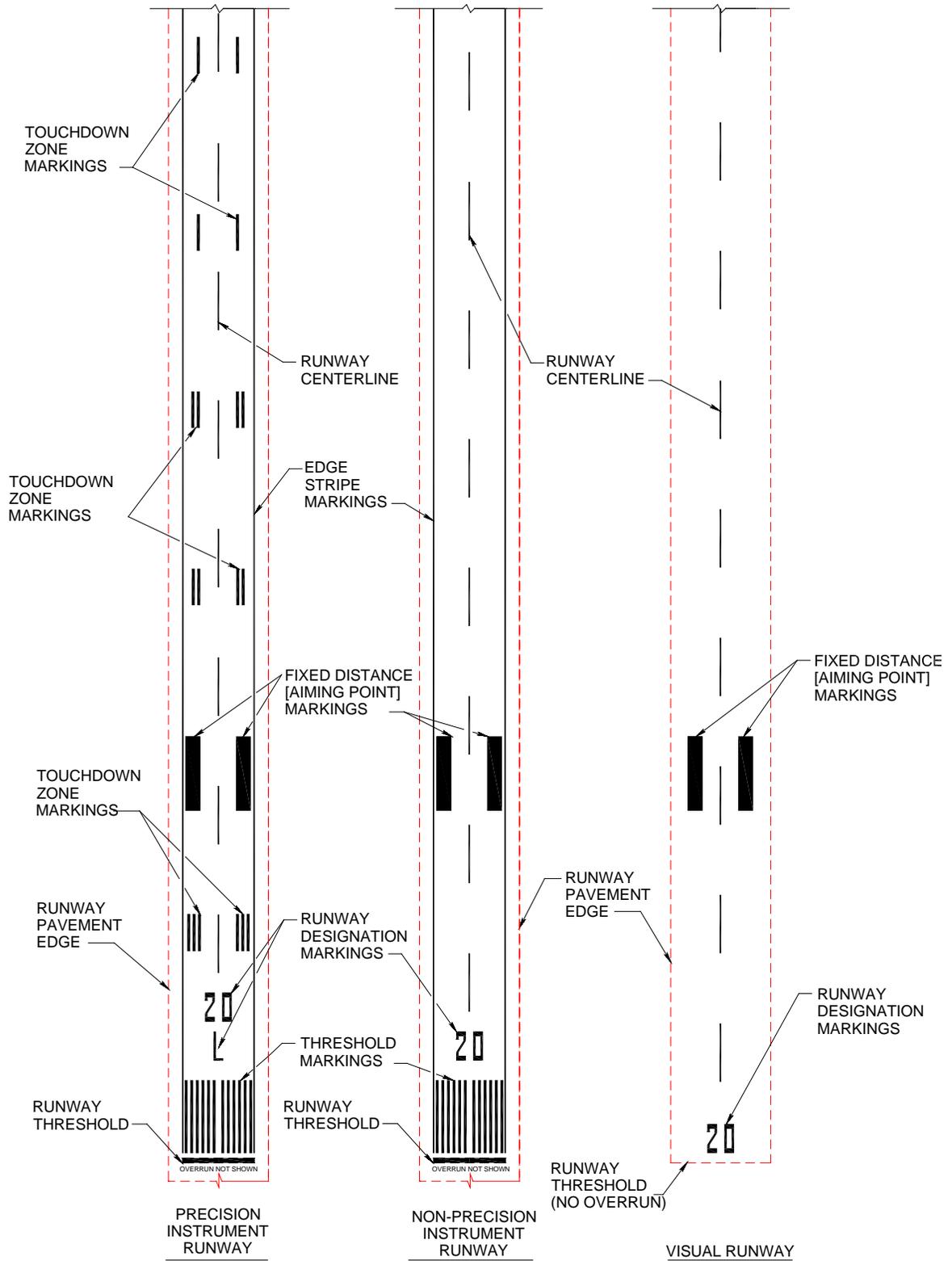


Figure 5-2. VFR Runway Markings

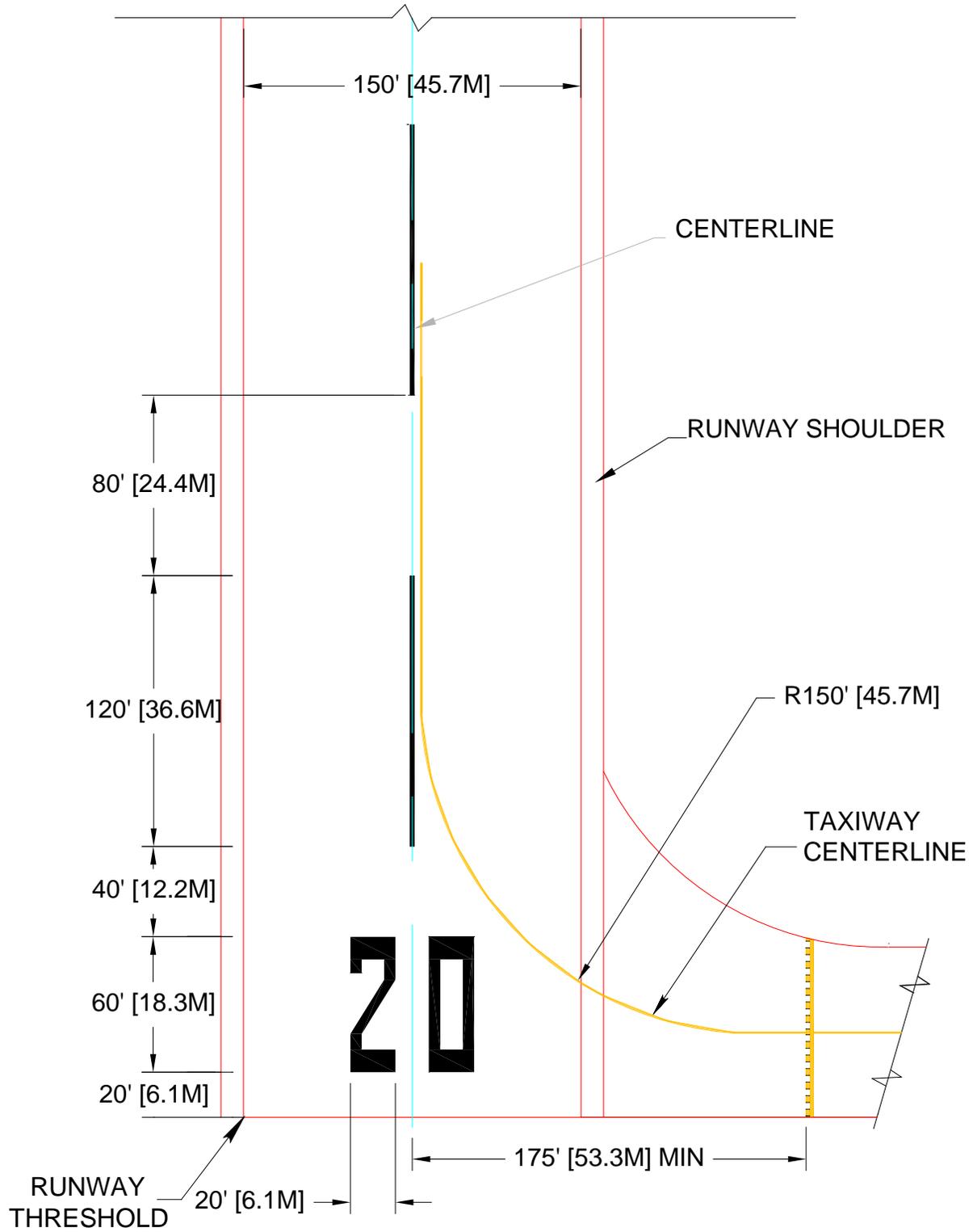
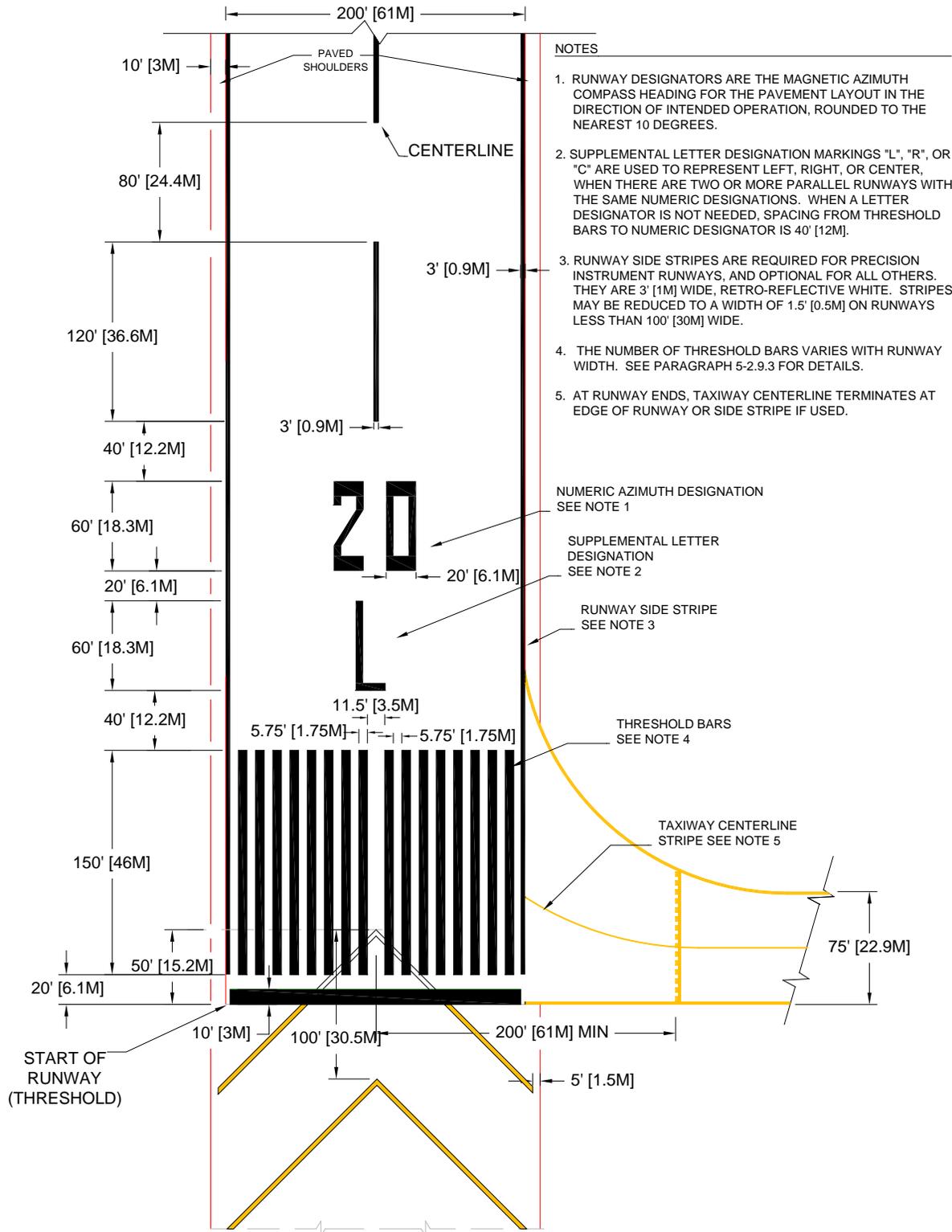


Figure 5-3. Non-Precision Instrument Runway Markings



- NOTES
1. RUNWAY DESIGNATORS ARE THE MAGNETIC AZIMUTH COMPASS HEADING FOR THE PAVEMENT LAYOUT IN THE DIRECTION OF INTENDED OPERATION, ROUNDED TO THE NEAREST 10 DEGREES.
 2. SUPPLEMENTAL LETTER DESIGNATION MARKINGS "L", "R", OR "C" ARE USED TO REPRESENT LEFT, RIGHT, OR CENTER, WHEN THERE ARE TWO OR MORE PARALLEL RUNWAYS WITH THE SAME NUMERIC DESIGNATIONS. WHEN A LETTER DESIGNATOR IS NOT NEEDED, SPACING FROM THRESHOLD BARS TO NUMERIC DESIGNATOR IS 40' [12M].
 3. RUNWAY SIDE STRIPES ARE REQUIRED FOR PRECISION INSTRUMENT RUNWAYS, AND OPTIONAL FOR ALL OTHERS. THEY ARE 3' [1M] WIDE, RETRO-REFLECTIVE WHITE. STRIPES MAY BE REDUCED TO A WIDTH OF 1.5' [0.5M] ON RUNWAYS LESS THAN 100' [30M] WIDE.
 4. THE NUMBER OF THRESHOLD BARS VARIES WITH RUNWAY WIDTH. SEE PARAGRAPH 5-2.9.3 FOR DETAILS.
 5. AT RUNWAY ENDS, TAXIWAY CENTERLINE TERMINATES AT EDGE OF RUNWAY OR SIDE STRIPE IF USED.

NUMERIC AZIMUTH DESIGNATION
SEE NOTE 1

SUPPLEMENTAL LETTER
DESIGNATION
SEE NOTE 2

RUNWAY SIDE STRIPE
SEE NOTE 3

THRESHOLD BARS
SEE NOTE 4

TAXIWAY CENTERLINE
STRIPE
SEE NOTE 5

5-2.6 Precision Instrument Runway.

For precision approach runways, in addition to the non-precision instrument approach and VFR runway marking elements, provide side stripes and touchdown zone (TDZ) markings (and instrument hold lines, if appropriate). Substitute fixed distance (aiming point) markings for the second pair of TDZ markings on each end of the runway (see Figures 5-1 and 5-4).

5-2.7 Runway Marking Precedence.

For runways that intersect or share a common end, interrupt or adjust markings on the runway with the lower priority. Give precedence in this order:

- Category III
- Category II
- Category I
- Non-precision instrument runway markings
- VFR runway markings

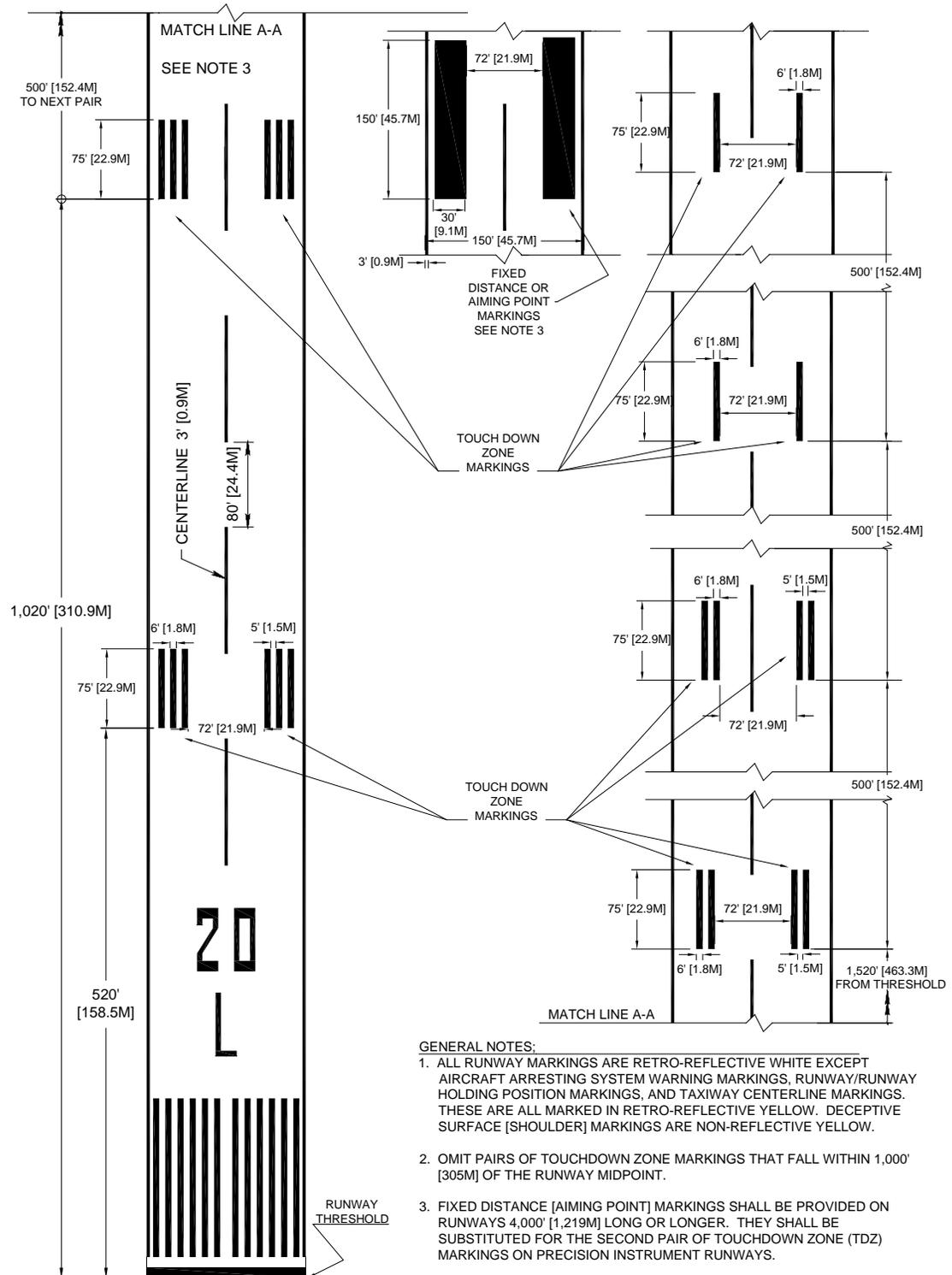
5-2.7.1 Where a need exists to mark a taxiway centerline across a runway, interrupt the marking 3 feet (0.9 meter) on either side of the runway marking.

5-2.7.2 Taxiway centerline is interrupted 5 feet (1.5 meters) either side of threshold markings or numbers.

5-2.8 Runway Centerline.

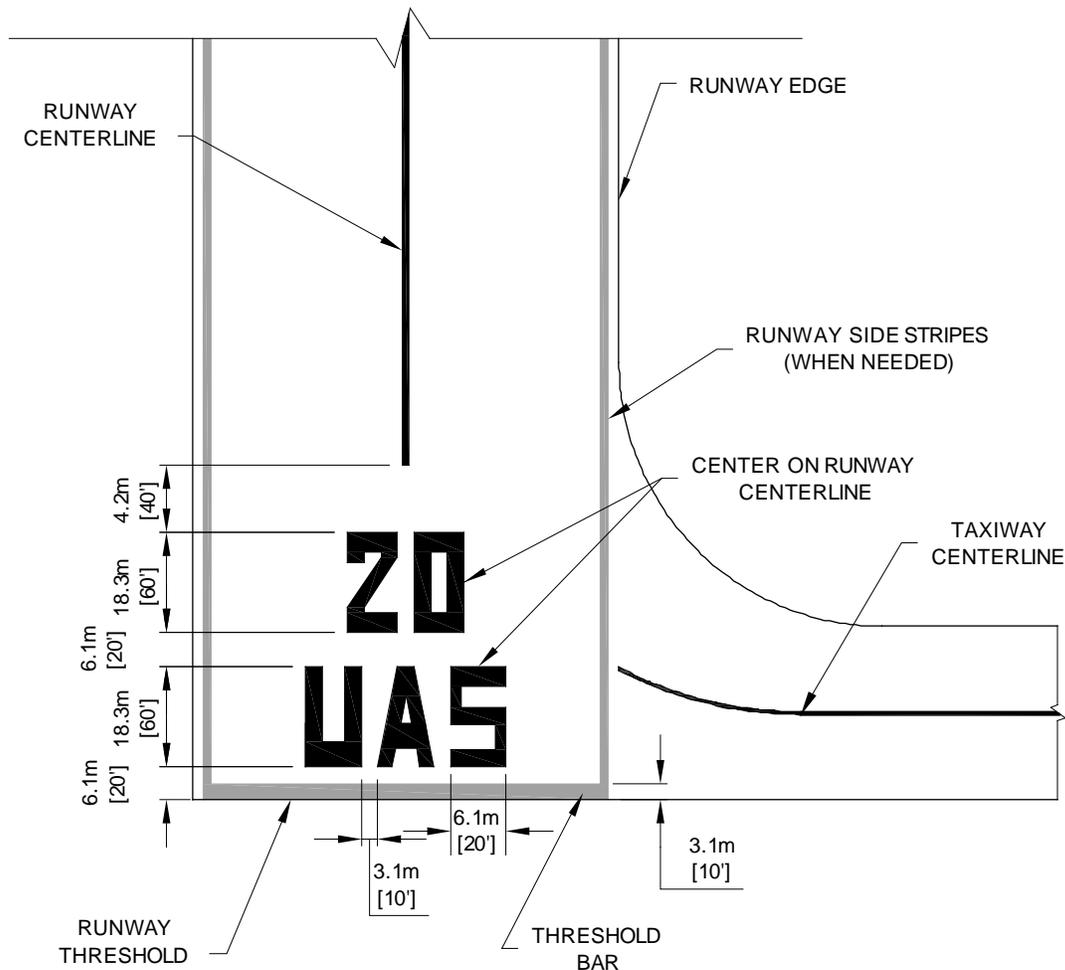
Runway centerlines are marked with a series of uniformly spaced retro-reflective white longitudinal stripes, 3 feet (0.9 meter) wide on instrument runways and at least 12 inches (305 millimeters) wide for VFR runways. Begin layout of centerline markings 40 feet (12.2 meters) from the runway designation (numeral[s]) and continue to the midpoint of the runway. Uniformly adjust the lengths of two stripes and three gaps or three stripes and two gaps (depending on which of the two falls at the center of the runway length) near the runway midpoint. See Figures 5-2 and 5-3.

Figure 5-4. Touchdown Zone and Fixed Distance (Aiming Point) Markings



- GENERAL NOTES:**
1. ALL RUNWAY MARKINGS ARE RETRO-REFLECTIVE WHITE EXCEPT AIRCRAFT ARRESTING SYSTEM WARNING MARKINGS, RUNWAY/RUNWAY HOLDING POSITION MARKINGS, AND TAXIWAY CENTERLINE MARKINGS. THESE ARE ALL MARKED IN RETRO-REFLECTIVE YELLOW. DECEPTIVE SURFACE [SHOULDER] MARKINGS ARE NON-REFLECTIVE YELLOW.
 2. OMIT PAIRS OF TOUCHDOWN ZONE MARKINGS THAT FALL WITHIN 1,000' [305M] OF THE RUNWAY MIDPOINT.
 3. FIXED DISTANCE [AIMING POINT] MARKINGS SHALL BE PROVIDED ON RUNWAYS 4,000' [1,219M] LONG OR LONGER. THEY SHALL BE SUBSTITUTED FOR THE SECOND PAIR OF TOUCHDOWN ZONE (TDZ) MARKINGS ON PRECISION INSTRUMENT RUNWAYS.

Figure 5-5. UAS Runway Markings



NOTES:

1. SEE FIGURE 5-6 FOR DESIGNATION NUMBER AND LETTER MARKING DIMENSIONS.
2. WHEN THESE MARKINGS ARE BEING USED ON RUNWAYS FOR RQ-7A/B ONLY (50' WIDE), THEN ALL DIMENSIONS SHOWN ON THIS DETAIL SHALL BE REDUCED BY ONE HALF. RUNWAYS FOR THESE AIRCRAFT WILL NOT HAVE THE CENTERLINE OR NUMERICAL DIRECTION MARKINGS EITHER.

5-2.9 Threshold Marking.

The runway threshold is the beginning of the full-strength pavement. The 10-foot (3 meter) wide threshold bar is marked at the threshold, and the designation number(s) or longitudinal threshold bars begin 20 feet (6.1 meters) inward from the threshold.

5-2.9.1 Visual Flight Rule (VFR) Runways.

Figures 5-1 and 5-2 provide the layout details for a VFR runway. Figure 5-6 provides layout dimensions and spacing details for designators.

5-2.9.2 Instrument Runways.

Precision and non-precision instrument runway thresholds are marked with a group of retro-reflective white longitudinal stripes, and a transverse threshold bar when there is any type of pavement preceding the runway pavement. The longitudinal threshold bars are spaced symmetrically about the runway centerline on 11.5-foot (3.5-meter) centers, configured of 5.75-foot (1.75-meter) -wide stripes and gaps, except at the center of the runway, where the gap dimension is doubled to 11.5 feet (3.5 meters). The transverse runway threshold bar is 10 feet (3 meters) in width and extends between the runway edges (as published in the DoD FLIP or between the runway side stripes, whichever is less). Figure 5-3 provides layout details for the threshold bars and longitudinal spacing for the runway designators, and Figure 5-6 provides layout dimensions and horizontal spacing details for designators.

5-2.9.3 Variances in Longitudinal Threshold Patterns.

The number of longitudinal stripes in a threshold pattern varies for different-width runways. Threshold bar length and widths are the same in all cases. The appropriate numbers of longitudinal stripes to be used are as follows:

- Four for 60-foot (18.3-meter) -wide runways;
- Six for 75-foot (22.9-meter) -wide runways;
- Eight for 100-foot (30.5-meter) -wide runways;
- Ten for 125-foot (38.1-meter) -wide runways;
- 12 for 150-foot (45.7-meter) -wide runways, and;
- 16 for 200-foot (61-meter) -wide or wider runways

5-2.9.4 Non-standard Width Runways.

For non-standard runway widths, the same stripe-gap pattern is continued from the runway centerline until the outermost longitudinal stripe is no closer than 4 feet (1.2 meters) from the runway edge or side stripes. Do not mark more than 16 threshold bars, even for runways wider than 200 feet (61 meters).

5-2.10 Runway Designations.

Designators for runways are retro-reflective white numeric characters that indicate the magnetic azimuth of the runway centerline to the nearest 10-degree increment. The designation consists of one or two numbers, or in the case of parallel runways, the numeric designator and a retro-reflective white letter (“L” for left, “C” for center, or “R” for right) to indicate the lateral position of the runway with respect to any others with the same numeric designator on the same airfield. See Figure 5.3 for placement on the runway pavement and Figure 5-6 for letter and numeral dimensions.

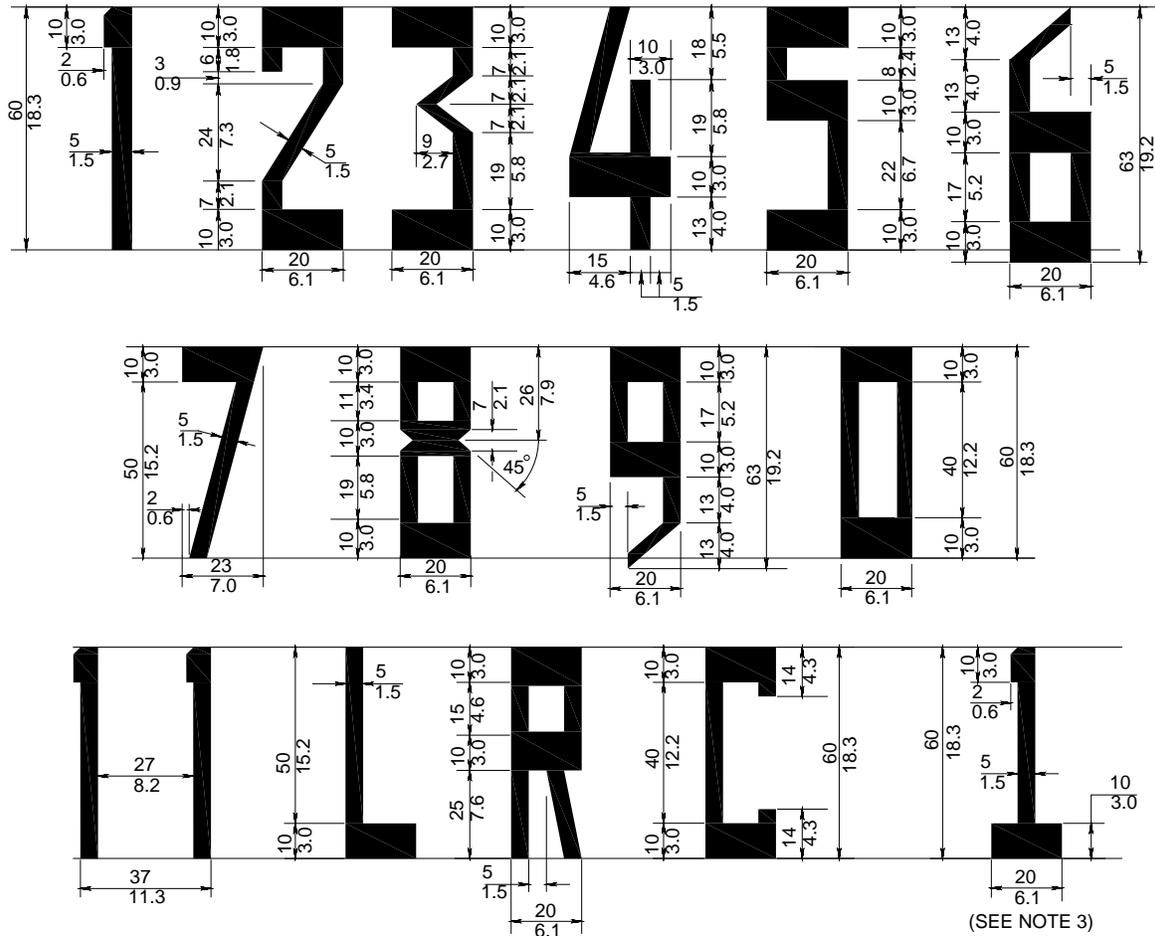
5-2.11 Dimensions for Designation Numbers and Letters.

Numbers are formed with 5-foot (1.5-meter) -wide vertical stripes and 10-foot (3-meter) -wide horizontal stripes. A zero (0) is marked to precede single-digit numbers on Class B runways except those subject to NAVAIR 51-50AAA-2. Lateral spacing between the numbers is 15 feet (4.6 meters), except for the number "11." Spacing between these numerals is 27 feet (8.2 meters). The dimensional layout is shown in Figure 5-6.

5-2.12 Runway Overruns.

Non-reflective yellow chevron markings are used on overruns to indicate the area is not a normal operational surface. For layout, the apex of the chevron is laid out (but not painted) 50 feet (15.2 meters) inward of the runway threshold. Only the portions of the chevron legs that are outward from the runway threshold are painted. Subsequent chevrons are placed at 100-foot (30.5-meter) intervals along the overrun, measured from chevron apex to chevron apex. The legs of the chevrons intersect the centerline at a 45-degree angle. The chevron legs extend laterally to within 5 feet (1.5 meters) of the paved surface edge or to align with the lateral limits of the runway shoulder markings (deceptive surface markings), if used. A typical layout plan and dimensions for these markings are shown in Figure 5-7.

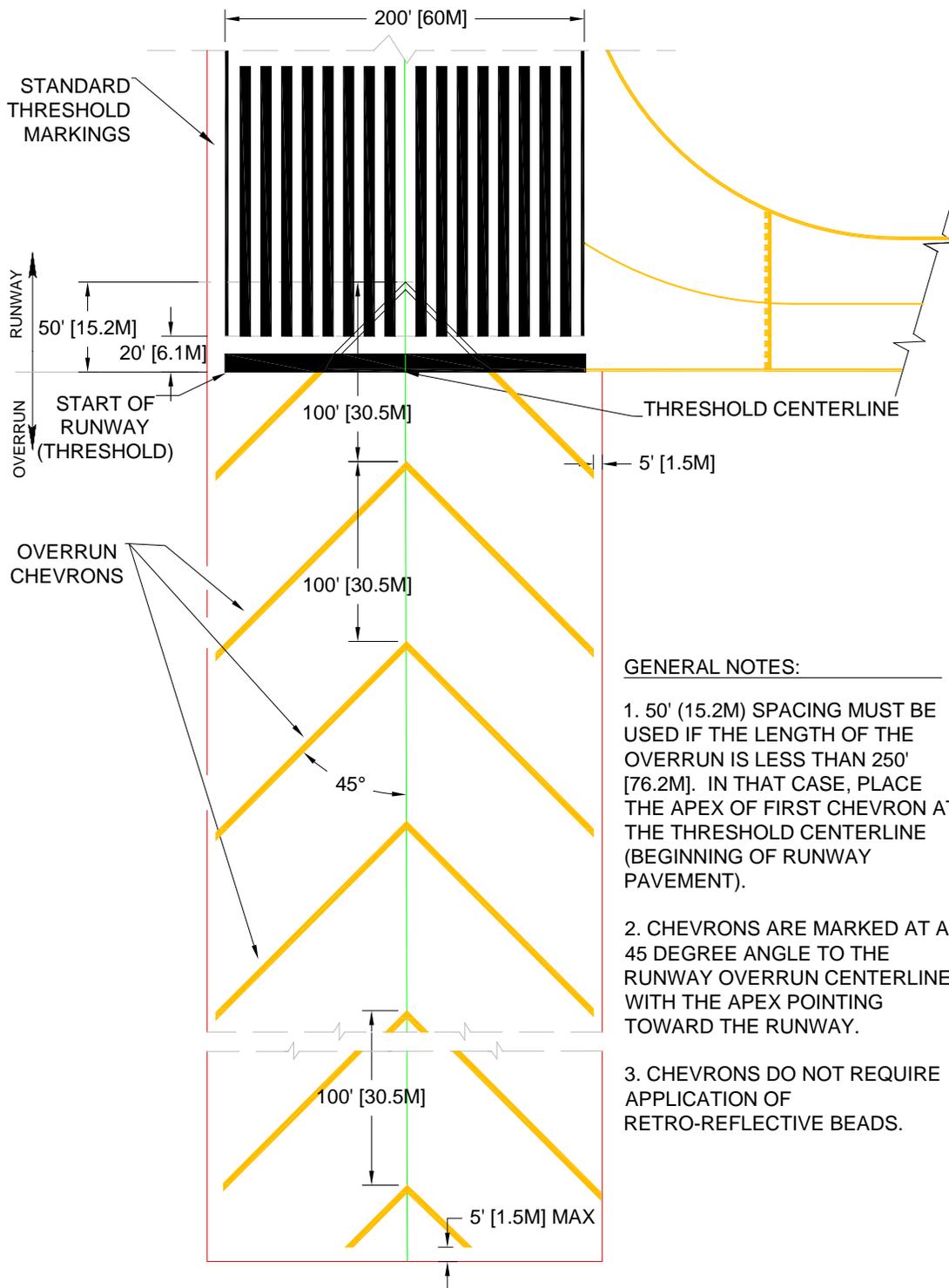
Figure 5-6 Runway Designators



NOTES:

1. ALL LETTERS AND NUMERALS EXCEPT THE NUMBER ELEVEN ARE HORIZONTALLY SPACED 15' [4.6 M] BETWEEN THE NEAR EDGES. THE NUMERALS USED TO FORM "11" ARE SPACED AT 27' [8.2M] BETWEEN INNER EDGES AS SHOWN ABOVE.
2. DIMENSIONS ARE EXPRESSED AS: $\frac{\text{FEET}}{\text{METERS}}$ (E.G. $\frac{60}{18.3}$).
3. WHEN USED ALONE, THE NUMERAL 1 IS PLACED ABOVE A HORIZONTAL BAR TO DIFFERENTIATE IT FROM THE RUNWAY CENTERLINE MARKING.
4. IMPERIAL UNITS OF MEASURE ARE USED AS THE PRIMARY DIMENSIONS IN THIS FIGURE. FOR DESIGNS WHICH USE ROUNDED METRICS FOR DIMENSIONS, CARE MUST BE TAKEN TO ENSURE THE NUMBERS AND LETTERS RETAIN THE INTENDED SHAPE AND PROPORTIONS.

Figure 5-7. Overrun Markings



5-2.13 Runway Side Stripes.

Retro-reflective white side stripes are marked on precision instrument runways. They are also used optionally on non-precision instrument and VFR runways. Side stripes are not intended to identify the edge of the full-strength pavement on DoD runways; they are intended to enhance the pilot's ability to recognize the runway environment at decision height on landing. If there is a lack of contrast between the full-strength runway pavement and the shoulder pavement, use non-reflective yellow shoulder markings (deceptive surface) on the shoulder pavement. See Figures 5-3 and 5-4.

Note: If there is a significant gap between the inner end of the shoulder markings (deceptive surface) and the runway side stripes (such as occurs when side stripes are spaced at 144-foot [44-meter] separation on a 300-foot [91-meter] -wide runway), also mark double 6-inch (152-millimeter) -wide retro-reflective yellow stripes, separated by a 6-inch (152-millimeter) -wide gap, to enhance delineating the limits of the useable (or full-strength) pavement. Details for these markings are the same as for taxiway or apron edge markings. Place the outer edge of the outermost stripe to coincide with the outermost edge of the useable (or full-strength) pavement and the inner end of the deceptive surface marking. These stripes are curved to follow the outer edge of fillets and terminate at the intersecting taxiway edge or joined to taxiway edge markings, if used.

5-2.13.1 Locating and Layout of Stripes.

The runway side stripe markings consist of one continuous stripe placed on each side of the runway. The side stripes are placed symmetrically about the runway centerline as shown in Figures 5-1 and 5-3. They have a minimum width of 3 feet (0.9 meter) for runways 100 feet (30.5 meters) or more in width and are at least 1.5 feet (0.5 meter) wide for runways less than 100 feet (30.5 meters) wide. The stripes begin 20 feet (6.1 meters) inward from the runway threshold and continue to within 20 feet (6.1 meters) of the runway threshold on the opposite end of the runway. There are exceptions when the threshold is displaced. See paragraph 5-2.14 and Figures 5-4, 5-8, 5-9, and 5-10 for examples.

5-2.13.2 Stripe Separation.

If special missions indicate a need for wider separation on runways 200 or 300 feet (61 meters or 91.4 meters) wide, the side stripes are placed as stated above, except the separation between the inner edges of the stripes is 194 feet (59.1 meters). Separation of side stripes greater than 194 feet (59.1 meters) is not authorized without a non-standard marking waiver.

5-2.14 Displaced Threshold Marking Schemes.

5-2.14.1 Layouts According to Intended Use of the Pavement.

There are four different schemes used to mark the pavement in the displaced area. Select a scheme from those shown in Figures 5-8 through 5-11 that indicates the appropriate and authorized use of the area. Note that for temporarily displaced

thresholds, existing markings need not be obliterated. However, Notice to Airmen (NOTAM), Flight Crew Information File (FCIF) memorandum, and any other available methods are used to convey the temporary changes and potential hazards that exist during the construction or maintenance period. See UFC 3-260-01, Appendix B, Section 1, for construction waiver requirements, and Appendix B, Section 14, for a construction phasing plan and safety checklist to be used for such projects.

5-2.14.1.1 Permanently Displaced Threshold Where Displacement Area is Used for Take-Off and/or Landing Ground Roll-Out.

Relocate the longitudinal threshold bars beginning 20 feet (6.1 meters) from the new threshold and place a retro-reflective white transverse stripe to precede them, with the outboard edges on the full-strength runway pavement, or to abut the runway side stripes. Reduce the width and length of the centerline stripes in the displaced threshold area and modify them with retro-reflective white arrowheads leading to the new threshold. Mark retro-reflective white chevrons to point toward the transverse threshold bar at evenly spaced increments across the pavement. Dimensions and layout details are shown in Figure 5-8.

5-2.14.1.2 Permanently Displaced Threshold Where Displacement Area is Used as a Taxiway (Referred to as Relocated Threshold in the Airman's Information Manual [AIM]).

Relocate the longitudinal threshold bars beginning 20 feet (6.1 meters) from the new threshold and place a retro-reflective white transverse threshold bar to precede them, with the outboard edge at the beginning of the runway pavement available for landing. Mark retro-reflective yellow chevrons to point toward the transverse threshold bar at evenly spaced increments across the pavement. Dimensions and layout details are shown in Figure 5-9.

5-2.14.1.3 Permanently Displaced Threshold Where Displacement Area Used as Taxiway and Take-Off and/or Landing Ground Roll.

Relocate the longitudinal threshold bars beginning 20 feet (6.1 meters) from the new threshold and place a retro-reflective white transverse threshold bar to precede them, with the outboard edge at the beginning of the runway pavement. Mark retro-reflective white chevrons to point toward the transverse threshold bar at evenly spaced increments across the pavement. Modify runway centerline stripes in the displacement area used for takeoff with retro-reflective white arrowheads. Mark a retroreflective yellow demarcation bar across the full width of the pavement at the end of the aligned taxiway, delineating the point where the takeoff roll begins. Dimensions and layout details are shown in Figure 5-10.

5-2.14.1.4 Temporarily Displaced Thresholds.

For temporarily displaced thresholds, place a retroreflective white transverse stripe that extends from side stripe to side stripe (or edge to edge of pavement if side stripes are not used) at the new threshold. Modify the centerlines within the displacement with arrowheads and mark chevrons across the runway width pointing to the transverse bar.

Use retroreflective white for arrowheads and chevrons if the area is used for takeoff or roll-out, or retroreflective yellow if the area is planned only for taxiing operations. It is not necessary to reposition the standard threshold markings, modify the width and length of centerline stripes, or obliterate other existing markings within the displaced area; however, NOTAM, FCIF memorandum, and any other available methods are used to convey the temporary changes and potential hazards to pilots. Dimensions and layout details are shown in Figure 5-11.

Figure 5-8 Permanently Displaced Threshold Where Preceding Pavement is Used as Runway (Take-Off or Landing)

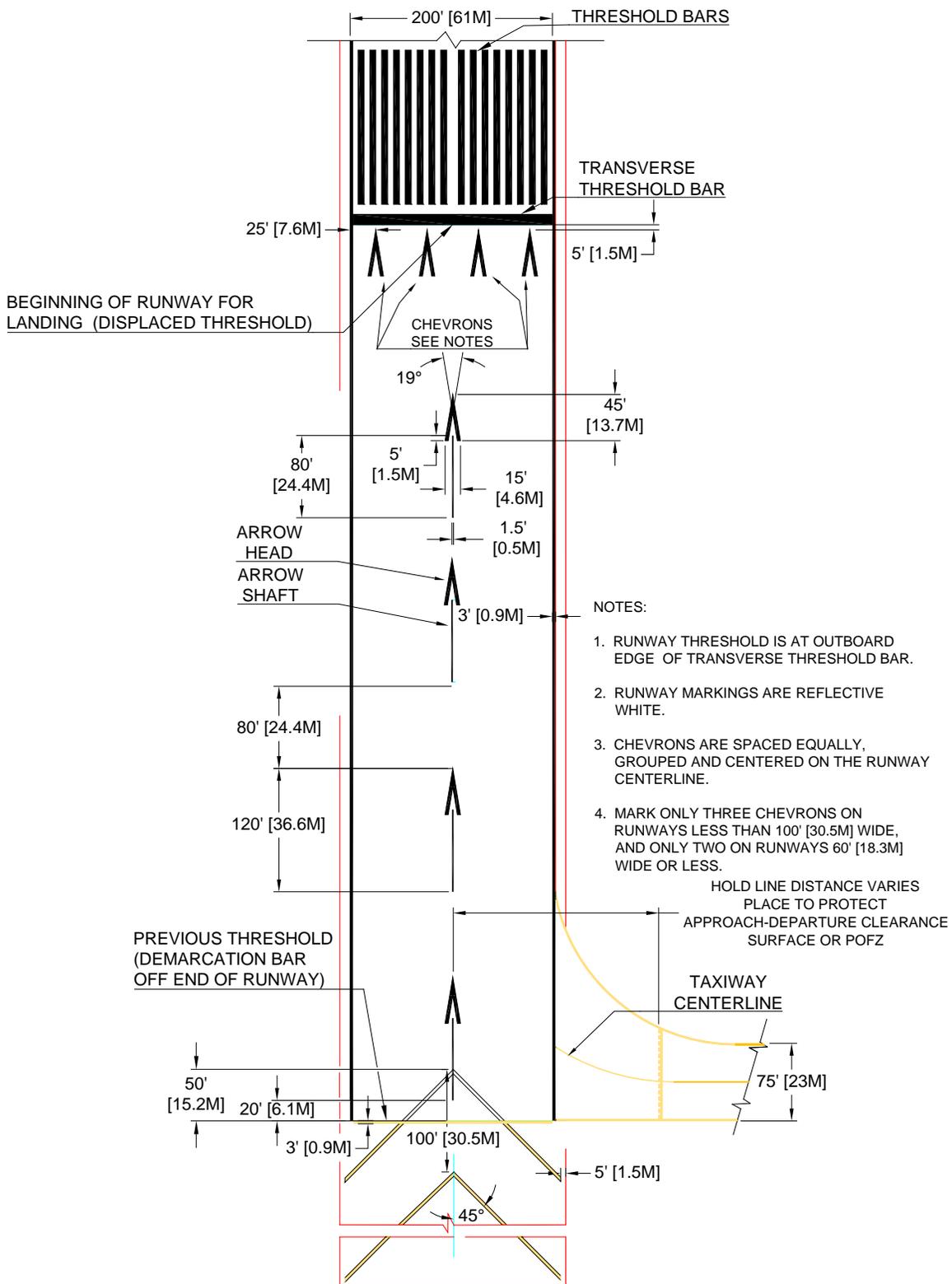


Figure 5-9. Permanently Displaced Threshold Where Preceding Pavement is Used as a Taxiway

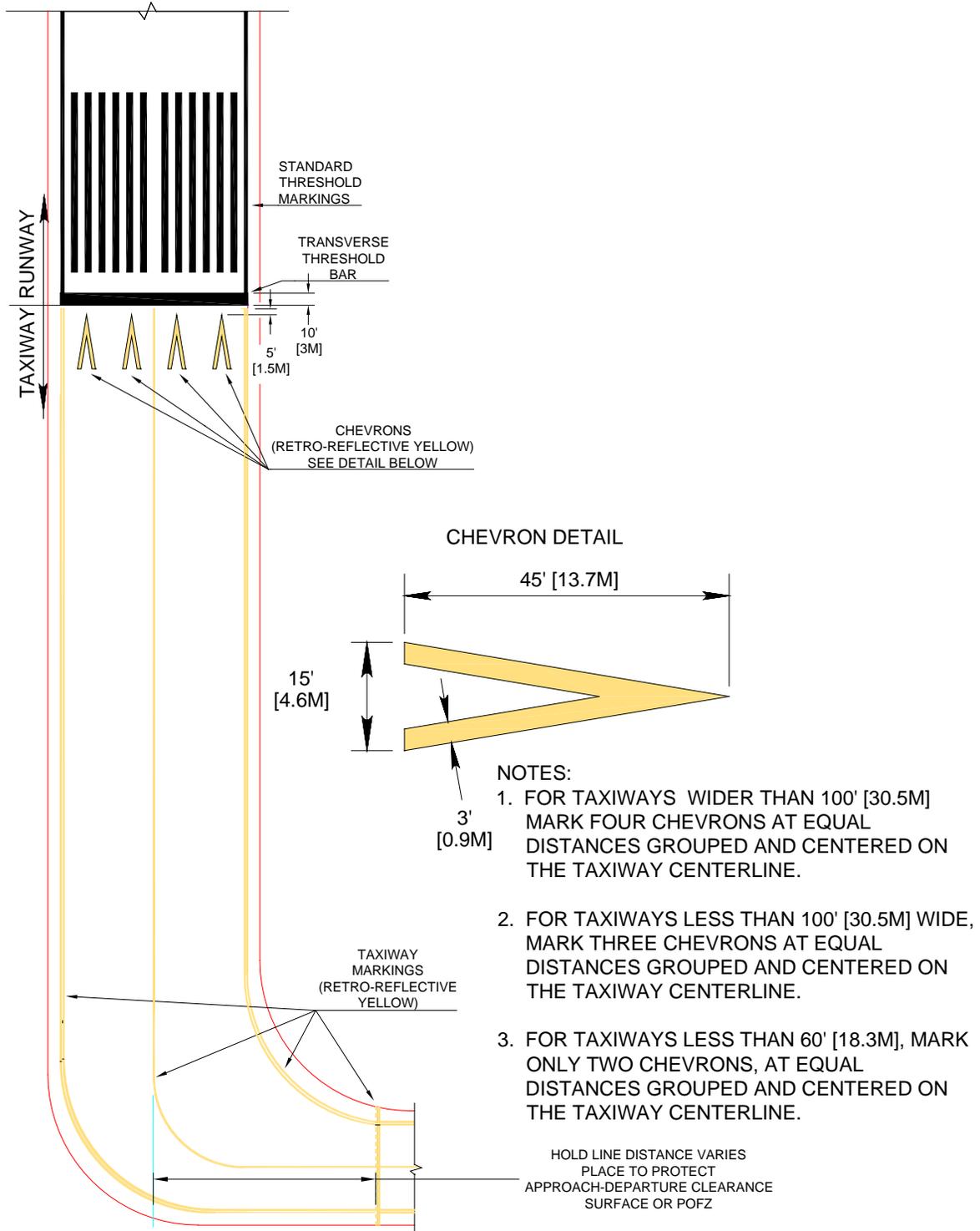


Figure 5-10. Permanently Displaced Threshold Where Displacement Area is Used as a Taxiway and for Take-Off and/or Landing Ground Roll

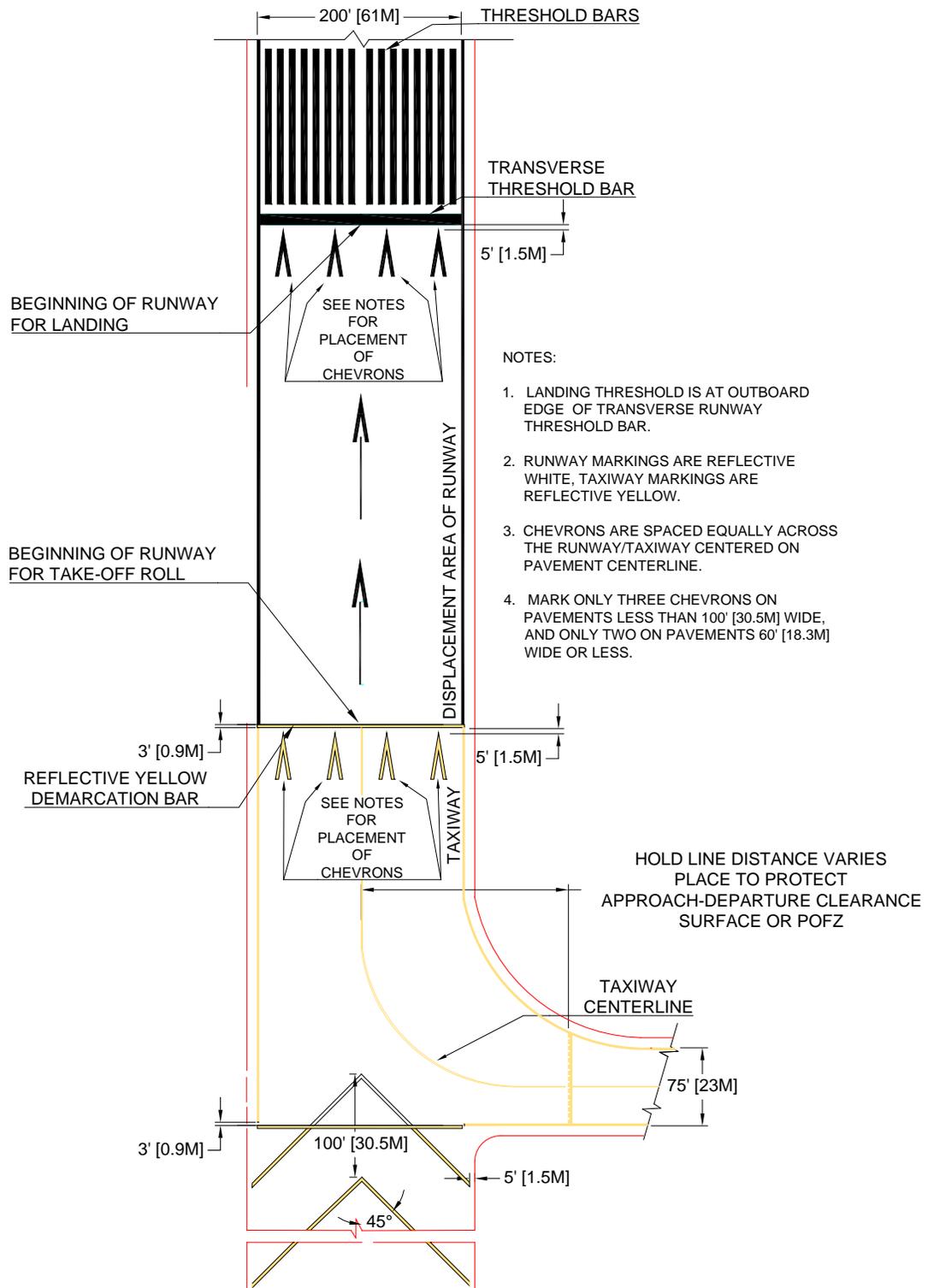
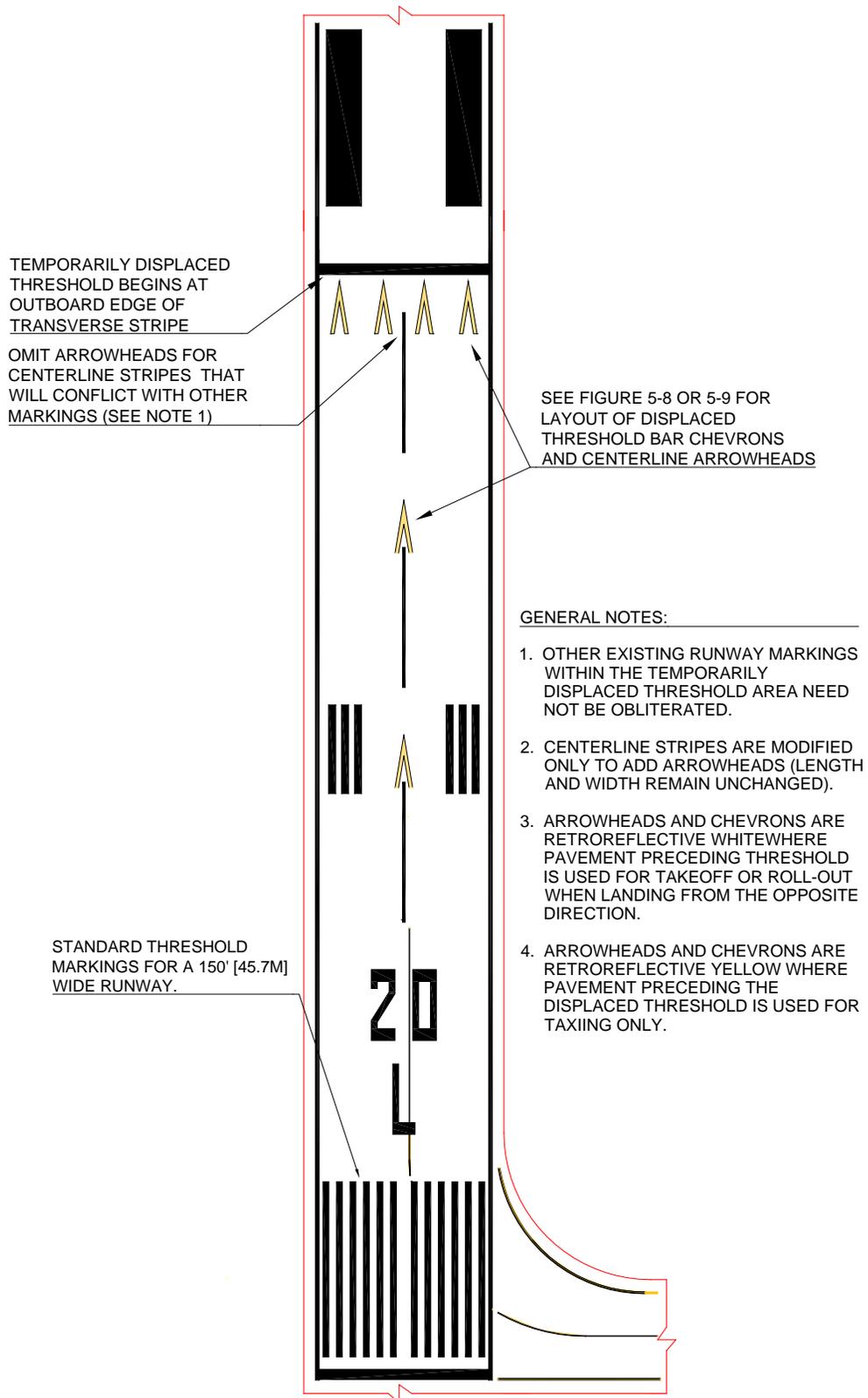


Figure 5-11. Temporarily Displaced Threshold



5-2.15 Touchdown Zone and Fixed Distance Markings.

5-2.15.1 Touchdown Zone (TDZ) Markings.

TDZ markings consist of pairs of longitudinal stripes placed symmetrically about the centerline. A group of three stripes are provided in the first two pairs of TDZ markings, two stripes in the next two groups of pairs, and single stripes in the last two pairs. Omit any pair of markings that fall within 1,000 feet (304.8 meters) of the runway midpoint. The lateral distance between each pair of longitudinal stripes measured at their inner edges is a constant 72 feet (21.9 meters). The layout and dimensions are shown in Figure 5-4.

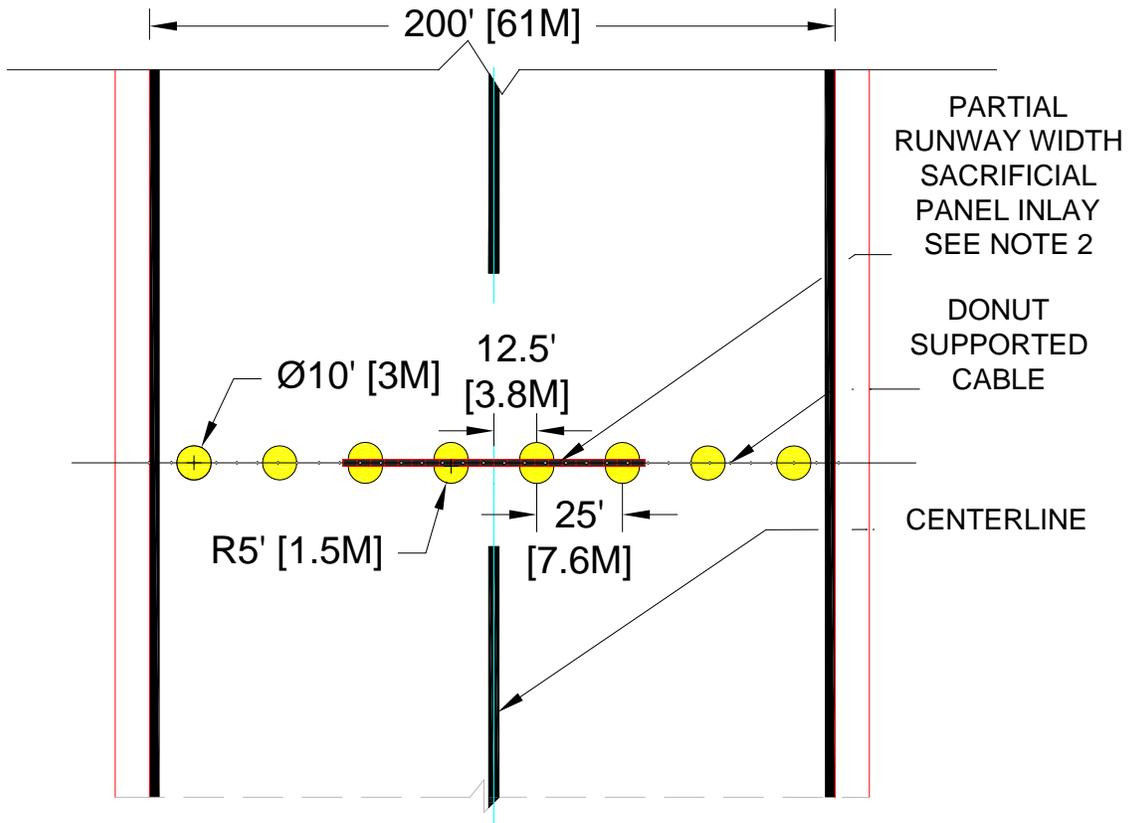
5-2.15.2 Fixed Distance (Aiming Point) Markings.

Provide aiming point markings on runways that are 150 feet (45.7 meters) or more wide and at least 4,000 feet (1,219.2 meters) long. Substitute them in place of the second pair of touchdown zone markings. The layout plan and dimensions are shown in Figure 5-4.

5-2.15.3 Aircraft Arresting System (AAS) Warning Markings.

Mark AAS locations on the runway with a series of discs placed beneath and centered on the pendant. Where TDZ and disc markings coincide, the TDZ marking is interrupted at that location for a minimum distance of 1 foot (0.3 meter) from the edge of the disc marking. If the designation and disc markings coincide, shift the designation marking longitudinally to eliminate the conflict. The layout plan and dimensions for these markings are shown in Figure 5-12. Do not use these markings in overruns.

Figure 5-12. Aircraft Arresting System (AAS) Warning Markings



NOTES

1. SIX WARNING MARKINGS ARE USED FOR 150' [46.7M] WIDE RUNWAYS, EIGHT ARE USED ON RUNWAYS 200' [61M] WIDE OR WIDER.
2. WHEN POLYETHYLENE PANELS ARE INSTALLED BENEATH PENDANTS, MARK 5' [1.5M] RADIUS SEMI-CIRCLES ON EITHER SIDE OF POLYETHYLENE PANEL INLAYS. PLACE THEM AT THE SAME SPACING ACROSS THE RUNWAY AS WHEN NO PANELS ARE USED.

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CHAPTER 6 TAXIWAY AND APRON MARKINGS

6-1 GENERAL INFORMATION.

Unless otherwise indicated, most taxiway, apron, and taxilane markings for both fixed and rotary-wing facilities are marked in retro-reflective yellow. All markings of any color on light-colored pavement are optionally highlighted by marking a black, non-reflectORIZED 6-inch (152-millimeter) border (see paragraph 3-1.5).

6-2 TAXIWAY AND TAXILANE CENTERLINE STRIPE.

Mark the centerline of all taxiways, guidelines on runways, and taxilanes on aprons as well as parking positions and pads, with a single continuous 6-inch (152-millimeter) -wide retro-reflective yellow stripe. The width is optionally increased to 12 inches (305 millimeters) when necessary; however, make the line width uniform (either one width or the other) wherever used over the entire airfield. Exceptions to this provision apply for parking positions and inside hangars.

6-2.1 Directional Changes.

All directional changes are accomplished with smooth, single radius curves. Position nose wheel guidelines to maintain a clearance of at least 10 feet (3 meters) between the aircraft's outermost main gear and the edge of the full-strength pavement when the cockpit is maintained over the nose wheel guideline through the turn. Also ensure adequate wingtip clearance is provided for the most demanding aircraft that uses the taxi route. On runways, the curve is tangent to a line parallel with and 3 feet (0.9 meter) from the near side of the runway centerline marking. The straight segment extends 200 feet (61 meters) beyond the point of tangency. See Figure 6-1 for these and other typical layout schemes.

6-2.2 Taxiway and Taxilane Turn Radii.

6-2.2.1 General Intersection Geometry.

On hammerheads, aprons, and pads, and at runway/taxiway and taxiway/taxiway intersections, the radius for the curves are greater than the minimum turning radius for the assigned mission aircraft and are positioned to maintain a clearance of at least 10 feet (3 meters) between the outermost main gear of a C-5 and the edge of the full-strength pavement. See USACE Transportation Systems Center Report 13-2 for aircraft turning diagrams. The recommended radius for 90-degree runway/taxiway intersections is 150 feet (45.7 meters). The recommended radius for 90-degree taxiway/taxiway intersections is 125 feet (38.1 meters). Other radii are allowed, depending on local requirements. In all cases, ensure these radii accommodate the necessary wingtip clearance distance as well as the pavement structure (clearance between outer main gear and edge of pavement) for the most demanding aircraft that uses the intersection before marking nose wheel guidelines.

6-2.2.2 Aprons for Cargo Aircraft.

Typical taxiway turning radii for cargo aircraft aprons are provided in Table 6.1 and Figure 6-2. Use these to determine the appropriate turning radii for cargo aircraft. For aircraft not shown in Table 6.1, compute the wing tip clearance and main gear distance from the appropriate aircraft characteristics found in the Facility Requirements Document (FRD) for the Mission Design Series (MDS) aircraft, or the aircraft turning diagrams found in USACE Transportation Systems Center Report 13-2. Use UFC 3-260-01, Table 6.1, "Cargo Aircraft Apron Layout Dimensions," or Table 6.2, "Rotary Wing Aprons," for minimum wingtip clearances. When marking an apron for a specific aircraft with features less stringent than for a C-5 or 747-8, coordinate with the airfield management and flight safety functions to ensure procedures are published to require aircraft wing-walkers be used for any aircraft that requires greater distances than those provided for safe clearance to obstacles. Publish this information in the Airfield Operating Instruction (AOI) at locations that require, have, or utilize an AOI.

6-3 TAXIWAY, APRON, AND TAXILANE EDGE STRIPES.

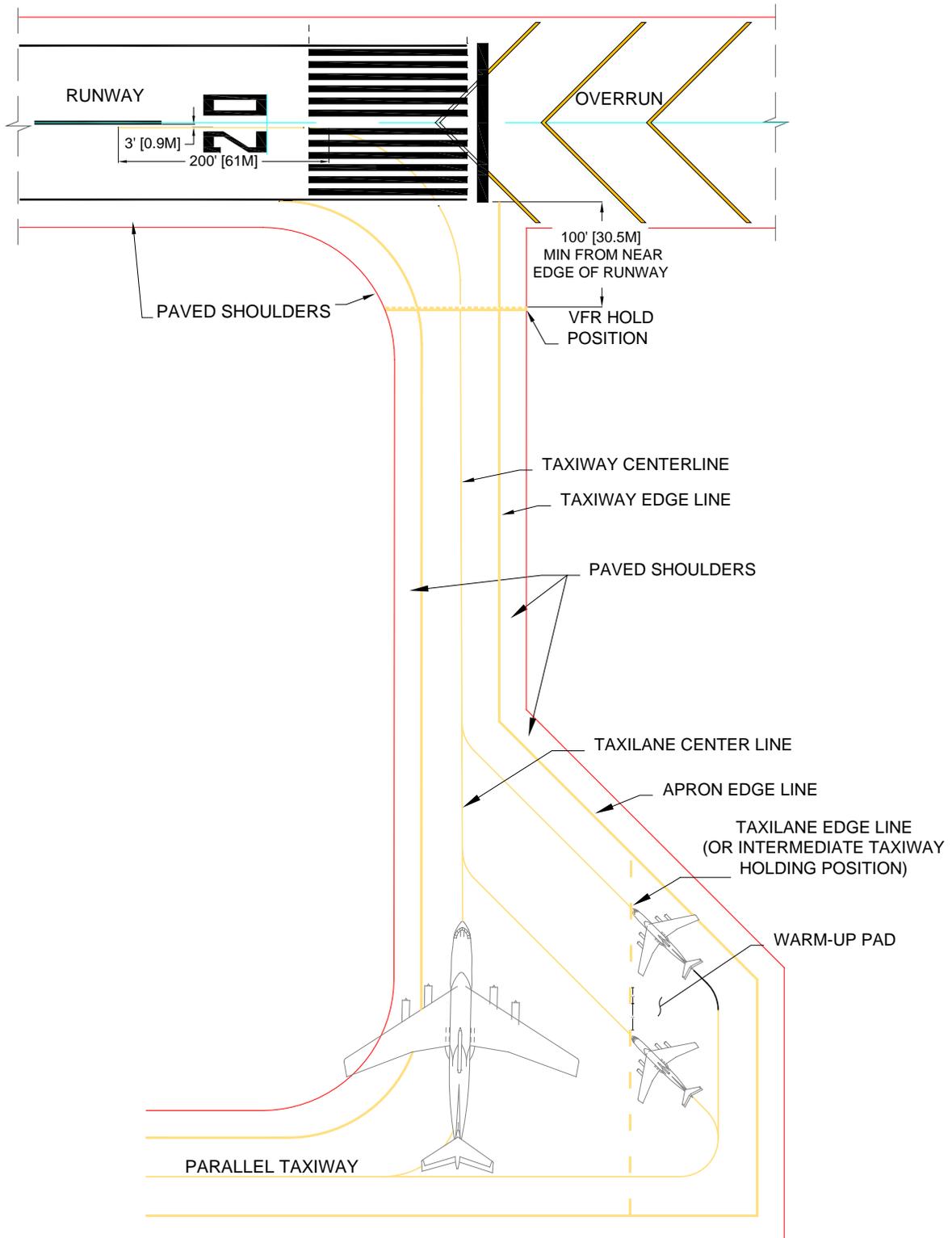
6-3.1 Taxiway and Apron Edge Stripes.

When there is little contrast between the full-strength taxiway or apron boundary and the adjacent paved shoulder or other paved area, mark the edge of the usable pavement with two continuous 6-inch (152-millimeter) -wide retro-reflective yellow stripes separated by a 6-inch (152-millimeter) -wide gap. This marking is used to delineate the usable limits of the taxiway or apron from other pavements or surfaces not intended for routine use by aircraft. It is never used in areas where aircraft are required to cross the designated boundary when operated by a pilot or qualified maintainer (towing aircraft across these markings is accepted if the adjacent area is designated and/or marked as a towway). No portion of the marking is placed on non-load-bearing pavements. Use the tangents for the taxiway centerline stripe on curves; in areas where this is not practical, form a uniform arc to establish the usable area on the full-strength pavement. Figure 6-1 shows typical taxiway/apron edge lines; Figure 6-3 provides the width of the stripes and the space between them. Edge stripes are optionally highlighted with black borders on light-colored pavement (see paragraph 3-1.5).

6-3.2 Taxilane Edge Stripes.

This marking is used to define the limits of a designated taxi route where the surrounding pavement is intended for use by aircraft. Aircraft movement across the designated boundary is permitted either by direction of air traffic control (ATC), a marshaller, or at the pilot's discretion. This marking consists of two 6-inch (152-millimeter) -wide broken stripes separated by a 6-inch (152-millimeter) -wide gap. The stripes are 15 feet (4.6 meters) long with gaps of 25 feet (7.6 meters). The detail and a typical layout are shown in Figures 6-1 and 6-9. Place the innermost edge of each stripe a distance from the centerline equal to half the wingspan of the most demanding aircraft that uses the taxilane, plus the appropriate wingtip clearance required by UFC 3-260-01, Table 6.1, items 5 or 6.

Figure 6-1. Typical Taxiway and Taxilane Markings



6-4 PARKING STOP BARS.

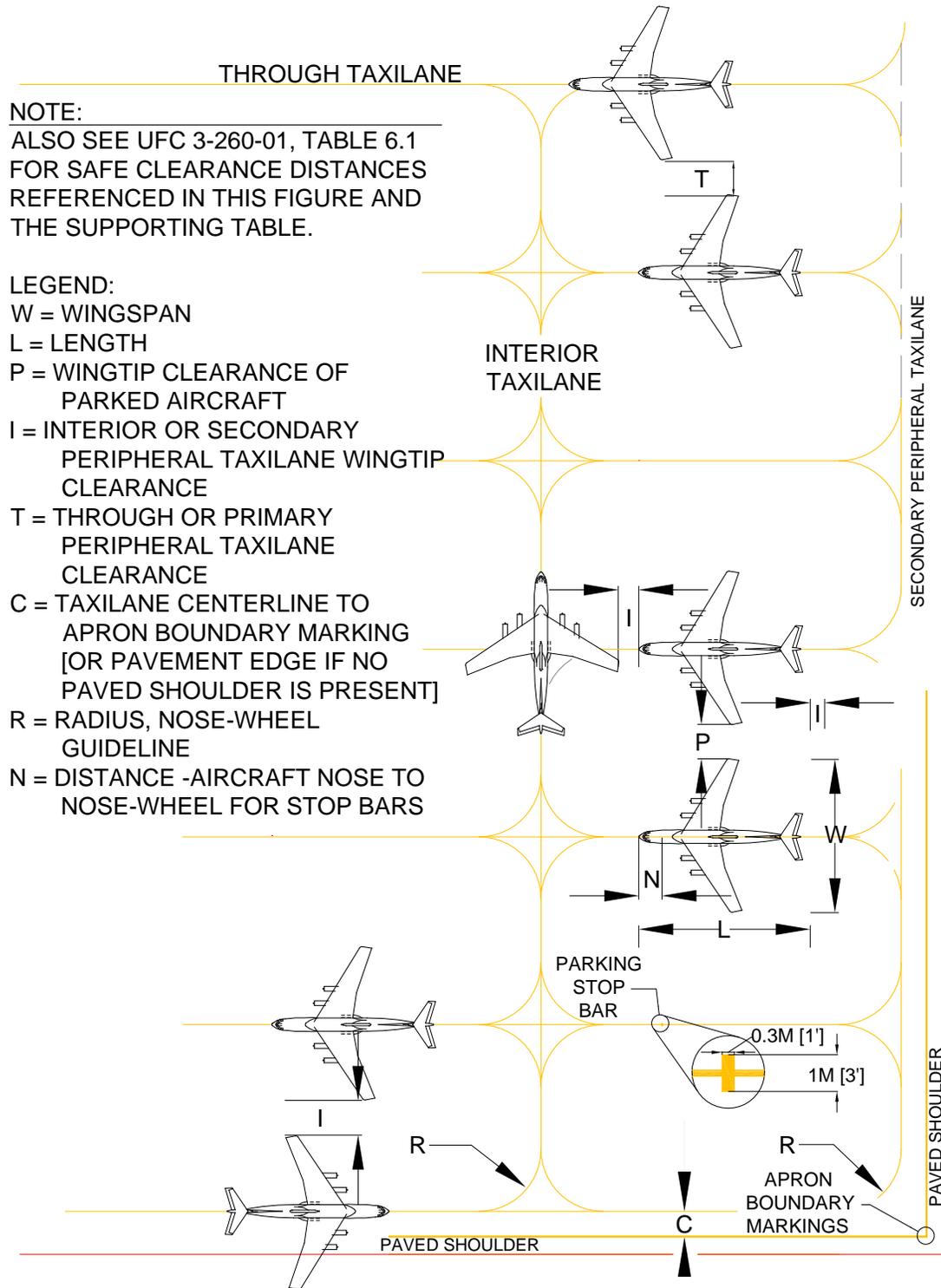
Parking stop bars are optionally painted at aircraft parking positions to indicate the intended location for the aircraft nose wheel when parked. Stop blocks are painted reflective yellow and are 3 feet (0.9 meter) long and 1 foot (0.3 meter) wide, centered on and oriented perpendicular to the nose wheel guideline. See Table 6-1 and Figure 6-2 for an example for locating these visual aids.

Table 6-1. Cargo Aircraft Apron Layout Dimensions

Aircraft	W	L*	P	I	T	C	R	N
C-5A	222.7' (67.9m)	247.8' (75.5m)	25' (7.6m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	90' (27.4m)	34.7' (10.6m)
C-9A	93.4' (28.5m)	119.3' (36.4m)	20' (6.1m)	20' (6.1m)	30' (9.1m)	25' (7.6m)	90' (27.4m)	7.6' (2.3m)
C-17	170' (51.8m)	173.3' (52.8m)	25' (7.6m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	90' (27.4m)	11' (3.4m)
C-130E/H/J	132.6' (40.4m)	99.5' (30.3m)	20' (6.1m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	60' (18.3m)	11.8' (3.6m)
C-130J-30	132.6' (40.4m)	112.8' (34.4m)	20' (6.1m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	60' (18.3m)	11.8' (3.6m)
C-141B	160' (48.8m)	168.3' (51.3m)	20' (6.1m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	90' (27.4m)	10.3' (3.1m)
KC-135R	130.8' (39.9m)	136.2' (41.5m)	50' (15.2m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	90' (27.4m)	17.4' (5.3m)
KC-10A	165.3' (50.4m)	182.1' (55.5m)	50' (15.2m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	100' (30.5m)	28' (8.5m)
B767-200ER	156.1' (47.6m)	159.2' (48.5m)	50' (15.2m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	90' (27.4m)	14.9' (4.5m)
B747-400	211' (64.3m)	231.8' (70.6m)	20' (6.1m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	100' (30.5m)	25.4' (7.7m)
B777-300	200' (61m)	242.3' (73.9m)	20' (6.1m)	30' (9.1m)	50' (15.2m)	37.5' (11.4m)	110' (33.5m)	19.3' (5.9m)

* Aircraft dimensions provided above do not include appurtenances such as antennas and do not include all model variations due to aircraft modifications.

Figure 6-2. Typical Mass Apron Layout for Cargo Aircraft



6-5 HOLDING POSITIONS.

Holding positions are necessary on all pavements that lead to an active fixed-wing or rotary-wing runway or helipad, and at critical taxiway or taxilane intersections. They designate a boundary intended to protect the runway, helipad, or primary taxi route from incursions or prevent interference with signals transmitted by electronic navigational aids.

6-5.1 Runway Hold Positions.

There are two patterns for marking runway hold positions: one is used to mark holding positions used for VFR conditions and the other is used to mark holding positions for IFR conditions. Both types are marked in retro-reflective yellow paint and are optionally enhanced with black borders on light-colored pavement. Runways served by precision instrument navigation aids might require an instrument holding position be marked in addition to the VFR holding position. Where practicable, collocate these markings and mark only the VFR holding position. If required, locate the instrument holding position further from the active runway to prevent taxiing or holding aircraft from interfering with signals transmitted to inbound aircraft during IMC and to prevent aircraft and vehicles from violating the precision obstacle free zone (POFZ). This marking is also used to identify the boundary of a microwave landing system (MLS) critical area and to identify the holding position for Category (CAT) II or CAT III operations.

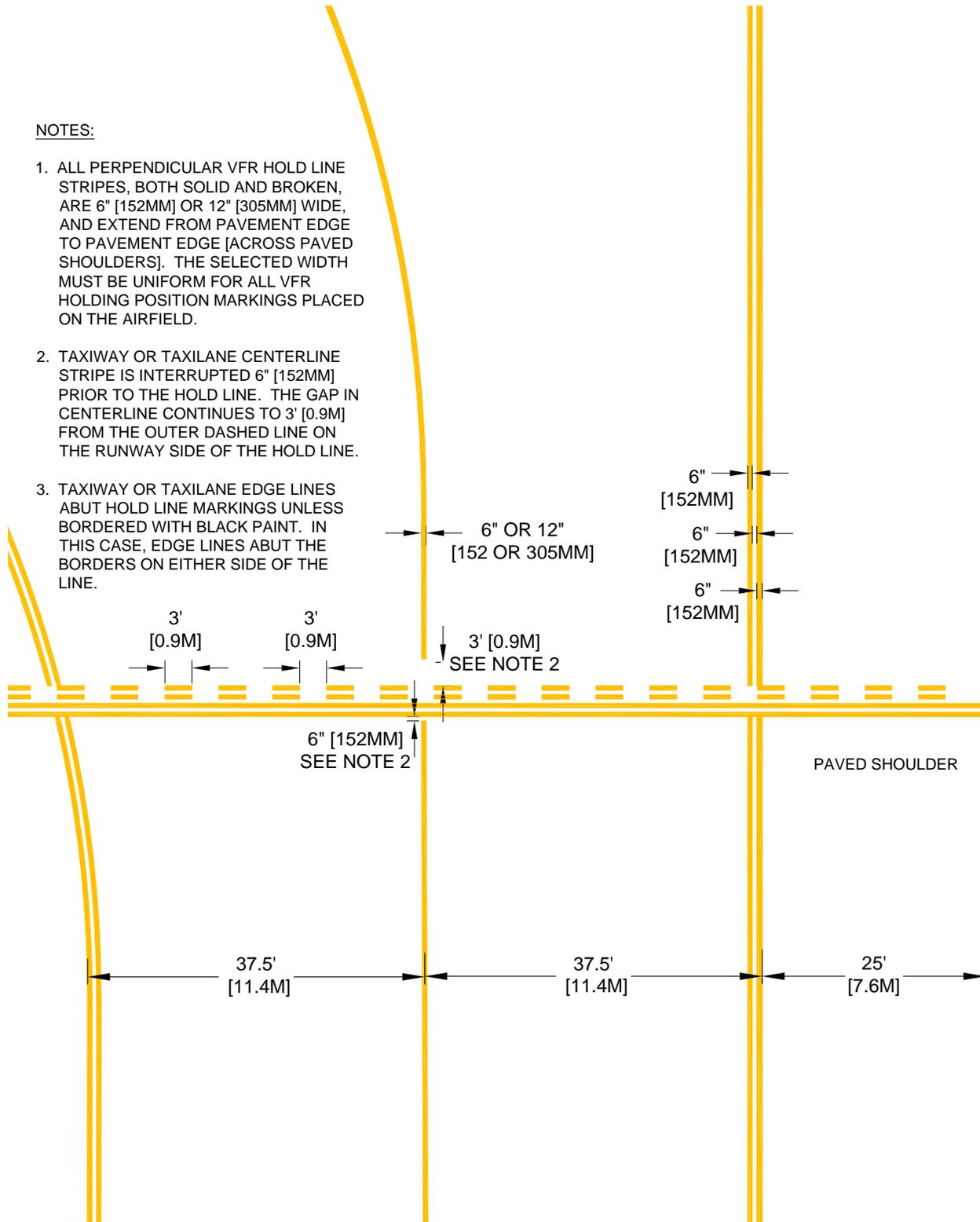
6-5.1.1 VFR Runway Holding Position.

In all cases, a VFR holding position is marked. This holding position is located 100 feet (30.5 meters) to 250 feet (76.2 meters) from the near edge of the runway. The minimum setback from the runway edge is 100 feet (30.5 meters). This distance is measured perpendicular to the long axis of the runway. Measure distances from the runway centerline (divide the published runway width shown in the DoD FLIP by 2 and add the required holding position distance). VFR holding positions are marked from edge to edge of the pavement surface, including paved shoulders. Interrupt taxiway edge lines at the outer edge of the holding position marking, or its black border, if provided. No gap at the edge line interruption is required. Figure 6-3 shows layout and typical positioning for a VFR hold line. Where practicable, setback distances for the VFR runway holding position are increased for instrument runways and where the wingspan of the controlling aircraft is greater than 79 feet (24.1 meters). Suggested setback distances from the runway edge are 175 feet (53.3 meters) for controlling aircraft with wingspans from 79 feet (24.1 meters) up to 171 feet (52.1 meters); and 205 feet (62.5 meters) for controlling aircraft with wingspans greater than 171 feet (52.1 meters). Increase these distances by 1 foot (0.3 meter) for each 100 feet (30.5 meters) of airfield elevation above mean sea level (MSL). Holding positions are placed perpendicular to the runway centerline on taxiways that enter at an angle to the runway; however, do not mark them to allow any portion of the holding aircraft to encroach beyond the minimum established distance.

Figure 6-3. VFR Hold Position Markings

NOTES:

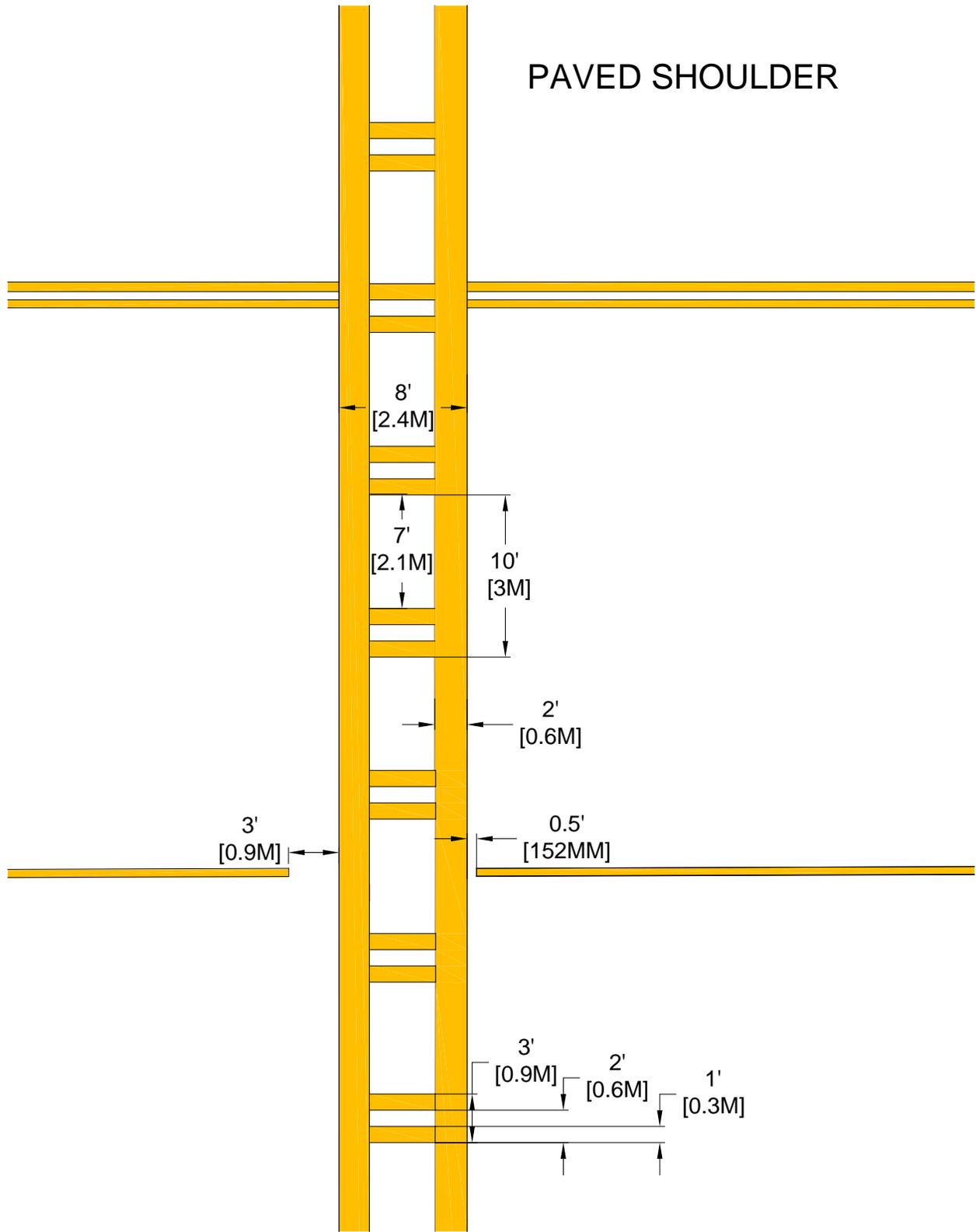
1. ALL PERPENDICULAR VFR HOLD LINE STRIPES, BOTH SOLID AND BROKEN, ARE 6" [152MM] OR 12" [305MM] WIDE, AND EXTEND FROM PAVEMENT EDGE TO PAVEMENT EDGE [ACROSS PAVED SHOULDERS]. THE SELECTED WIDTH MUST BE UNIFORM FOR ALL VFR HOLDING POSITION MARKINGS PLACED ON THE AIRFIELD.
2. TAXIWAY OR TAXILANE CENTERLINE STRIPE IS INTERRUPTED 6" [152MM] PRIOR TO THE HOLD LINE. THE GAP IN CENTERLINE CONTINUES TO 3' [0.9M] FROM THE OUTER DASHED LINE ON THE RUNWAY SIDE OF THE HOLD LINE.
3. TAXIWAY OR TAXILANE EDGE LINES ABOUT HOLD LINE MARKINGS UNLESS BORDERED WITH BLACK PAINT. IN THIS CASE, EDGE LINES ABOUT THE BORDERS ON EITHER SIDE OF THE LINE.



6-5.1.2 Instrument Meteorological Conditions (IMC) Holding Position.

The IMC hold position is configured differently from a VFR hold. Locations for the instrument hold line vary, depending on the type and capability of the landing aid. An IMC holding position is only marked when located at a different point along the taxiway (or on a cross-wind runway used for taxi operations or LAHSO). When needed, they are located to prevent interference with electronic navigational aids (NAVAIDs) and provide additional safety during periods of reduced visibility. If an instrument hold line is needed and the taxiway where it needs to be marked also penetrates the POFZ, only one holding position marking is installed to delineate the applicable critical area and the POFZ. The holding position marking is located at the more conservative boundary of the two areas (generally the farthest from the runway). In this instance, the instrument and POFZ holding position markings are not replaced with a VFR runway holding position marking. The airfield manager works with the instrument procedures specialist to designate the applicable critical area and POFZ boundaries, and, as appropriate, determine the holding position location. Figure 6-4 shows the layout for an instrument hold line. Figures 6-5 and 6-6 depict typical positioning for these hold lines. The markings are typically installed perpendicular to the taxiway centerline but might be canted from the perpendicular in unique situations. All holding positions are marked from edge to edge of the pavement surface, including paved shoulders. Interrupt taxiway edge lines at the outermost edges of the holding position marking, or the black borders, if provided. Interrupt centerlines 6 inches (152 millimeters) before the side of the marking where aircraft are to hold and provide a 3-foot (1-meter) gap on the runway side of the marking. No gap at the interruption of edge lines is required. The gap distances cited for the centerline include the black borders, when provided.

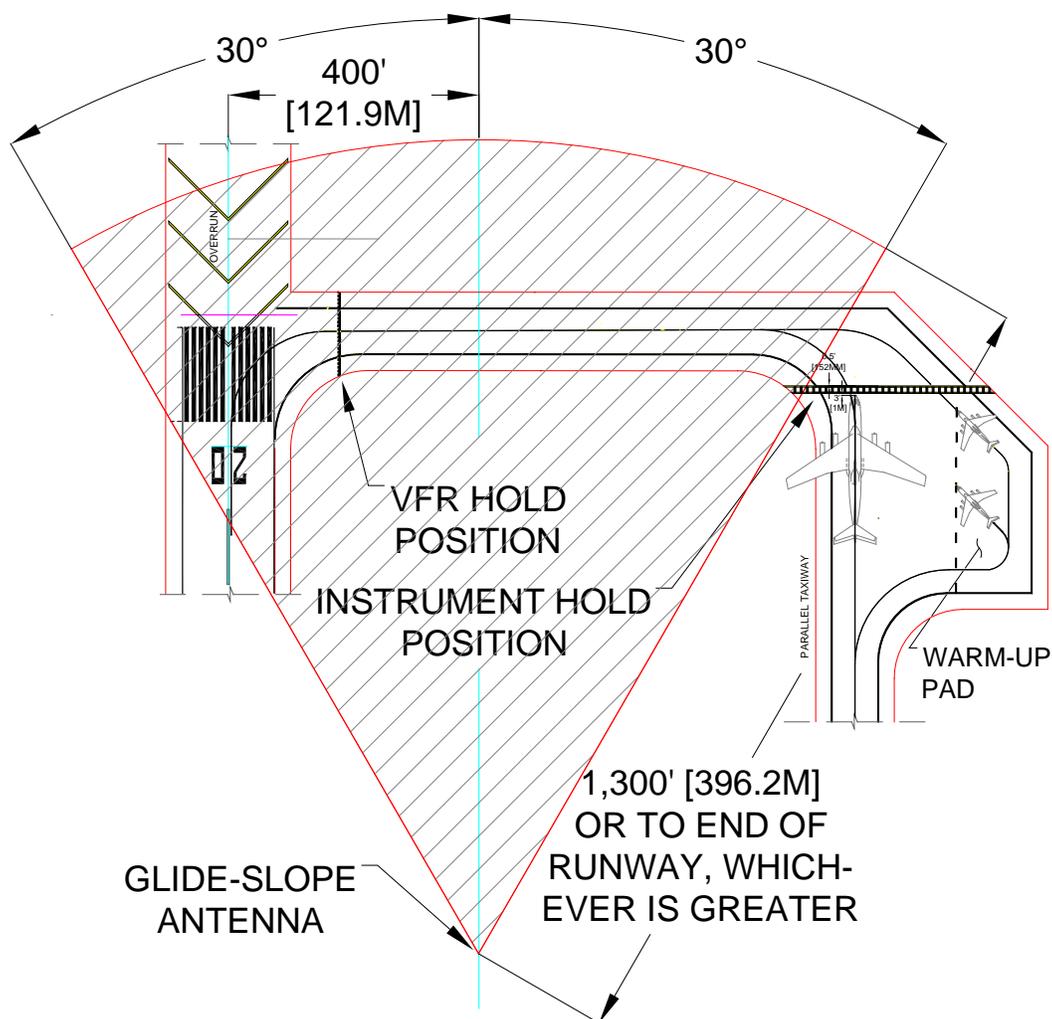
Figure 6-4. ILS Hold Position Details



6-5.1.3 Locating IMC Hold Position Markings.

If the height above touchdown (HAT) is 200 feet (61 meters) or greater (ask the airfield manager), mark the instrument holding position at the edge of the glide slope critical area as shown in Figure 6-5. If the HAT is less than 200 feet (61 meters), mark the holding position at the edge of the TDZ critical area or the glide slope critical area, whichever results in a distance farther from the edge of the runway. The glide slope critical area and TDZ critical areas are shown in Figures 6-5 and 6-6. The instrument hold line is placed at least 500 feet (152.4 meters) from the runway centerline when TDZ critical area criteria apply.

Figure 6-5. Locating Instrument Hold Position to Protect Glideslope Critical Area



6-5.2 Runway/Runway Holding Position Marking Layout and Placement.

LAHSO for runway/runway intersections require a letter of agreement between the airfield operations authority and the air traffic control tower (ATCT) authority. When a holding position is necessary for such operations, it is marked in one of the patterns described above; however, its location is not less than 280 feet (85.3 meters) from the adjacent runway centerline. This distance is increased by 1 foot (0.3 meter) for each 100 feet (30.5 meters) of airfield elevation above MSL. Such hold lines are located further away to avoid interference with intersecting taxiway clearances and interrupts all other runway markings other than a designation marking. The runway holding position marking extends across the full width of the runway but not onto the runway shoulders or onto any intersecting taxiway fillet.

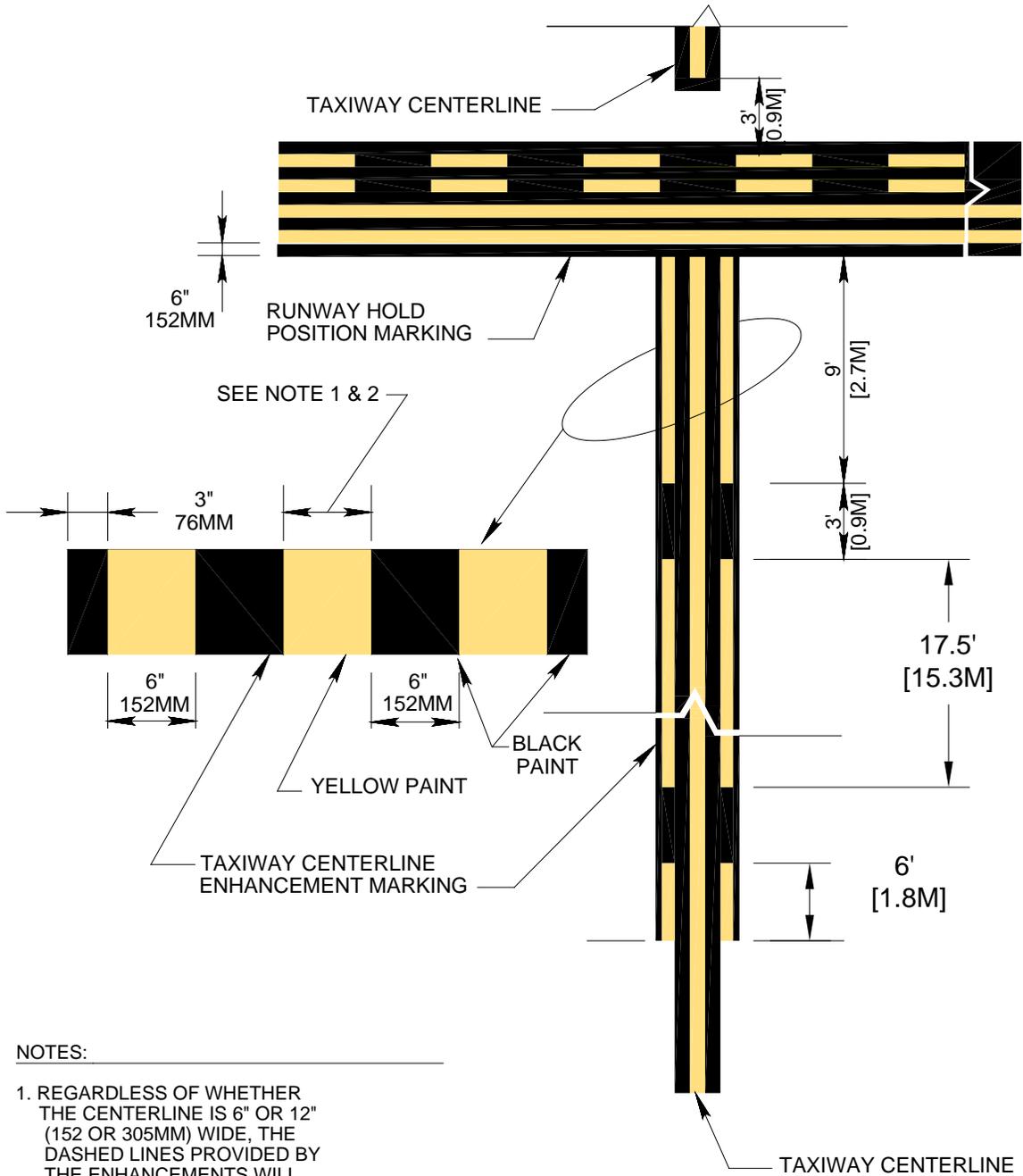
6-5.3 Enhanced Hold Position Marking.

Enhanced markings are intended to be a visual precursor to an approaching runway holding position. These markings are intended to prevent runway incursion and are optionally marked at any runway intersection for any DoD installation but are required at Part 139 (14 CFR Part 139) airports. See Figure 6-7 for details. For additional guidance on marking pavements at civil-owned facilities, see FAA AC 150/5340-1.

6-5.4 Intermediate Hold Position Markings.

Intermediate holding position markings identify the location for aircraft to hold short of an intersecting taxiway, or taxilane on an apron. These permissible markings are placed only where there is an operational need for aircraft to hold short of another taxiway or taxilane intersection. Intermediate holding position markings are retro-reflective yellow and are placed at a distance from the intersecting taxiway or taxilane to provide one-half the wingspan of the most demanding aircraft that uses the taxi path, plus the appropriate wingtip clearance as shown in Table 6-1 of UFC 3-260-01. When placing these markings to protect a taxiway, use the greater wingtip clearance as shown for a through taxilane. The intermediate hold position marking is a 6-inch (152-millimeter) or 12-inch (305-millimeter) -wide dashed line, where the dashes are 3 feet (0.9 meter) long and the gaps are 3 feet (0.9 meter) long; see Figure 6-8 for layout details. Interrupt taxiway or taxilane centerlines and edge lines 6 inches (152 millimeters) before and after the hold position line. Center a dash on the taxipath centerline. If the hold line crosses more than one centerline, center a dash on the path of highest use.

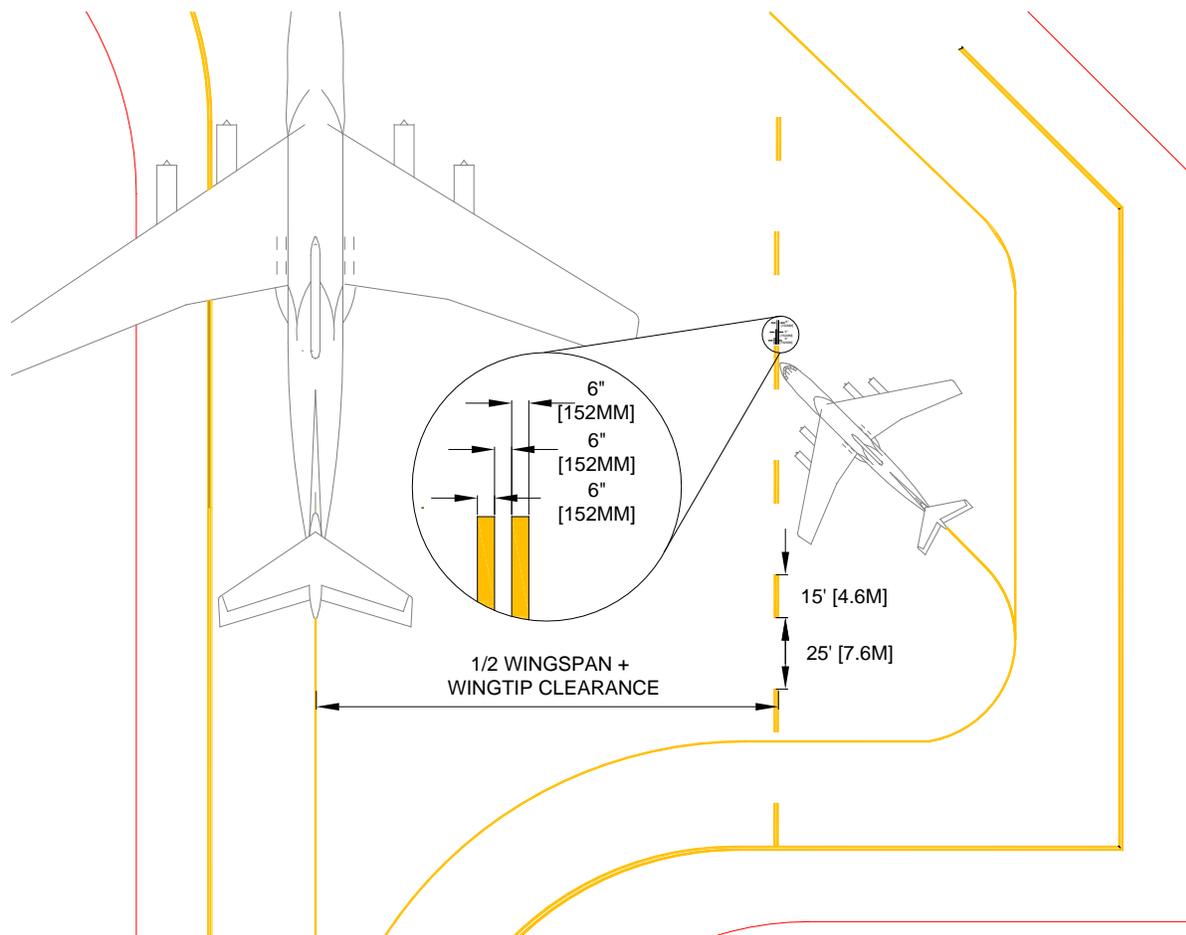
Figure 6-7. Enhanced Hold Position Markings



NOTES:

1. REGARDLESS OF WHETHER THE CENTERLINE IS 6" OR 12" (152 OR 305MM) WIDE, THE DASHED LINES PROVIDED BY THE ENHANCEMENTS WILL ALWAYS BE 6" (152MM)
2. IF TAXIWAY CENTERLINE LIGHTS ARE PRESENT, SHIFT THE TAXIWAY CENTERLINE EITHER RIGHT OR LEFT TO ENSURE THE ENHANCEMENT MARKINGS DO NOT COVER THE LIGHTS.

Figure 6-9. Taxilane Edge Stripes



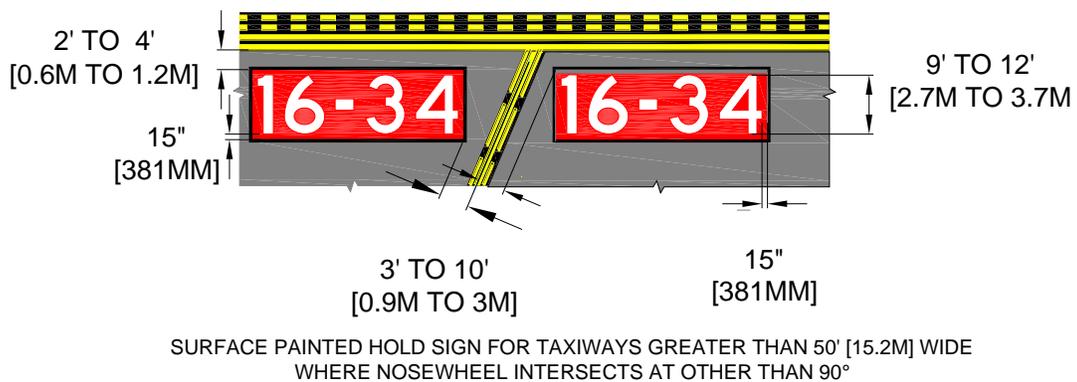
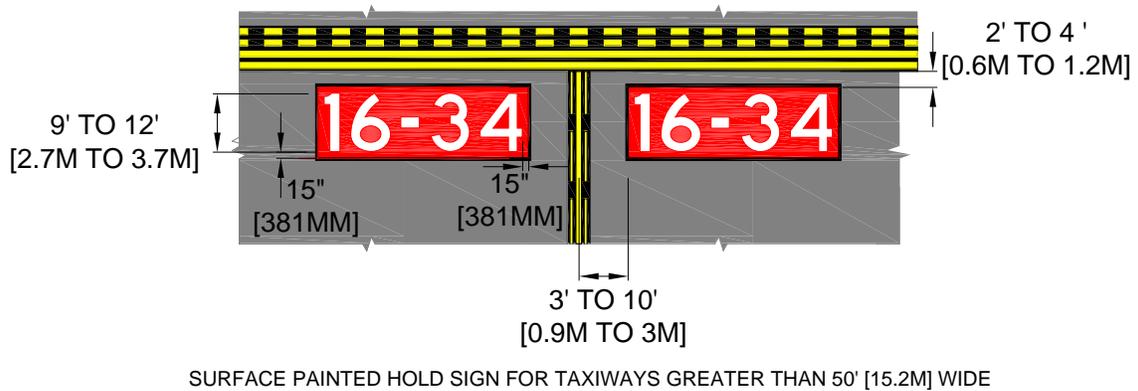
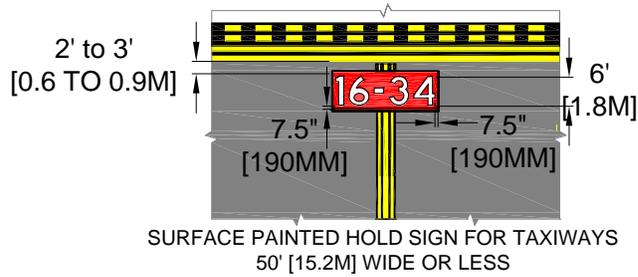
6-5.5 Surface Painted Signs.

Taxiway signs are described in UFC 3-535-01. Where it is desirable to furnish additional guidance at intersections or along taxiways or taxilanes, additional information is provided on the pavement surface. The most common surface-painted sign types are location, direction, and runway hold position signs. Under special circumstances, geographic position marking (GPM) signs are required. GPM signs are used repeatedly along a designated taxi route to serve as indicators of specific locations to allow pilots to confirm their position on the airfield during periods of low visibility. Low-visibility operations are defined as taxiing operations prior to takeoff or after landing that occur when the runway visual range (RVR) is below 1,200 feet (365.8 meters). See FAA AC 120-57 and both UFC 3-535-01 and FAA AC 150/5340-18 for sign requirements. See FAA AC 150/5340-1 for placement, layout, colors, and dimensions. Figures 6-10 through 6-12 show examples of typical runway hold position, location, and direction surface painted signs. The letters and numbers are formed according to the patterns shown in Figures 6-13 through 6-15.

6-5.6 Surface Painted Holding Position Signs.

The surface painted holding position sign provides supplemental visual cues that alert pilots and vehicle drivers of an upcoming holding position location and the associated runway designator(s) as a method to minimize the potential for a runway incursion, and, for certain airport geometries, wrong runway takeoffs. Several configurations of this surface painted sign are allowed to provide maximum flexibility. See Figure 6-10 for three possible layout scenarios. Inscriptions have a height of 12 feet (3.7 meters) where practicable; however, the height is reduced to a minimum height of 9 feet (2.7 meters) when necessary to appropriately fit the marking. Examples of these situations include taxiways with widths narrower than the applicable standard or taxiways that need to display multiple runway designations with directional arrows. In all cases, inscriptions follow inscription criteria shown in Figures 6-13 through 6-15. All other taxiway entrances to the same runway not needing the reduction are to maintain the 12-foot (3.7-meter) height dimension.

Figure 6-10. Surface Painted Runway Hold Position Signs



6-5.7 Surface Painted Taxiway Location Signs.

The surface painted taxiway location sign identifies the taxiway upon which the aircraft is located and is optional when required signage is not available. When necessary, this marking is also used to supplement other signs located along the taxiway system, or where operational experience has indicated that its presence assists flight crews in better ground navigation. These type signs are normally located on the right side of the taxiway centerline in the direction of travel. The edge (excluding the border) of the surface painted taxiway location sign is placed 3 feet (0.9 meter) from the outer edge of the taxiway centerline stripe. When adequate pavement width exists, a surface painted taxiway location sign might be located on the left side of the taxiway centerline if it is co-located with a surface painted holding position sign. In this case, the two surface painted signs mimic the mandatory holding position signs, and the surface painted taxiway location sign is placed to the left of the surface painted holding position sign to be readable in the direction of taxiing toward the runway. The inscription is 12 feet (3.7 meters) in height; however, the height is reduced if necessary to a minimum height of 9 feet (2.7 meters). See Figure 6-11 for an example and detail dimensions. The inscriptions conform in appearance and proportion with the letters, numbers, and symbols in Figures 6-13 through 6-15.

6-5.8 Surface Painted Taxiway Direction Signs.

The surface painted taxiway direction sign is always combined with an arrow to provide directional guidance at an intersection when it is not possible to provide an illuminated taxiway direction sign in accordance with UFC 3-535-01. An exception is where operational experience indicates the addition of a surface painted sign at a troublesome taxiway intersection assists aircrews.

6-5.8.1 The inner edge of surface painted taxiway direction signs (excluding the border, if used) is placed 3 feet (0.9 meter) from the near edge of the taxiway or taxilane nose wheel guideline and is placed on the same side of the nose wheel guideline as the direction the aircraft turns. For example, signs indicating left turns are located on the left side of the line and signs indicating right turns are located on the right side of the line.

6-5.8.2 The surface painted taxiway direction sign is not painted on runways, including runways sometimes used as a taxiway, between the runway VFR holding position marking and the runway, nor with surface painted hold position signs.

6-5.8.3 For crossing taxiways, a surface painted taxiway direction sign, combined with arrows, indicates the intersecting taxiway designation at the near intersection. In such cases, a single surface painted sign is located on the left side of the taxiway centerline to accommodate the possible directions of travel.

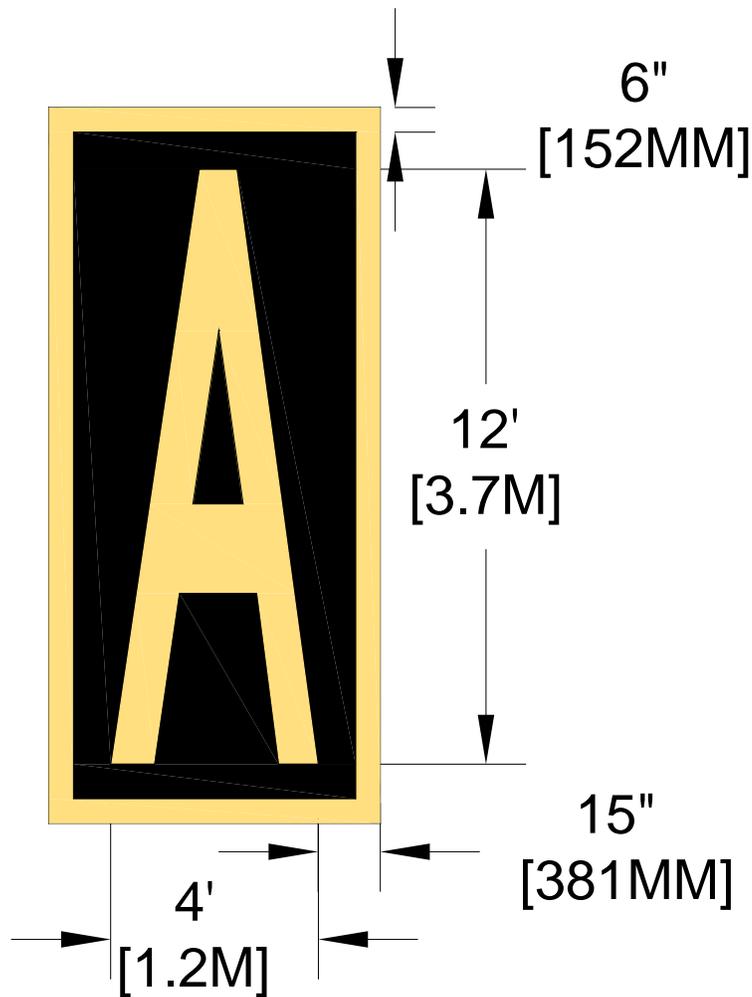
6-5.8.4 Locate these surface painted direction signs a longitudinal distance from crossing taxi routes at the appropriate aircraft wingtip clearance distance for the most demanding aircraft that uses the intersecting taxi route (taxiway or taxilane). These clearances are provided in UFC 3-260-01, Table 6-1, for fixed wing aircraft, and Table 6-2 for rotary wing aircraft.

6-5.8.5 The surface painted taxiway direction sign has a retro-reflective yellow background with a black inscription that includes one or more arrows. See paragraph 3-1.5 for recommended techniques to enhance this marking on light-colored pavements.

6-5.8.6 The black inscription is 12 feet (3.7 meters) in height; however, the height is reduced if necessary to a minimum height of 9 feet (2.7 meters). The black inscription is accompanied by an arrow oriented to show the general direction and angle of the turn. The inscriptions and arrows conform in appearance and proportion with the letters, numbers, and symbols in Figures 6-13 through 6-15.

6-5.8.7 The yellow background is rectangular and extends a minimum of 15 inches (381 millimeters) horizontally and vertically beyond the extremities of the black inscription, including the arrow head. A 6-inch (152-millimeter) -wide vertical black stripe separates any two black inscriptions when more than one is included on the same side of the nose wheel guideline.

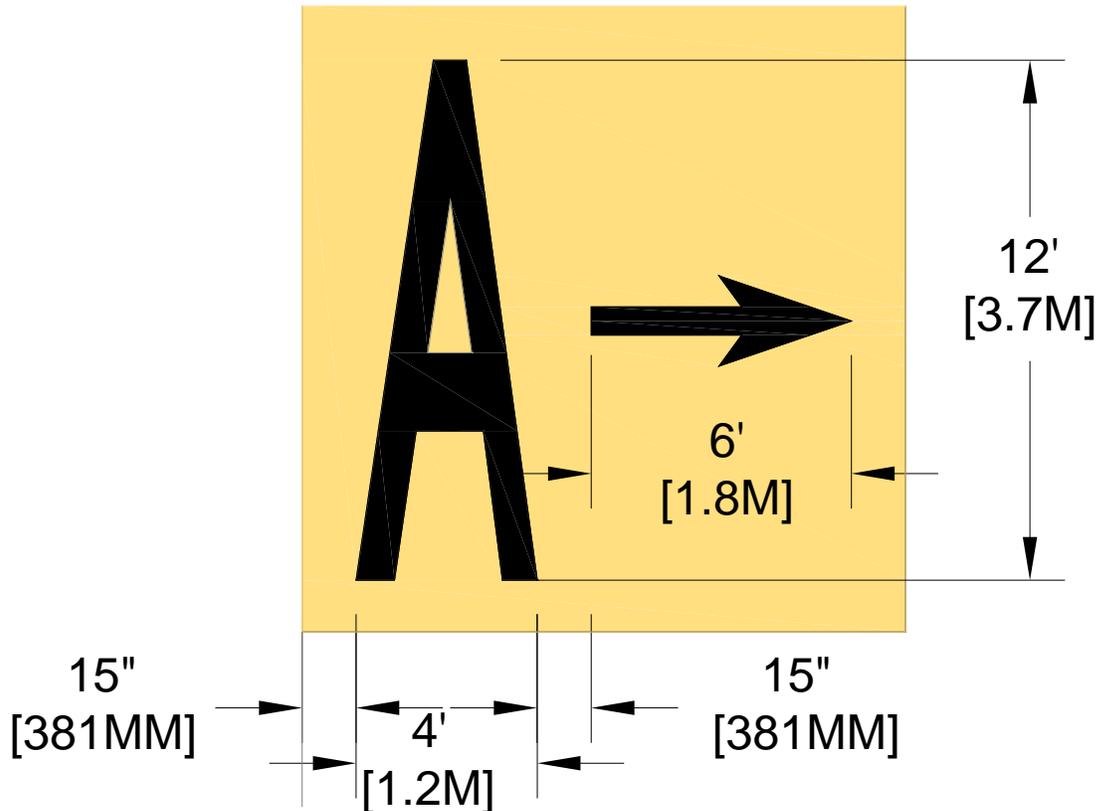
Figure 6-11. Surface Painted Taxiway Location Sign



NOTES:

1. CHARACTER HEIGHT, WIDTH, AND LENGTH MAY BE REDUCED PROPORTIONATELY BY A FACTOR OF 0.75 (12' [3.7M] HEIGHT MAY BE REDUCED TO 9' [2.7M] HEIGHT IF STROKE AND CHARACTER WIDTH ARE ALSO REDUCED PROPORTIONATELY).
2. LOCATION SIGNS ARE NOT USED BETWEEN THE VFR HOLD POSITION AND THE RUNWAY, OR ON RUNWAYS USED AS TAXIWAYS.

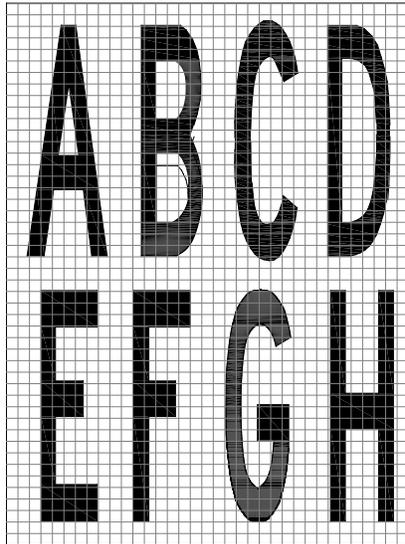
Figure 6-12. Surface Painted Taxiway Direction Sign



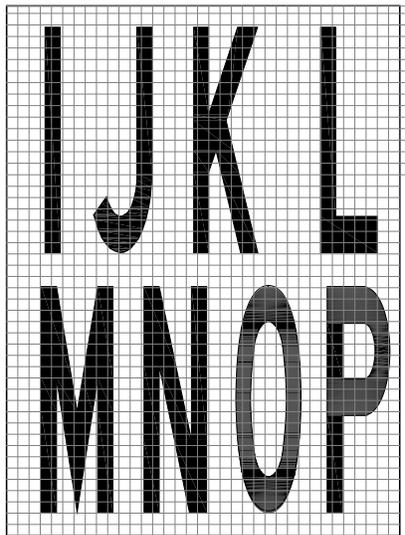
NOTES:

1. CHARACTER AND ARROW HEIGHT, WIDTH, AND LENGTH MAY BE REDUCED PROPORTIONATELY BY A FACTOR OF 0.75 (12' [3.7M] HEIGHT MAY BE REDUCED TO 9' [2.7M] HEIGHT IF STROKE AND CHARACTER WIDTH ARE ALSO REDUCED PROPORTIONATELY).
2. LOCATION SIGNS ARE NOT USED BETWEEN THE VFR HOLD POSITION AND THE RUNWAY, ON RUNWAYS USED AS TAXIWAYS, NOR ARE THEY COLLOCATED WITH SURFACE PAINTED HOLD POSITION SIGNS.

Figure 6-13. Surface Painted Sign Inscription Layout, A through P

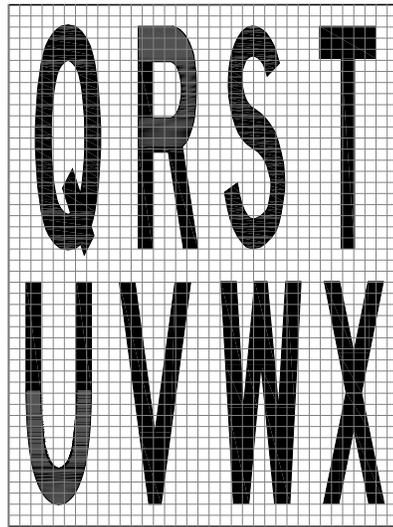


↑
DIVIDE OVERALL DESIRED
HEIGHT OF CHARACTER BY
20 TO DETERMINE SIZE
OF INDIVIDUAL SQUARES.

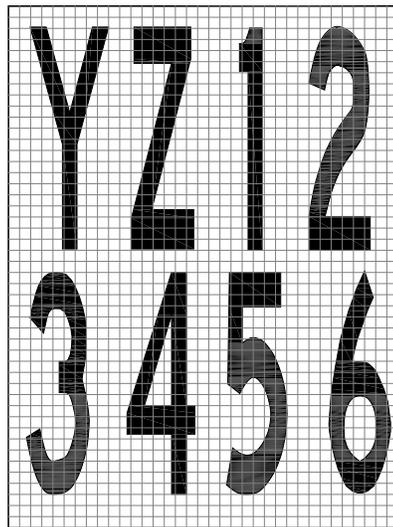


↑
DIVIDE OVERALL DESIRED
HEIGHT OF CHARACTER BY
20 TO DETERMINE SIZE
OF INDIVIDUAL SQUARES.
↓

Figure 6-14. Surface Painted Sign Inscription Layout, Q through 6

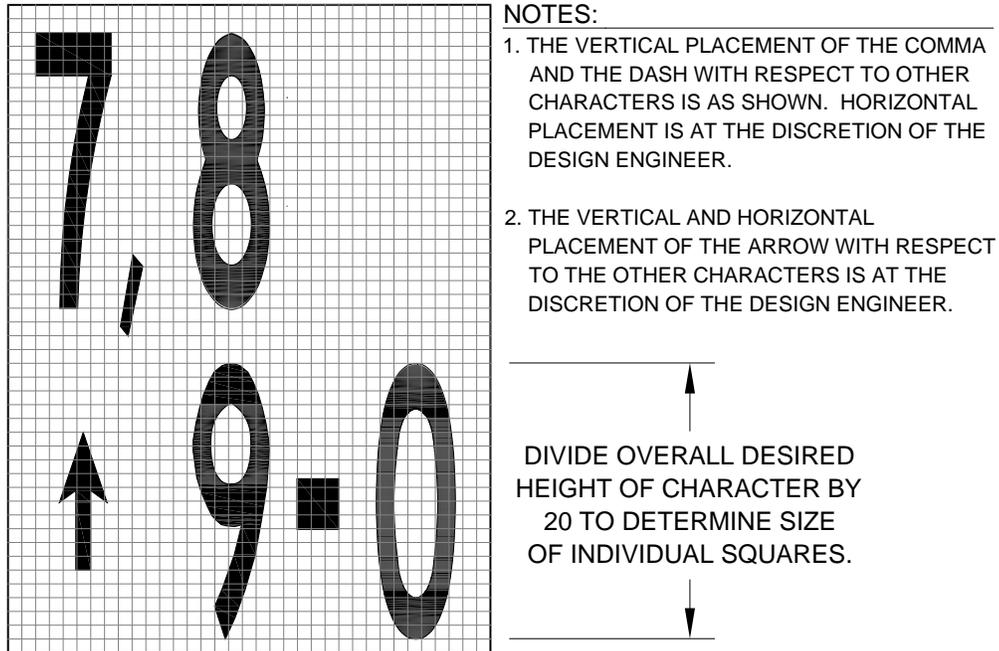


↑
DIVIDE OVERALL DESIRED
HEIGHT OF CHARACTER BY
20 TO DETERMINE SIZE
OF INDIVIDUAL SQUARES.
↓



↑
DIVIDE OVERALL DESIRED
HEIGHT OF CHARACTER BY
20 TO DETERMINE SIZE
OF INDIVIDUAL SQUARES.
↓

Figure 6-15. Surface Painted Sign Inscription Layout, 7 through 0 and Directional Arrow



6-5.9 Towway Markings.

For taxilanes where aircraft are to be towed, provide a single, solid, continuous 6-inch (152-millimeter) -wide white painted stripe. A significant gap is provided between the yellow taxilane marking and the white towway lane marking to allow the taxiing pilot to see that the towway is not a continuation of the taxilane. See Figure 6-16.

6-5.10 Restricted Area and Restricted Area Entry Control Points (ECP).

USAF AFI 31-101 and U.S. Army Regulation (AR) 190-16 prescribe signage, security force equipment, and security procedures for the protection of aircraft and the areas surrounding them. Borders and signage are necessary to identify these controlled and restricted areas. In cases where it is not practicable to establish a raised physical barrier, it is sometimes permissible to delineate such borders with a retro-reflective red, 6-inch (152-millimeter) -wide painted line surrounding the area, supplemented with ECP markings and warning signs at specific intervals. Spacing between boundary signs is usually 100 feet (30.5 meters); however, there are exceptions for areas with irregular terrain features and for abrupt changes in direction of the boundary, where the maximum distance is reduced. See UFC 3-120-01 for details necessary to mark retro-reflective signs on the pavement. See Figure 6-17 for an example of an ECP and Figure 6-18 for an example of a restricted area warning sign but refer to the specific Service component's security directives for the markings and sign legends required in each situation.

Figure 6-17. Restricted Area Entry Control Points (ECP)

NOTES:

1. ENTRY CONTROL POINT MARKINGS ARE 6" [152MM] WIDE BY 3' [0.9M] LONG RETROREFLECTIVE WHITE BARS SEPARATED BY 6" [152MM] GAPS.
2. THE RESTRICTED AREA BOUNDARY IS A 6" [152MM] WIDE RED BORDER AROUND THE RESTRICTED AREA. SEE AFMAN 31-101, *INTEGRATED DEFENSE*.



Figure 6-18. Typical Restricted Area Boundary Warning Sign



CHAPTER 7 MARKING PAVEMENTS FOR ROTARY WING OPERATIONS

7-1 GENERAL.

Marking rotary wing facilities conforms to the requirements as set forth below and govern the initial marking and re-marking of serviceable runways, taxiways, landing pads, and other areas designated for rotary wing operations.

7-2 MARKING WITH PAINT OR THERMOPLASTICS.

Do not use thermoplastics to mark rotary-wing helipads, runways, landing lanes, or taxiways due to potential for FOD.

7-3 COLORS AND REFLECTIVITY OF MARKINGS.

Rotary-wing runways, hoverpoints, and pads are marked with retro-reflective white except as noted below. Rotary-wing taxiways, taxi-lane and aprons are marked with retro-reflective yellow except as noted below. Hospital helipads incorporate red in the designator and borders. Rotary-wing shoulders (deceptive surfaces) and overruns are marked in non-reflective yellow durable marking materials except where noted otherwise. For Class A airfields and heliports that are not used strictly for missile security or survival school and are not trafficked by jet aircraft on a daily basis, identification markers, landing pads, and hoverpoints are marked using non-reflective white marking materials. In addition, taxiways, taxilanes, and apron markings on these Class A airfields and heliports are marked using non-reflective yellow durable marking materials except where otherwise noted.

7-4 PAVEMENT CURING TIME AND APPLICATION RATES.

Durable marking materials are applied only after the pavements have been allowed to cure thoroughly. New pavement surfaces are allowed to cure for a minimum of 30 days before application of marking materials. Take care to ensure the pavement surface is dry and clean prior to application of markings. See Chapter 3 for material application rates.

7-4.1 Rigid Pavements.

When painted markings are to be applied to rigid pavements cured with a membrane-type curing compound, the surface to be painted is thoroughly cleaned and the curing compound removed by sandblasting or high-pressure water blasting. Do not allow excessive blasting of the concrete surface when using high water pressure methods. Employ removal methods sufficient only to remove curing compound, old paint, or laitance, and not expose the coarse aggregate in the concrete.

7-4.2 Flexible pavements.

Flexible pavements are allowed to cure as long as practicable before marking to prevent undue softening of the bitumen by the paint or primers, as well as to limit bleeding. The maximum drying-time requirements of the paint specifications are strictly enforced.

7-5 INCREASING VISIBILITY OF MARKINGS.

A hoverpoint is a surface used as a reference or control point for arriving and departing helicopters. Mark hoverpoints with a white circle 30 feet (9.1 meter) in diameter on Class A airfields or heliports except when used for missile security or survival school or on asphalt surfaces where jet aircraft operate. On Class B airfields or Class A airfield/heliports used for missile security or survival school or on asphalt surfaces where jet aircraft operate, mark hoverpoints with a 30-foot (9.1-meter) -outside diameter circle formed with a 12-inch (305-millimeter) -wide white line. When located on a taxiway, the marking is centered on the taxiway centerline. See Figure 7-4.

7-6 HELICOPTER RUNWAY AND LANDING LANE MARKINGS.

Markings on serviceable runways consist of centerline marking, runway azimuth heading numbers, and an "H" letter without a helipad border as shown in Figure 7-1. Helicopter landing lanes are also marked to delineate three equal-length segments to accommodate four equally spaced landing pads, as shown in Figure 7-7.

7-6.1 Rotary-Wing Runway Designator.

The helipad "H" letter is located centered on the runway pavement centerline, 20 feet (6.1 meters) inboard from the beginning of the rotary-wing runway surface. The rotary-wing designator "H" is approximately 30 feet (9.1 meters) in length and 20 feet (6.1 meters) in width. See Figure 7-2 for placement on the runway pavement and Figure 7-3 for dimensions.

7-6.2 Azimuth Runway Designation Marking.

Runway designation is the numeric azimuth heading of the paved strip rounded to the nearest 10-degree increment. Each runway end is designated by number and, where required, by letter to indicate left, right, or center. Numbers and letters assigned are determined from the approach direction and conform to the form and dimensions shown in Figure 7-3.

7-6.2.1 The numeral(s) are retro-reflective white characters consisting of one or two numbers. The number assigned is the whole number nearest one-tenth of the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. Single-digit headings are not preceded by a zero (0). Lateral spacing between the numbers is 10 feet (3 meters), except for the numbers "10" and "11." Spacing between numerals for these runway designations are 7.5 feet (2.3 meters) and 12.5 feet (3.8 meters), respectively.

7-6.2.2 In the case of parallel runways, the retro-reflective white numeric designator and a letter ("L" for left, "C" for center, or "R" for right) are marked to indicate the lateral position of the runway with respect to any others with the same numeric designator on the same airfield.

7-6.2.3 In the case where a letter designation is required, it is placed between rotary-wing designator "H" and the numeric azimuth designator, with a 20-foot (6.1-

meter) gap between each of the characters. See Figure 7-1 for placement on the runway pavement and Figure 7-3 for letter dimensions.

7-6.3 Runway Centerline Marking.

The runway centerline is marked as a solid and continuous reflective white line, 1 foot (0.3 meter) in width. The centerline stripe of each runway terminates 20 feet (6.1 meters) from the runway direction numbers as shown in Figure 7-2.

7-6.4 Runway Side Stripe (Edge) Marking.

When there is little contrast between the runway and the paved shoulder or the surrounding area, the edge of the full-strength pavement is marked with a continuous 12-inch (0.3-meter) -wide stripe. This marking is used to delineate the edge of the runway from other pavements placed to prevent FOD or erosion. Such surfaces are not intended for routine use by aircraft. See Figure 7-1 for an example.

Figure 7-1. Helicopter Runway Markings

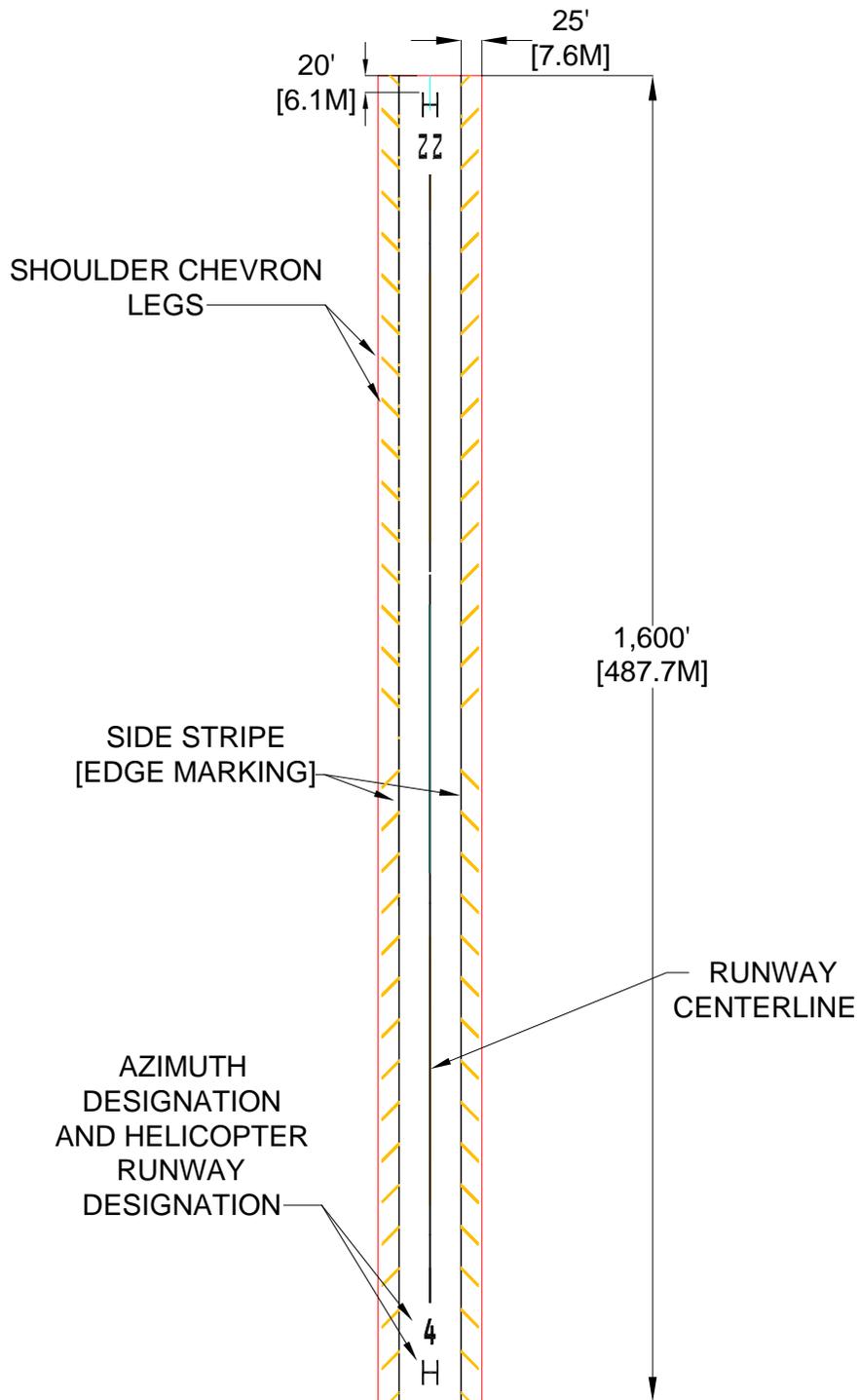


Figure 7-2. Rotary-Wing Designator and Designation Markings

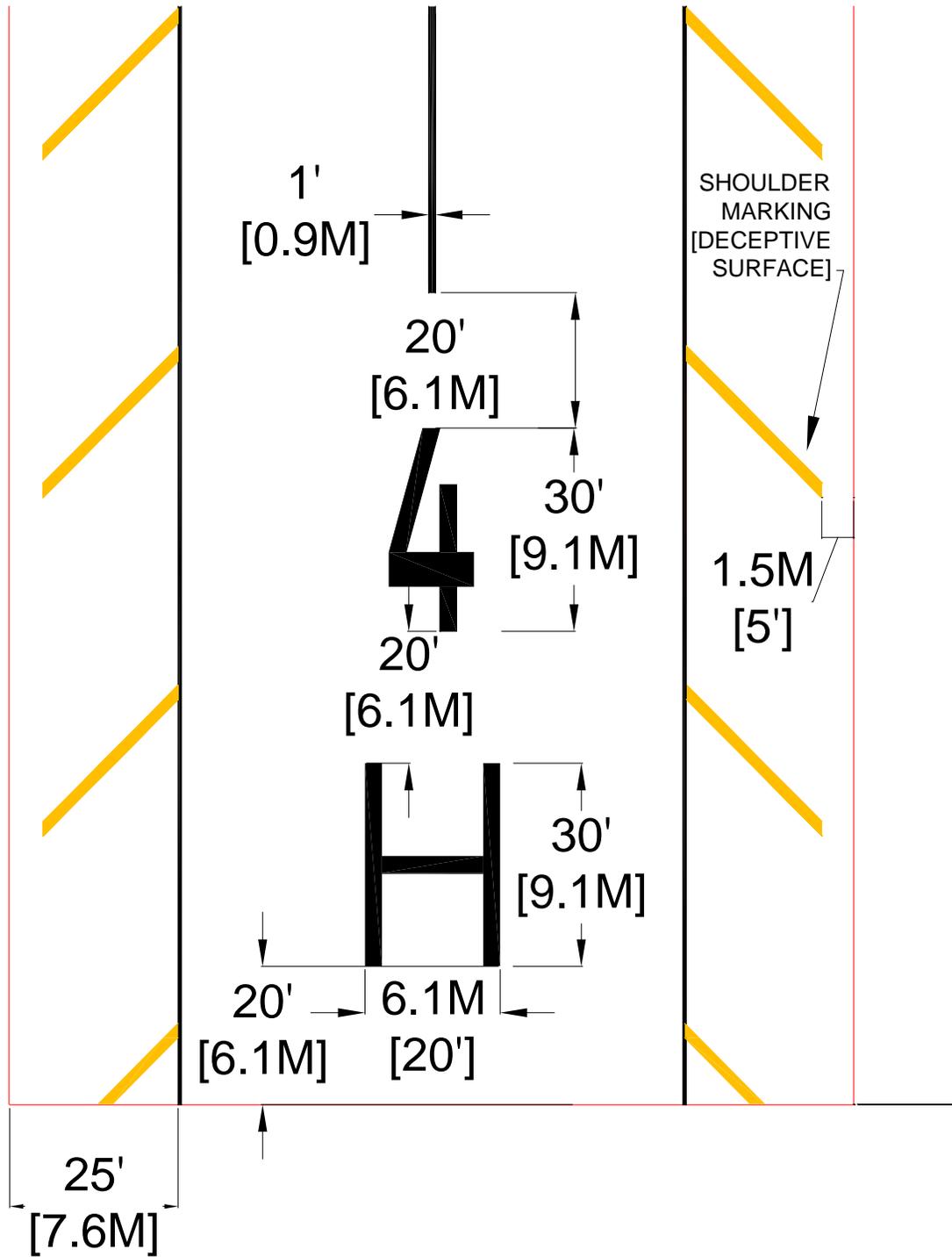
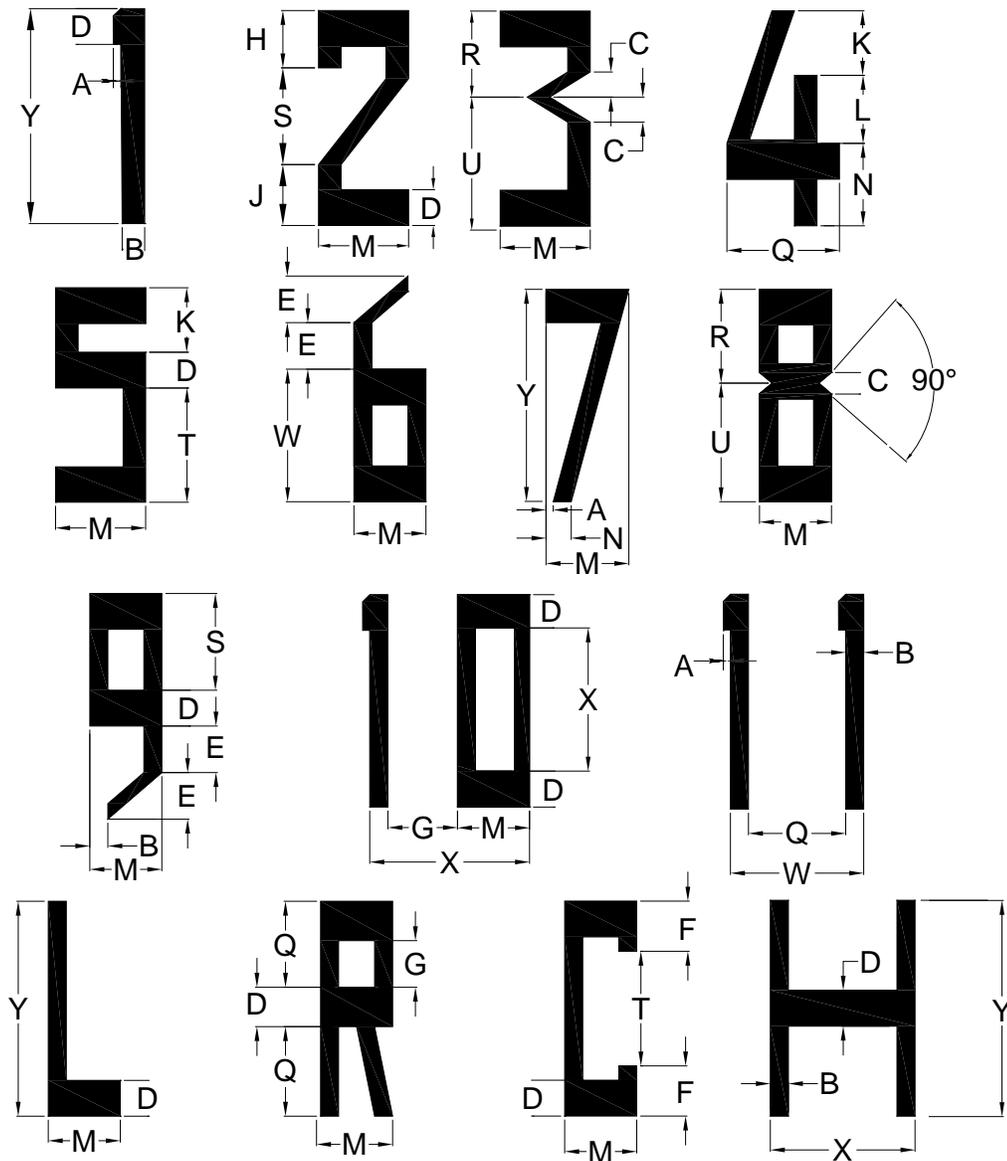


Figure 7-3. Rotary-Wing Runway Designation Numbers and Letters



DIMENSIO N	FEE T	METER S	DIMENSIO N	FEE T	METER S	DIMENSIO N	FEE T	METER S
A	1	0.3	J	8.5	2.6	R	13	4.0
B	2.5	0.76	K	9	2.7	S	13.5	4.1
C	3.5	1.1	L	9.5	2.9	T	16	4.9
D	5.0	1.5	M	10	3.0	U	17	5.2
E	6.5	2.0	N	11.5	3.5	V	18	5.5
F	7.0	2.1	O*	11	3.4	W	18.5	5.6
G	7.5	2.3	P	12	3.7	X	20	6.1
H	8.0	2.4	Q	12.5	3.8	Y	30	9.1

* Not used.

7-7 TAXIWAY MARKINGS.

7-7.1 Centerline Marking.

Marking on serviceable taxiways consists of a centerline stripe and a holding line configured the same as for fixed-wing runways (see Chapter 5). The centerline stripe is a solid retro-reflective yellow line 6 inches (152 millimeters) in width. Where a taxiway and a runway have a common intersection, the centerline marking of the taxiway terminates at a point in line with the inside edge of the runway as shown in Figure 7-4.

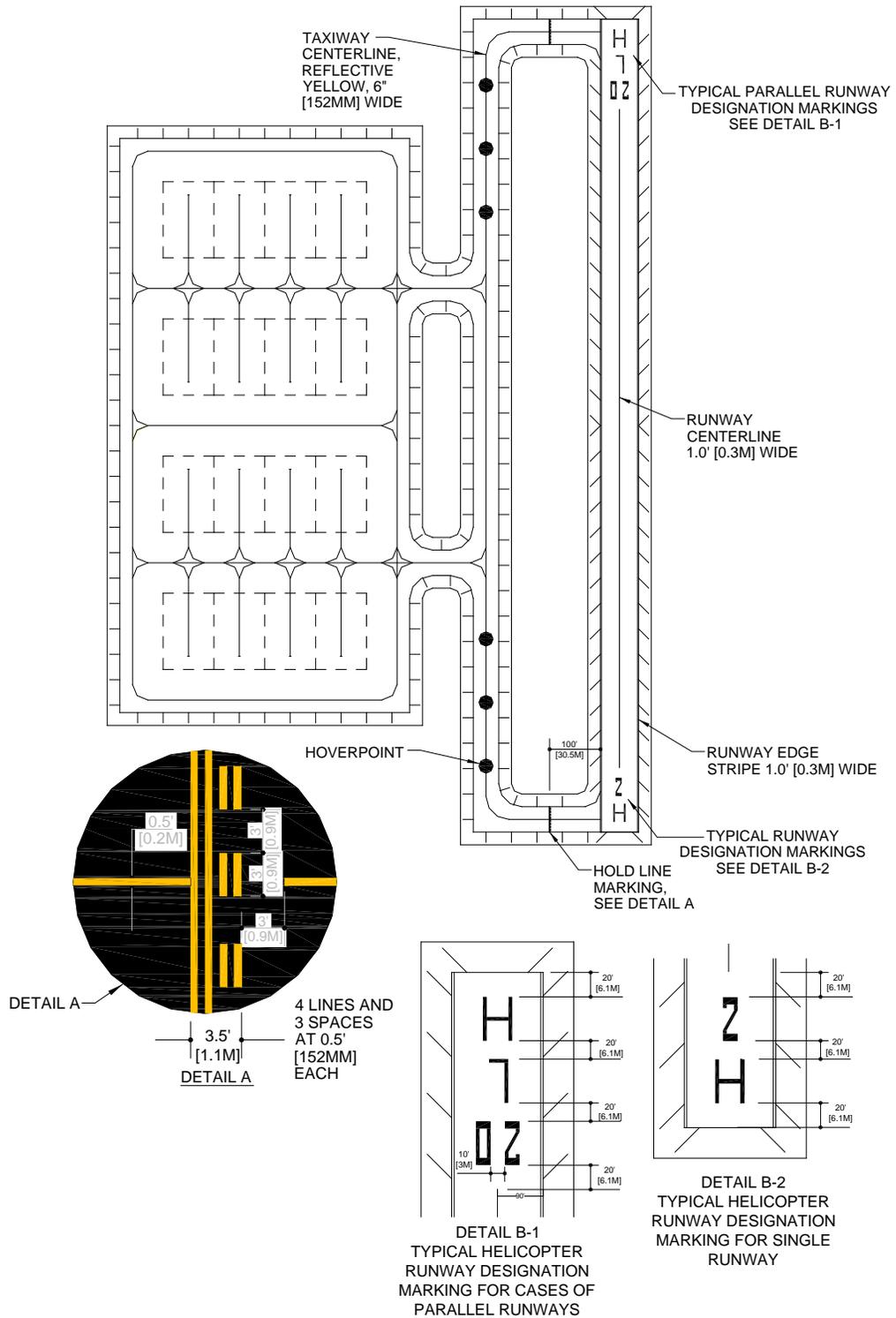
7-7.2 Hold-Line Marking.

Provide hold position markings at appropriate locations to protect against incursions. The hold-line marking for VFR conditions is shown in Detail "A" of Figure 7-4 and is located 100 feet (30.5 meters) from the near edge of the adjacent runway. Also mark an instrument hold marking for runways or helipads provided with IMC landing aids. See paragraph 6-5.1.2 to determine if an instrument hold position is needed, and, if so, where. If any taxiways enter the helipad in the normal direction of approach or departure, place a holding position marking outside the clear zone so there is no potential penetration of the approach departure clearance surface by holding aircraft. See UFC 3-260-01 for applicable dimensions and imaginary surface slopes.

7-8 HOVERPOINTS.

A hoverpoint is a surface used as a reference or control point for arriving and departing helicopters. Mark hoverpoints with a white circle 30 feet (9.1 meter) in diameter on class A airfields or heliports except when used for missile security or survival school or on asphalt surfaces where jet aircraft operate. On Class B airfields or Class A airfield/heliports used for missile security or survival school or on asphalt surfaces where jet aircraft operate, mark hoverpoints with a 30-foot (9.1-meter) -outside diameter circle formed with a 12-inch (305-millimeter) -wide white line. When located on a taxiway, the marking is centered on the taxiway centerline. See Figure 7-4.

Figure 7-4. Heliport Markings



7-9 APRON MARKINGS.

Apron taxi centerlines are a solid yellow line 6 inches (152 millimeters) in width. Rotary wing parking positions are marked with dashed white perimeter lines 6 inches (152 millimeters) in width, and centering guidelines are 6-inch [152-millimeter] -wide solid yellow as shown in Figures 7-12, 7-13, 7-14 and 7-15. Other apron markings such as apron edge markings, deceptive surface (shoulder) markings, and closed or hazardous area markings are as shown in Figure 7-11 and Chapter 8.

7-10 HELIPADS.

Mark a perimeter boundary with a capital "H" in the center to identify a pad intended for helicopter operations. Orient the "H" so it is aligned with the normal direction of approach (appears as an "H" to pilots during their approach to landing). If the facility is intended for single-direction ingress and egress, mark a bar beneath the "H" to show the intended direction of approach/departure. A bar is also placed under the "H" when it is necessary to distinguish the preferred approach direction for bi-directional helipads. The length of the bar is at least equal to the overall width of the "H" and the width equal to Dimension "C" in Figure 7-5. Provide a space between the "H" and the bar equal to half of the bar width. The perimeter boundary marking consists of a broken square marked at the corners and along the edges to delineate the limits of the safe touchdown area. The boundary is sized to accommodate the overall length of the largest helicopter using the facility. Figure 7-5 provides dimensions and layout details.

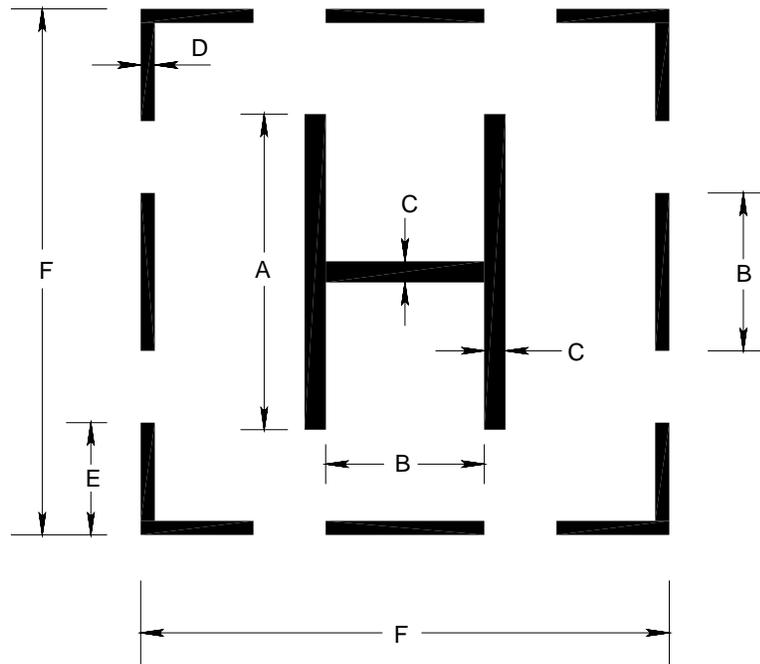
7-10.1 Hospital Helipad Markings.

Medical facility helipads are marked similarly to standard helipads, with the following exceptions: the perimeter border is formed of a solid line and bordered in red, and the letter "H" is marked in red and superimposed on a white cross. Figure 7-6 shows the dimensions and colors for this marking scheme. The cross and pad boundary markings are white and outlined with a 6-inch (152-millimeter) -wide red border to improve contrast. Pad boundary markings are either a solid or segmented line as shown in Figure 7-5.

7-10.2 Elevated Helipad Markings.

The markings are as shown in Figures 7-5 or 7-6, with two information boxes centered in the lower right-hand quadrant of the pad perimeter and oriented to be read in the preferred direction of ingress to the helipad. The boxes provide the maximum allowable helicopter weight expressed in thousands of pounds and the maximum allowable rotor diameter expressed in feet. Details for layout of the elevated helipad are shown in Figures 7-9 and 7-10.

Figure 7-5. Helipad Markings



IDENTIFIER DIMENSIONS

A : 0.6 F (maximum of 20 meters)

B : 0.5 A

HELIPAD SIZE (F)	PATTERN LINE WIDTH (C)	BORDER EDGE WIDTH (D)	CORNER EDGE LENGTH (E)
43.0 - 59 13.1 - 18.0	3.0 0.9	1.3 0.4	5.0 1.5
60.0 - 79.0 18.3 - 24.1	4.0 1.2	2.0 0.6	7.0 2.13
80.0 - 98.0 24.4 - 29.9	5.0 1.5	2.0 0.6	10 3.0
99 OR LARGER 30.2 OR LARGER	6.5 2.0	2.5 0.8	11.5 3.5

NOTE:

1. DIMENSIONS IN TABLE ARE EXPRESSED AS: $\frac{\text{FEET}}{\text{METERS}} \text{ e.g. } \frac{3}{10}$
2. ALL COLOR IS NON-REFLECTIVE WHITE FOR U.S.ARMY FACILITIES, BUT RETRO-REFLECTIVE WHITE FOR USAF FACILITIES.

Figure 7-7. Landing Lane Layout

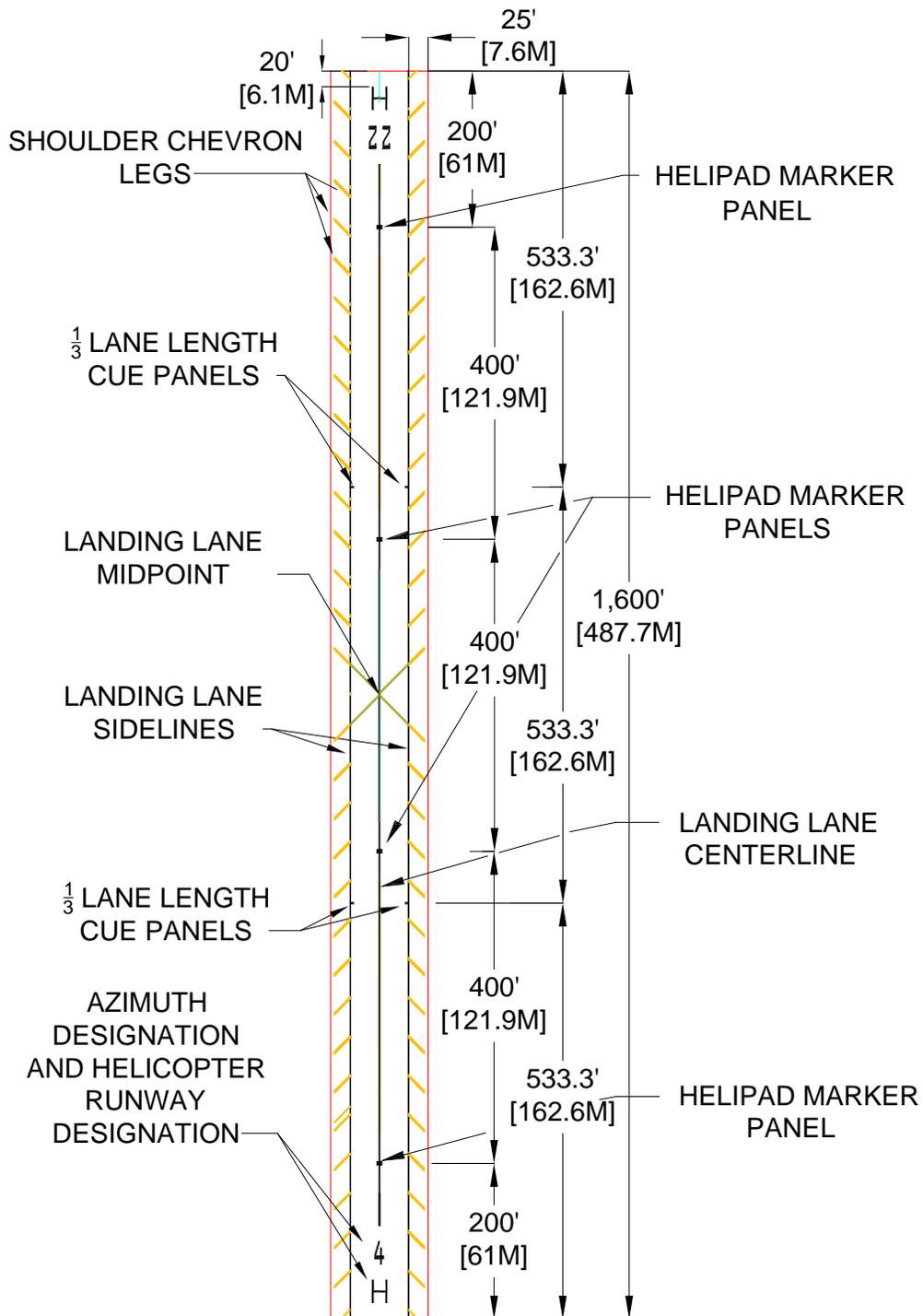


Figure 7-8. Landing Lane Helipad and 1/3rd Length Marker Panels

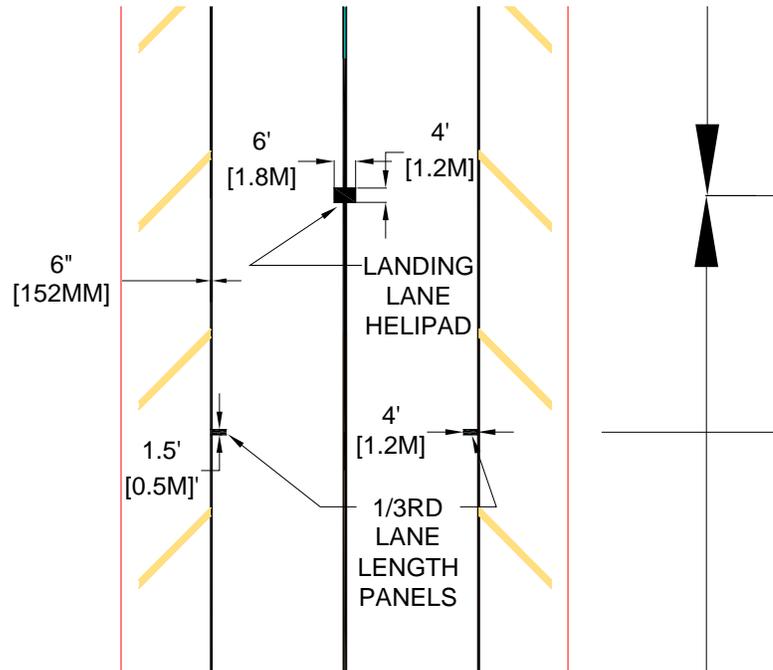


Figure 7-9. Elevated Helipad Example

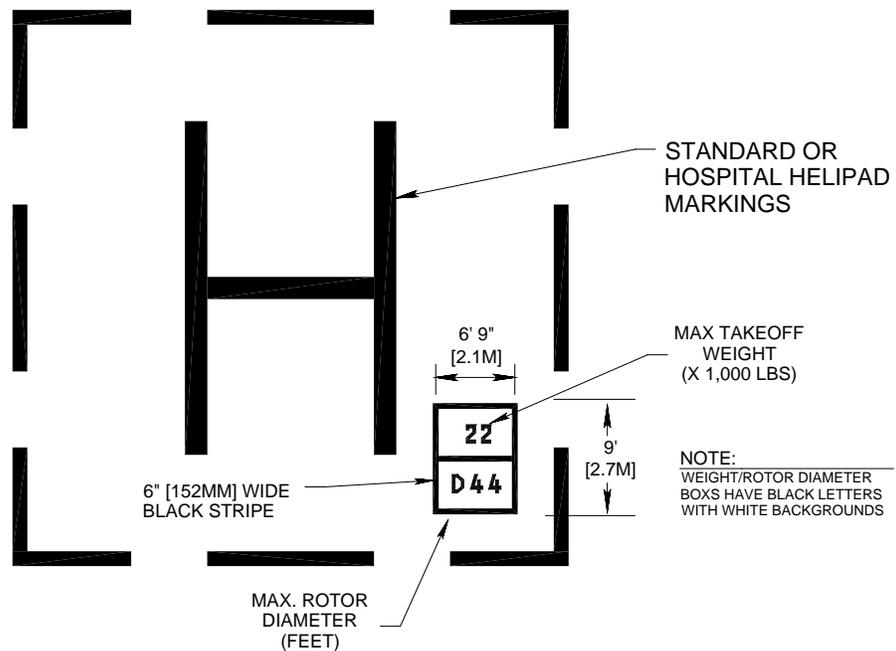
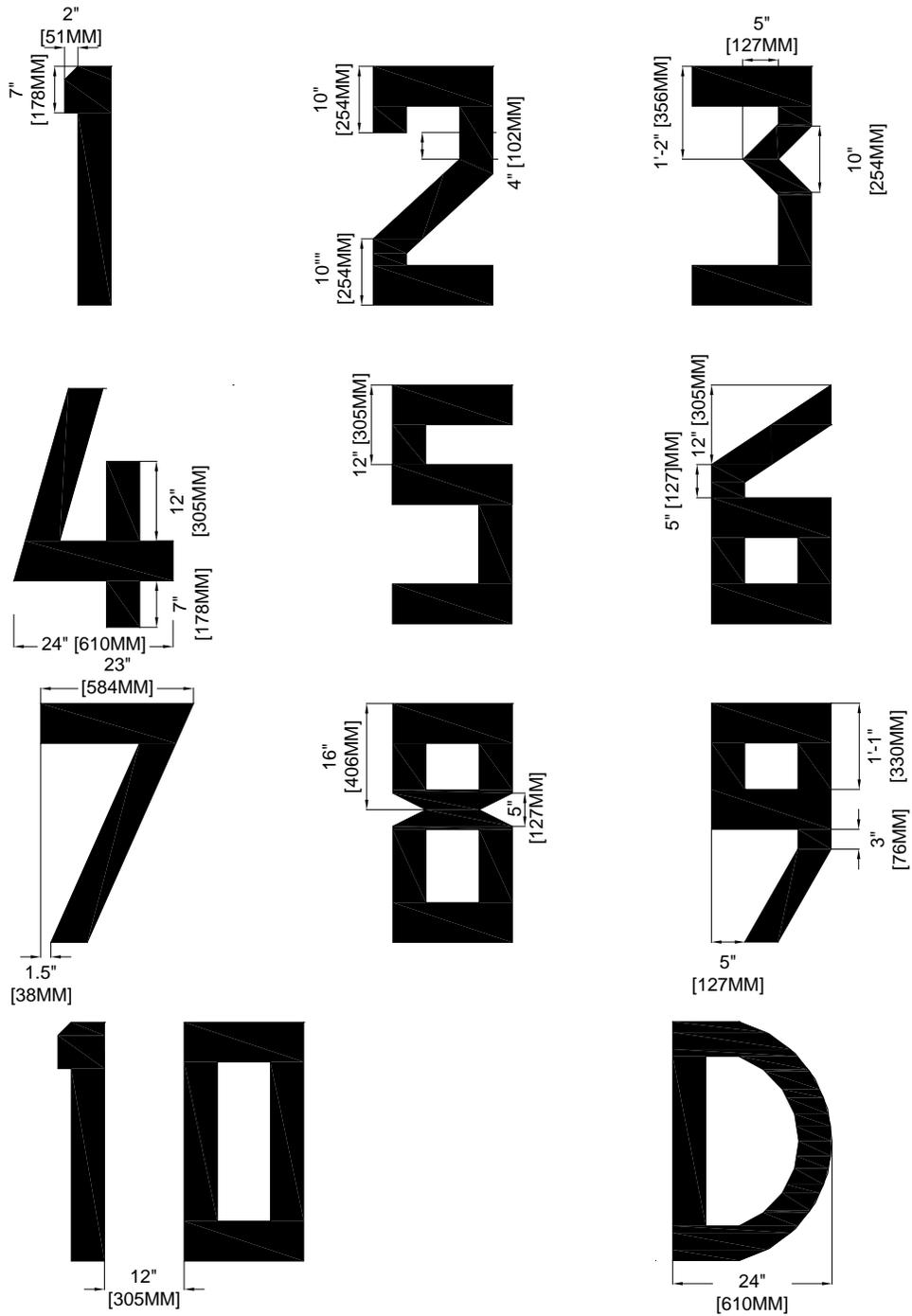


Figure 7-10. Dimensions for Supplemental Elevated Helipad Markings



ALL CHARACTERS HAVE THE FOLLOWING CHARACTERISTICS UNLESS SPECIFIED OTHERWISE:

36" [914MM] HEIGHT VERTICAL STROKE OF 5" [127MM]
18" [457MM] WIDTH HORIZONTAL STROKE OF 6" [152MM]

7-10.3 Application.

Rotary wing runway, landing lane, and helipad marking patterns, as appropriate, are used as an identification marker at all heliports, whether at ground level or elevated, and at helicopter takeoff and landing areas. All helicopter landing areas bearing the outdated day marker or nonstandard identification marking are re-marked with the proper identification marking as soon as practicable.

7-10.4 Location.

The appropriate markings are placed in the approximate center of the touchdown area of all helicopter landing pads and on the ends of all helicopter runways and landing lanes.

7-11 OVERRUNS AND SHOULDER MARKINGS.

7-11.1 General.

Overrun and shoulder areas not intended for aircraft traffic are identified with overrun chevrons and shoulder (deceptive surface) markings. These markings consist of lines 18 inches (457 millimeters) wide, marked to within 5 feet (1.5 meters) of the shoulder edge, or for a total length of 25 feet (7.6 meters), whichever is less, in accordance with the requirements below. Configurations complying with these requirements are detailed in Figure 7-11.

7-11.2 Color.

All heliport overrun and shoulder areas are marked with non-reflective yellow paint.

7-11.3 Materials.

Non-reflective paint used in marking or re-marking overrun and shoulder areas consists of any of the materials described in Chapter 3.

7-11.4 Overrun Areas.

Overrun areas are identified with a chevron marking layout as shown in Figure 7-11. The index point for the layout of the chevron marking is the point of intersection of the runway centerline and the runway threshold line. The apex of the first full chevron on the approach side of the threshold is placed 25 feet (7.6 meters) outward from the index point. Subsequent chevrons are placed on 50-foot (15.2-meter) centers as shown in Figure 7-11. The portion of the partial chevron that overlaps the threshold is not painted on the full-strength pavement. The apex of each chevron is on the centerline, with each leg intersecting at an angle of 45 degrees with the runway centerline, and an unmarked extension of the runway centerline. The chevrons terminate 5 feet (1.5 meters) inside the outer paved edge of the overrun.

7-11.5 Runway Shoulder Areas.

Shoulder areas are not intended for routine aircraft traffic. In cases where the surface does not provide sufficient differing contrast from the surrounding area, they are marked with shoulder (deceptive surface) markings as shown in Figure 7-11. Shoulder markings are a continuation of the chevron legs used in marking overrun areas described above. The chevrons used to form the legs are uniformly laid out from both ends of the runway as shown in Figure 7-11. Shoulder markings terminate at a length of 25 feet (7.6 meters) or at a point 5 feet (1.5 meters) inside the outer edge of the paved shoulder area.

Figure 7-11. Rotary Wing Overruns and Shoulder Markings

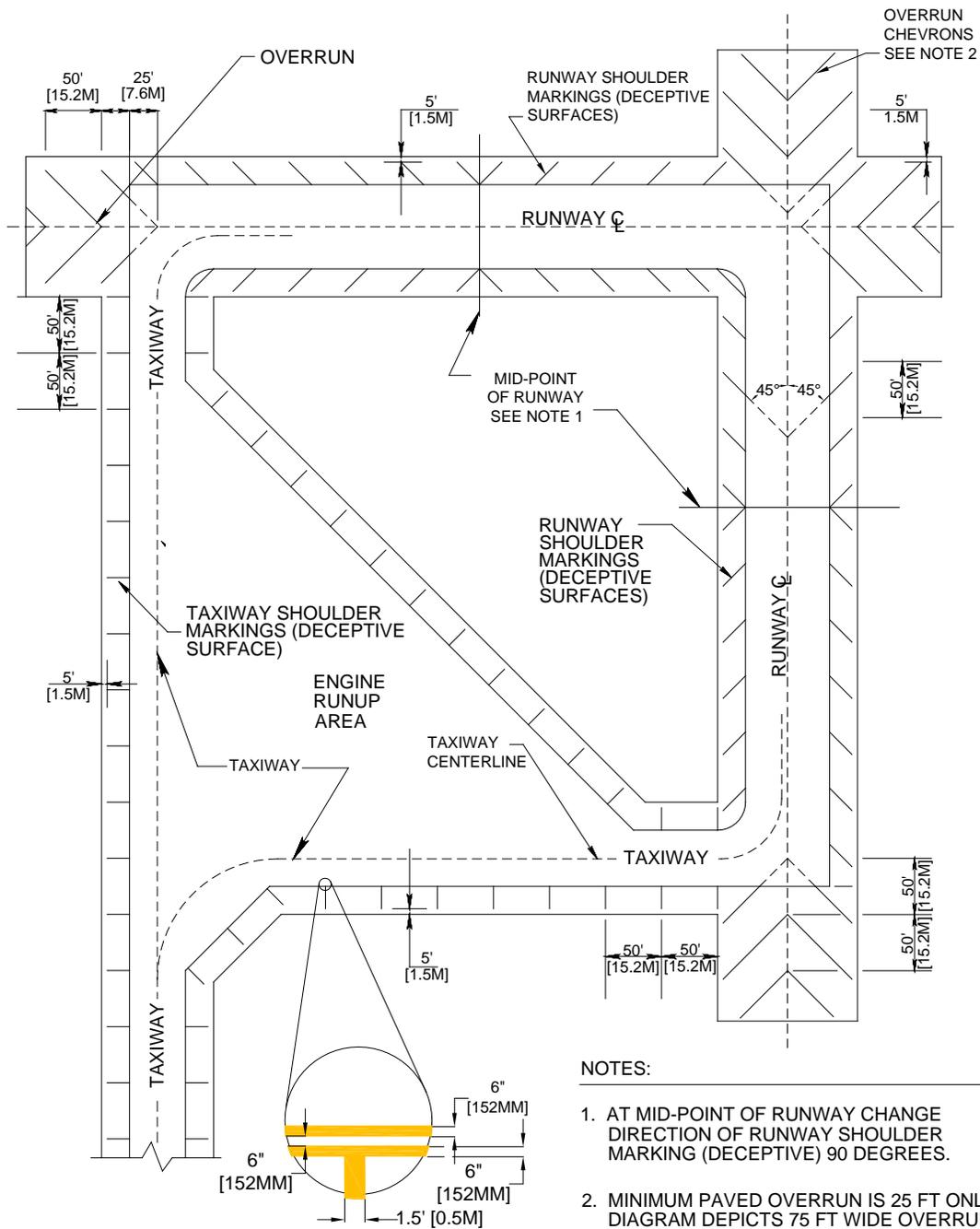
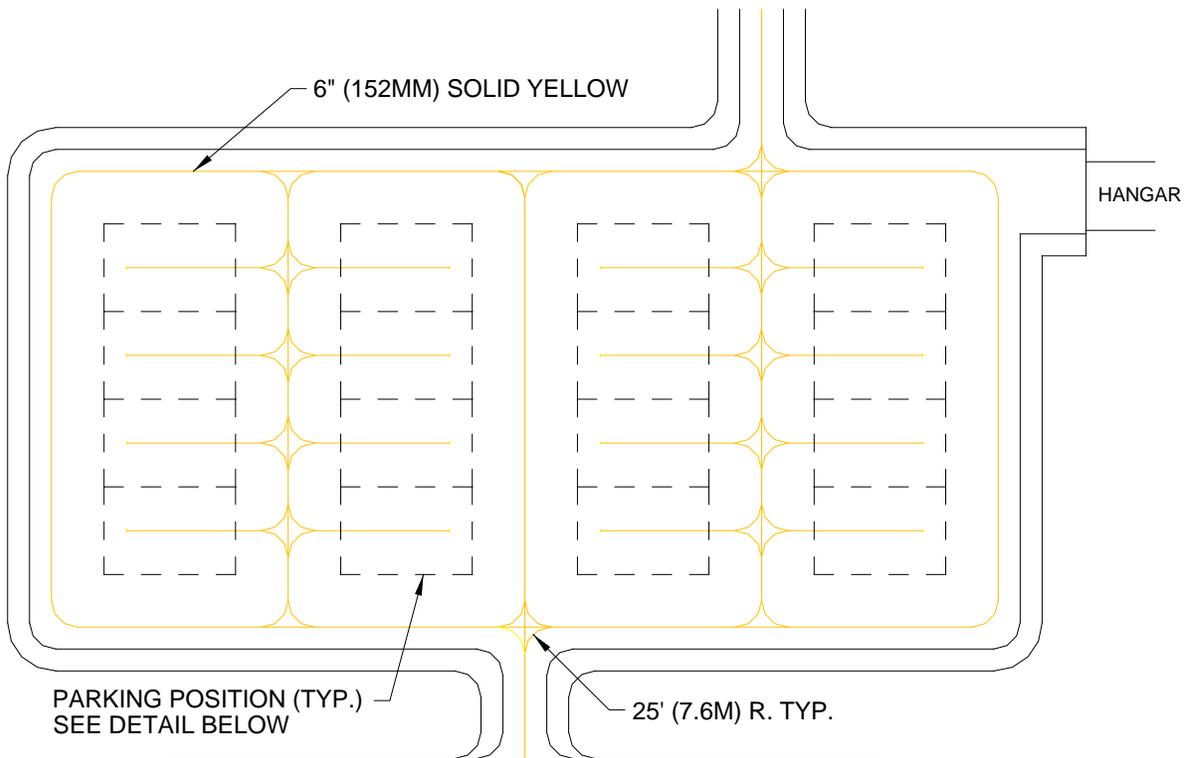


Figure 7-12. Type 1 Parking for CH-47



TYPE 1 PARKING FOR CH-47

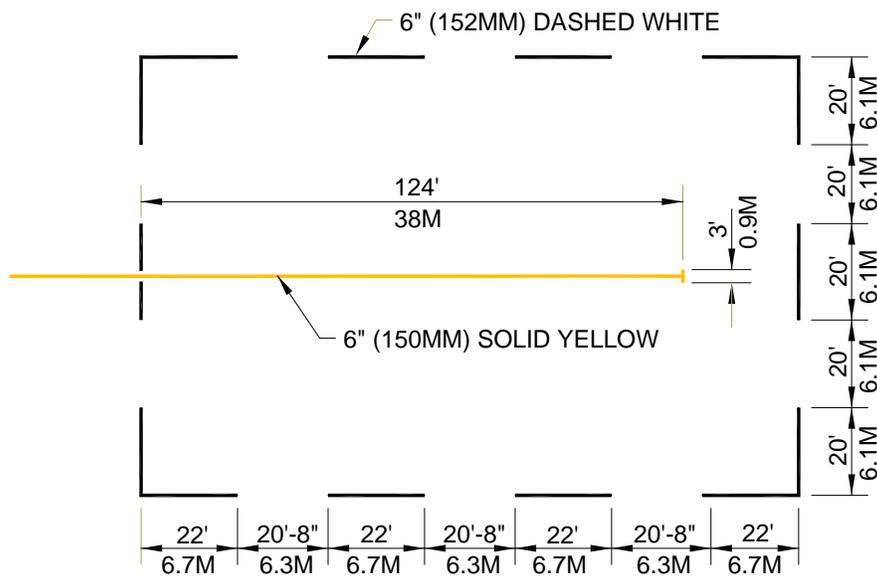
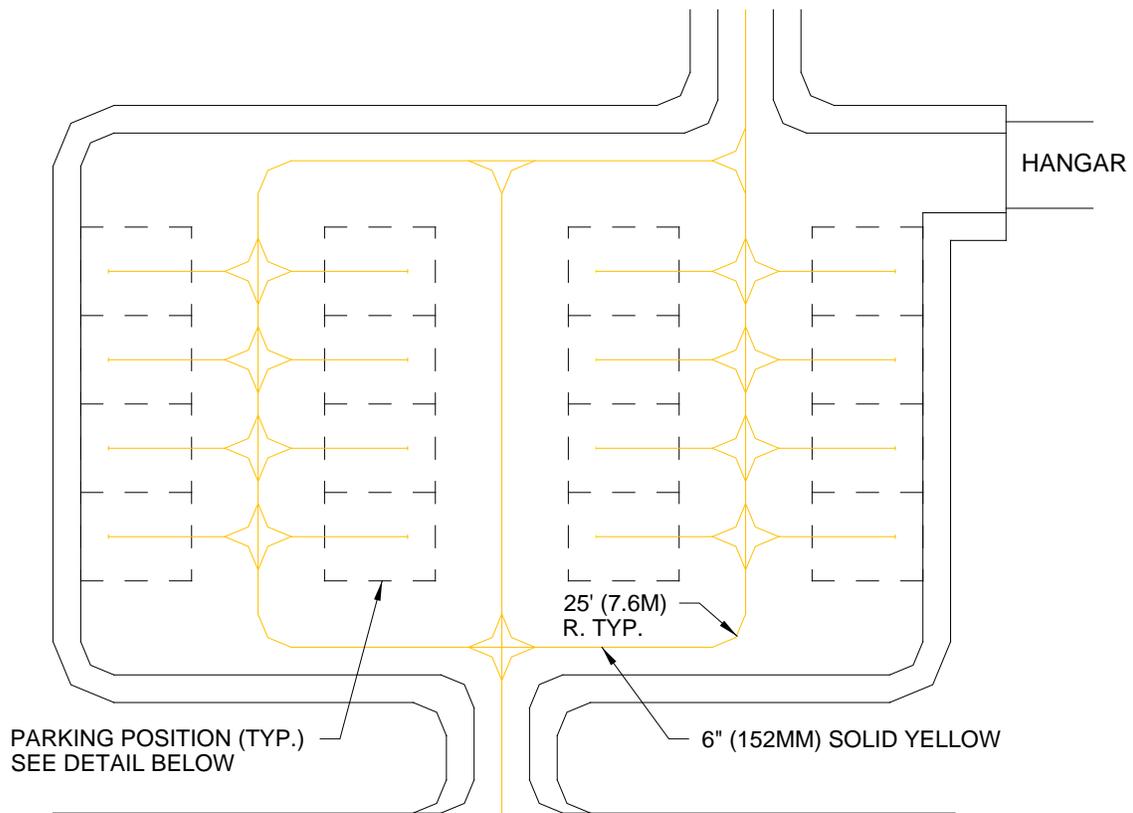


Figure 7-13. Type 1 Parking for all Rotary Wing Aircraft Except CH-47



TYPE 1 PARKING FOR ALL ROTARY-WING AIRCRAFT EXCEPT CH-47

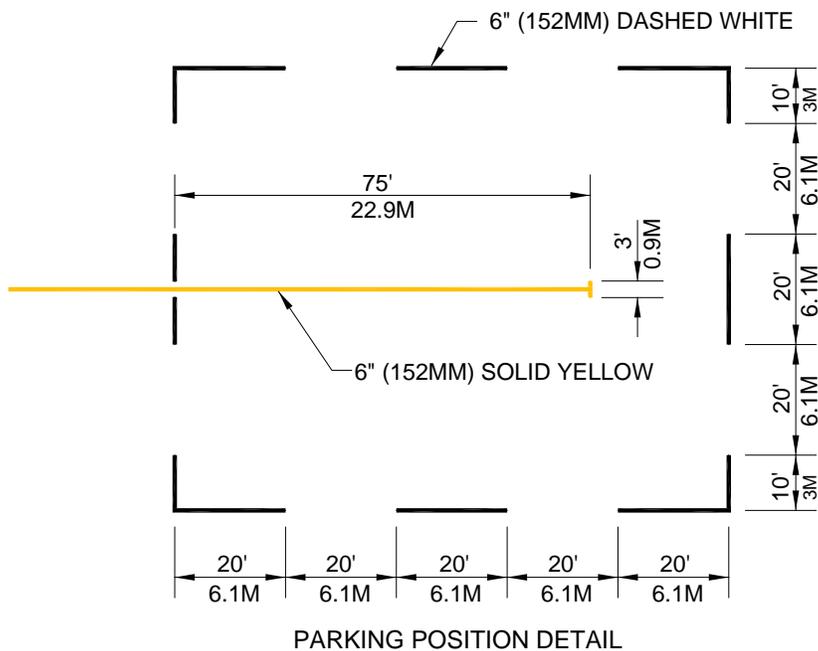
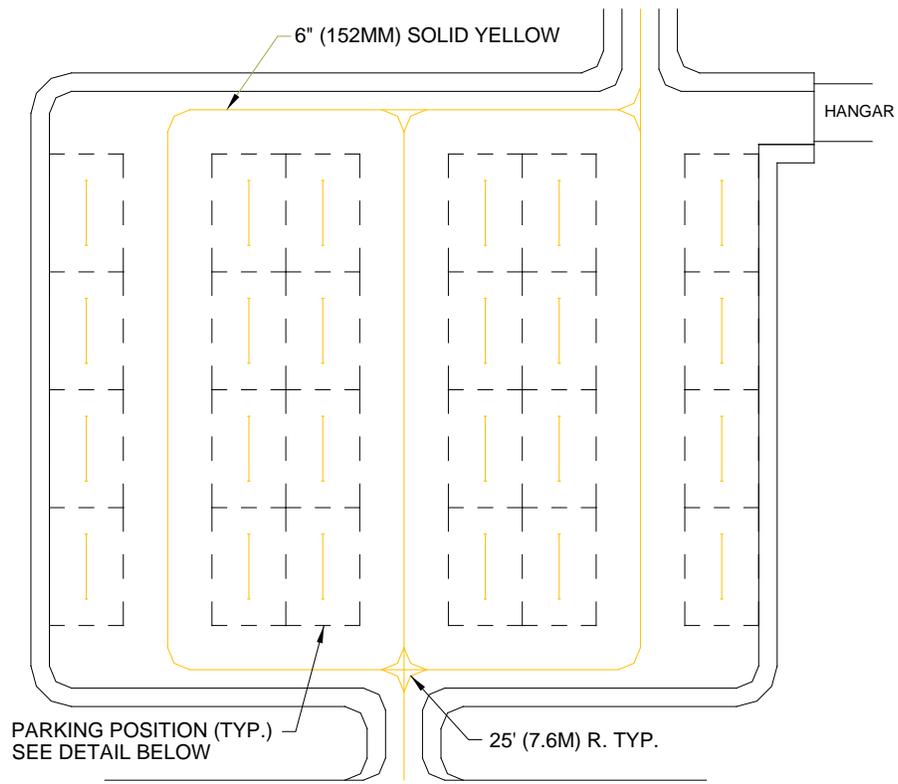


Figure 7-14. Type 2 Parking for Wheeled Rotary Wing Aircraft



TYPE 2 PARKING FOR WHEELED ROTARY WING AIRCRAFT

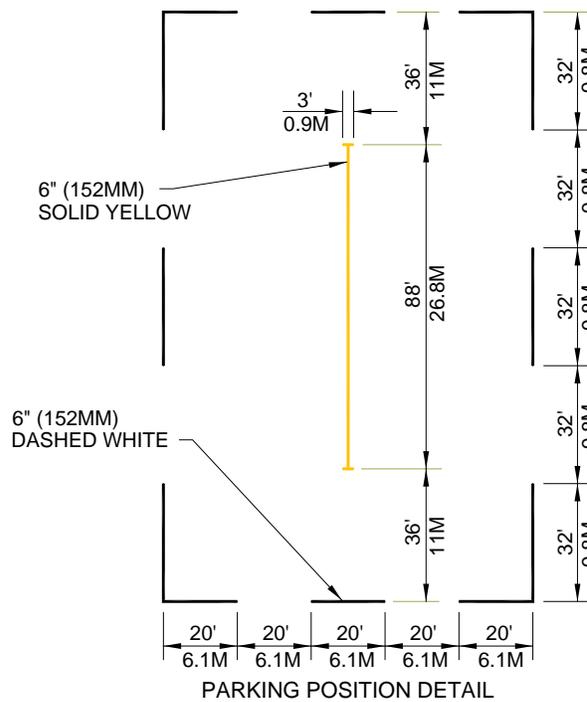
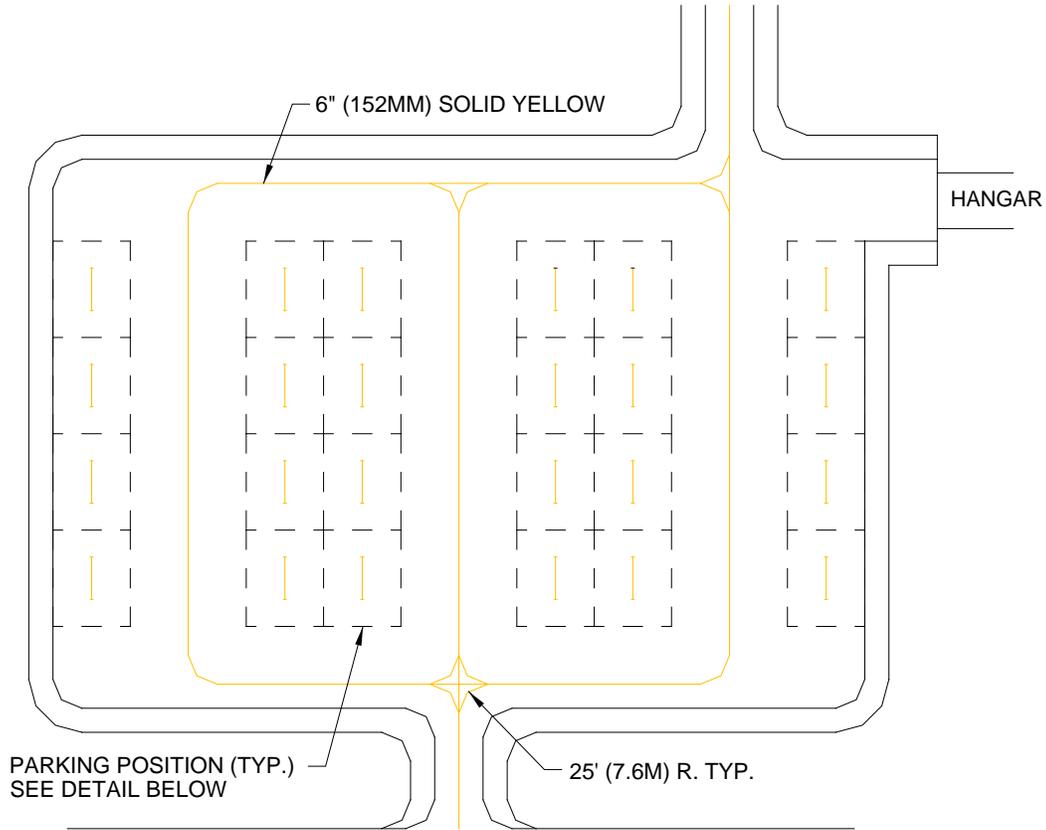
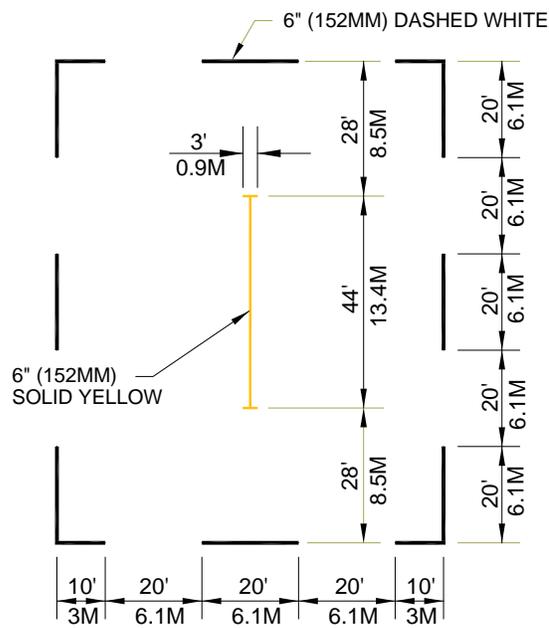


Figure 7-15. Type 2 Parking for Skid Rotary Wing Aircraft



TYPE 2 PARKING FOR SKID ROTARY-WING AIRCRAFT



PARKING POSITION DETAIL

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CHAPTER 8 OTHER PAVEMENT MARKINGS

8-1 CLOSED PAVEMENT MARKINGS.

All pavements that are hazardous to aircraft traffic are marked with Xs. Larger ones are used for runways. Smaller Xs, with a slightly different angle where the two legs intersect, are used for taxiways and apron areas. Additional cones, barricades, and lights are used, or sometimes substituted for the Xs, to aid in delineation of substantially hazardous areas, areas that are only hazardous during construction, or some other special project, such as an air show. Refer to Figure 8-1 and Figure 8-2 for dimensions and layout details. The following paragraphs describe the placement of these markings and alternatives for temporarily closed areas.

8-2 PERMANENTLY CLOSED RUNWAYS.

Closed runways are marked to reflect their non-operational status. Ensure markings are visible to aircrew to avoid confusion and prevent mishaps that occur from attempting operations from a pavement of unknown condition or status.

8-2.1 Runway Markings.

For permanently closed runways, obliterate the runway designation markings on both ends of the runway and mark a yellow "X" at each end of the runway and at 1,000-foot (305-meter) intervals along the length, centered on the runway centerline.

8-2.2 Intersections.

For permanently closed runways that intersect an active runway, a solid yellow "X" marking is placed on the closed runway centerline, not more than 50 feet (15.2 meters) from the center of the X to the near paved shoulder edge of the open intersecting runway. See Figure 8-2 for an example.

8-3 PERMANENTLY CLOSED TAXIWAYS OR TAXILANES.

Obliterate the centerline stripe for a minimum of 200 feet (61 meters) from the nearest edge of any serviceable pavement and mark the taxiway or taxilane with an "X" within 25 feet (7.6 meters) of every intersection with any other serviceable pavement (measured from near outer paved shoulder edge of serviceable pavement to the center of the X), and along the taxiway or taxilane centerline at evenly spaced intervals not exceeding 1,000 feet (304.8 meters). Refer to Figure 8-1 for the dimensions of the Xs and Figure 8-2 for a typical layout and placement examples. Additionally, obliterate all extraneous taxiway markings from the adjacent serviceable pavements. For example, remove or hide any line or directional information signs or other markings delineating a route from an active runway to a closed taxiway.

8-4 PERMANENTLY CLOSED APRONS.

When an apron is closed on an active airfield, taxilanes and taxiways leading to the closed area are marked as closed. If the closed apron area adjoins an active apron, supplemental markings are needed to indicate the division between the two areas. The separation is marked with two continuous apron edge stripes as described in Chapter 6 and shown in Figure 6-1. The letter "X," dimensioned as shown in Figure 8-1, is marked 3 feet (0.9 meter) inward toward the closed apron at intervals not exceeding 200 feet (61 meters) on the closed apron sides. Figure 8-3 shows the typical layout for these markings.

8-5 TEMPORARILY CLOSED AIRFIELD PAVEMENTS.

8-5.1 Temporarily Closed Runways.

Place an "X" at both ends of the runway on top of the runway designation number. For temporary purposes, the dimensions of the "X" shown in Figure 8-1 are reduced to allow use of standard 4-foot by 8-foot (1219-millimeter by 2438-millimeter) sheets of plywood. **Note:** Runways closed for periods of five days or less do not need to be marked if a NOTAM is issued to publicize the closure. When temporarily closing a runway, fabricate the "X" from plywood, canvas, painted picket fence sections, preformed marking tape, or other materials, such as yellow snow fencing. Anchor these materials by any suitable means, such as mechanical screw or wedge-type anchors, or sandbags. Another alternative is using lighted Xs as described in FAA AC 150/5340-1 and FAA AC 150/5345-55.

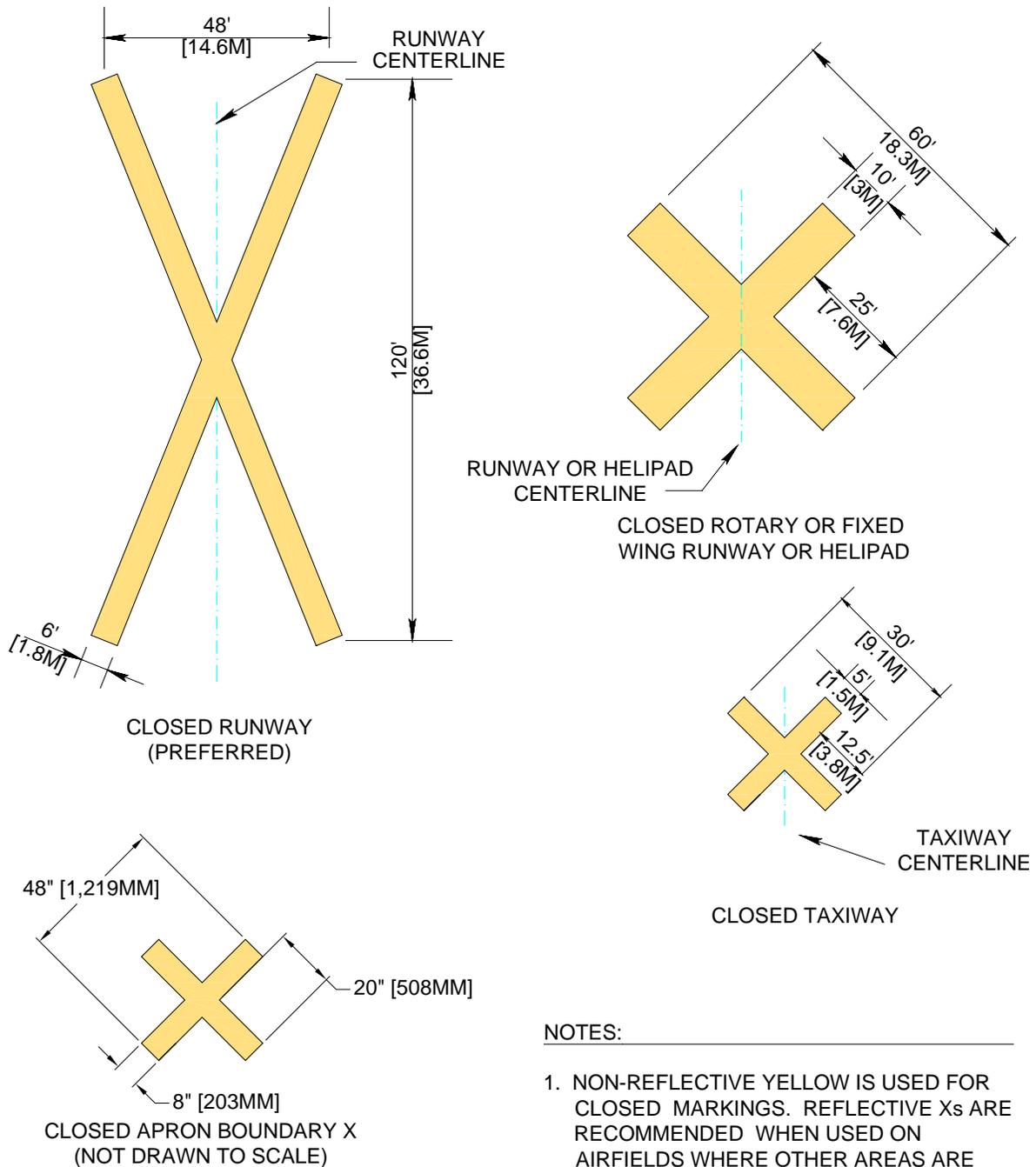
8-5.2 Temporarily Closed Taxiways or Taxilanes.

Ensure an "X" is placed at all access points to the closed pavement. In this case, it is not necessary to obliterate the existing markings. Areas used during periods of reduced visibility or darkness use lighted barricades to ensure the area is adequately marked. If lighted barricades are used to block the access point to the closed pavement, the "X" is omitted. See paragraph 8-6 and Figure 8-4. Use materials described in paragraph 8-5.1 to construct and fasten markers to the pavement.

8-5.3 Temporarily Closed Aprons.

When an apron is closed on an active airfield, taxilane and taxiway centerline markings leading to the closed area are removed. However, hazardous areas on aprons caused by construction or other activities of a temporary nature are delineated using barricades or traffic cones equipped with a red light (see Figure 8-4). The lights are optionally steady burning or flashing but ensure they meet the luminance requirements of the FHWA MUTCD for safety zones. Lights are mounted on barricades and spaced at no more than 10-foot (3-meter) intervals. Lights are operated between sunset and sunrise and during periods of low visibility during operations. They are operated by photocell or manually. Solar-powered lights and light-emitting diode (LED) lights are acceptable as long as they meet the above-stated requirements.

Figure 8-1. Runway, Taxiway, and Apron Area Closure Markings



NOTES:

1. NON-REFLECTIVE YELLOW IS USED FOR CLOSED MARKINGS. REFLECTIVE Xs ARE RECOMMENDED WHEN USED ON AIRFIELDS WHERE OTHER AREAS ARE AVAILABLE FOR NORMAL OPERATIONS.
2. DIMENSIONS ARE SHOWN AS: $\frac{\text{FEET}}{\text{METERS}}$ E.G. $\frac{10}{3}$ EXCEPT WITHIN THE DIAGRAM FOR THE APRON BOUNDARY X.

Figure 8-2. Closed Runway, Taxiway, and Taxilane Pavement Markings

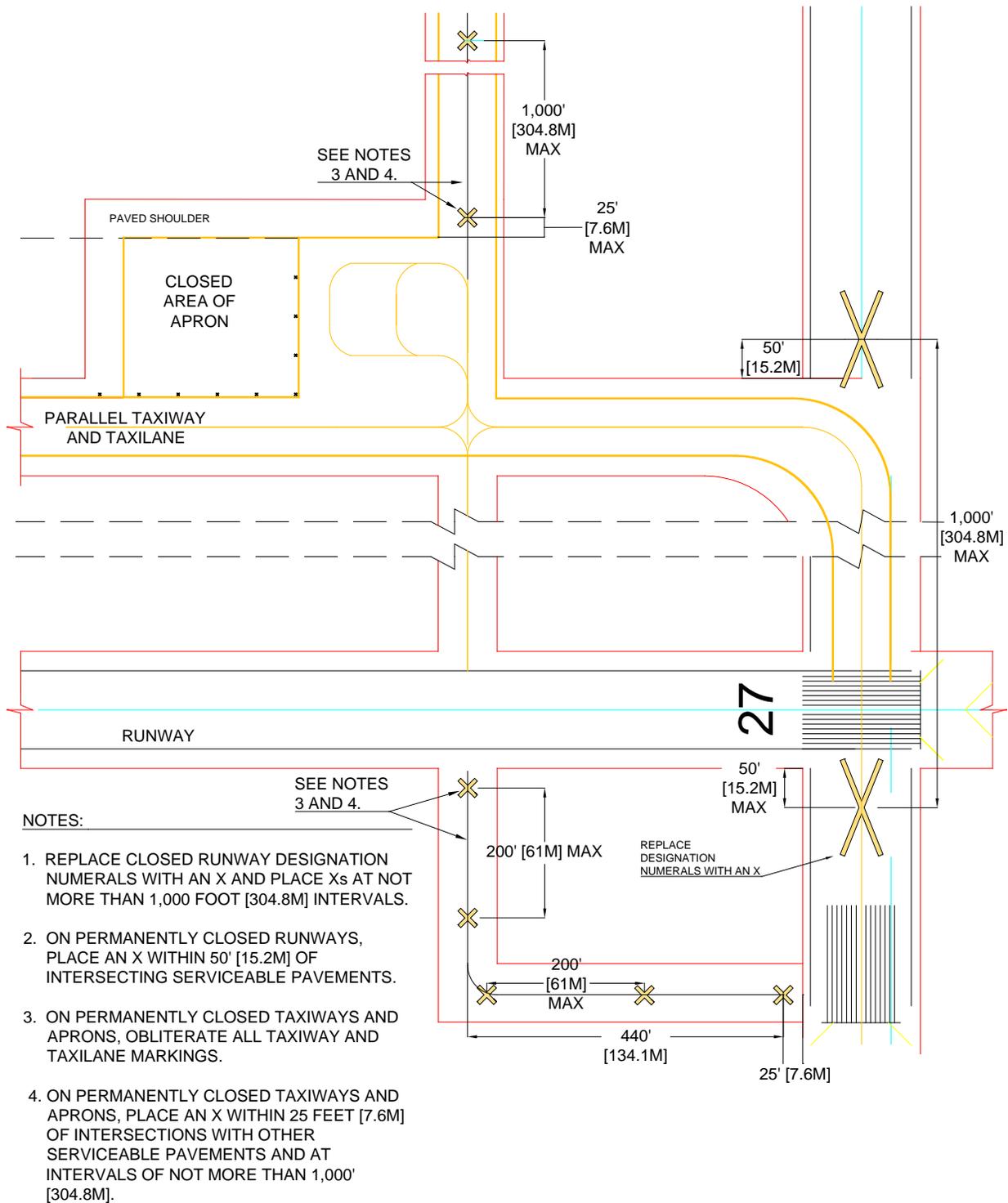
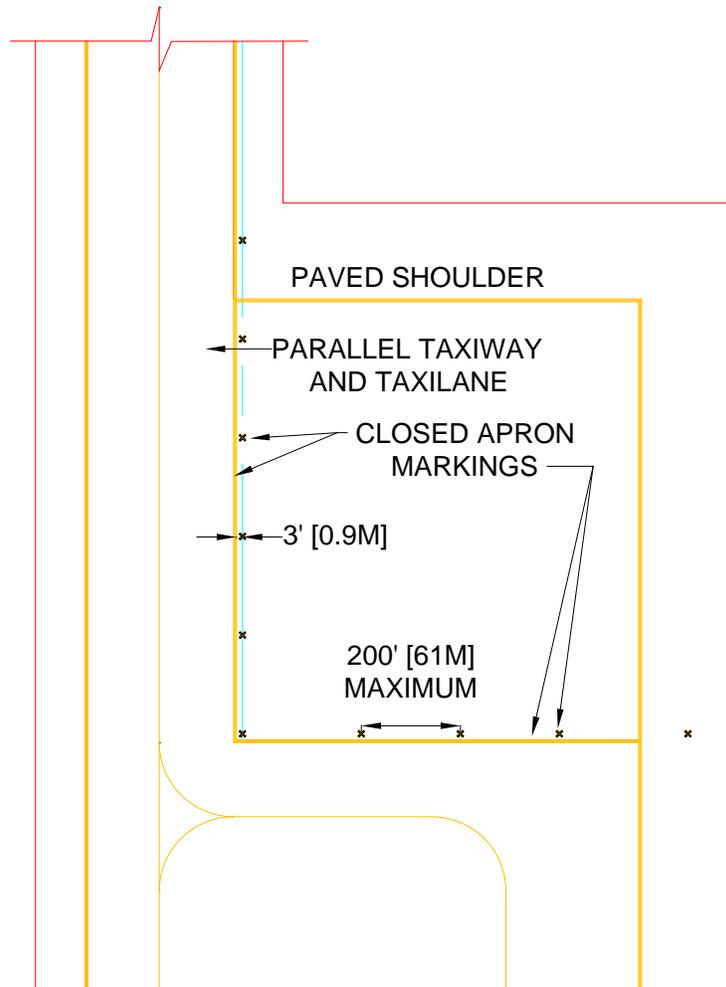


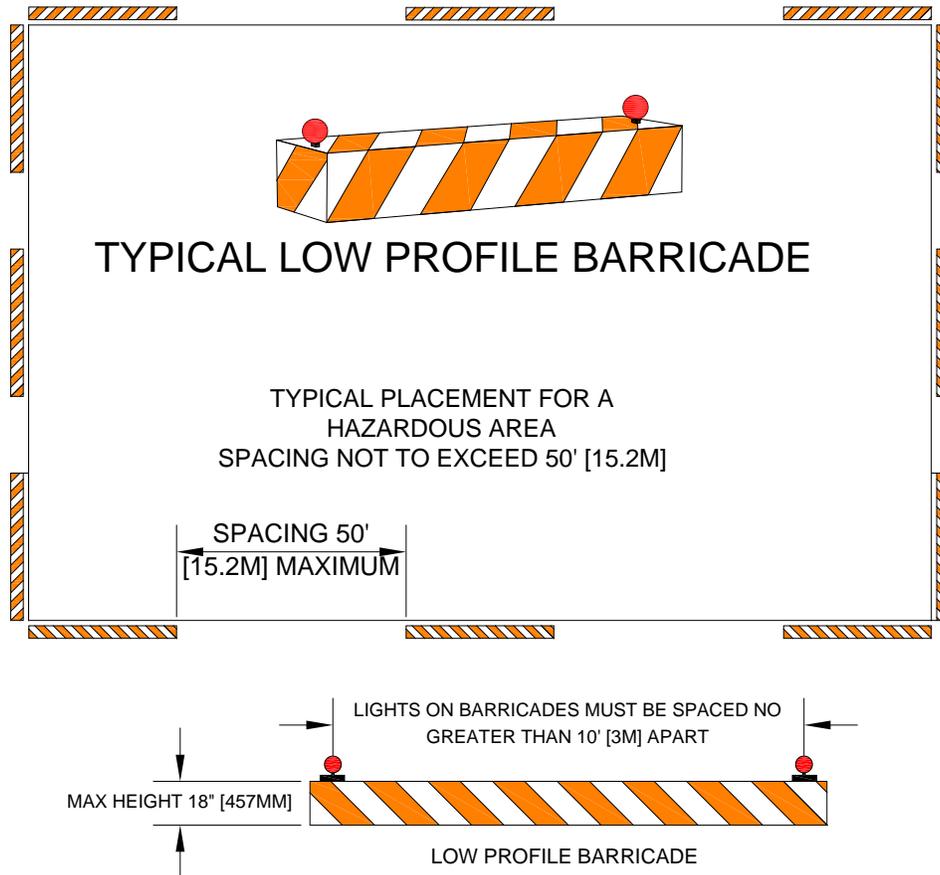
Figure 8-3. Placement of Permanently Closed Apron Pavement Markings



8-6 BARRICADES.

Where pavement markings do not provide adequate definitions of closed or hazardous areas, supplement the markings using retro-reflective orange and white barricades or traffic cones with securely fastened red lights aligned toward aircraft and vehicle ground traffic. All barricades and traffic cones are anchored or weighted to be heavy enough to remain in place during aircraft operations in near proximity. Ensure flashing lights are at least five candelas effective intensity and flash at a rate of from 55 to 160 flashes per minute. Ensure continuous burning lights have an effective intensity of 10 candelas. Low-profile barricades are the preferred method for marking construction areas. Examples are shown in Figure 8-4. Ensure lighted barricades used in close proximity to each other are all of the same type and colors. If flashing lights are used, ensure they have the same flash rates. Place barricades at maximum intervals of 50 feet (15.2 meters) and use dual barricades and lights on each corner and at the ends.

Figure 8-4. Low Profile Barricades



NOTES:

1. BARRICADES MAY NOT EXCEED 18" [457MM] IN HEIGHT (EXCLUSIVE OF SUPPLEMENTARY LIGHTS AND FLAGS) AND SHOULD BE SPACED TO PREVENT BREACH, BUT IN NO CASE GREATER THAN 50' [15.2M] APART. THEY MUST BE OF LOW MASS; EASILY COLLAPSIBLE UPON CONTACT WITH AN AIRCRAFT; AND WEIGHTED OR STURDILY ATTACHED TO THE SURFACE TO PREVENT DISPLACEMENT FROM JET BLAST OR OTHER WIND DISTURBANCE.
2. THE REQUIRED LIGHTS MUST BE RED AND MAY EITHER BE STEADY BURNING OR FLASHING. INTENSITIES AND LUMINANCE MUST BE AT LEAST FIVE CANDELAS EFFECTIVE INTENSITY AND FLASH AT A RATE OF FROM 55 TO 160 FLASHES PER MINUTE.
3. HAZARD LIGHTS MAY NOT BE SPACED GREATER THAN 10' [3M] APART.
4. LIGHTS MUST BE OPERATED BETWEEN SUNSET AND SUNRISE AND DURING PERIODS OF LOW VISIBILITY WHENEVER THE AIRPORT IS OPEN FOR OPERATIONS.
5. BARRICADES MAY BE SUPPLEMENTED WITH ALTERNATING ORANGE AND WHITE FLAGS AT LEAST 20" BY 20" (508MM BY 508MM) SQUARE.

8-7 NON-MOVEMENT AREA BOUNDARY MARKING.

Non-movement area boundary markings are used to delineate the air traffic or ground radio-controlled movement area from the non-controlled movement area. This marking is used only when there is a need specified in the AOI or the letter of agreement between the airport operator and airport traffic control tower since they are sometimes misinterpreted as a holding position marking.

8-7.1 Location.

Locate the non-movement area boundary marking on the boundary between the movement and non-movement area. To avoid confusing this marking with a VFR hold or intermediate hold position, do not place this marking to coincide with the edge of a taxiway.

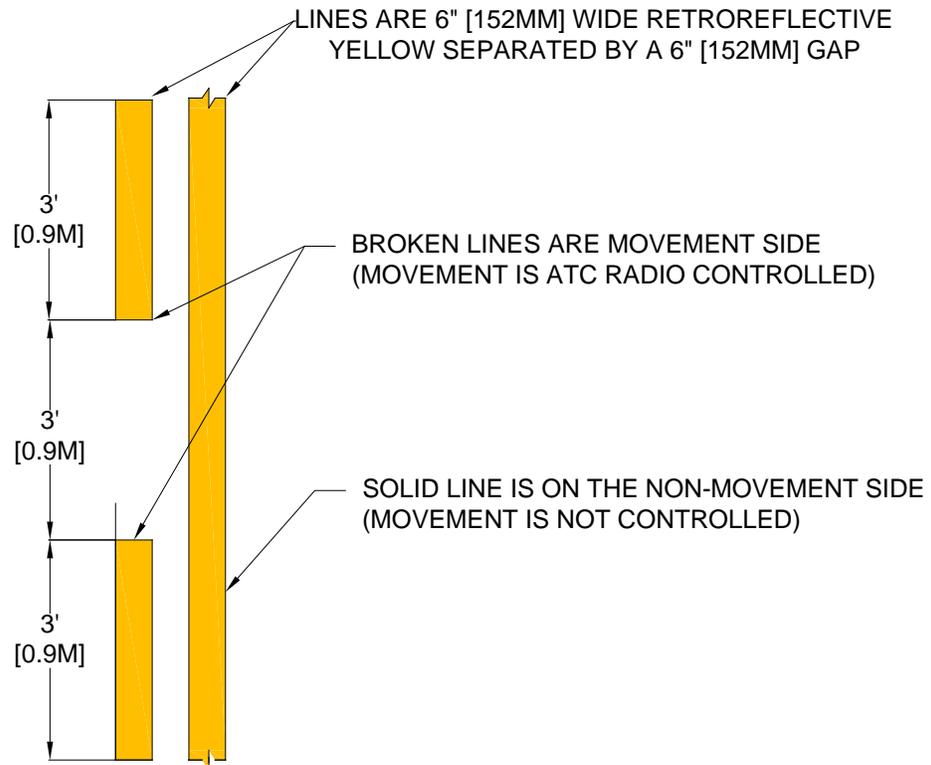
8-7.2 Layout.

The non-movement area boundary marking consists of two retro-reflective yellow lines, one solid and one dashed, as shown in Figure 8-5. The solid yellow line is located on the non-movement (or non-radio controlled) area side; the dashed yellow line is located on the movement (air traffic control/ground control-supervised and radio-controlled) area side. Each line is 6 inches (152 millimeters) in width, with a 6-inch (152-millimeter) gap between the lines. The width of the lines and spaces are optionally doubled to 12 inches (305 millimeters). The dashes are 3 feet (0.9 meter) in length with a 3-foot (0.9-meter) gap between dashes. If a taxiway centerline intersects a non-movement area boundary marking, the taxiway centerline is interrupted 6 inches (152 millimeters) from the solid line (movement area side) and 3 feet (0.9 meter) from the dashed line (non-movement area) side.

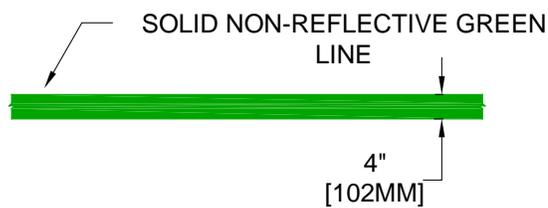
8-8 OBSTRUCTION CLEARANCE LINE.

On Class A airfields, heliports, or aprons servicing only rotary wing aircraft, and where needed, an obstruction clearance line is marked to delineate an apron lateral clearance area as defined by UFC 3-260-01. The line is placed to prevent fixed and mobile objects (e.g., maintenance vehicles, equipment, and storage bins) from being located where they encroach into the required apron lateral clearance distance. The obstruction clearance line consists of a single solid green non-reflective line 4 inches (102 millimeters) wide. The obstruction clearance line is not painted within the usable portion of the apron or on portions of the airfield traversed by aircraft under their own power such as runways, vertical landing pads, helipads, overruns, hoverpoints, taxiways, taxi-lanes, warm-up pads, arm/de-arm pads, hot cargo pads, hot refueling areas, forward arming and refueling pads, compass calibration pads, trim pads, engine run-up or engine check pads; however, it might be painted at or near hangar entrances and exits. See Figure 8-5 for obstruction clearance line details. An obstruction clearance line is not required at installations which ensure the apron lateral clear areas are accessed only by personnel trained on proper placement and movement of equipment, materials, and structures on active airfield pavements and which do not bring or leave such materials, equipment, or structures unattended or without informing the airfield managers and controllers and restricting aircraft movement in the area.

Figure 8-5. Non-Movement Area Boundary and Obstruction Clearance Line Markings



NON-MOVEMENT AREA MARKING



OBSTRUCTION CLEARANCE LINE

8-9 DECEPTIVE SURFACES (SHOULDER MARKINGS).

Shoulders and other areas of airfield pavements that are not intended for aircraft traffic but have the appearance of operational pavement are marked as deceptive surfaces. Use deceptive surface markings when the paved shoulder width exceeds the standard dimension given in UFC 3-260-01 or if experience shows there is a lack of definition between the full-strength pavement and shoulders. **Note:** If there is a significant gap between the deceptive surface markings and the runway side stripe (such as occurs when side stripes are spaced at a 144-foot [43.9-meter] separation on a 300-foot [91.4-meter] -wide runway), double 6-inch (152-millimeter) -wide yellow stripes separated by a 6-inch (152-millimeter) -wide gap are optionally added to the inner ends of the deceptive surface markings to longitudinally delineate the limit of the load-bearing pavement. Place the outer edge of the outermost stripe to coincide with the outer edge of the full-strength pavement and the inner end of the deceptive surface marking. These stripes are curved to follow the outer radius of fillets and terminated at the intersecting taxiway edge, or joined to taxiway edge markings, where used.

8-10 RUNWAY SHOULDERS.

Mark deceptive surfaces on the edges of runways with diagonal stripes as shown in Figure 8-6. The stripes are uniformly laid out from each end of the runway to the midpoint, reversing direction at the midpoint. Begin the measurement for spacing at the initial overrun chevron apex. Stripes are located so the inner edge of the marking is coincident with the edge of the full-strength pavement and the stripe extends to within 5 feet (1.5 meters) of the outer pavement edge or for a length of 25 feet (7.6 meters), whichever results in the shorter length line.

8-11 TAXIWAY AND APRON SHOULDERS.

Mark deceptive surfaces on the edges of taxiways and aprons with perpendicular stripes as shown in Figure 8-7. These markings consist of a series of 3-foot (0.9-meter) -wide stripes positioned perpendicular to the edge markings. On curves, a stripe is placed at each point of tangency and intermediate stripes are spaced uniformly up to 30 feet (9.1 meters) apart. Stripes are placed so the inner edge of the marking is coincident with the edge of the full-strength pavement.

8-12 VEHICULAR ACCESS MARKING.

Mark vehicular access routes according to the FHWA MUTCD. Additionally, ensure all vehicular access roads leading to a movement area or taxiway/taxilane are marked with a white "stop" bar. See paragraph 4.5.

8-13 INERTIAL NAVIGATION SYSTEM (INS) CHECKPOINT MARKINGS.

INS checkpoint markings are provided to allow data input or calibration of the aircraft INS. Contrasting colors are used for the border, numerals, and letters. A record of actual coordinates is normally maintained by base operations flight data, transient alert, and maintenance control. Figure 8-8 shows a typical layout scheme. Suggested locations are nose wheel parking spots on aprons and ramps; engine run-up areas

adjacent to runway ends; hammerheads; or taxiway and apron holding positions. **Note:** For Air Force installations, survey support for NAVAIDs and INS checkpoints are coordinated with base and MAJCOM mapping, charting, and geodesy offices, according to AFI 14-205.

8-14 GROUND RECEIVER CHECKPOINT MARKINGS.

Identify instrument navigation checkpoint markings such as VHF omni range (VOR) and tactical air navigation (TACAN) markings as shown in Figure 8-8. Where directional alignment of the aircraft is required, paint a 6-inch (152-millimeter) -wide line through the center of the circle that extends outside the circle aligned toward the transmitter. Terminate the line with an arrowhead. Black or white paint is used to contrast this marking, as required. If the checkpoint marking conflicts with a taxiway centerline, interrupt the taxiway centerline 3 feet (0.9 meter) on either side of the checkpoint marking. A supplemental sign is required for the checkpoint marking; see UFC 3-535-01 for size, lettering, and placement. **Note:** For Air Force installations, survey support for NAVAIDs and INS points are coordinated with base and MAJCOM mapping, charting, and geodesy offices, according to AFI 14-205.

Figure 8-6. Runway Shoulder Markings (Deceptive Surfaces)

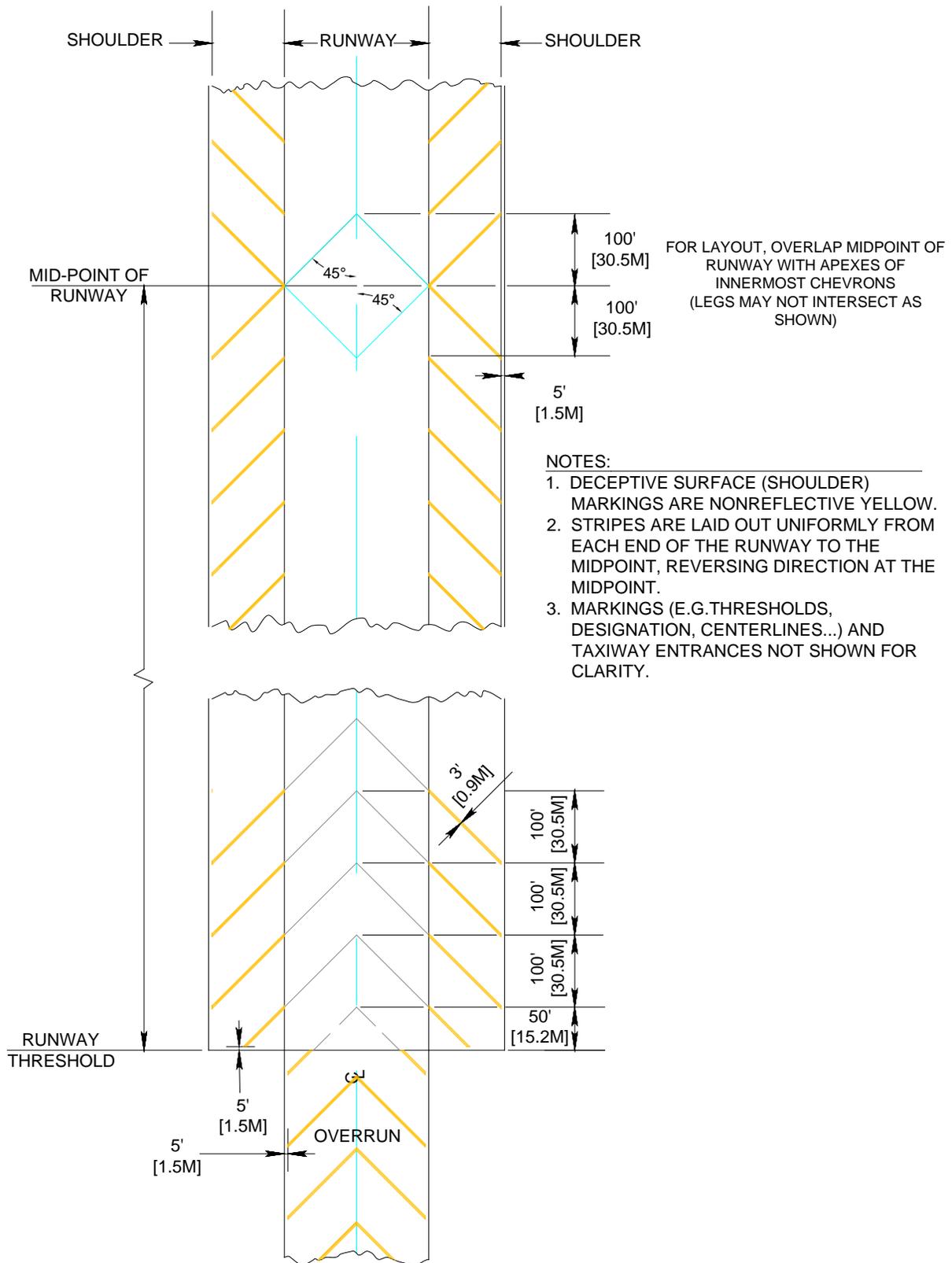


Figure 8-7. Taxiway and Apron Shoulder Markings (Deceptive Surfaces)

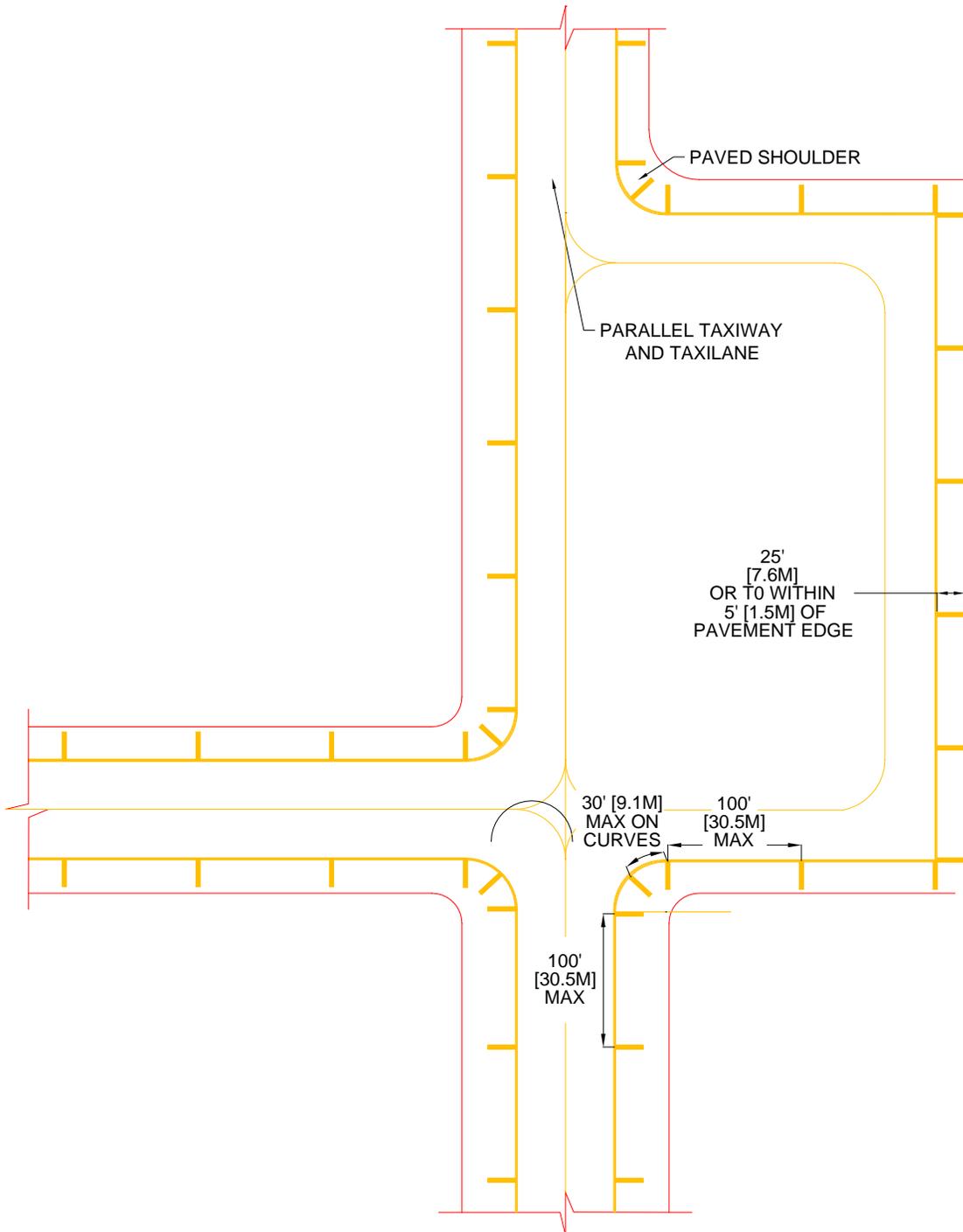
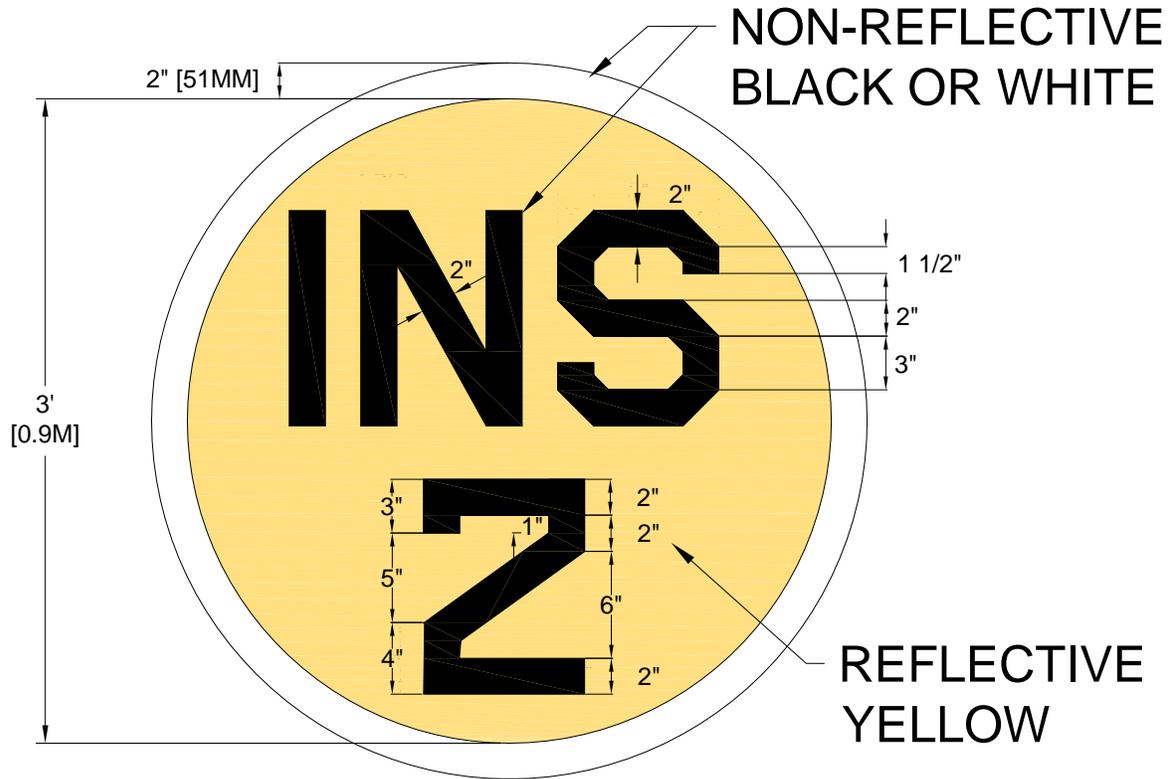
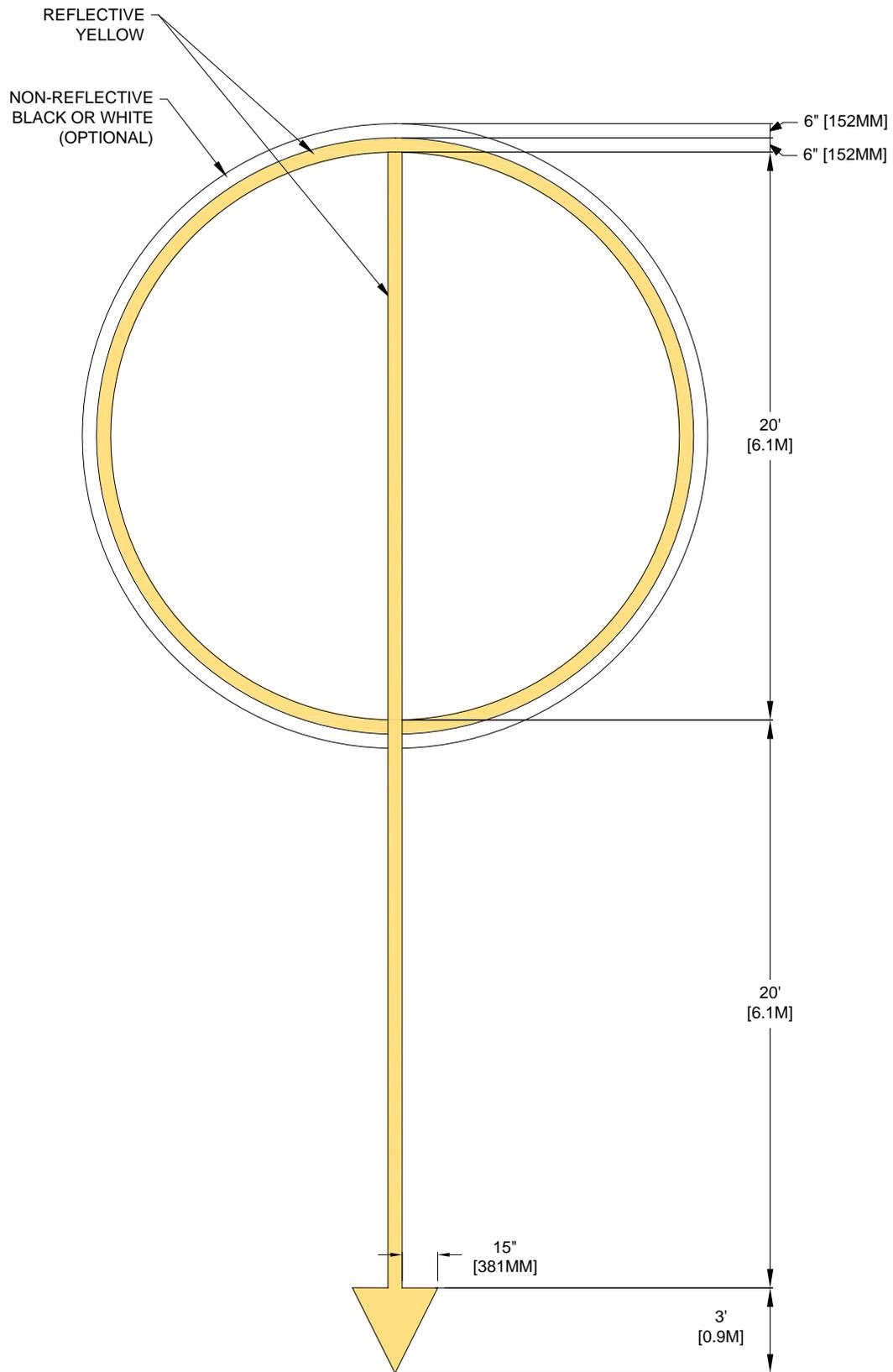


Figure 8-8. Typical Inertial Navigation System Marking



MULTIPLY BY 25.4 TO CONVERT INCHES TO MILLIMETERS

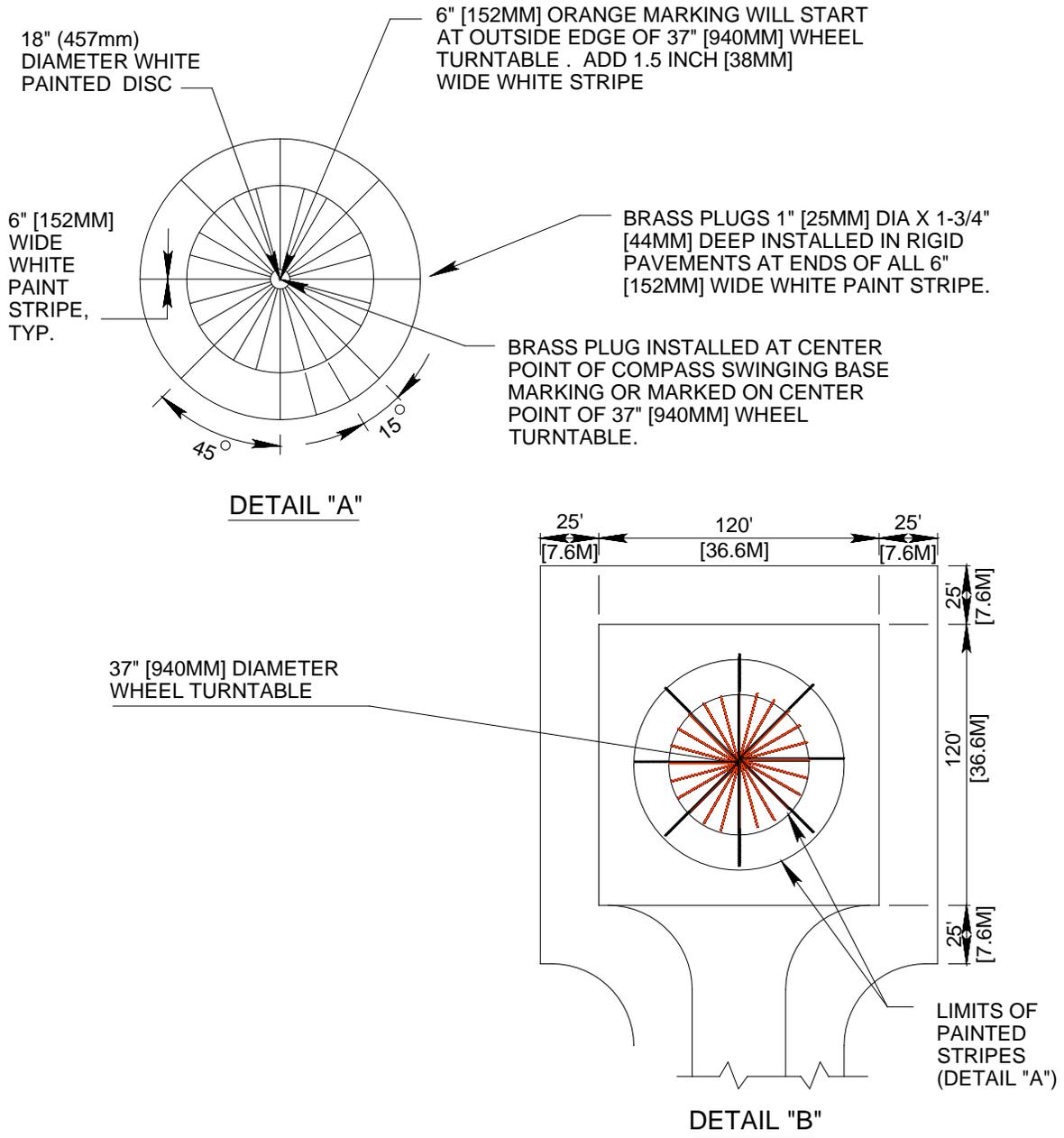
Figure 8-9. Ground Receiver Checkpoint (Directional)



8-15 COMPASS CALIBRATION PAD (CCP) MARKINGS.

Compass swinging bases are established in accordance with UFC 3-260-01, Chapter 6 and Appendix B10. Mark CCPs in accordance with the applicable aircraft maintenance Technical Order (T.O.), considering primarily the most demanding aircraft that are serviced on the apron. If aircraft are serviced which do not require a specific marking within the T.O., optionally use either the more restrictive criteria provided in UFC 3-260-01 and described below or the general guidelines for compass calibration pads in FAA AC 150/5300-13 for Class B airfields; otherwise, use the criteria described below. Swinging bases for aligning aircraft for the precise calibration of all types of air navigation equipment are marked as shown in Figures 8-10 and 8-11. The stripes are set at magnetic directions from the corresponding true compass rose control point at every 15 degrees (15°). A 6-inch (152-millimeter) -wide orange stripe is painted for each of the 24 compass rose control points. These stripes begin at the center of the pad and extend outward for a minimum length of 25 feet (7.6 meters). Border each stripe with a 1.5-inch (38-millimeter) -wide white stripe. At a distance of 27 feet (8.2 meters) from the center of the pad, identify the azimuth of each stripe as measured from magnetic north with 24-inch (610-millimeter) -high by 15-inch (381-millimeter) -wide orange block numerals (Figure 8-11). All azimuth numbers contain three numerals (e.g., 045). The stroke of each numeral is a minimum of 3.5 inches (89 millimeters) wide. Each azimuth number is painted on a solid white background formed from a rectangle 26 inches (660 millimeters) high by 51 inches (1,295 millimeters) wide.

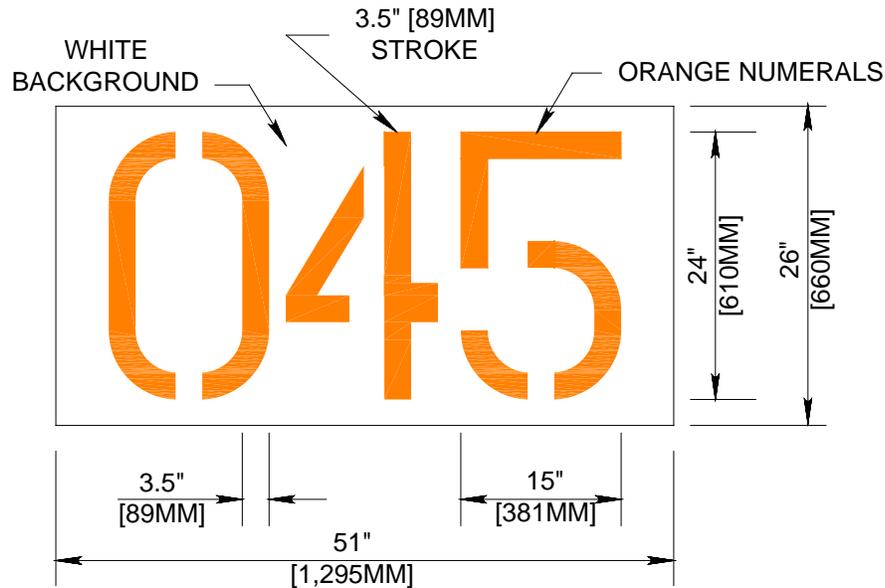
Figure 8-10. Compass Calibration Pad Markings



NOTES:

1. UNITS ARE EXPRESSED AS $\frac{\text{FEET}}{\text{METERS}}$ (e.g. $\frac{10}{3}$).
2. SEE UFC 3-260-01 FOR SURVEY REQUIREMENTS AND UFC 3-260-02 FOR PAVEMENT AND SUBGRADE DESIGN REQUIREMENTS.

Figure 8-11. Compass Calibration Pad Numerals



8-16 T-6 PROPELLER HAZARD PAVEMENT MARKINGS.

In an effort to reduce the hazard caused by T-6 propellers, T-6 parking positions are marked in accordance with Figure 8-12.

8-17 F-16 ENGINE INLET DANGER AREA PAVEMENT MARKINGS.

In an effort to reduce the hazard caused by F-16 engine inlet suction, F-16 parking positions are optionally marked in accordance with Figure 8-13; however, aircraft maintenance personnel determine whether the radius is established at 15 feet (4.6 meters) for idle thrust or 25 feet (7.6 meters) for mil-thrust.

8-18 HYDRANT FUEL PIT LID MARKING.

If needed to alert pilots, vehicle operators, or maintenance personnel, hydrant fuel pit covers and/or adjacent pavement is optionally marked as shown in Figure 8-14. In areas where snow is not a factor, these pits do not necessarily require markings of this type.

8-19 STATIC GROUND MARKINGS.

See UFC 3-575-01, *Lightning and Static Electricity Protection Systems*, and Army Techniques Publication (ATP) 4-43, *Petroleum Supply Operations*, for static grounding, testing, and marking requirements.

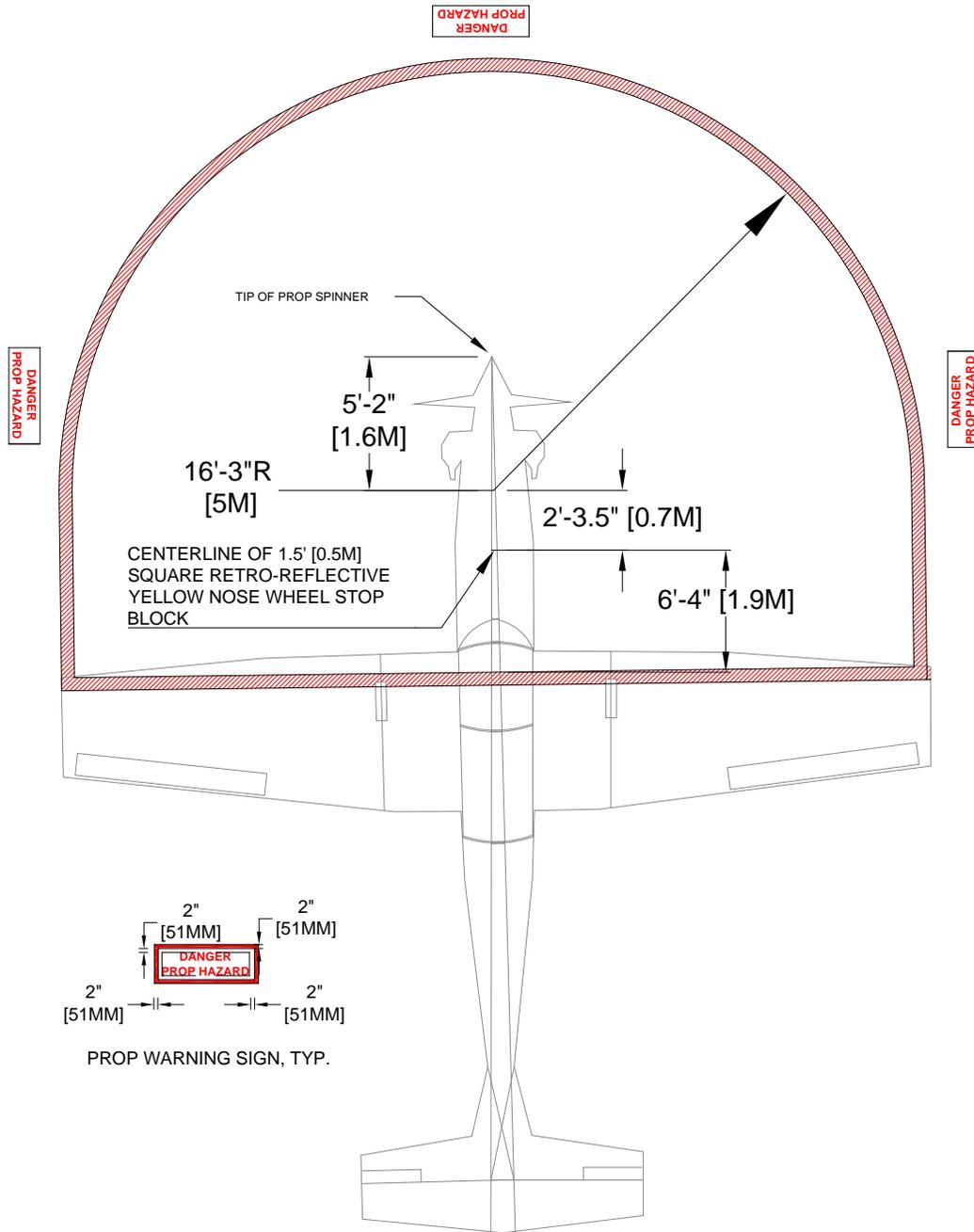
8-20 C-12 PROP HAZARD WARNING MARKING.

In an effort to reduce the hazard caused by C-12 propellers and exhaust, C-12 parking positions are marked in accordance with Figure 8-15.

8-21 EXPEDIENT AIRFIELD MARKINGS.

There are two VFR types of expedient airfields: the landing zone (LZ) (formerly called shortfields or assault landing zones) and the minimum operating strip (MOS). They are rapidly developed to support operations due to an urgent need but support different types of operations. LZs are developed to support airlift operations for C-130 and C-17 aircraft and the MOS is developed for base recovery after an attack to allow the launch and recovery of fighter aircraft. The schemes for marking an MOS are described in T.O. 35E2-6-1, *Minimum Airfield Operating Surface Marking System*. The schemes for marking an LZ are provided in TM 3-34.48-2, *Theater of Operations: Roads, Airfields, and Heliports – Airfield and Heliport Design*, Volume II.

Figure 8-12. T-6 Propeller Hazard Area Pavement Markings



NOTES:

1. WARNING SIGNS WILL BE 4" [102MM] HIGH RED LETTERS ON A WHITE BACKGROUND THAT EXTENDS AT LEAST 2" [51MM] BEYOND THE EXTREMITIES OF THE LETTERS. PLACEMENT SHALL BE AT MINIMUM, AS SHOWN ABOVE.
2. PROP WARNING ARC AND OTHER BOUNDARIES WILL BE A 6" [152MM] CONTINUOUS RED LINE WITH RETRO-REFLECTIVE BEADS EMBEDDED. AN ANTI-SKID MATERIAL SHOULD ALSO BE INCORPORATED ACCORDING TO THE MANUFACTURERS RECOMMENDATIONS.
3. PAINT AND GLASS BEADS SHALL BE IN ACCORDANCE WITH STANDARDS PROVIDED IN CHAPTER 3 OF THIS MANUAL.

Figure 8-13. F-16 Engine Inlet Danger Area Pavement Markings for Idle Thrust

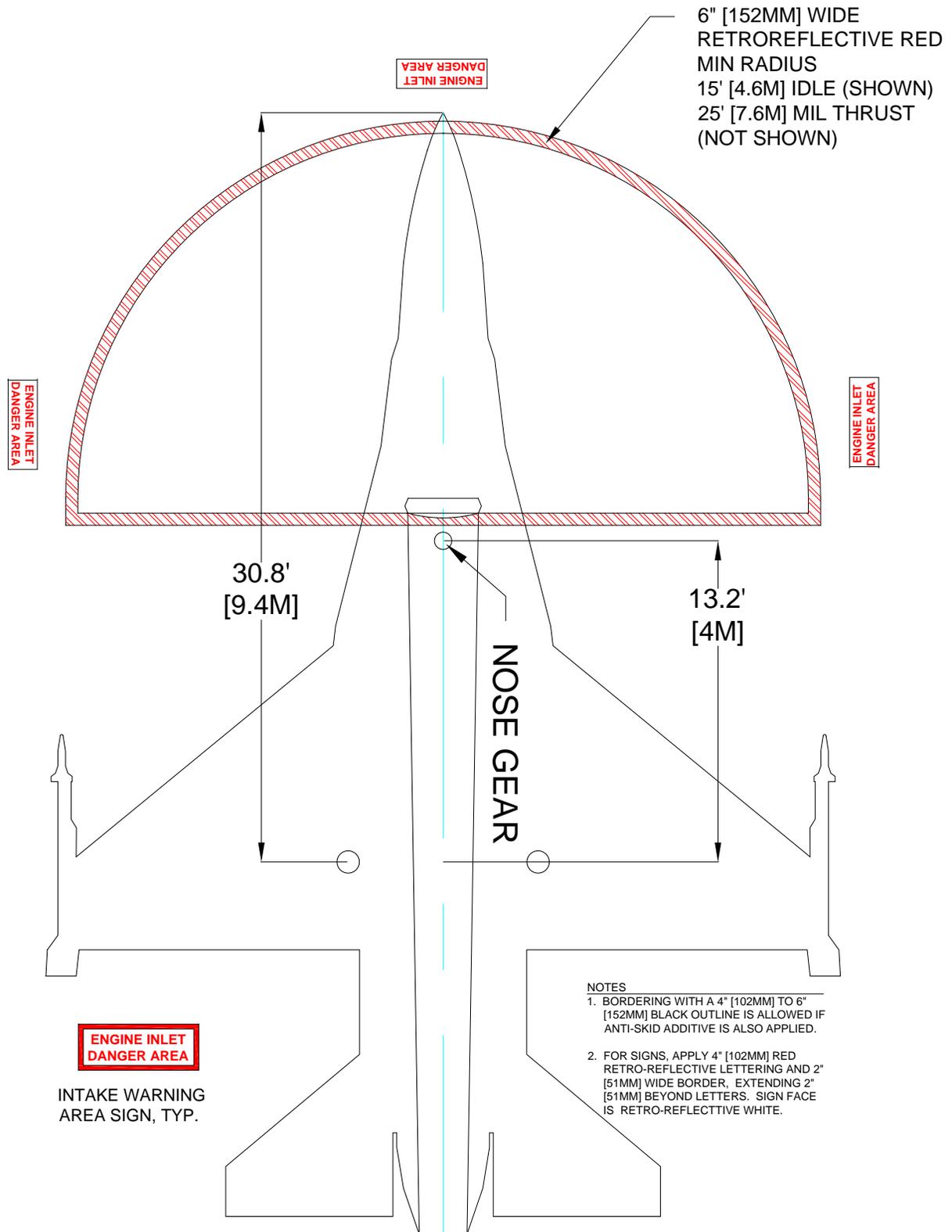


Figure 8-14. Hydrant Fuel Pit Markings

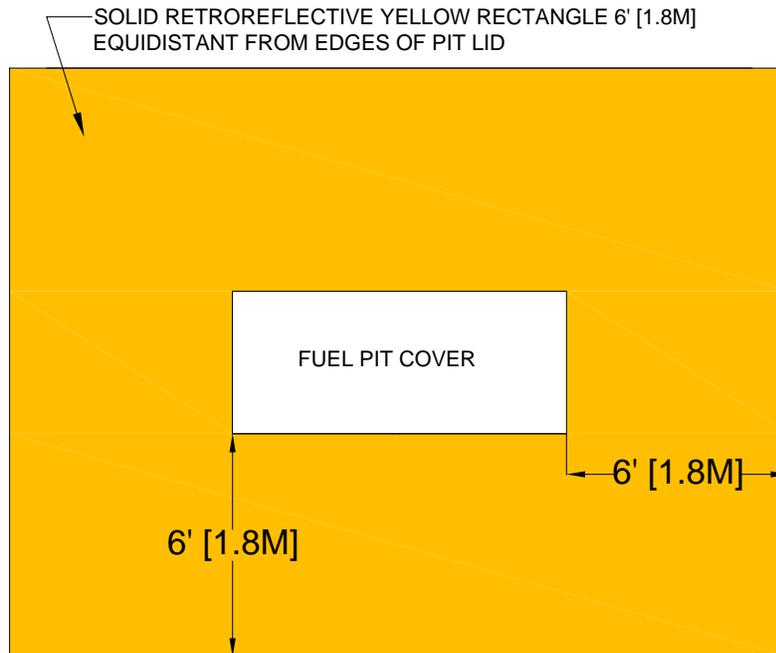
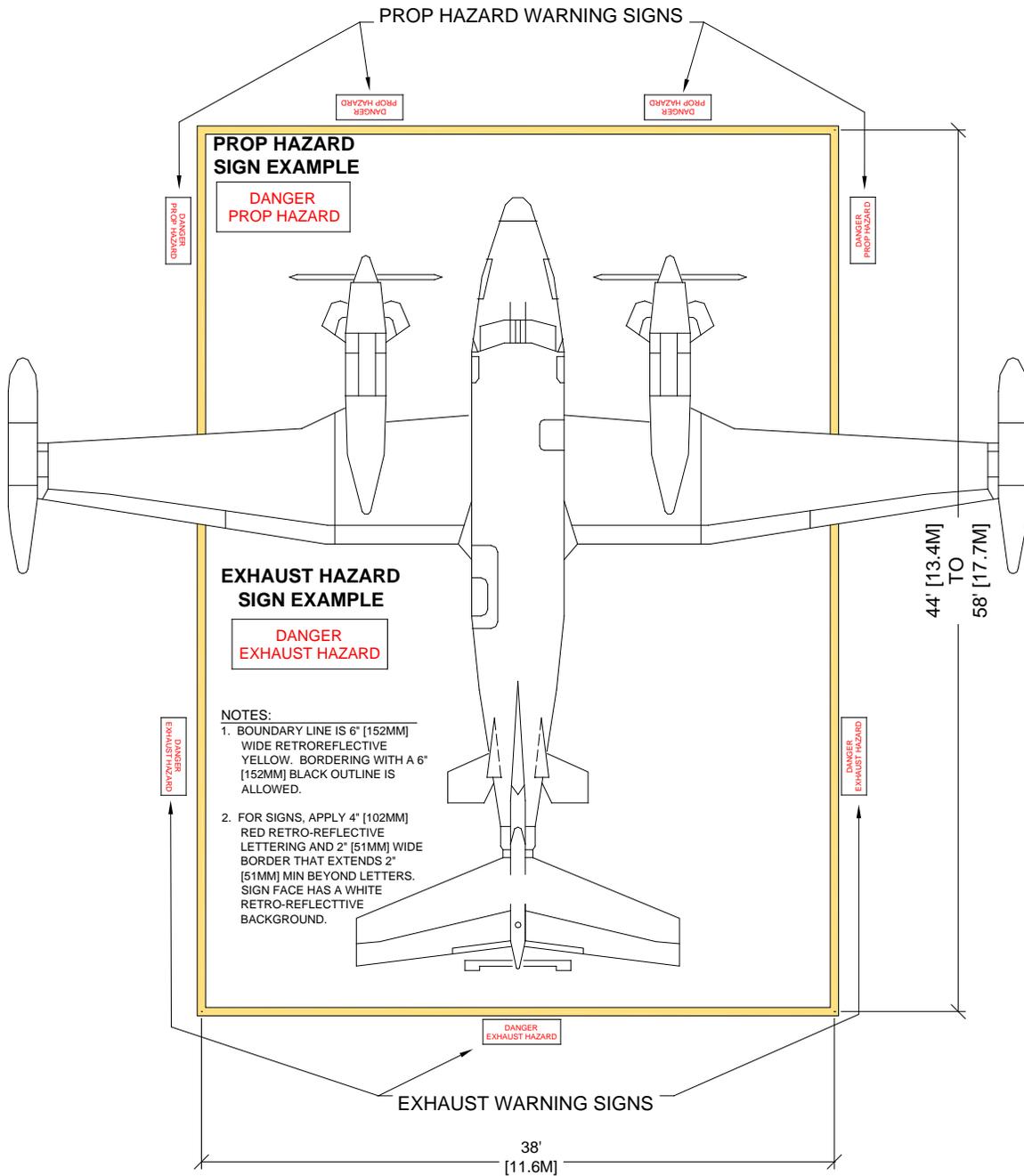


Figure 8-15. C-12 Propeller and Exhaust Hazard Area Pavement Markings



APPENDIX A REFERENCES

AIR FORCE

- AFI 13-217, *Drop Zone and Landing Zone Operations*, <http://www.e-publishing.af.mil/>
- AFI 14-205, *Geospatial Information and Services (GI&S)*, <http://www.e-publishing.af.mil/>
- AFI 31-101, *Integrated Defense* (FOUO)
- AFI 32-1044, *Visual Air Navigation Systems*, <http://www.e-publishing.af.mil/>. (This AFI gives information on aircraft arresting system locations and lighted signs required for runway, taxiway, and instrument hold positions.)
- T.O. 35E2-6-1, *Minimum Airfield Operating Surface Marking System*
- ETL 09-6, *C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria* (FOUO), https://www.wbdg.org/ccb/browse_cat.php?c=125

ARMY

- AR 190-16, *Physical Security*,
<https://armypubs.army.mil/Search/ePubsSearch/ePubsSearchDownloadPage.aspx?docID=0902c8518001047d>
- ATP 4-43, *Petroleum Supply Operations*,
<http://www.apd.army.mil/ProductMaps/PubForm/ATP.aspx>
- SDDCTEA Pamphlet 55-14, *Traffic Engineering for Better Signs and Markings*,
https://www.sddc.army.mil/sites/TEA/Functions/SpecialAssistant/TrafficEngineeringBranch/Pamphlets/SDDCTEA_Pamphlet_55-14.pdf
- SDDCTEA Pamphlet 55-17, *Better Military Traffic Engineering*,
https://www.sddc.army.mil/sites/TEA/Functions/SpecialAssistant/TrafficEngineeringBranch/Pamphlets/SDDCTEA_Pamphlet_55-17_2011.pdf
- TM 3-34.48-2, *Theater of Operations: Roads, Airfields, and Heliports – Airfield and Heliport Design*, Vol. II,
https://armypubs.us.army.mil/epubs/DR_pubs/DR_a/pdf/web/tm3_34x48_2.pdf
- USACE TSC 13-2, *Aircraft Characteristics for Military Aircraft*,
<https://transportation.ercd.dren.mil/tsmcx/criteria.aspx>

NAVY

NAVAIR 51-50AAA-2, *General Requirements for Shore Based Airfield Marking and Lighting*. Download a copy at <http://www.wbdg.org/ffc/dod/supplemental-technical-criteria> (designated TSEWG NAVAIR 51-50111-2, *General Requirements for Shorebased Airfield Marking and Lighting*) or contact the management authority for NAVAIR 51-50-AAA-2 at: Commanding Officer Naval Air Warfare Center Aircraft Division, Lakehurst Logistics, Code 6.8.5.1, Lakehurst, NJ, 08733, phone (732) 323-5073.

JOINT PUBLICATIONS

TSPWG Manual 3-260-04.18-01, *Life-Cycle Cost Analysis of Retroreflective Glass Beads*, <http://www.wbdg.org/ffc/dod/supplemental-technical-criteria/>

TSPWG Manual 3-260-04.18-02, *Airfield Marking Waiver Procedures*, <http://www.wbdg.org/ffc/dod/supplemental-technical-criteria/>

UFC 1-200-01, *DoD Building Code (General Building Requirements)*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-120-01, *Design: Sign Standards*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-201-01, *Civil Engineering*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-260-01, *Airfield and Heliport Planning and Design*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-260-02, *Pavement Design for Airfields*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-535-01, *Visual Air Navigation Facilities*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFC 3-575-01, *Lightning and Static Electricity Protection Systems*, https://www.wbdg.org/ccb/browse_cat.php?c=4

UFGS 32 17 23, *Pavement Markings*, https://www.wbdg.org/ccb/browse_cat.php?c=3

FEDERAL AVIATION ADMINISTRATION (FAA)

FAR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, <http://www.ecfr.gov/cgi-bin/text-idx?SID=c957224f6e2b4fb1f2fc236f5da09558&node=pt14.2.77&rgn=div5>

AC 70/7460-1, *Obstruction Marking and Lighting*, http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1028657

AC 120-57, *Surface Movement Guidance and Control System*,
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/23193

AC 150/5300-13, *Airport Design*,
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1020359

AC 150/5340-1, *Standards for Airport Markings*,
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1022266

AC 150/5340-18, *Standards for Airport Sign Systems*,
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/321003
AC 150/5345-55, *Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure*,
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/22296

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

Manual on Uniform Traffic Control Devices (MUTCD), <http://mutcd.fhwa.dot.gov/>

FEDERAL SPECIFICATIONS AND STANDARDS

TT-P-1952, *Paint, Traffic and Airfield Marking, Waterborne*,
http://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=51859

TT-B-1325, *Beads (Glass Spheres), Retroreflective*,
http://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=51830

AIR STANDARDIZATION COORDINATING COMMITTEE (ASCC)

Air Standard 90/28, *Aerodrome Pavement Markings*

INNOVATIVE PAVEMENT RESEARCH FOUNDATION (IPRF)

Project 05-1, *Develop and Publish a Best Marking Practices Handbook*,
<http://www.iprf.org/products/main.html>

INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO)

Annex 14, Volume I, *Aerodromes*, <http://www.icao.int/>

Annex 14, Volume II, *Heliports*, <http://www.icao.int/>

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

STANAG 3111, *Airfield Marking Tone-Down*

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) INTERNATIONALE

SAE-AMS-STD-595, *Colors Used in Government Procurement*, www.sae.org

APPENDIX B BEST PRACTICES

B-1 PAVEMENT MARKING.

B-1.1 DEVELOPMENT SPONSORSHIP.

The FAA funded, and the American Concrete Pavement Association (ACPA), in cooperation with the Innovative Pavement Research Foundation (IPRF), executed Project 05-1, *Develop and Publish a Best Marking Practices Handbook*. The products were delivered in September 2008 and are available for download:

<http://www.iprf.org/products/main.html>

B-1.2 CONTENTS.

The manual is composed of the following products:

- Airfield Marking Handbook (pdf format)
- PowerPoint Presentation
- Instructional video (The instructional video requires the DivX codec, which is downloadable from the same website.)

Note: Printed copies of this report are available at no cost; however, a nominal shipping and handling fee applies.

B-1.3 EXCEPTIONS.

The practices, methods, and recommended materials provided within the report do not necessarily comply with the mandatory policies established within this UFC or individually by the Services. In cases where there are conflicts, this UFC, as well as Service, MAJCOM, and MACOM-specific policies, govern.

B-2 PREVIOUS AIRFIELD MARKING PATTERN STANDARDS.

B-2.1 PATTERN SIZES AND LAYOUTS.

Previous pavement marking standards called for smaller and differently spaced marking schemes from those standardized by the FAA or ICAO. This UFC attempts to standardize marking standards and practices across DoD in an effort to enable uniform recognition of surface painted markings and better promote aviation safety, regardless of the geographic location of the airfield.

When to Implement New Marking Patterns/Layouts.

Due to the potentially significant budgetary impact caused by arbitrary implementation of new standards, continue marking current patterns until renovation of the pavement (reconstruction or overlay) or at least 50 percent of the individual pavement feature (e.g., a runway, a taxiway system, or individual aprons and taxilanes). This allows a phased approach to replacing obsolete patterns or marking schemes.

Exceptions to Civil Standards on DoD-Owned Facilities.

Note that not all FAA-promulgated size requirements and enhancements have been made mandatory requirements in this UFC. This is because military missions, needs, and funding constraints are different from those of civil operational interests. Where FAA or ICAO standards differ from those within this UFC, these standards govern unless waived by the appropriate authority.

B-2.2 PREVIOUS STANDARDS.

Obsolete USAF Standards.

- AFI 32-1042, *Standards for Marking Airfields*, 14 January 2015, is downloadable at <https://www.my.af.mil/gcss-af/USAF/ep/contentView.do?contentType=EDITORIAL&contentId=cE3494DD0577CE8B5015790ED79F400C1&programId=t2D8EB9D6386BFB8B01394F5729351F52&channelPageId=s2D8EB9D637283B5601377B2CE4030666>
- ETL 04-2, *Standard Airfield Pavement Marking Schemes*, 19 July 2004, is downloadable at <https://www.my.af.mil/gcss-af/USAF/ep/contentView.do?contentType=EDITORIAL&contentId=cE3494DD0577CE8B5015790ED79F400C1&programId=t2D8EB9D6386BFB8B01394F5729351F52&channelPageId=s2D8EB9D637283B5601377B2CE4030666>

Obsolete U.S. Army Standards.

- U.S. Army Technical Letter No. 1110-3-512, *Army Airfield and Heliport Markings*, is downloadable at <http://www.publications.usace.army.mil/USACE-Publications/Engineer-Technical-Letters/>
- UFC 3-260-05A, *Marking of Army Airfield Heliport Operational and Maintenance Facilities*, 16 January 2004, is downloadable at https://www.wbdg.org/ccb/browse_cat.php?c=4&a=1
- Engineering and Construction Bulletin 2012-28, *Marking of Army Airfields and Heliports*, is downloadable at http://www.wbdg.org/ccb/browse_cat.php?c=268&a=1

B-3 METRICATION OF DIMENSIONS.

B-3.1 METRIC VALUES TO USE.

The technologies addressed in this UFC when developed were based on the inch-pound system used in the United States. Because DoD operates in many foreign countries, and because it is beneficial and necessary to use SI units when developing and constructing projects in those theaters, rational conversions are shown here for cases where NATO or ICAO standards are not called out. In an effort to maintain compliance with both U.S. civil standards and international civil aviation standards, imperial and metric dimensions are provided where practicable within the text. The following table was developed to reduce crowding of dimensions and improve clarity and readability in some of the figures within the document. If necessary, use these values to validate the values provided in the figures.

Table B-1 Inches to Millimeters

Inch-Pound Dimension (Inches)	SI Dimension (Millimeters)
2.00 inches	51 millimeters
3.00 inches	76 millimeters
3.50 inches	89 millimeters
4.00 inches	102 millimeters
5.00 inches	127 millimeters
6.00 inches	152 millimeters
7.00 inches	178 millimeters
7.50 inches	191 millimeters
8.00 inches	203 millimeters
10.00 inches	254 millimeters
12.00 inches	305 millimeters
13.00 inches	330 millimeters
14.00 inches	356 millimeters
15.00 inches	381 millimeters
16.00 inches	406 millimeters
18.00 inches	457 millimeters
20.00 inches	508 millimeters
23.00 inches	584 millimeters
24.00 inches	610 millimeters
26.00 inches	660 millimeters
36.00 inches	914 millimeters
37.00 inches	940 millimeters
48.00 inches	1219 millimeters
51.00 inches	1,295 millimeters

Table B-2 Feet to Meters

Inch-Pound Dimension (Feet) [Nominal Tolerance Dimension]	Metric Used (rounded to nearest tenth of meter)
0.5 foot	0.2 meter
1 foot	0.3 meter
1.3 feet	0.4 meter
1.5 feet	0.5 meter
2 feet	0.6 meter
2.29 feet	0.7 meter
2.5 feet	0.8 meter
3 feet	0.9 meter
3.5 feet	1.1 meters
4 feet	1.2 meters
4.5 feet	1.4 meters
5 feet	1.5 meters
5.17 feet	1.6 meters
5.5 feet	1.7 meters
5.75 feet	1.75 meters
6 feet	1.8 meters
6.33 feet	1.9 meters
6.5 feet	1.98 meters
6.6 feet	2.0 meters
6.75 feet	2.1 meters
7 feet	2.13 meters
7.5 feet	2.3 meters
8 feet	2.4 meters
8.4 feet	2.56 meters
8.5 feet	2.6 meters
9 feet	2.7 meters
9.5 feet	2.9 meters
10 feet	3 meters
11 feet	3.4 meters
11.5 feet	3.5 meters
12 feet	3.7 meters
12.5 feet	3.8 meters
13 feet	3.96 meters
13.2 feet	4.0 meters
13.5 feet	4.1 meters
14 feet	4.3 meters
15 feet	4.6 meters

Inch-Pound Dimension (Feet) [Nominal Tolerance Dimension]	Metric Used (rounded to nearest tenth of meter)
16 feet	4.9 meters
16.25 feet	5.0 meters
17 feet	5.2 meters
17.5 feet	5.3 meters
18 feet	5.5 meters
18.5 feet	5.6 meters
19 feet	5.8 meters
20 feet	6.1 meters
20.66 feet	6.3 meters
22 feet	6.7 meters
24 feet	7.3 meters
24.5 feet	7.5 meters
25 feet	7.6 meters
26 feet	7.9 meters
27 feet	8.2 meters
28 feet	8.5 meters
30 feet	9.1 meters
30.8 feet	9.4 meters
32 feet	9.8 meters
35 feet	10.7 meters
36 feet	11.0 meters
37 feet	11.3 meters
37.5 feet	11.4 meters
40 feet	12.2 meters
43 feet	13.1 meters
44 feet	13.4 meters
45 feet	13.7 meters
48 feet	14.6 meters
50 feet	15.2 meters
59 feet	18.0 meters
60 feet	18.3 meters
63 feet	19.2 meters
72 feet	21.9 meters
75 feet	22.9 meters
79 feet	24.1 meters
80 feet	24.4 meters
88 feet	26.8 meters
98 feet	29.9 meters
99 feet	30.2 meters

Inch-Pound Dimension (Feet) [Nominal Tolerance Dimension]	Metric Used (rounded to nearest tenth of meter)
100 feet	30.5 meters
120 feet	36.6 meters
124 feet	38.0 meters
125 feet	38.1 meters
144 feet	43.9 meters
150 feet	45.7 meters
171 feet	52.1 meters
175 feet	53.3 meters
194 feet	59.1 meters
200 feet	61.0 meters
205 feet	62.5 meters
250 feet	76.2 meters
280 feet	85.3 meters
300 feet	91.4 meters
400 feet	121.9 meters
440 feet	134.1 meters
500 feet	152.4 meters
520 feet	158.5 meters
533.3 feet	162.5 meters
1000 feet	304.8 meters
1200 feet	365.8 meters
1300 feet	396.2 meters
1600 feet	487.7 meters
3000 feet	914.4 meters
3200 feet	975.4 meters
4000 feet	1,219.2 meters

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APPENDIX C GLOSSARY

C-1 ACRONYMS AND ABBREVIATIONS

AAS	Aircraft Arresting System
AC	Advisory Circular
AFI	Air Force Instruction
AFMAN	Air Force Manual
AOI	Airfield Operating Instruction
ATP	Army Techniques Publication
CCP	Compass Calibration Pad
CONUS	Continental United States
DoD	Department of Defense
ECP	Entry Control Point
ETL	Engineering Technical Letter
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCIF	Flight Crew Information File
FHWA	Federal Highway Administration
FLIP	Flight Information Publication
FOD	Foreign Object Damage
HAT	Height Above Touchdown
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rule
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation System

IPRF	Innovative Pavement Research Foundation
LAHSO	Land And Hold Short Operations
LZ	Landing Zone
m	Meter
MACOM	U.S. Army Major Command
MAJCOM	USAF Major Command
MILS	Thousandths of an Inch Film Measurement (0.000")
MIN	Minimum
mm	Millimeters
MOS	Minimum Operating Strip
MSL	Mean Sea Level
MUTCD	Manual on Uniform Traffic Control Devices
NATO	North Atlantic Treaty Organization
NAVAID	Navigational Aid
NAVAIR	Naval Air Systems Command
NDAA	National Defense Authorization Act
NOTAM	Notice To Airmen
OCONUS	Outside Continental United States
PCC	Portland Cement Concrete
POFZ	Precision Obstacle Free Zone
SDDCTEA	Military Surface Deployment and Distribution Command Transportation Engineering Agency
SOFA	Status of Forces Agreement
STANAG	Standardization Agreement
TDZ	Touchdown Zone
TM	Technical Manual

T.O.	Technical Order
TSC	Technical Services Center
U.S.	United States
UAS	Unmanned Aircraft System
UFC	Unified Facilities Criteria
UFGS	Unified Facilities Guide Specification
USACE	U S Army Corps of Engineers
USAF	United States Air Force
VFR	Visual Flight Rules

C-2 TERMS

Precision Approach Runway Category I—A runway served by an instrument landing system (ILS), microwave landing system (MLS), or precision approach radar (PAR) and visual aids intended for operations down to 60 meters (200 feet) decision height, and down to a runway visual range (RVR) on the order of 720 meters (2,400 feet).

Precision Approach Runway Category II—A runway served by ILS or MLS and visual aids intended for operations down to 30 meters (100 feet) decision height and down to an RVR on the order of 360 meters (1,200 feet).

Precision Approach Runway Category III—A runway served by ILS or MLS (no decision height being applicable) and:

Category IIIa: By visual aids intended for operations down to an RVR on the order of 210 meters (700 feet).

Category IIIb: By visual aids intended for operations down to an RVR on the order of 45 meters (150 feet).

Category IIIc: Intended for operations without reliance on external visual reference. (The RVR is 0).

Entry Control Point—A marked location on the periphery of a controlled and restricted area for accessing and exiting the designated area.

Index of Refraction—The ratio of the speed of radiation (as light) in one medium (as a vacuum) to that in another medium—also called *refractive index*.

Taxilane—Designated path marked through parking, maintenance, or hangar aprons, or on the perimeter of such aprons, to permit the safe ground movement of aircraft operating under their own power.

Taxitrak—A specially prepared or designated path, on an airfield other than mass parking areas, on which aircraft move under their own power to and from taxiways to dispersed platforms.

Taxiway—A specially prepared or designated path, on an airfield or heliport other than apron areas, on which aircraft move under their own power to and from landing, service, and parking areas.

Towway—Paved surface over which an aircraft is towed.