Helicopter Safety Advisory Conference

Safety Through Cooperation - Since 1978

Legacy Helideck Design and Marking Guidelines

RP Number:

162

Assessment, Upgrades, Modification, Replacement and Marking of Existing and Temporary Helidecks

Second Edition

December 2019

International Association of Oil & Gas Producers

HeliOffshore
Safety Through Collaboration

Published by Helicopter Safety Advisory Conference (HSAC), 2019

Recommended Practices (RP) are published under the direction of the Helicopter Safety Advisory Conference (HSAC). RPs are a medium for discussion of aviation operational safety pertinent to the transmission of product, energy exploration and production industry in the United States. RPs are not intended to replace individual engineering or corporate judgment or to replace instruction in company manuals or government regulations. Adoption of this HSAC RP as a company internal standard is the responsibility of each individual company and is highly recommended. In this HSAC RP the word 'shall' is used to indicate high value safety practices not an imperative command. Companies choosing to adopt practices recommended in this document should be aware that substitution of "shall" to "should" would likely diminish the effectiveness of the practice. HSAC encourages and welcomes suggestions for subject matter relating to this document intended to improve or update practices contained within.

First published May 2017 (HSAC RP 2016-2)
First Edition - Revision 1, November 2017
Second edition, December 2019 (Renamed HSAC RP 162)

Enquiries regarding the content of this publication should be addressed to HSAC Helideck Committee Chairman
For contact details, see HSAC Website (*http://www.hsac.org/membership-contacts*)

The latest version of this document is available in electronic format at: *http://www.hsac.org/library*

1. TABLE OF CONTENTS

2. GENERAL

2.1 Scope

This document provides guidance for assessment, repairs, upgrades, modifications, replacement, and markings of all legacy helidecks. A legacy helideck is a helideck designed, constructed, or installed prior to initial issuance of Helicopter Safety Advisory Conference (HSAC) Recommended Practice 2016-1 "New Build Helideck Design Guidelines" in May 2016 (HSAC RP 2016-1 was renamed to HSAC RP 161 with issuance of the 2nd Edition in 2019).

The criteria described in this document are dependent on the specifications used for the redesign of legacy helidecks, which may result in assessment against the requirements of the original specification or assessment against the criteria set forth in this document. These guidelines are in effect since the publication of the first edition of this document in June 2017.

Legacy facility owners should consider updating legacy helidecks to the guidelines in HSAC RP 161. Any repair, upgrade, modification, or replacement in kind of a legacy helideck shall be designed and constructed utilizing the specifications in this document (HSAC RP 162). If these standards cannot be met due to engineering, economic, or other justifications, a risk assessment (Annex A) should be performed by the facility owner/operator to document reasons for non-conformance. If not a replacement in kind then the new helideck shall be designed in accordance with HSAC RP 161. American Petroleum Institute (API) RP 2L Helideck Design is not recognized by HSAC as acceptable for either design of new build or marking/upgrade of legacy helidecks.

Note 1: The requirements for helidecks on Mobile Offshore Drilling Units (MODUs) are documented in the IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code) and for ships requirements are documented in the ICS Guide for Helicopter/Ship Operations.

Note 2: HSAC RP 163 provides guidance for the Inspection, Maintenance, and Operation of Offshore Helidecks inlcusive of design guidance for fuel systems, required emergency response equipment, and checklists that can be used for helideck and fuel system inspections.

2.2 References

The following publications, recommended practices, and industry best practices have been taken into account/have been reviewed in the development of this document and in some cases are cited herein. The most recent edition of the documents listed below should be used, unless otherwise specified.

ORGANIZATION	REFERENCE #	TITLE
Helicopter Safety Advisory Conference (HSAC)	HSAC RP 161	New Build Helideck Design Guidelines *http://www.HSAC.org*
	HSAC RP 162	Recommended Practice for Assessment, Upgrades, Modification, Replacement and Marking of Existing Helidecks *http://www.HSAC.org*
	HSAC RP 163	Inspection, Maintenance and Operation of Offshore Helidecks *http://www.HSAC.org*
	HSAC Tables of Helicopter Design Data	Helicopter size and loading criteria (weight/mass, dimensions, etc.) for helidecks is available on the HSAC Web Site "Documents Library" with the title "Tables of Helideck Design Data"
American Petroleum Institute (API)	API RP 2 SIM	Recommended Practice for Structural Integrity Management of Fixed Offshore Platforms *http://www.api.org/products-and-services/standards/purchase*
	API RP 2A-WSD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms *http://www.api.org/products-and-services/standards/purchase*
	API RP 500 or 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division 2, Division 3 *http://www.api.org/products-and-services/standards/purchase*
Federal Aviation Administration (FAA)	FAA Advisory Circular 150/5345-43G	Specification for Obstruction Lighting Equipment *http://www.faa.gov/documentlibrary/media/advisory_circular/150_5345_43g.pdf*
	FAA Engineering Brief No. 87	Heliport Perimeter Light for Visual Meteorological Conditions *https://www.faa.gov/airports/engineering/engineering_briefs/media/eb-87.pdf*

ORGANIZATION	REFERENCE #	TITLE
International Maritime Organization (IMO)	IMO MODU Code	Code for Construction and Equipment of Mobile Offshore Drilling Units (MODU Code) *http://www.imo.org/en/Publications/Documents/Newsletters%20and%20Mailers/Mailers/I810E.pdf*
International Chamber of Shipping (ICS)	ICS Guide	ICS Guide to Helicopter/Ship Operations *http://www.ics-shipping.org/docs/default-source/publications/safety-security-and-operations/ics-guide-to-helicopter-ship-operations.pdf?sfvrsn=10*
International Civil Aviation Organization (ICAO)	ICAO Annex 14 Vol II	Annex 14 Volume II – Heliports *https://store1.icao.int/index.php/*
	ICAO 9261-AN/903	Heliport Design and Services Manual (Part I) - DRAFT
National Fire Protection Association (NFPA)	NFPA 407	Standard for Aircraft Fuel Servicing *http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards?mode=code&code=407*
	NFPA 418	Standard for Heliports *http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards?mode=code&code=418*

Table 1: References

2.3 Terms, Definitions, and Abbreviations

The following terms and associated definitions are used in this document. Additional detailed guidance is covered later in the document.

Term	Definition
As Low As Reasonably Practicable (ALARP)	Term used in the area of safety-critical and safety-involved systems. The ALARP principle is that the residual risk shall be as low as reasonably practicable. For a risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent on the attempt of reducing a risk to zero. It should not be understood as simply a quantitive measure of benefit against detriment. It is more a best common practice of judgement of the balance of risk and societal benefit.
D-Value	The largest overall dimension of the helicopter when rotor(s) are turning measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plane or rearward extension of the helicopter structure.
Final Approach and Takeoff Area (FATO)	A defined area over which the final phase of an approach to a hover or a landing is completed, and from which the takeoff maneuver is initiated, and to compensate for permitted maneuvering. **Note:** The FATO shape should match the shape of the TLOF.
Flight Path Alignment Arrow	Arrow markings on a helideck with a TLOF less than 0.83D but not less than 0.62D that has a 180 degree obstacle sector (OS) to provide visual cues of proper orientation of the helicopter over the TDPM.
Friction Coefficient	The coefficient of friction μ is a value that shows the relationship between two objects and the normal reaction between the objects that are involved. The coefficient of friction is dimensionless and it does not have any unit. The coefficient of friction depends on the objects that are causing friction. The value is usually between 0 and 1 but can be greater than 1. A value of 0 means there is no friction at all between the objects; such is possible with Super-fluidity. All objects, otherwise, will have some friction when they touch each other. A value of 1 means the frictional force is equal to the normal force. It is a misconception that the coefficient of friction is limited to values between zero and one. A coefficient of friction that is more than one just means that the frictional force is stronger than the normal force. The frictional force or force of friction can be expressed as $F_f = \mu N$, where F_f is the frictional force (in Newtons), μ is the frictional coefficient (dimensionless) and N is the normal force (in Newtons).
Ground Effect	An improvement in helicopter lift capability that develops whenever the helicopter flies or hovers at a height of 1 rotor diameter or less over the touch down or liftoff area (TLOF). It a result of the interference of the surface with the airflow pattern of the rotor system, and it is more pronounced the nearer the ground is approached

Term	Definition
	resulting in increased blade efficiency while operating in ground effect. Ground effect results from the cushion of denser air built up between the surface and helicopter by the air displaced downward by the rotor.
Ground Effect Area	The solid area that provides ground effect. Note: This area can be provided by the touch down and liftoff (TLOF) area or the touch down and liftoff (TLOF) plus a safety shelf (if installed).
Helideck	An area on a fixed or floating offshore facility designated for the landing and takeoff of helicopters, which includes, as applicable, some or all of the supporting facilities/equipment necessary for helicopter operations, such as personnel/cargo handling, parking, tiedown, fueling, maintenance, etc.
0.62D Helideck	A helideck on which the TLOF is of sufficient size to contain a circle with a diameter of 0.62D of the largest helicopter that will use the helideck.
0.83D Helideck	A helideck on which the TLOF is of sufficient size to contain a circle with a diameter of 0.83D of the largest helicopter that will use the helideck.
1.0D Helideck	A helideck on which the TLOF is of sufficient size to contain a circle with a diameter of 1.0D of the largest helicopter that will use the helideck.
Maximum Take Off Mass (Weight)	A maximum allowable helicopter weight (mass) on the helideck (TLOF) based on dynamic loads incurred during takeoff and landings. MTOM is used interchangeably in many documents as MTOW.
Legacy Helideck	Any helideck, designed, constructed, or installed prior to the initial issuance of HSAC RP 161.
Limited Obstacle Sector (LOS)	An area on the structure side of the helideck in which obstacles may be permitted within a 150 degree or less sector, provided the height of the obstacles above the level of the TLOF is limited and within a prescribed profile.
Minimum Structure	A structure with one or more of the following attributes: ▸ Structural framing which provides less reserve strength and redundancy than a typical well braced, three-leg template type platform; ▸ Free-standing and guyed caisson platforms which consist of one large tubular member supporting one or more wells; ▸ Well conductor(s) or free-standing caisson(s), which are utilized as structural and/or axial foundation elements by means of attachment using welded, non-welded, or nonconventional welded connections; ▸ Threaded, pinned, or clamped connections to foundation elements (piles or pile sleeves); ▸ Braced caissons and other structures where a single element structural system is a major component of the platform, such as a deck supported by a single deck leg or caisson.
Obstacle	All fixed (including temporary and permanent) and moveable objects or parts of these that are located in an area intended for the safe movement of helicopters or extend

Term	Definition
	above a defined surface intended to protect the helicopter or are located outside of those defined surfaces and have been assessed as a hazard to helicopters.
Obstacle-Free Dropdown Sector (OFDS)	An obstacle clear area provided below the helideck (TLOF) surface measured from the outer edge of the safety shelf or perimeter netting located around the landing area down to water level for an arc of not less than 180° that passes through the center of the landing "H" and outwards to a distance that will allow for safe clearance from obstacles below the helideck in the event of an engine failure for the type of helicopter the helideck is intended to serve.
Obstacle Free Sector (OFS)	An area free of all obstacles above helideck level outwards to a distance that will allow for an unobstructed arrival and departure path to/from the helideck for the helicopter(s) it is intended to serve.
Obstacle Sector (OS)	An area on the structure side of the helideck in which obstacles within a 180 degree sector may be permitted.
Parking Area	An area, designed to accommodate a parked helicopter of the same size and weight of the landing area design helicopter, separated from the TLOF by a parking transition area.
Reference Point	One of the below definitions used depending on the obstacle sector provided for the TLOF: ▸ **210 degree or more OFS/150 degree or less LOS Reference Point**: The apex/point-of-origin of the obstacle-free sector (OFS) and the limited obstacle sector (LOS) perimeter. ▸ **180 Degree OS Reference Point:** The point-of-origin of the obstacle sector (OS) used to define the separation of the OS from the outer edge of the safety shelf and main rotor of the helicopter.
Rotor Diameter (RD)	The diameter of a circle made by the main rotor blades while rotating.
(Perimeter) Safety Net	A netting section around the perimeter of the TLOF, and if applicable, the parking area and parking transition area, used to provide fall protection for personnel. **Note:** Perimeter safety nets do not provide ground effect.
Safety Shelf	A solid surface capable of providing ground effect around the perimeter of the TLOF and limited fall protection for personnel.
System International Units (SI)	SI units are a system of physical units based on the meter, kilogram, second, ampere, kelvin, candela, and mole, together with a set of prefixes to indicate multiplication or division by a power of ten.
Temporary Helideck	A helideck which is not part of the permanent structural design configuration of the facility that is used as a designated landing area for the pickup or discharge of passengers and cargo in support of non-typical routine operations on the platform

Term	Definition
	(such as construction and drilling activities) for a limited duration (typically less than one year).
Touchdown and Liftoff area (TLOF)	The load bearing area of the helideck on which a helicopter may touch down or lift off from.
Touchdown/Positioning Marking (TDPM)	A yellow circle or yellow line marking on the TLOF used by the pilot for guidance and obstacle clearance information while landing, taking off, or maneuvering. **Note:** The TDPM is described as the aiming circle in some previous design documents.
Variance	A deviation from the standard or an acceptable alternative means of compliance to meet the standard other than the one specified.

Table 2: Terms, Definitions, and Abbreviations

2.4 Abbreviations Used in Document

Abbreviation	Description
CFD	Computational Fluid Dynamics
FATO	Final Approach and Take-Off Area
ALARP	As Low As Reasonably Practicable
LOS	Limited Obstacle Sector
μ	See *Friction Coefficient* in **Error! Reference source not found.**
OFS	Obstacle-Free Sector
OFDS	Obstacle-Free Dropdown Sector
OS	Obstacle Sector
RD	Rotor Diameter of The Main Rotor
TDPM	Touchdown Positioning Marking
TLOF	Touchdown and Lift-Off Area
UPS	Uninterruptible Power Supply

Table 3: Abbreviations Used in Document

3. ASSESSMENT

Existing helidecks located on offshore structures should periodically, on a minimum of a five year basis, be assessed for structural integrity/damage by an engineer for it to be in conformance with the facility owner plan.

> **Note:** Some corrosion is acceptable; however significant corrosion may weaken the structural integrity of the helideck and/or the associated safety equipment (ladders, hand rails, fencing etc.).

Legacy and temporary helidecks should follow the requirements included in this Recommended Practice (RP). Where conditions are at variance with the requirements in this RP, a risk assessment, as defined in API 2SIM and Annex A of this document, should be completed by the facility owner with input from the helicopter operator.

Helideck markings should periodically be reviewed for clarity and accuracy based on the requirements in this document at least every 12 months. Any markings found to be ambiguous, erroneous, or create a hazard, or confusion should be remediated. Helideck inspections should be incorporated into the company's regularly scheduled inspection program, with minimum acceptable limits defined.

> **Note:** Helidecks designed, constructed, and installed after the initial release date of HSAC RP 161 (May 2016) should be assessed against the design criteria set forth in the latest edition of that document.

Before modification of helidecks or installation of new equipment in the vicinity of helidecks, review obstacle clearance requirements as defined in this document, review the plans with the helicopter operator and seek the endorsement of the facility owner's aviation advisory personnel.

> **Note:** Other regulations may affect helideck operations (i.e. lighting, release of combustible gases, aviation fuel systems, etc.). It is the responsibility of the operator to determine which rules/regulations/guidance are applicable and should be followed, depending upon the location, type of facility and type of operations to be conducted.

3.1 Damage

If there is visible damage to the existing helideck or the possibility of non-visible damage to the helideck, an engineering evaluation and assessment per Section 7 of API 2SIM should be performed.

If damage is suspected, a documented engineering evaluation is the minimum required course of action. The following action may be necessary to mitigate issues found during the engineering evaluation:

a) If the damaged configuration passes assessment per the loading requirements of HSAC RP 161, Section 5 and does not compromise helideck integrity/structural strength, no further action is required.

b) If specific sections of the helideck configuration are considered to be damaged beyond repair, replace the damaged sections in-kind.

c) If repair and in-kind replacement will not resolve the structural integrity issues, a retrofit to meet the required structural strength should be engineered using HSAC RP 161.

d) When the damage is attributed to corrosion and the structure passes the engineering evaluation, the corroded members should be cleaned and painted to arrest the existing corrosion and to prevent further degradation or damage.

3.2 Helideck Loading Requirements

The loading requirements shall conform to HSAC RP 161, Section 6.2

3.3 Helideck Surface

3.3.1 Helideck Surface Friction Requirements

The helideck (TLOF) surface shall be a leak free solid deck or a deck with built in sub-surface passive fire protection, so that a ground cushion is created by the rotor downwash. All materials, coverings, or coatings used shall provide a non-skid surface. The minimum average surface-friction-coefficient of 0.65µ shall be achieved on the TLOF surface and including the paint markings. It is important that adequate friction exists in all directions and in worst-case conditions, i.e. when the deck is wet.

Extruded section or grid construction aluminum (or other similar material) surfaces may provide adequate resistance to sliding without painting, but they shall be coated with a non-slip material unless friction properties have been confirmed by measurement and meet the required surface friction coefficient of 0.65µ.

Note 1: For proper testing and demonstration of frictions values, guidance can be found in UK CAP437.

Note 2: When painting any helideck surface, maintain the minimum friction coefficient of 0.65µ.

Note 3: Extruded Aluminum Helidecks are difficult to measure periodically by friction tester; therefore initial OEM testing in conformance with CAP 437 will be considered acceptable for the lifetime of the helideck surface, unless the surface is coated afterwards.

3.4 Helideck Size

Legacy helidecks shall be provided with one final approach and takeoff area (FATO) co-located with a touchdown and liftoff area (TLOF) and satisfy one of the following with preference in the order listed:

3.4.1 Legacy Helideck meets the size requirements of HSAC RP 161 including the Obstacle Free Sector (OFS), Obstacle-Free Dropdown Sector (OFDS) and Limited Obstacle Sector (LOS) as defined section 3.4.3.

The FATO may be any shape but shall be of sufficient size to contain a circle with a diameter of not less than 1.0D of the largest helicopter the helideck is intended to serve. The TLOF may be any shape, but shall be of sufficient size to contain one of the following:

a) A circle with a diameter of not less than 1.0D of the largest helicopter the helideck is intended to serve providing the TLOF is surrounded with a 5 ft (1.5 m) perimeter safety net (see Figure 1), or

b) A circle with a diameter of not less than 0.83D[1] of the largest helicopter the helideck is intended to serve providing the TLOF is surrounded with a 5 ft (1.5 m) safety shelf (see Figure 2). The TLOF together with the safety shelf must provide an area which can accommodate a circle with a diameter of not less than 1.0D.

Note 1: The size of the safety shelf or safety net and structure shall be 5 ft. (1.5 m) wide (measured horizontally from the outside of the perimeter to the outer edge of the net frame) around the perimeter.

Note 2: Figure 1 and Figure 2 below (reproduced from HSAC RP 161), indicate the TDPM, TLOF perimeter marking, and "H" marking in addition to showing the FATO, TLOF, and LOS.

Note 3: The OFS may be swung by up to 15 degrees to the avoid obstacles above or below the helideck (TLOF), see Chevron Marking for a TLOF with a LOS of 150°or less:Figure 12. Addditionally, the TDPM may be offset by a maximum of 0.1D (see 4.4.1.2 and Figure 13) to aid in improving obstacle clearances.

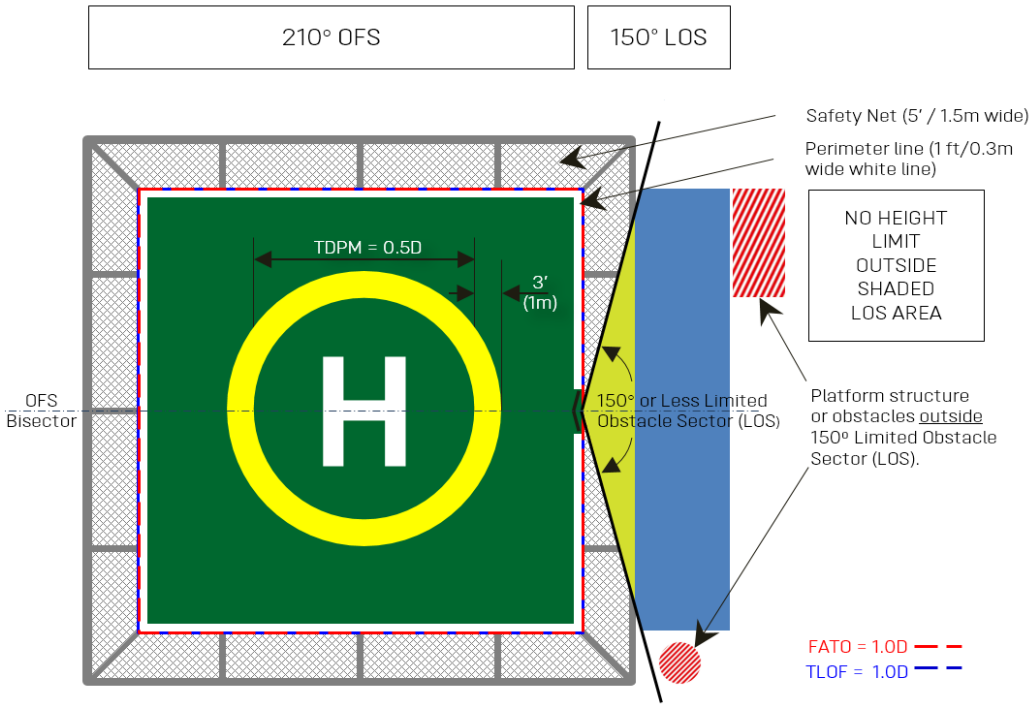


Figure 1: Square Helideck with a 1.0D FATO, a 1.0D TLOF and a 210° OFS/150° LOS

[1] 0.83D is approximately one rotor diameter (RD). 1.0D can be estimated using the relationship 1.0D = 1.2 RD and 1 RD using the relationship 1 RD = 0.83D.

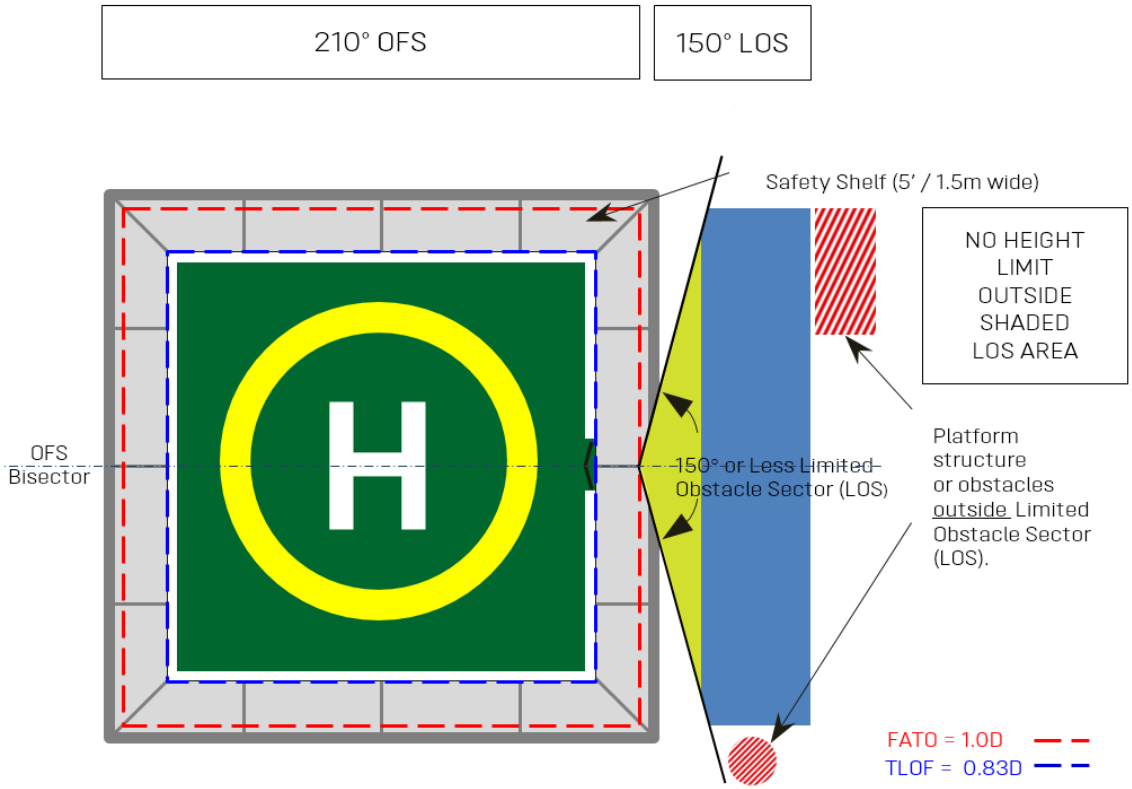


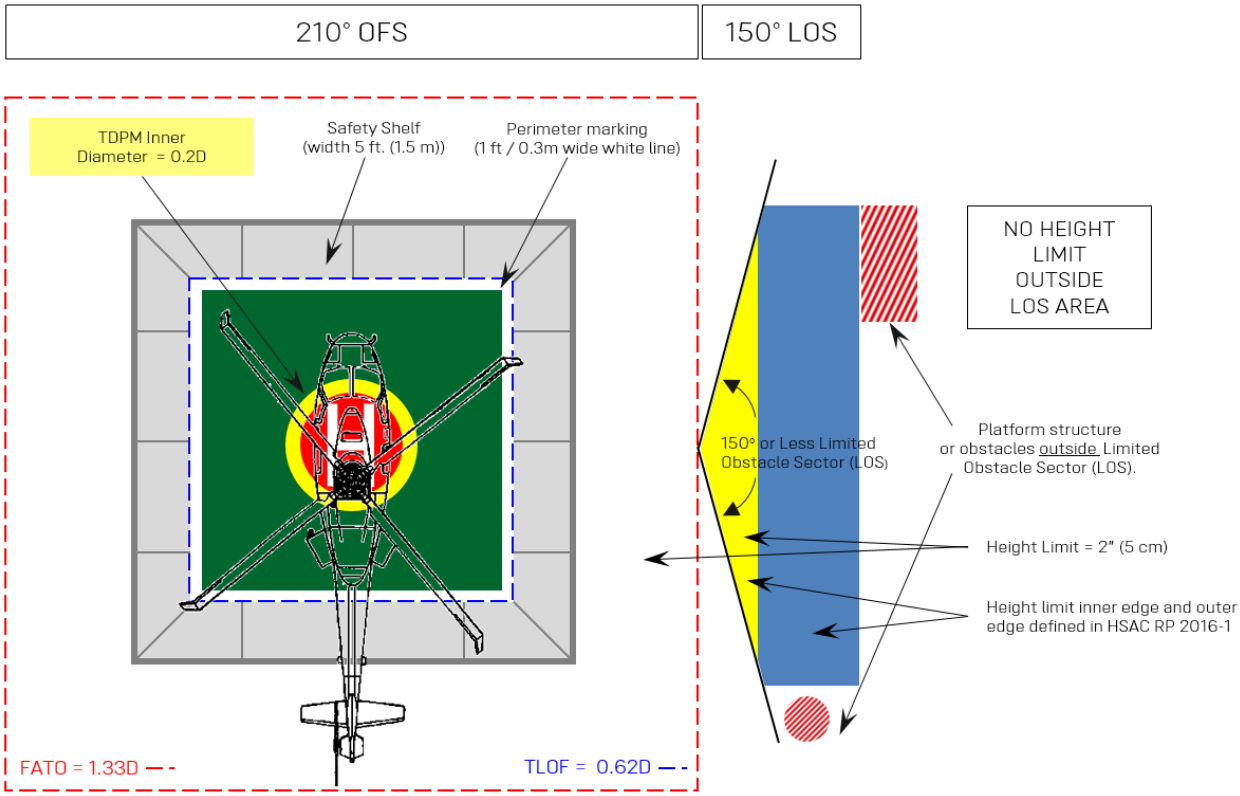
Figure 2: Square Helideck with 1.0D FATO, a 0.83D TLOF and an OFS of 210°

3.4.2 Legacy Helideck with TLOF size less than 0.83D but not less than 0.62D

The TLOF may be any shape, but shall be of sufficient size to contain a circle with a diameter less than 0.83D but not less than 0.62D of the largest helicopter the helideck is intended to serve providing the TLOF is surrounded with a 5 ft. (1.5m) safety shelf. See Figure 3: Legacy helideck with a 0.62D TLOF and a 210o OFS/150o LOS

which depicts a legacy helideck with a TLOF of 0.62D.

The FATO may be any shape but shall be of sufficient size to contain a circle with a diameter of not less than 1.33D (See Figure 3).



Note: Chevron and weight markings not shown

Figure 3: Legacy helideck with a 0.62D TLOF and a 210° OFS/150° LOS

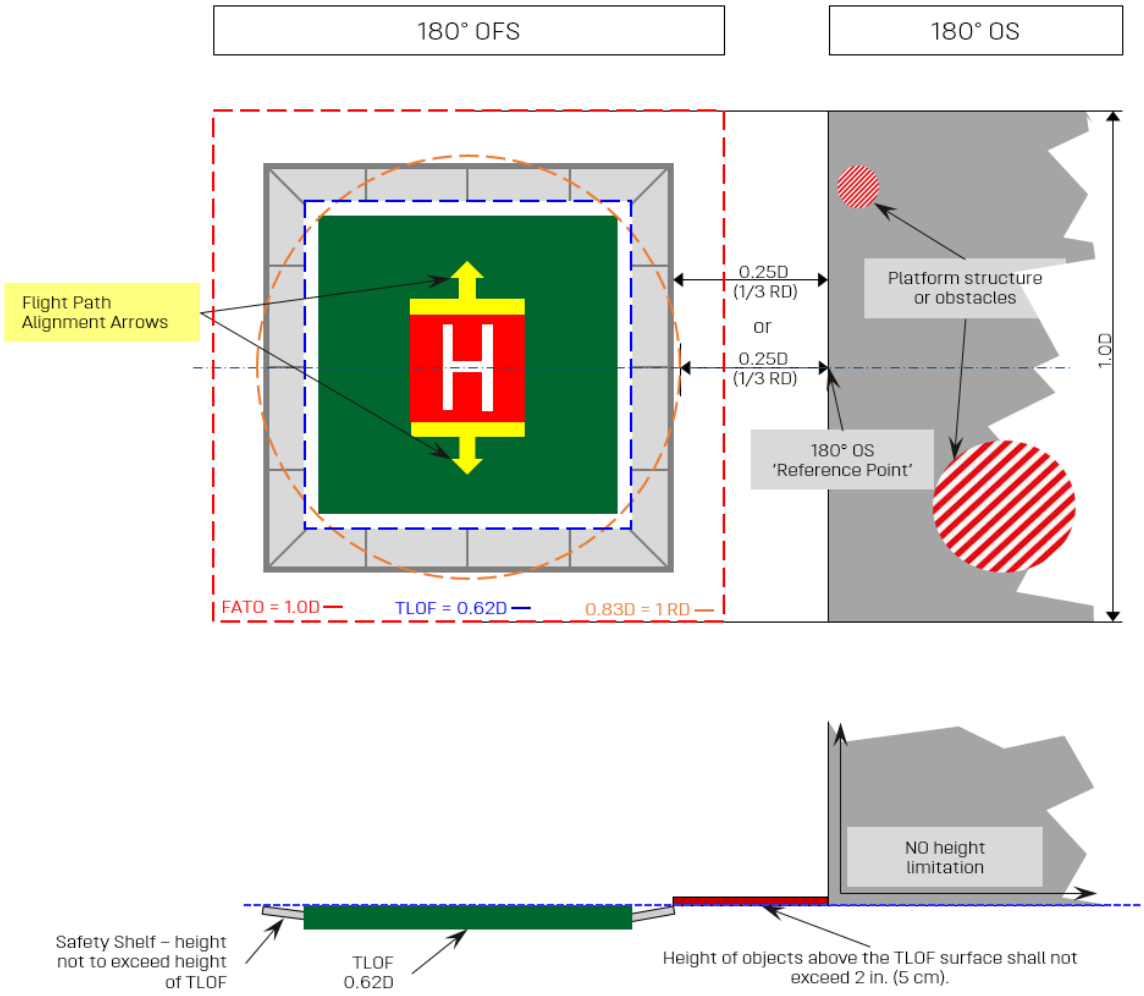
Note 1: Except for avoiding the LOS there are no limitations on the touchdown or takeoff direction.

Note 2: The red TDPM interior color indicates that the TLOF is less than 0.83D

Note 3: The interior diameter of the TDPM is 0.2D for a TLOF less than 0.83D, instead of 0.5D for a TLOF greater than or equal to 0.83D.

3.4.3 Legacy helideck with a TLOF size less than 0.83D but not less than 0.62D, and the Obstacle Free Sector (OFS), Obstacle-Free Dropdown Sector (OFDS) and Obstacle Sectors (OS) as defined section 3.4.3.

The TLOF may be any shape, and shall be of sufficient size to contain a circle with a diameter of less than 0.83D but not less than 0.62D of the largest helicopter the helideck is intended to serve providing the TLOF is surrounded with a 5 ft. (1.5m) safety shelf (See Figure 4).



Note: The 0.83D circle above does not represent the position of the actual rotor diameter of the helicopter when on the TLOF, the position of the actual rotor diameter circle would be displaced parallel to the flight path alignment arrows.

Figure 4: Legacy Helideck with a 0.62D TLOF and 180° OFS /OS where Landing/Takeoff shall be aligned with the Touchdown Alignment Arrows

3.5 Required Helideck Sectors

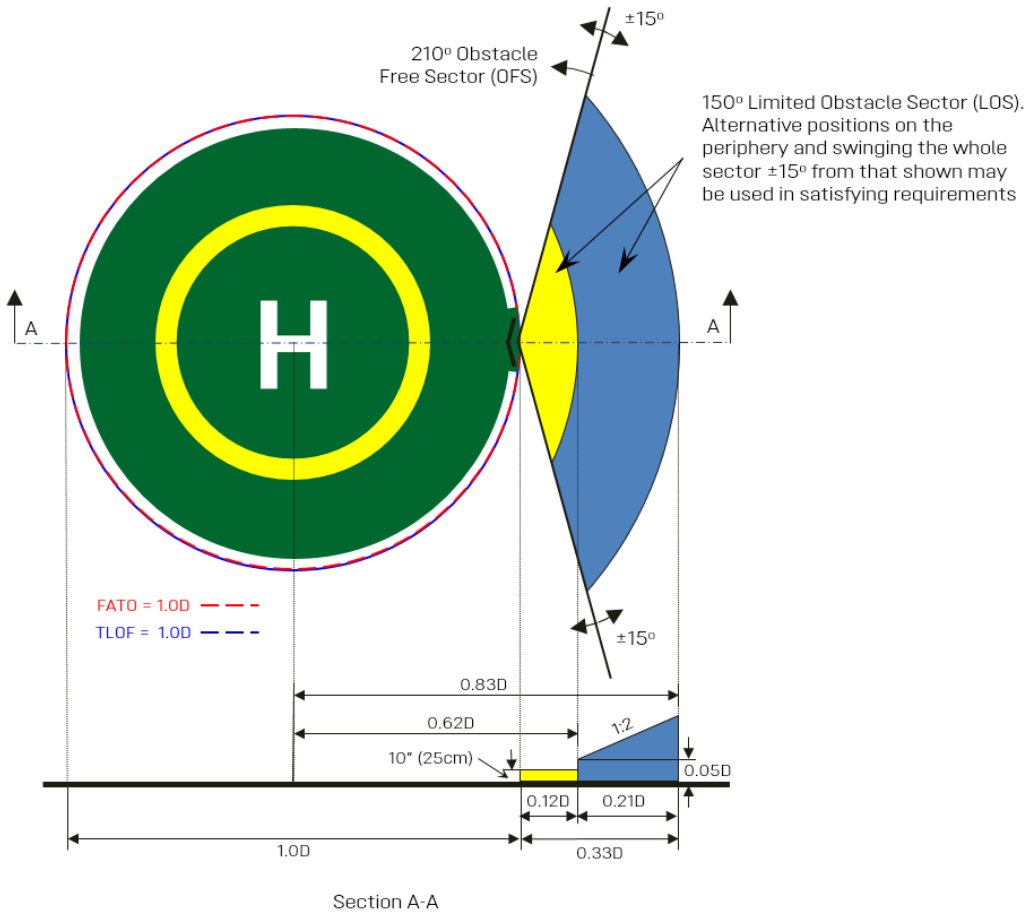
Helideck sectors that might be required are: Obstacle Free Sector (OFS), Obstacle-free Dropdown Sector (OFDS), Limited Obstacle Sector (LOS) and Obstacle Sector (OS).

A legacy helideck shall have an OFS, an OFDS, and a LOS -or- an OFS, an OFDS, an OFDS and an OS.

Note: For helidecks mounted on top of single leg (toad stool configuration) or minimum structures in accordance with API 2A-WSD, that assures a 360 degree unobstructed access above the TLOF, an LOS is not required, but a 180 degree OFDS shall still be provided.

3.5.1 Legacy Helidecks which meet the size requirements of HSAC RP 161 (≥0.83D)

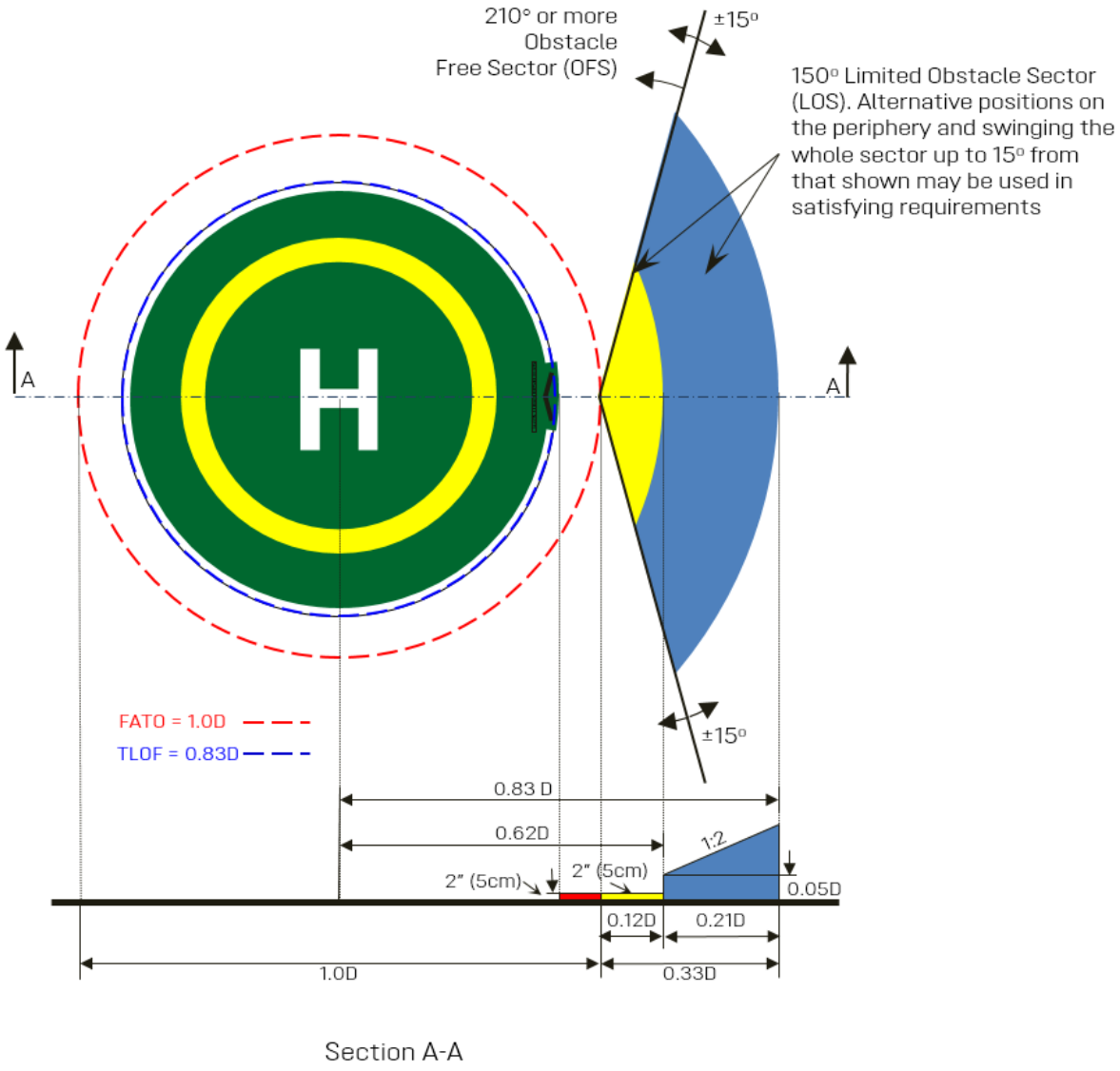
Maintain, at a minimum, the TLOF dimensions defined in HSAC RP 161 with an OFS of at least 210º, an LOS of 150º or less (See Figure 1 and Figure 2) and an OFDS of at least 180º. When objects are required to be located on the TLOF or in the FATO outside the TLOF, they should be limited in height (see Figure 5 and Figure 6).



Note: For clarity Perimeter Safety Net not shown

Figure 5: Obstacle Limitation Sector and Obstacle-free Sector for a Helideck with a Circular 1.0D FATO and 1.0D Circular TLOF

Note: If the LOS is made less than 150 degrees, the OFS should be increased by the same amount so that the LOS and OFS angle is 360 degrees. Such a decrease in the LOS will provide a larger clear area for the helicopter to operate.`



Note: For clarity Safety Shelf not shown

Figure 6: Obstacle Limitation Sector and Obstacle-Free Sector for a Helideck with a Circular 1.0D FATO and 0.83D Circular TLOF

3.5.2 Legacy Helidecks with a TLOF size less than 0.83D but not less than 0.62D and the Obstacle Free Sector (OFS) and Limited Obstacle Sectors (LOS) as defined in HSAC RP 161

Maintain the configuration defined in HSAC RP 161 with an OFS of at least 210°, and a LOS of 150° or less. (See Figure 1 and Figure 2).

3.5.3 Legacy helideck with a TLOF size less than 0.83D but not less than 0.62D, 180 Degree Obstacle Free Sector (OFS), and 180 degree Obstacle Sector (OS) with Landing/Takeoff Direction Limited to flight path trajectory remaining parallel to the established 180 degree Obstacle Sector (OS).

The flight path direction(s) shall be aligned with the Touchdown Alignment Arrows parallel to the 180° OS and with a minimum separation of 0.25D between the OS reference point and the outer edge of the safety shelf or the outer edge of the main rotor tip planeof the largest helicopter the helideck is intended to serve, whichever is greater. The length of the OS parallel to the flight path shall be 1.0D. There are no width limitations. See Figure 4: Legacy Helideck with a 0.62D TLOF and 180o OFS /OS where Landing/Takeoff shall be aligned with the Touchdown Alignment Arrows

Note 1: There is no limitation on the height of objects in the OS. See Figure 10 and Figure 11.

Note 2: 0.25D is approximately 1/3 RD

3.5.4 Obstacle-Free Dropdown Sector

For helidecks with a TLOF that is 0.83D and larger, the requirements in HSAC RP 161 should be used. See Figure 7.

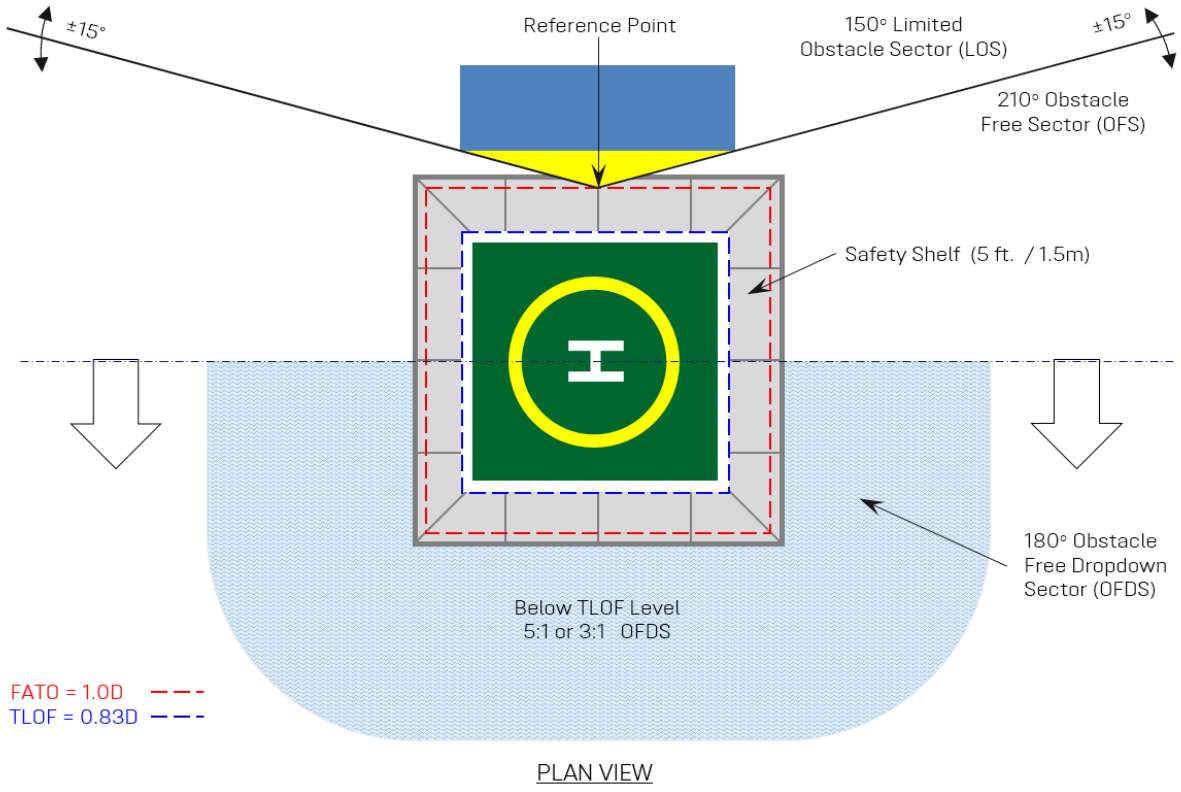


Figure 7: Obstacle Free Sector, Limited Obstacle Sector and Obstacle Free Dropdown Sector for Helideck with 0.83D TLOF

For legacy helidecks with a TLOF that is less than 0.83D and larger than or equal to 0.62D with an OFS of at least 210° and an LOS of 150° or less, the requirements below should be used.

a) Below the TLOF level, within the same arc as the OFS, the OFDS should extend downward from the outer edge of the safety shelf at an elevation corresponding to that of the TLOF to the water level; within an arc of not less than 180 ° with the origin at the center of the 'H' and outwards to a distance that will allow for safe clearance from the obstacles below the helideck; see Figure 7, Figure 8 and Figure 9.

b) The OFDS should have a falling gradient with a ratio of five units vertically to one unit horizontally (5:1) from the outer edge of the safety net or safety shelf within the 180° sector.

c) For helidecks designed for the use of only multi-engine helicopters, the horizontal component of the falling gradient within the 180° sector may have a less demanding ratio of three units vertically to one unit horizontally (3:1); see Figure 9.

Note: The obstacle-free dropdown sector properties may need adjustment depending upon the performance of the selected helicopter and height of the helideck above the sea. The aircraft manufacturer should be able to provide the necessary technical data and in most cases this is included in the helicopter flight manual.

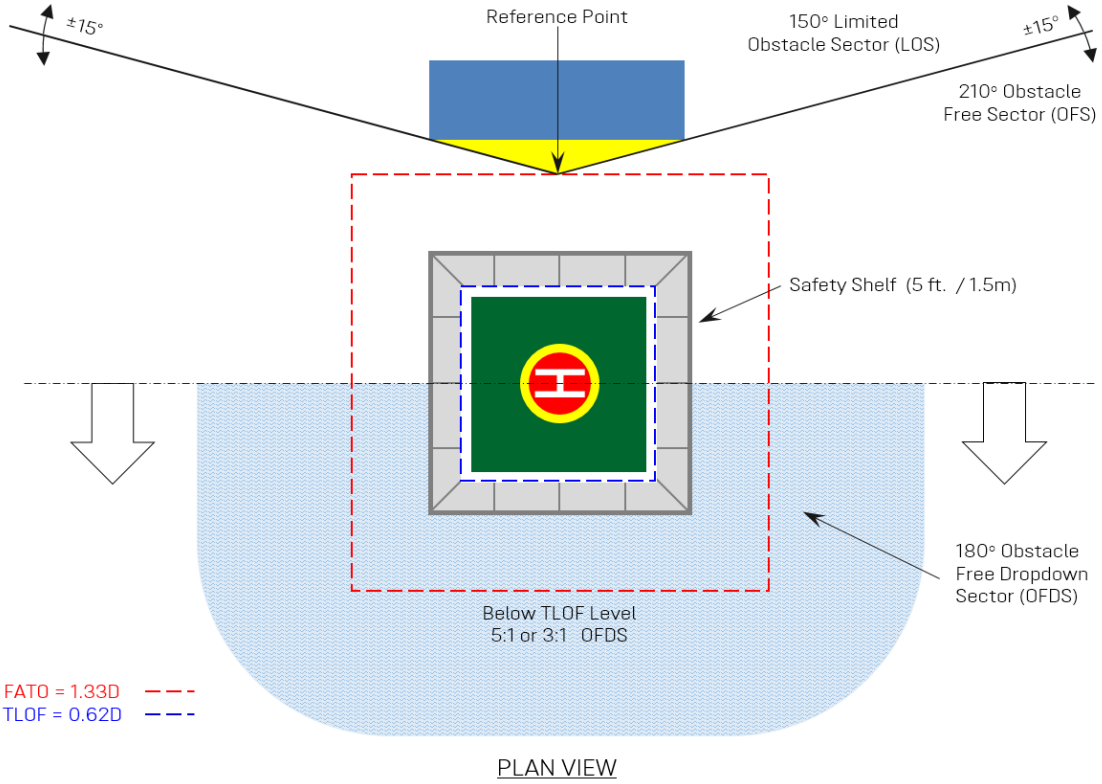


Figure 8: Obstacle Free Sector, Limited Obstacle Sector and Obstacle Free Dropdown Sector for Helideck with 0.62D TLOF

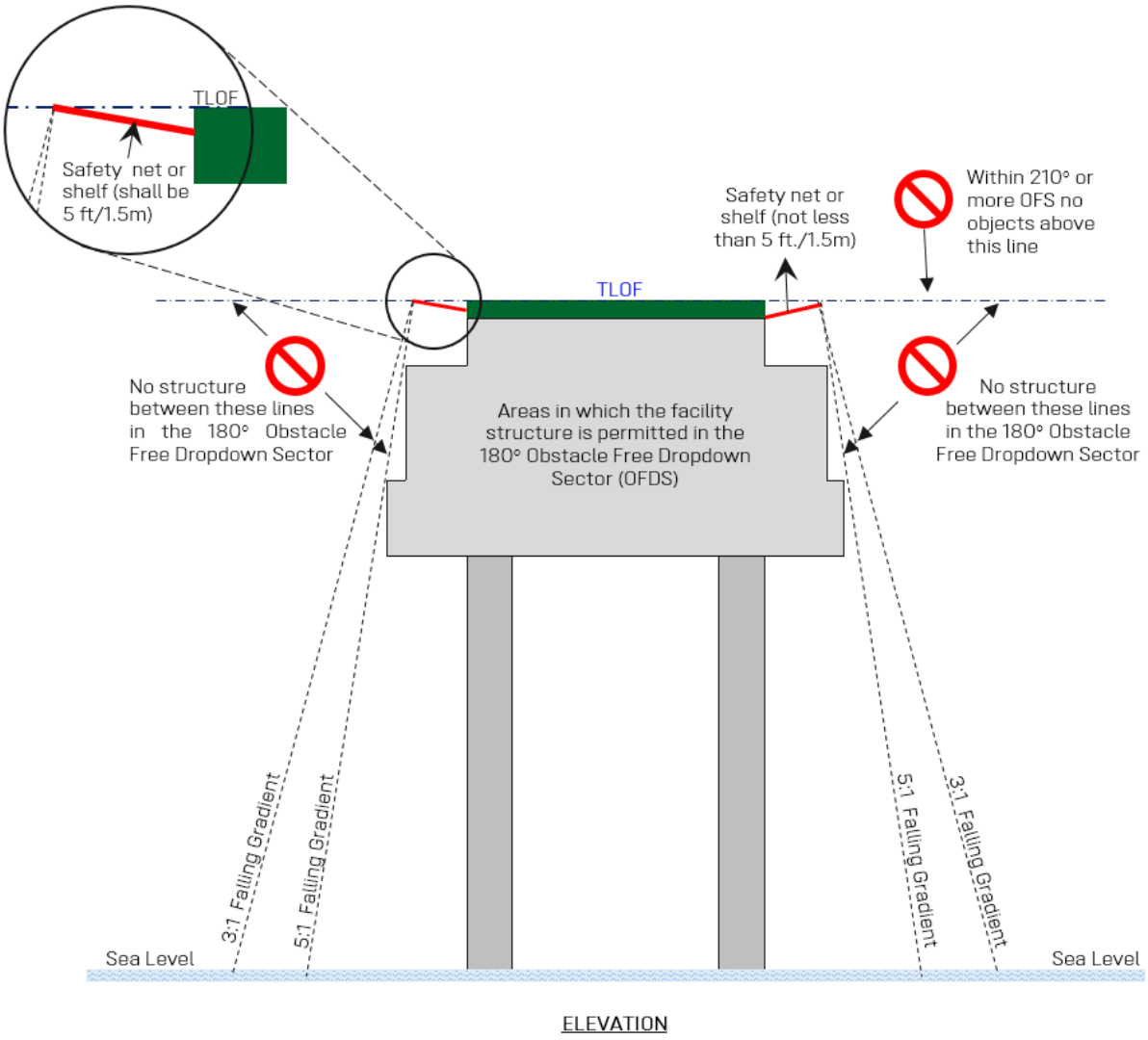
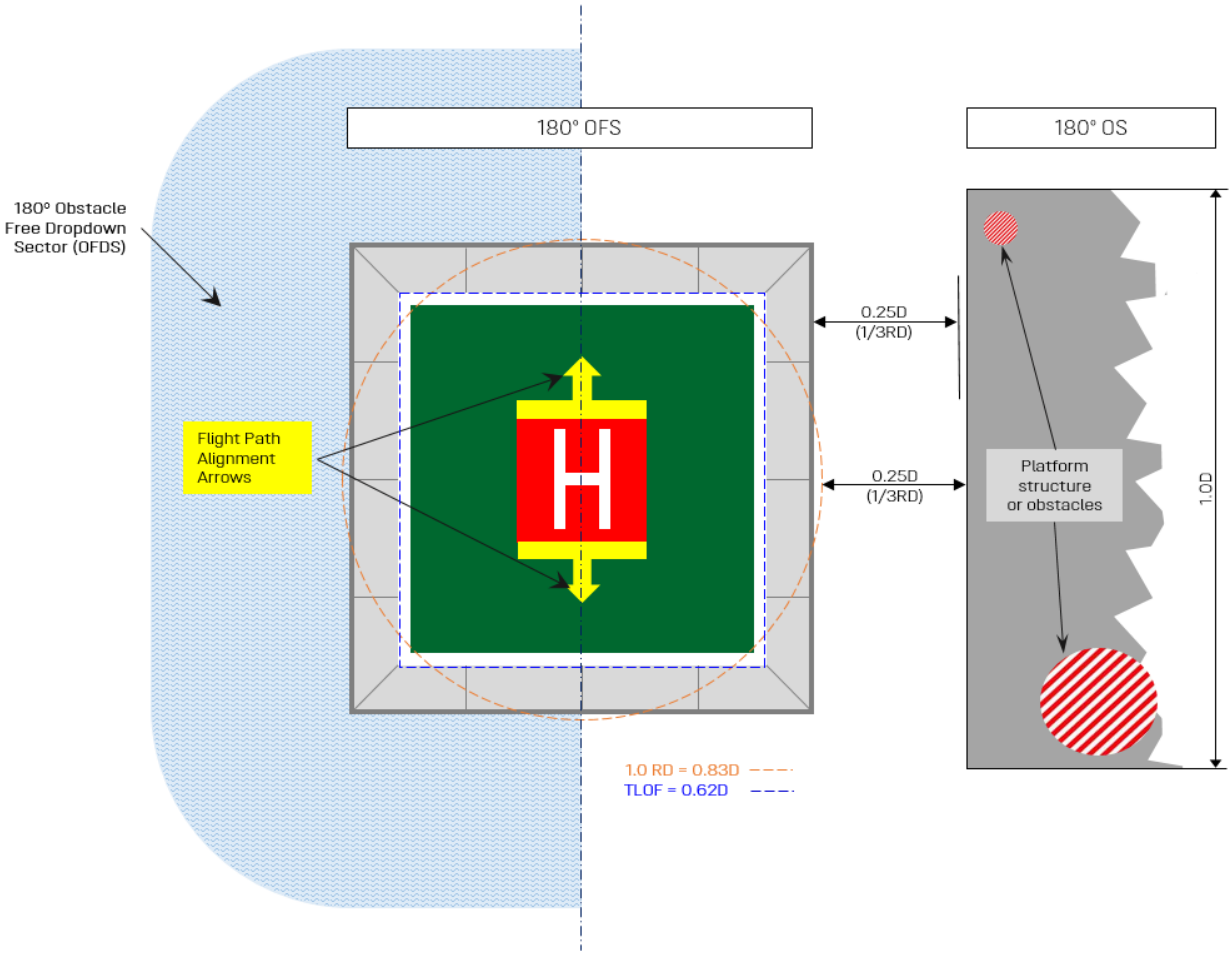


Figure 9: Obstacle Free Sector (OFS) and Obstacle Free Dropdown Sector (OFDS)

For legacy helidecks with an 180° OFS and an 180° OS and a TLOF with a landing/takeoff direction aligned with the Touchdown Alignment Arrows (parallel to the 180° OFS/OS), the following requirements below should be used:

a) The requirements listed in paragraph 3.5.4 subparagraphs b) and c) shall be followed.

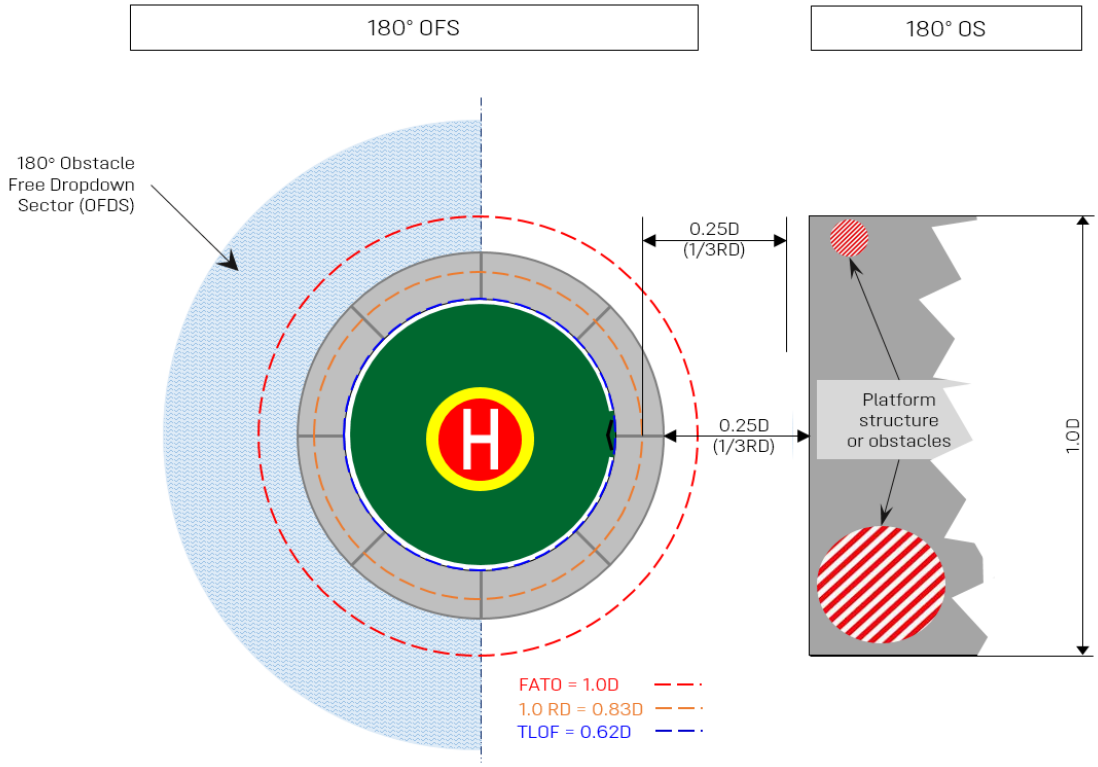
b) Below the TLOF level, the OFDS should extend downward from the outer edge of the safety shelf at an elevation corresponding to that of the TLOF to the water level; within an arc of not less than 180° with the origin at the center of the 'H' and outwards to a distance that will allow for safe clearance from the obstacles below the helideck; see Figure 7, Figure 8 and Figure 9.



Note: The 0.83D circle above does not represent the position of the actual rotor diameter of the helicopter when on the TLOF, the position of the actual rotor diameter circle would be displaced parallel to the flight path alignment arrows.

Figure 10: Obstacle Free Dropdown Sector for TLOF with Landing/Takeoff Direction Aligned with the Touchdown Alignment Arrows (parallel to the 180° OFS /OS)

Note: The red square TDPM indicates that turning on the TLOF is not permitted as obstacle clearances are not assured.



Note: The 0.83D circle above does not represent the position of the actual rotor diameter of the helicopter when on the TLOF, the position of the actual rotor diameter circle would be displaced parallel to the flight path alignment arrows.

Figure 11: Obstacle Free Sector, Obstacle Sector and Obstacle Free Dropdown Sector for Helideck with 0.62D Circular TLOF

3.5.5 Swinging the OFS/LOS

The OFS and LOS may be swung (rotated) to avoid obstacles above or below the helideck (TLOF) by up to 15° in either direction. The option for a 15° clockwise swing is illustrated in the following Figures:

a) Figure 5: Obstacle Limitation Sector and Obstacle-free Sector for a Helideck with a Circular 1.0D FATO and 1.0D Circular TLOF,

b) Figure 6: Obstacle Limitation Sector and Obstacle-Free Sector for a Helideck with a Circular 1.0D FATO and 0.83D Circular TLOF,

c) Figure 7: Obstacle Free Sector, Limited Obstacle Sector and Obstacle Free Dropdown Sector for Helideck with 0.83D TLOF,

d) Figure 8: Obstacle Free Sector, Limited Obstacle Sector and Obstacle Free Dropdown Sector for Helideck with 0.62D TLOF, and

e) Figure 13: Displaced TDPM for a 1.0D TLOF.

If the 210º (or larger) OFS is swung, then the 180º OFDS with a 3:1 or 5:1 falling gradient shall also be swung the same angle. This also changes the location of the LOS, but in all cases the chevron will be at the apex of the LOS. If the OFS is swung the "H" shall also be swung by a corresponding angle, and the "H" crossbar should remain parallel to the bi-sector of the OFS as illustrated in Figure 12.

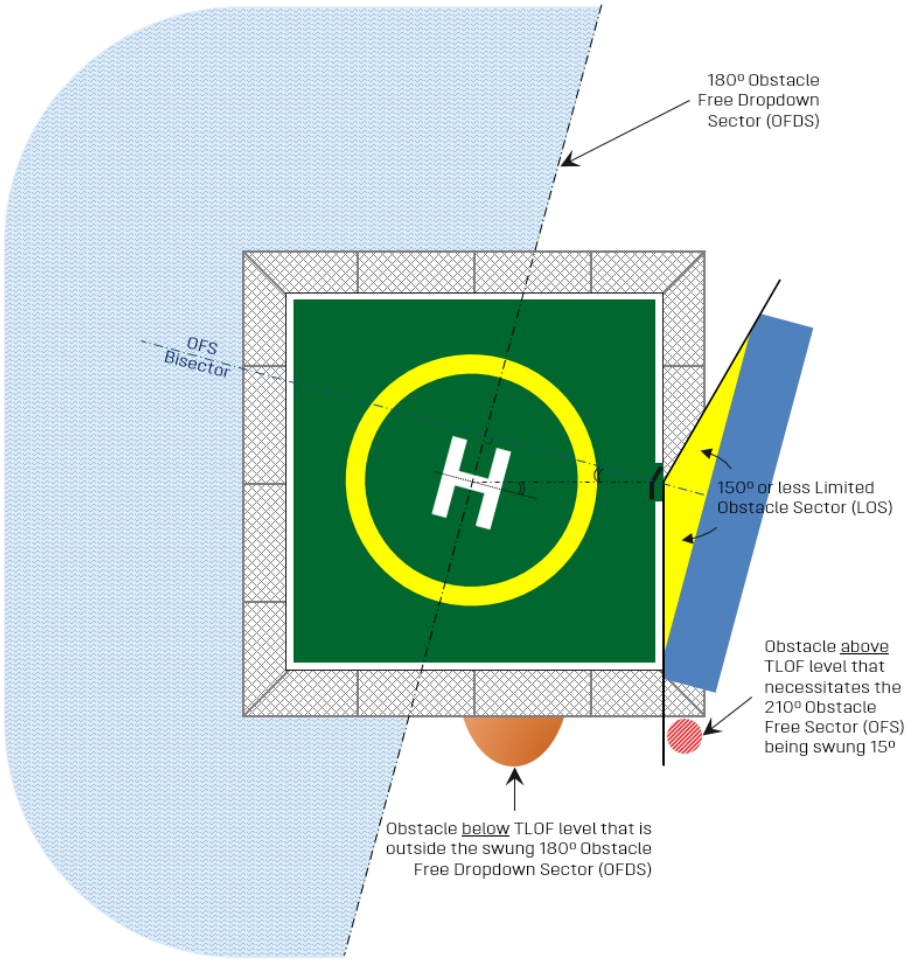


Figure 12: OFS Sector Swung by 15 Degrees

3.6 Tie-down Points

A minimum of four tie-down points shall be provided for securing the helicopter to the TLOF when the TLOF does not meet the (≥0.83D) size requirements of HSAC RP 161. These tie-down points should be recessed where practical. If not recessed, the tie-downs constitute a landing gear hazard and require obstruction marking (see paragraph 4.9).

The tie-down points should be arranged so as to secure one helicopter in the middle of the TDPM. The tie-down points should be so located and of such strength and construction as to be suitable for securing the

largest helicopter the helideck is designed to accommodate, and the range of helicopters anticipated to use the helideck, during the maximum anticipated environmental conditions.

For helidecks that meet the (≥0.83D) size requirements of HSAC RP 161, the tie-down requirements in that document shall be followed.

3.7 Drainage

The TLOF surface should be provided with adequate surface drainage arrangements and a free-flowing collection system that will quickly and safely direct any standing water, fuel spillage and/or firefighting media away from the helideck surface to a safe place on the facility and to prevent liquids from spreading to, or spilling onto, accommodation spaces or working spaces.

3.8 Access and Egress

The location of access and egress stairways or ladders should be determined from platform configuration, equipment arrangement, and safety objectives. When possible, the access and egress routes should be outside the TLOF. One route should be located remotely from the other; limited to emergency use and so marked to prohibit normal passenger flow.

The helideck should be provided with a primary access and an egress route. Where practical, there should be a protected passenger waiting area at a minimum of 7 ft. (2.0 m) below the elevation of the TLOF surface. Where a secondary route is provided, it should be limited to emergency use only, and normal passenger use is prohibited. When practical, improvements to the access and egress routes should be made by following the guidance provided in HSAC RP 161 Paragraph 5.4.

> **Note 1:** Where structures have only one access route (and one egress route) it should be documented in the helideck information plate (HIP) (see HSAC RP 164).
>
> **Note 2:** Two personnel access and egress routes (one primary and one secondary), is the preferred configuration when practicable.

3.8.1 Handrails

For normally manned installations, the installation of handrails associated with helideck access/egress should be considered.

Where handrails associated with helideck access/escape points are to be installed or are already installed they should be retractable, collapsible or removable. When retracted, collapsed or removed the handrails should not impede access/egress. Handrails which are retractable, collapsible or removable should be painted or marked using other visual materials in a contrasting (preferably black and yellow) color scheme See Figure 5, Figure 6 and Figure 4 for allowable height (either 2 in. (5 cm) or 10 in. (25 cm) as applicable) above the TLOF).

> **Note:** The use of steep stairways or ladders should be limited, where possible, to minimum structures.

3.9 Air Turbulence

Air turbulence requirements for Legacy and Temporary Helidecks shall satisfy one of the following:

a) Meet the requirements of HSAC RP 161.

b) Provide an unobstructed minimum air gap of 6 ft. (1.8 m) between the TLOF and any building roof.

c) Maintain the current air gap if a risk assessment justifies maintaining the current configuration. Annex A provides guidance on risk assessments.

3.10 Perimeter Safety Net and Safety Shelf

The helideck should be fitted with a 5 ft. (1.5 m) wide (measured horizontally from the outside of the perimeter to the outer edge of the net frame) perimeter safety net or safety shelf for fall protection of personnel around the perimeter, except at stairwells where the perimeter safety net or safety shelf should extend completely around the opening. The perimeter safety net or safety shelf need not extend around stairways oriented perpendicular to the helideck perimeter. The perimeter safety net or safety shelf should provide an outward and upward inclined surface of 10 degrees beginning below the helideck (TLOF). The outer edge should not protrude above the height of helideck (TLOF).

A flame retardant, ultra violet (UV) resistant safety net/shelf to provide fall protection for personnel must be installed around the helideck as prescribed in HSAC RP 161 and capable of supporting 300 lbs. (136kg) at any point, unless safety is ensured by another form of construction around the helideck.

Safety shelves will have these design features in addition to those required for a safety net:

a) Painted or constructed of materials in contrasting color to the helideck surface, normally yellow.

b) Constructed of corrugated materials and may be covered with chain link fencing, if desired.

c) Include an outer grab rail painted red.

Note 1: If the TLOF is less than 1.0D a safety shelf shall be provided.

Note 2: A solid safety shelf instead of a safety net can reduce the turbulence problems from adjacent structures located near helidecks and will serve to disperse the burble effect of the wind and in addition to provide an increased ground effect area. Additionally, the maintenance requirements are significantly less for a safety shelf as periodic drop testing of panels is not required as it is for perimeter safety nets. Safety shelves should be painted in colors contrasting to the TLOF surface (preferably gray).

4. MARKINGS

4.1 General

Helideck markings are used by pilots to obtain a final pre-landing confirmation that the correct helideck is being approached. Markings also provide additional information regarding the suitability of the helideck for the helicopter type being flown. Some markings provide safety information for pilots. It is therefore vital the helideck markings are maintained in the best possible condition, regularly re-painted and kept free of all visibility-reducing contaminants. Helideck owners/operators should ensure specific inspection, re-painting maintenance procedures, and schedules for helideck markings taken into account the importance of their purpose. Additionally, helideck markings should be clearly displayed in such positions on the TLOF so they can be easily identified from the air at all normal angles and directions of approach. Where possible, markings from HSAC RP 161 should be used. However, due to limited space available on TLOFs less than 0.83D, the markings in this RP have in some cases been downsized or altered to allow the smaller legacy decks to safely continue to support helicopter operations.

4.2 Color Use

TLOF perimeter line, touchdown/positioning and other markings for normal helicopter operations should be provided. The majority of the markings are either white or yellow and should contrast when painted on the dark green painted TLOF surface. Some aluminum helidecks may not have the green painted TLOF surface. The conspicuity of the white or yellow markings on these helidecks can be improved by outlining it, on one or both sides, in black outline of 4 inches (10 cm) width. Additionally, red is reserved for the following markings:

a) The inner area of a TDPM for helidecks with a TLOF of less than 0.83D.

b) Weight (mass)/size limitation marking,

c) "EXIT" marking, and

d) General obstruction markings.

Helideck (TLOF) textual markings require maximum legibility while minimizing the area being occupied by the lettering and numbers on the helideck and should be in contrasting color to the background color. All textual markings on helidecks should use the Clearview Hwy 5-W as the standard font type. However, where horizontal spacing has to be reduced in order to keep helideck markings from overlapping, the horizontal width restricted variant Clearview Hwy 5-W(R) may be used. Details and diagrams regarding the Clearview Hwy 5-W and 5-W(R) font type are provided in Annex D in HSAC RP 161.

> **Note:** The letters and numbers in the HSAC RP 161 Annex D charts are based on upper case letter height of 4 in. (10 cm) and should be scaled (adjusted) to the height defined in this document for the various markings.

4.3 TLOF Perimeter Line Marking

The requirements defined in HSAC RP 161 Paragraph 7.2 should be followed. I.e. a 1 ft. (0.30 m) wide solid white line should be used to mark the perimeter of the TLOF.

4.4 Touch-Down/Positioning Marking (TDPM)

The touchdown/positioning marking is the aiming point for a normal touchdown (landing) so located that when the pilot's seat is over the marking, the whole of the undercarriage will be within the TLOF and all parts of the helicopter will be clear of any obstacles by a safe margin. The TDPM also provides the same protection (clearance) when maneuvering/turning operations on the TLOF are allowed.

The relationship of the TLOF and TDPM to the LOS is shown in Figure 3 and Figure 4 for a 0.62D TLOF.

The interior of the TDPM shall be RED in color for any TLOF that is less than 0.83D.

> **Note:** The TDPM with a 180º OFS/OS does not allow maneuvering/turning operations on the TLOF, see 4.4.2.

4.4.1 **For Legacy helidecks with a 210º or more OFS and a 150º or less LOS, the TDPM requirements below should be used.**

4.4.1.1 For helidecks with a TLOF of 0.83D or greater:

The TDPM shall be marked as specified in HSAC RP 161. This requires a TDPM circle with an inner diameter of 0.5D and a 3 ft. (01 m) wide yellow line. See 4.7.2 for marking of the displaced obstacle chevron.

> **Note:** The interior area of the 0.5D inner diameter should be the same color as the TLOF.

4.4.1.2 Offset TDPM.

An offset TDPM (see Figure 13) can aid in improving obstacle clearances for the following:

a) The 150 degree or less LOS does not meet design requirements,

b) 0.25D (1/3 RD) parking transition area (PTA) between the TLOF and a parking area.

When offsetting the TDPM is being considered, a risk assessment (Annex A) should be undertaken and documented confirming that such an offset is warranted and can be accomplished without compromising safety.

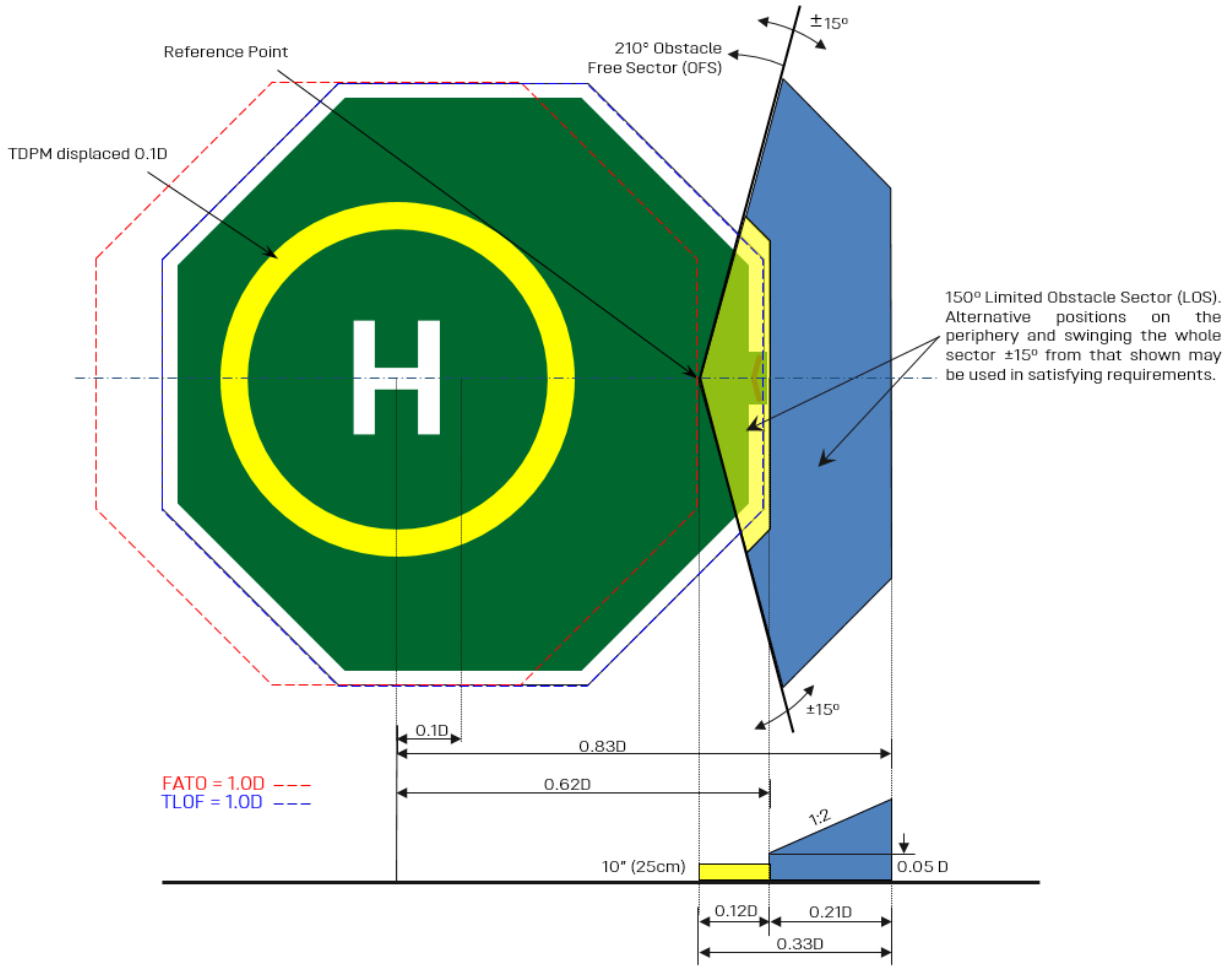


Figure 13: Displaced TDPM for a 1.0D TLOF

4.4.2 Legacy Helidecks with a TLOF of less than 0.83D but not less than 0.62D with a 210°or more OFS and a 150° or less LOS

The inner diameter of the TDPM circle shall be 0.2D as illustrated on the right hand side of Figure 14. The width of the yellow line of the circle shall be 1.5 ft./(0.45 m). See also Figure 3.

> **Note:** The interior of the TDPM shall be RED in color for any TLOF that is less than 0.83D to draw attention to the fact that the TLOF is smaller than that associated with new build helidecks defined in HSAC RP 161 and sized to ≥0.83D.

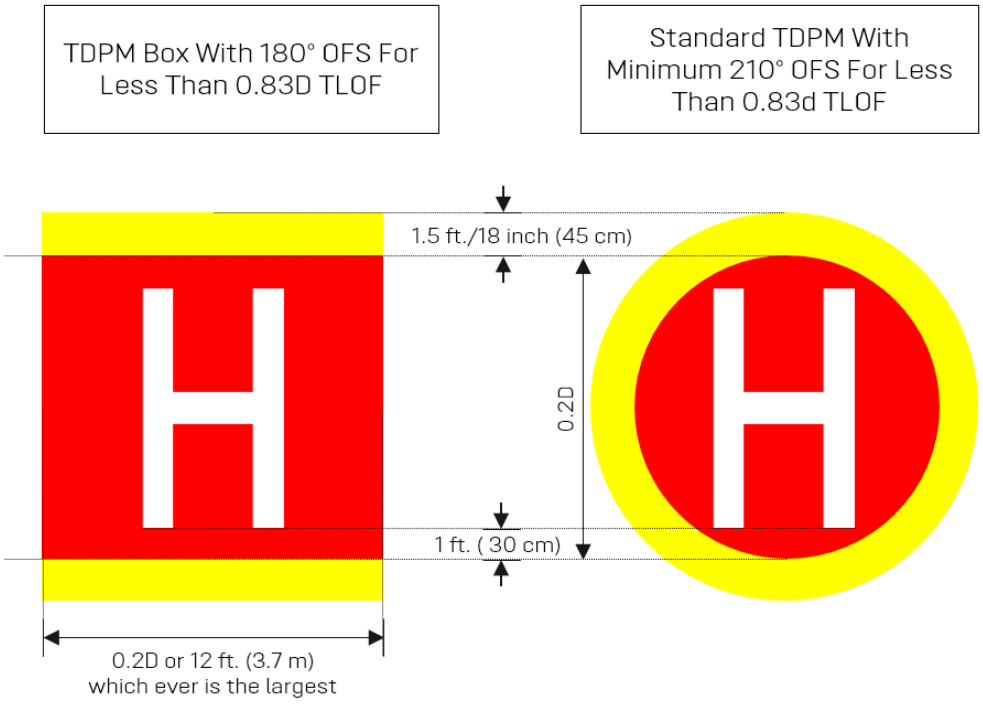


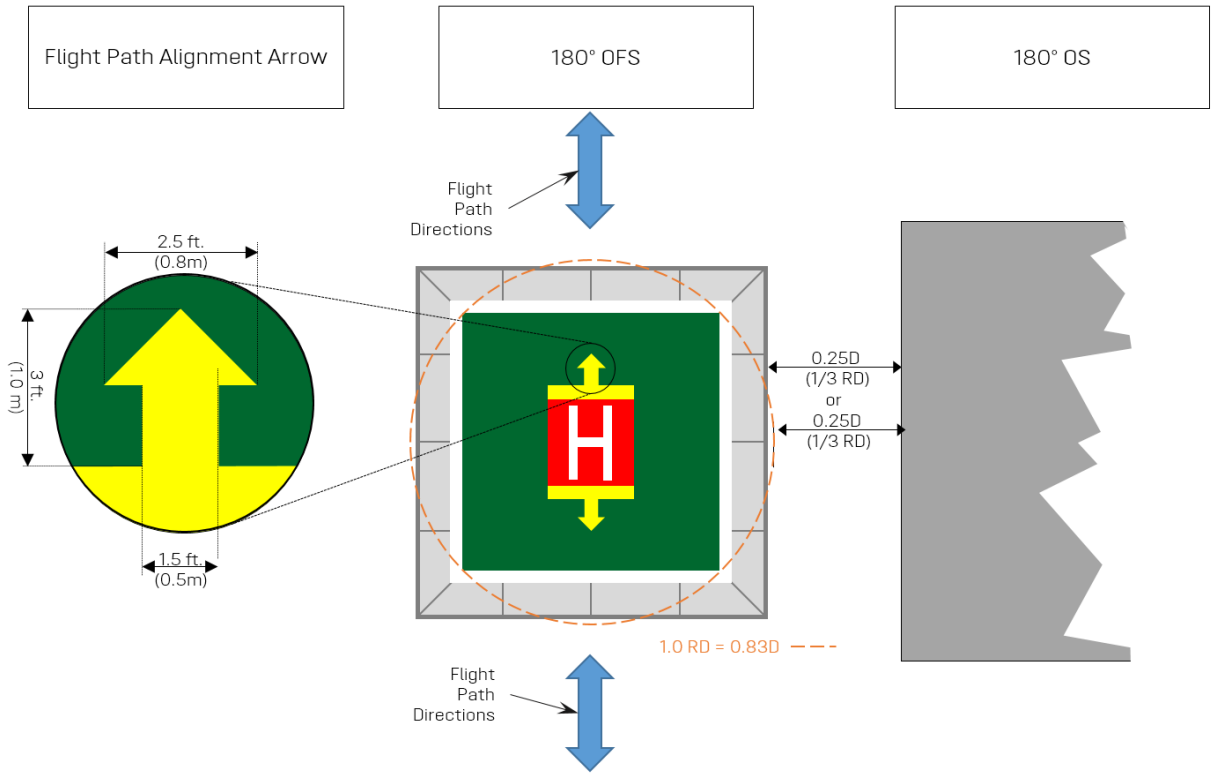
Figure 14: TDPM and H Marking for a Helidecks with a 0.62D to less than 0.83D TLOF

4.4.3 Legacy Helidecks with a TLOF of less than 0.83D but not less than 0.62D with a 180° OFS and a 180° LOS

The height of the TDPM 'box' shall be 0.2D and the width shall be 0.2D or 12 ft. (3.7 m) whichever is greater (as illustrated on the left hand side of Figure 14). The width of the yellow lines shall be 1.5 ft./(0.45 m). The touchdown alignment arrow shall be 30 in. (0.8 m) wide and 3 ft. (1.0 m) tall. See Figure 4 showing the marking on a TLOF with the TDPM 'box'.

Note 1: The interior of the TDPM shall be RED in color for any TLOF that is less than 0.83D to draw attention to the fact that the TLOF is smaller than would be associated with new build helidecks defined in HSAC RP 161.

Note 2: To ensure 0.25D (1/3RD) separation from the LOS is maintained during landing, the pilot should land on the TDPM with pilot seat over the TDPM horizontal yellow marking and the centerline indicated by the Flight Path Alignment Arrow. See Figure 4, Figure 14 and Figure 15. No maneuvering is allowed except for forward or backward movement to align with the TDPM and Flight path Alignment Arrows.



Note: The 0.83D circle above does not represent the position of the actual rotor diameter of the helicopter when on the TLOF, the position of the actual rotor diameter circle would be displaced parallel to the flight path alignment arrows.

Figure 15: Example of the TDPM for a Square Helideck with a 180° OS

4.4.4 TDPM for a Circular Helideck (TLOF) with a 360° OFS:

If the OFS is 360° with no obstacles above and below the TLOF, and the helicopter can land/takeoff in any direction, then the TDPM as described in Figure 14 (right side) should be a circle with size of the inner diameter of 0.2D and as depicted on a TLOF in Figure 3. No chevron marking is required since no obstacles are present above the TLOF level.

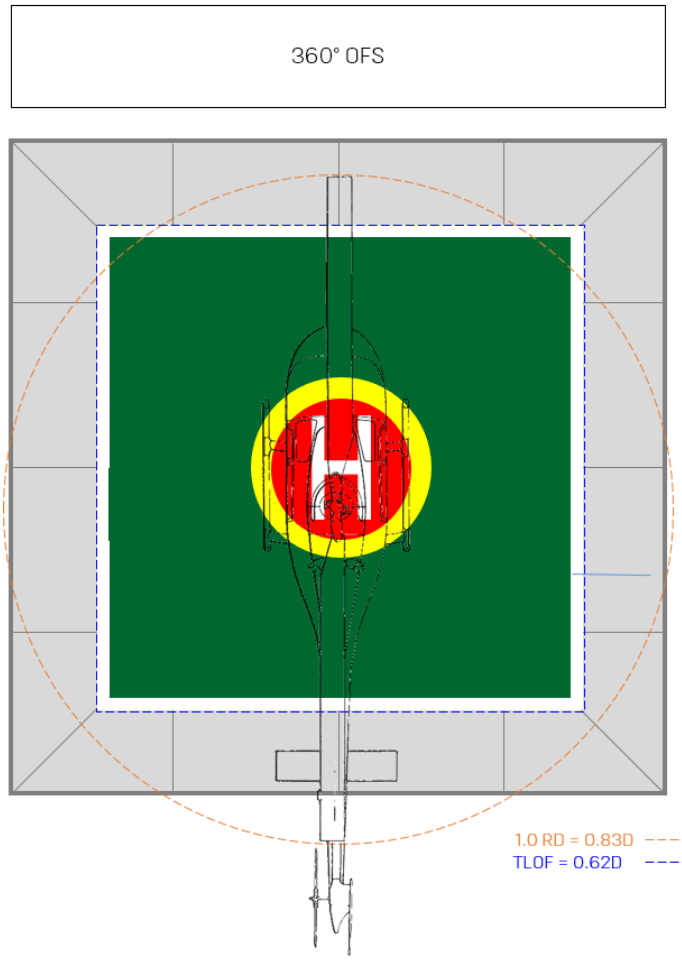


Figure 16: TDPM for 0.62D TLOF with a 360° OFS

4.5 'H' Marking

In HSAC RP 161 the height of the 'H' is 4m for a TLOF size that exceeds 0.83D. For helidecks less than 0.83D the height will be reduced to 10 ft. and the height will need an additional reduction if the TDPM marking is 0.2D and the D-value for the largest helicopter using the Helideck is less than 55 ft. (i.e. if 0.2D is less than 11 ft). For such helidecks the size/height of the 'H' will need to be adjusted so it 'fits' inside the 'red circle' and 'red box'. See Figure 14, Figure 15 and notes below.

Note 1: For example, the height of the 'H' required for a 0.2D circular TDPM designed for the Sikorsky S-76 will be 8.5 ft. (2.6 m) and for Bell 206L4 6.5 ft. (2.0 m) the overall width and 'line widths' of the 'H' will also need to be decreased by a corresponding amount as illustrated in Figure 14 and Figure 19.

Note 2: The separation between the 'legs' of the 'H' and the edge of the TDPM is driven by the need to fit the 'H' within the circular TDPM. See Figure 14. If only a TDPM for a 180°OFS is considered the separation can be reduced to 6 in. (15 cm).

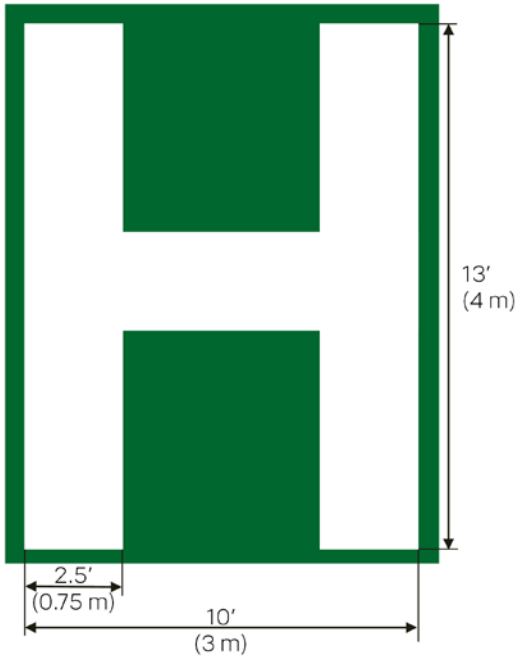


Figure 17: "H" Marking For helidecks with TLOF greater than or equal to 0.83D

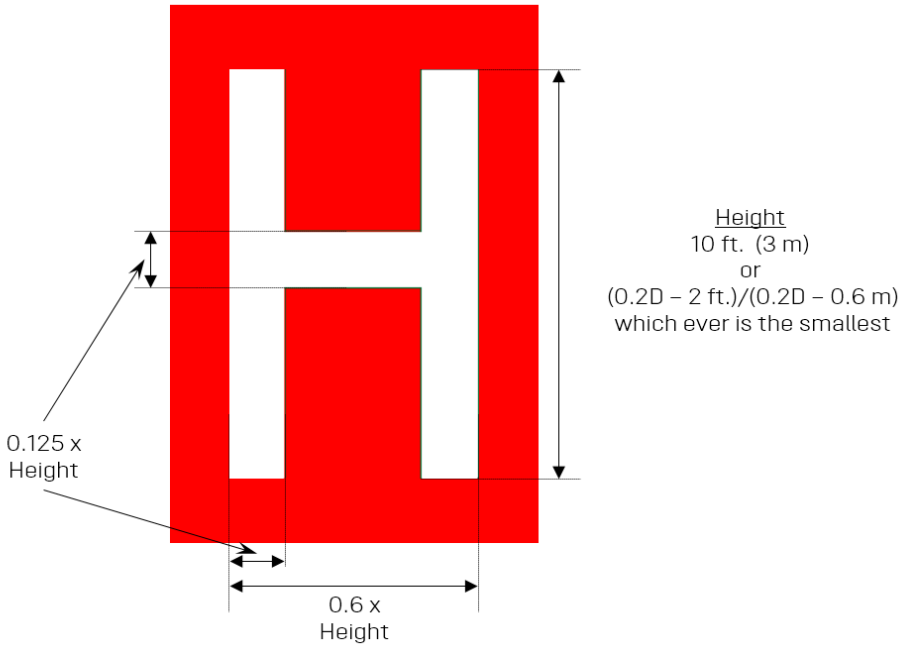


Figure 18:"H" Marking for helidecks with TLOF between 0.62D and 0.83D

4.6 Helideck Weight (Mass) and Size Limitation Markings

4.6.1 For TLOFs 0.83D and larger HSAC RP 161 shall be used.

4.6.2 For TLOFs less than 0.83D the following shall be used:

The marking of maximum allowable weight (mass) limit, D-value and the actual TLOF dimensions are required on all TLOFs, but on helidecks with a TLOF of less than 0.83D it is difficult to mark since space is limited. Where a three-tier box defined in HSAC RP 161 Paragraph 7.6 and shown in Figure 19 will not fit, a two-tier box may be used for the 'weight' (mass) and the D-value, and the TLOF dimensions are indicated in a separate box as shown in Figure 20. The size of the numbers and letters should be 2 ft. (0.6 m).

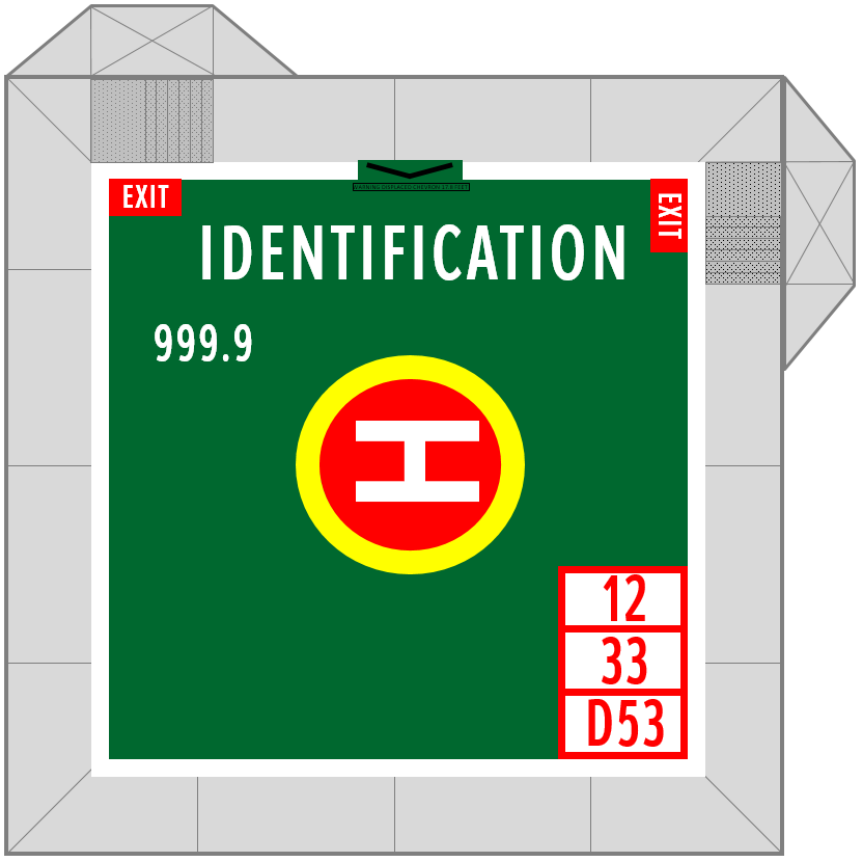


Figure 19: D-value, TLOF Size and Weight Markings for a Square 0.62D TLOF (i.e. medium size twin engine transport helicopter, like a Sikorsky S-76C)

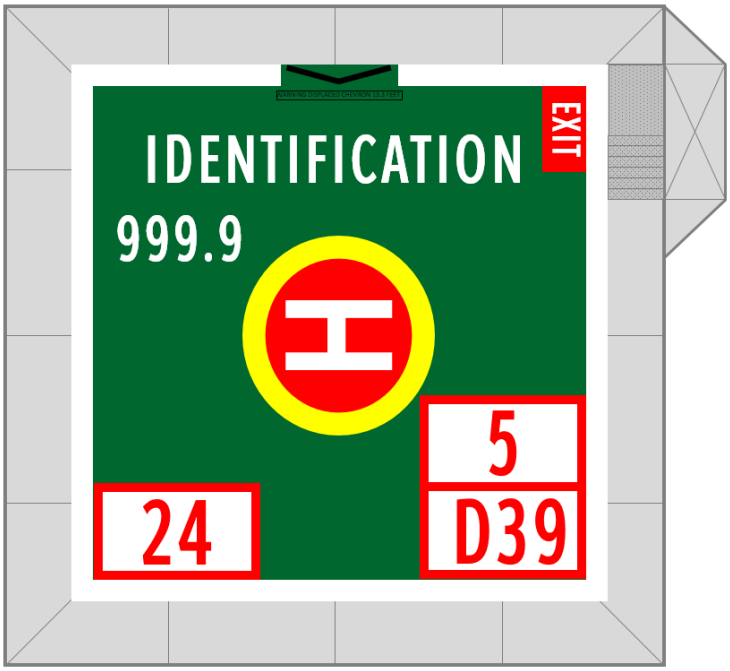


Figure 20: D-value, TLOF Size and Weight Markings for a Square 0.62D TLOF (i.e. single or light twin engine helicopter, like a Bell 206B)

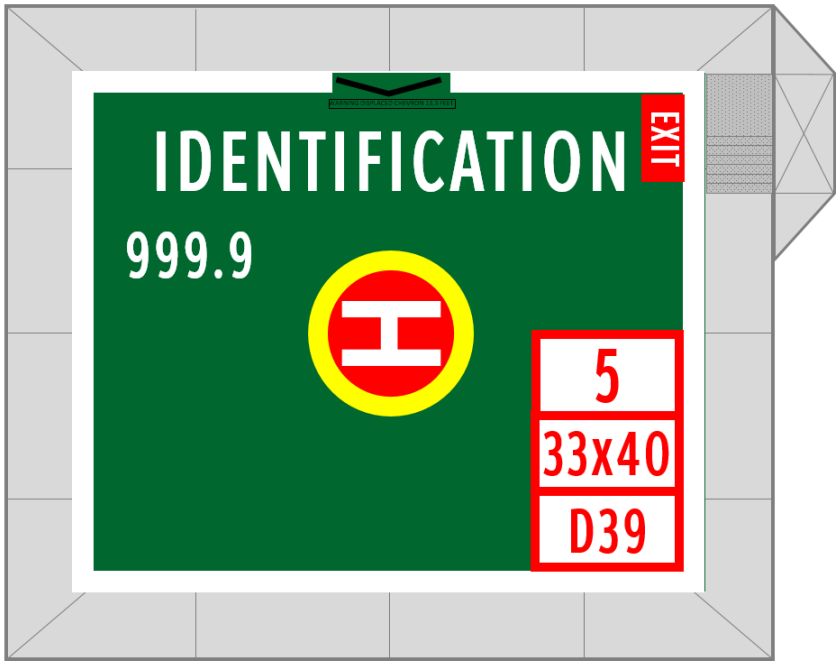


Figure 21: D-value, TLOF Size and Weight Markings for a 0.62D a Rectangular TLOF (i.e. single engine helicopter, like a Bell 206B)

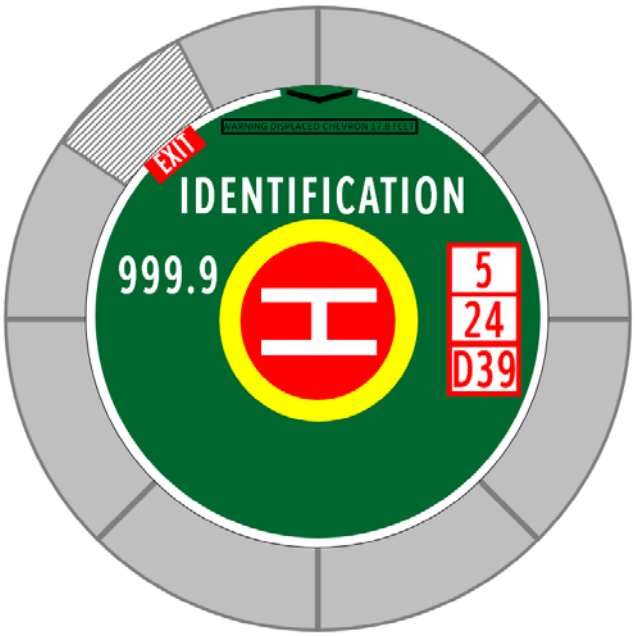


Figure 22: D-value, TLOF Size and Weight Markings for a 0.62D TLOF with a Circular TLOF (i.e. single engine helicopter, like a Bell 206B)

4.7 Helideck Obstacle Free Sector (OFS) Chevron Marking

4.7.1 Chevron Marking for a TLOF with a LOS of 150°or less:

A helideck obstacle-free sector (OFS) marking, a chevron, should be located on the FATO perimeter, unless the TLOF is the same size as the FATO this will not be on the perimeter of the TLOF. The marking should indicate the obstacle-free sector and the limited obstacle sector and the directions of the boundaries of these sectors. The reference point origin of the OFS and LOS may not be at the marked location of chevron (see Note 1 and Note 2 below). See HSAC RP 161 Paragraph 7.7 and Figure 23 for details on dimensions, etc. The chevron should be marked in black color on the TLOF perimeter line, or a contrasting background, as shown in Figure 23.

Note 1: Placing the chevron marking on the FATO perimeter line will actually displace the apex of the chevron approximately 1 foot from the outer edge of the FATO perimeter where the reference point of the OFS and LOS actually begins. Thus the actual placement of allowable obstacles begins at the LOS reference point and not at the apex of the chevron.

Note 2: The actual OFS reference point/point of origin will in most cases be located on the safety shelf for the safety shelf design provides adequate load bearing strength for personnel access, the chevron for a 0.83D TLOF or similar sized TLOF where the LOS falls on the safety shelf may be painted on the safety shelf surface versus using a displaced chevron marking (see 4.7.2 and Figure 24 and Figure 25).

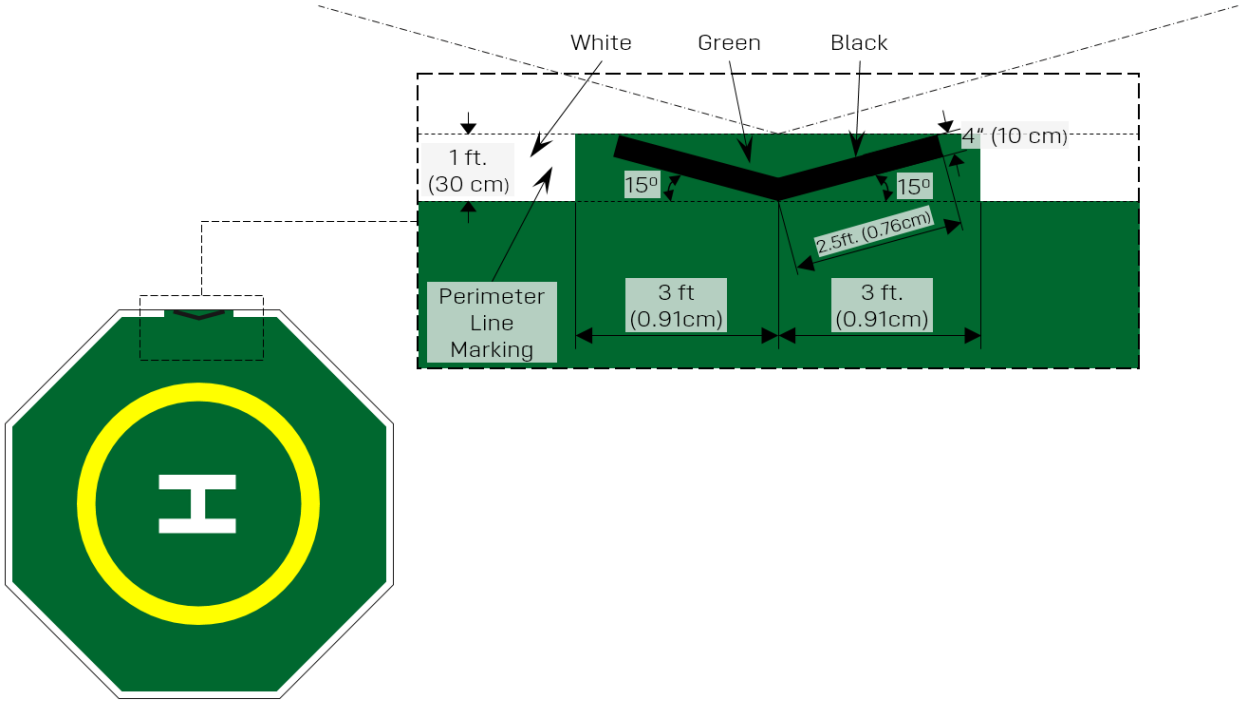


Figure 23: Standard Chevron Marking

4.7.2 Displaced Chevron: OFS/LOS as defined in HSAC RP 161.

Where there is no space available to place the chevron on the edge of the FATO or the FATO edge is non-load bearing (i.e. not a solid surface), the chevron marking, but not the reference point/point of origin, is displaced towards the center of the FATO.

The distance the chevron is displaced from the FATO edge towards the center of the FATO should be indicated as shown in Figure 24 and Figure 25 for a TLOF less than 1.0D.

The marking should be a box (thin black outline) around wording in black letters 9 in. (23 cm) tall stating "WARNING DISPLACED CHEVRON X.X ft (Y.Y m)" where X is the displaced distance.

On helidecks where there are no obstacles for 360°, no chevron is required.

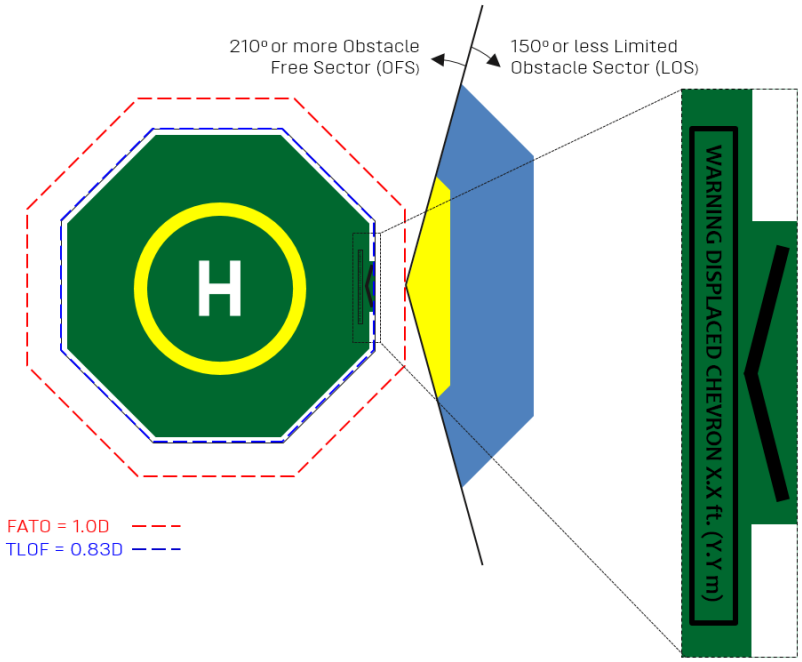


Figure 24: Displaced Chevron Marking

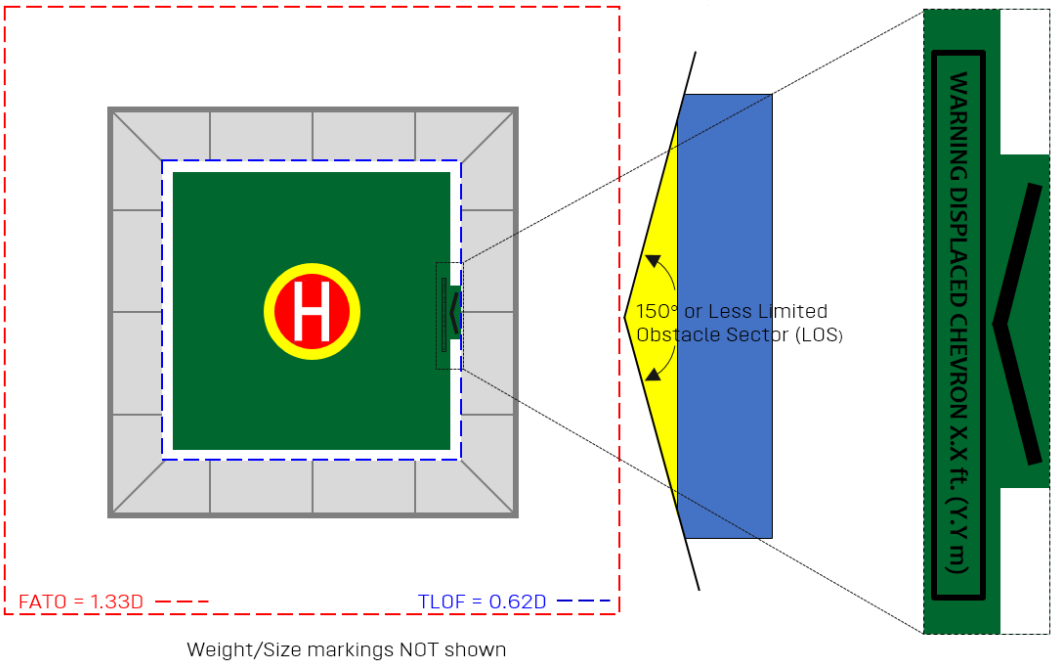


Figure 25: Displaced chevron for a 210° OFS/150° LOS and a 0.62D Deck

4.7.3 Chevron Marking for a TLOF with a 180º OS:

A chevron marking is not required; however for a TLOF with a 180° OS, the words "No Obstacle Closer than X.X ft." or "No Obstacle Closer than (X.X m) From This Line" (depending on the metric used) shall be marked on top of the perimeter line to indicate the distance from the TLOF edge to the closest allowed obstacle beyond the closest edge of the 180° OS as depicted in Figure 26. The marking should be in black letters 9 in. (23 cm) tall.

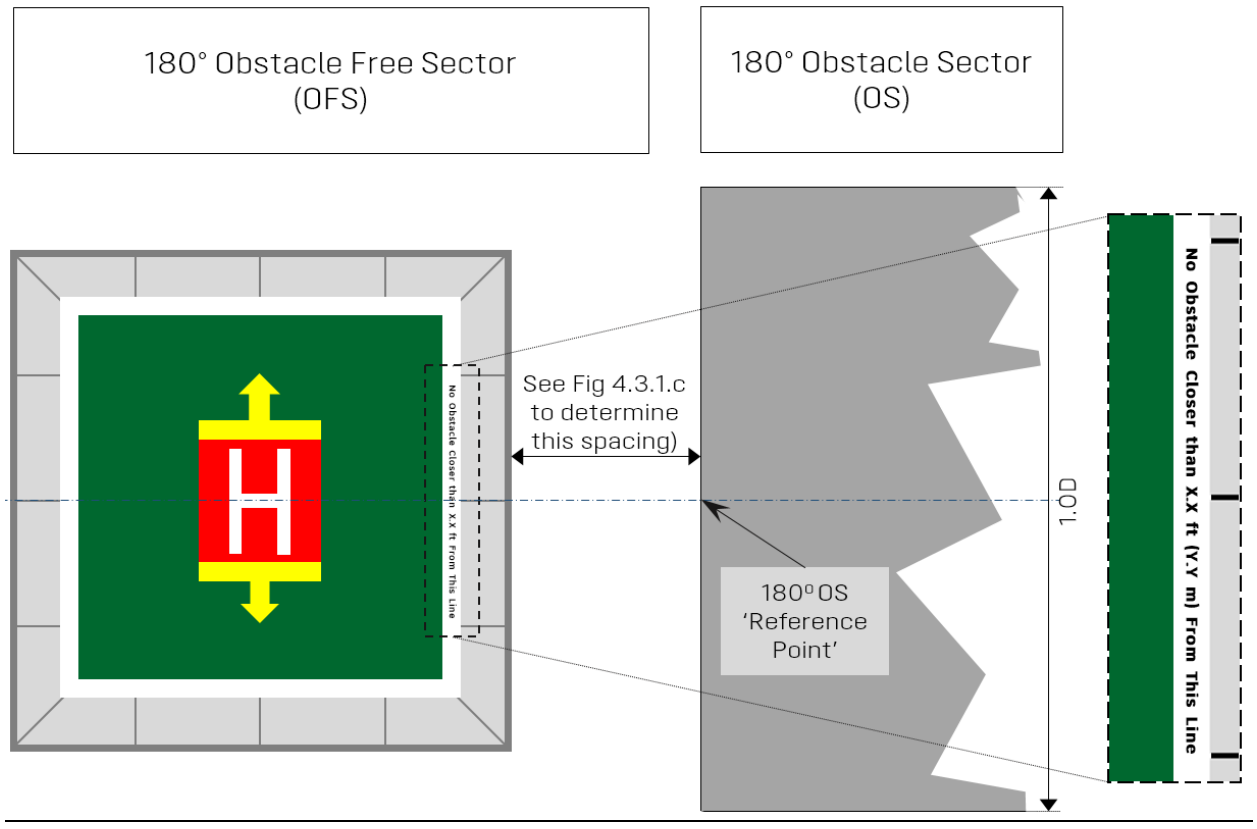


Figure 26: Obstacle Marking for a TLOF with a 180° OS

4.7.4 360 degrees OFS Chevron Marking.

For helidecks where there are no obstacles above the TLOF surface for 360°, an obstacle chevron marking is not required (see Figure 15).

4.8 Helideck Name and Radio Frequency Markings

The TLOF should be marked with a facility identification (name or block number) marking and radio frequency marking. These markings should be aligned with the LOS.

4.8.1 For TLOF of 0.83D or larger:

See HSAC RP 161.

4.8.2 For TLOF of 0.82D or smaller:

The facility identification (facility name or block number) should be marked on the TLOF surface between the chevron (or displaced chevron) marking on the TLOF and the TDPM in letters and/or numbers 3 ft (1.0 m) high and in a white color which contrasts with the dark green colored helideck surface. If the facility name will not fit with 3ft. (1.0 m) high letters, it may be downsized, but should be no less than 2 ft. (0.6 m) in height.

The radio frequency should be marked underneath the identification marking to the left side when looking at a drawing that has the chevron marking at the top. The radio frequency marking should be in white colored numbers and letters of 2 ft. (0.6 m) height as shown in HSAC RP 161 Figures 20, 22, 23, 32, 33, and 34, and Figure 19, Figure 20, Figure 21 and Figure 22 in this document.

> **Note:** For TLOFs that have a 360º OFS and no chevron marking, any location between TLOF perimeter and TDPM can be used for the identification marking. All other markings shall be aligned with the identification marking, so they can be seen coherently from a single direction..

4.9 Obstruction Markings

For obstacles that cannot be easily removed from the TLOF surface such as raised tie-down points, etc., the obstacles shall be marked in red with a minimum of 4 in. (10 cm) wide red line. Objects that infringe the OFS or OS shall be removed.

4.10 Other Markings

For Parking Area and Parking Transition Area (TLOF 0.83D and larger), Exit, Walkway Markings and TLOF Surface Colors, see HSAC RP 161 Chapter 7.

5. LIGHTING

5.1 General

Lights shall be required on all manned facilities and all other facilities that require night or instrument flights.

When needed, upgrades to Helideck lighting should be made by following the guidance provided in HSAC RP 161 Chapter 8.

5.2 TLOF Perimeter Lighting

For night use, lights uniformly spaced at intervals of not more than 10 ft. (3.0 m) should be used to delineate the TLOF perimeter (See Figure 27 below). Aviation green omni-directional lights shall be used. The omni-directional perimeter lights should have an intensity and intensity distribution (beam spread) corresponding to the values defined in FAA Engineering Brief No. 87.

> **Note:** FAA Engineering Brief No. 87 applies to onshore heliports but the intensity and intensity distribution (beam spread) requirements are equally applicable to offshore helidecks.

For square or rectangular shaped TLOFs there should be a minimum number of four lights on each side including one light at each corner as shown in HSAC RP 161 Paragraph 8.2, also see Figure 27 below. For circular TLOFs, there should be a minimum of eight lights. For hexagonal or octagonal shaped TLOFs, there should be at least one light at or near as practicable to each corner and lights between the corners must be equally spaced as shown in HSAC RP 161 Figure 36.

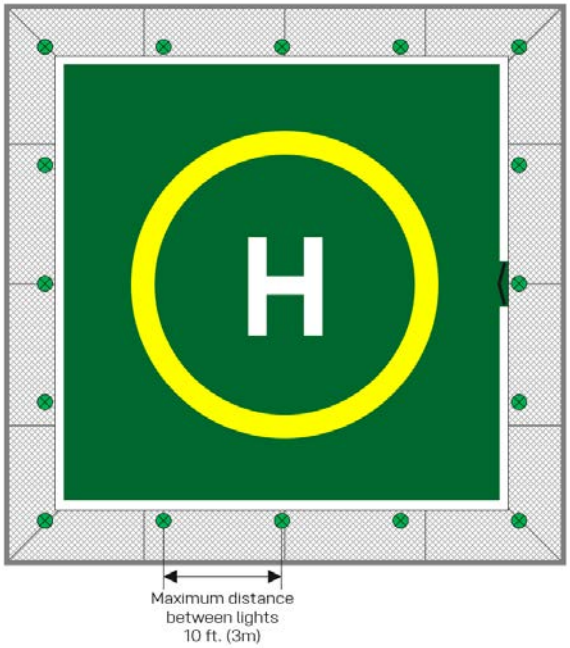


Figure 27: Example of Typical TLOF Lighting Arrangement for a 1.0D TLOF

Perimeter lights should be outboard and adjacent to the TLOF edge, or in-set within 12 in. (30 cm) of the TLOF edge (i.e. on the TLOF perimeter line marking), and should not protrude more than 2 in. (5 cm) above the elevation of the TLOF surface. They should have no exposed wiring, and be located so as not to be an obstruction. Any inboard lighting should be flush mounted.

Note 1: All lighting components and fitment should meet safety regulations relevant to a helideck environment as prescribed in API 500 or API 505 for lighting requirements, and as a minimum be rated for Class 1, Division 2.

Note 2: When guttering or curbing is used as part of the helideck drainage arrangement, the visibility of the perimeter lights should be ensured, as the guttering or curbing may obstruct the lights.

5.3 Parking Area/Parking Transition Area Lights

When transition and parking area lights require replacement, the operator should replace them with aviation blue omni-directional lights as described in HSAC RP 161 Paragraph 8.4.

5.4 Flood Lighting

Flood lighting may be required for the pilot to see the TLOF markings (TDPM, 'H', size/weight (mass) limits) and to illuminate the TLOF and surrounding area for helicopter operations. As well as providing the visual cues needed for helideck recognition for approach and landing, Helideck floodlighting may be used at night to facilitate helideck operations such as passenger movements, refueling operations, freight handling etc. See HSAC RP 161 Paragraph 8.3 for guidance on flood lighting. Existing flood lighting arrangements should be assessed for glare to pilots and potential glare situations should be mitigated.

5.5 Helideck Status Light(s)

The installation of helideck status light(s) should be considered on all manned facilities. However, for manned facilities with the possibility of methane ingestion status lights shall be installed. The intent of the helideck status light(s) is to indicate to a pilot that a helideck is unsafe or unprepared for use and a means for enhancing safe operations to/from the facility. See HSAC RP 161 Paragraph 8.5 for guidance on helideck status light(s).

5.6 Lighting of Obstructions

Obstructions that are not clearly visible under all conditions should be marked with omni-directional red lights. Specifications for obstruction lights (low intensity type L-810) are given in FAA Specification for Obstruction Lighting Equipment, FAA Advisory Circular 150/5345-43J. Where the highest point on the platform exceeds the elevation of the TLOF by more than 50 ft. (15 m), an omni-directional red light should be fitted at that position, with additional such lights fitted at 35 ft. (10 m) intervals extending down to the elevation of the TLOF flight Helideck. Where obstructions are clearly visible during the day, flood lighting of the obstacle for night operations is allowable when no glare to pilots is ensured.

5.7 Uninterruptible Power Supply (UPS)

Arrangements should be made so that there is no loss of critical (specified) lighting due to a failure of the primary power system on the facility. See HSAC RP 161 Paragraph 8.7 for additional guidance.

Note: A critical lighting analysis should require at least 50% of perimeter lighting and 100% lighting for access and egress routes, helideck status lights, obstruction lights, and windsock lights will remain operational.

This lighting should be supplied from the emergency generator/power bus so that power to the lighting is maintained, and provided from an uninterruptible power supply (UPS) sufficient to power the specified lighting for the period required for the emergency generator to assume the load after the loss of primary power.

6. WINDSOCK

A windsock (wind vanes are not acceptable) should be provided so as to be visible to the pilot on his final approach to land. It should be situated in clear 360º airflow and accordance with the required obstruction clearances. It should give a clear indication of the direction of the wind blowing across the helideck. If no clear 360º airflow can be achieved, a second windsock covering the wind directions that cannot be adequately indicated by the primary windsock should be installed.

The windsock shall be illuminated where night operations are anticipated. This lighting should not be a hazard to flight nor interfere with windsock operation. This windsock lighting should not be a glare hazard to pilots.

A windsock should be made of fabric of orange color. A windsock should be a truncated cone made of lightweight (mass) fabric and should have the following minimum dimensions: length 4 ft (1.2 m), diameter (larger end) 14 in. (0.3 m) and diameter (smaller end) 8 in. (0.15 m).

7. FUELING STATIONS

At a minimum, helicopter fueling stations should be located to avoid obstructing the following sectors: OFS, LOS, OFDS and any access or egress route serving the helideck. For helideck upgrades, fueling systems should meet the requirements of the HSAC RP 161 Chapter 9.

Fuel storage transfer containers (totes) should be located in a place to limit exposure to hot air discharges from compressors and cooling systems and avoid obstructing any helideck access or egress route serving the helideck.

Note: HSAC RP 163 provides guidance for the Inspection, Maintenance, and Operation of Offshore Helidecks inclusive of design guidance for fuel system design and checklists that can be used for fuel system inspections.

8. FIRE PROTECTION EQUIPMENT

A risk assessment (see Annex A: Commentary on Risk Assessments) shall be completed to determine the level of fire protection necessary to contain a post-crash fire in the event of a helicopter crash where in a worst case scenario the largest helicopter using the helideck has rolled onto its side with a full passenger load. The fire protection system should provide adequate time to rescue all occupants from the helicopter and evacuate them safely from the helideck.

When conducting the risk assessment, many parameters should be considered to determine the scope of the fire protection equipment required for each helideck. At a minimum, the following parameters should be considered:

a) Size of TLOF (helideck),

b) Presence of a fueling station,

c) Helicopter models that are expected to use the platform including personnel and fuel capacity of such helicopters,

d) Whether the platform is manned or unmanned, and

e) Typical number of personnel on board helicopter if the platform is manned.

The requirements and fire protection system performance shall, as a minimum, be in accordance with NFPA 418 (see Table 4 below extracted from NFPA 418), in particular Chapters 5 and 8, and when fueling systems are provided NFPA 407. Additional Information is available in API 2A-WSD.

A minimum of one 30 pound ABC hand-held dry chemical extinguisher (purple k) shall be provided in an easily accessible area for each helideck and fuel system.

Helideck Category	Helicopter Overall Length	Minimum Rating
H-1	Less than 50 ft.(15.2 m)	4-A:80-B
H-2	50 ft. (15.2 m) up to but not including 80 ft. (24.4 m)	10-A:120-B

Table 4: Extract from NFPA 418 Table 9.2

Note: The most important factors bearing on effective crash-fire rescue in a survivable helicopter accident are helideck team members' competence, the effectiveness of the rescue equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can respond and the effectiveness of that response.

Consider, when upgrading or replacing in kind a helideck, the requirements of HSAC RP 161 should be met.

9. HOT AIR, RAW GAS AND HYDROGEN SULFIDE (H_2S) DISCHARGE

9.1 Hot Air Discharge.

Hot air discharges from compressors and cooling systems adjacent to helidecks may be hazardous to helicopter operations and can drastically affect helicopter performance and appropriate restrictions shall be imposed on the use of the helideck where either of the above exists. As a general rule, a limit for the vertical airflow velocity of 5.75 ft/s (1.75 m/s) shall not be exceeded.

9.2 Raw Gas Discharge.

The maximum permissible concentration of raw hydrocarbon gas within the helicopter operating area is 10% Lower Flammable Limit/ Lower Explosive Limit (LFL/LEL). Concentrations above 10% LFL or LEL have the potential to cause helicopter engines to surge and/or flame out. Additionally, in forming a potential source of ignition for flammable gas, the helicopter can pose a risk to the facility. It is considered unlikely that routine 'cold flaring' will present any significant risk, but the operation of emergency blow-down systems shall be assumed to result in excessive gas concentrations.

9.3 Hydrogen Sulfide (H_2S) Gas Discharge.

Hydrogen sulfide (H_2S) gas discharge in higher concentrations (300 ppm to 500 ppm) can cause loss of consciousness within a few seconds or affect helicopter performance.

When designing helidecks that have been identified to have any of the above conditions that may be hazardous to helicopter operations a visual warning system (e.g. Helideck Status lights) shall be provided to alert pilots of the hazard. An additional H_2S specific horn unit should be considered to be installed in vicinity of helideck to alert landed crew if H_2S is present after landing.

Sources of discharges shall be located as far as practicable away from the helideck, flight path, and oriented so the typical prevailing wind will carry the discharges away from the helideck area.

> **Note:** Gas detectors/Sniffers (generic term used to describe automated vapor detection devices) or other detection devices (infrared, etc.) may be used to detect these discharges and to automatically activate status lights (see 5.5) when discharges present a hazard to flight operations.

ANNEX A: COMMENTARY ON RISK ASSESSMENTS

A1 General

The facility management program should require that a written risk assessment (RA - risk analysis, risk assessment) be performed for any legacy helideck subject to this recommended practice. The purpose of this analysis is to identify, evaluate, and, where unacceptable, reduce to As Low As Reasonably Practicable (ALARP) the likelihood and/or minimize the consequences of health, safety and environmental hazards. Human factors should be considered in this analysis as well as failures of control systems (software and hardware).

An RA shall be performed for any legacy helideck that has any changes or does not meet the minimum requirements in this RP due to damage, helideck size, obstacle clearances (OFS, LOS), air turbulence or other factors that may necessitate an RA.

A2 Methodology

Facility/Helideck Owner Management should determine, dependent on the level of risk inherent with each facility, what analysis techniques should be employed. The methodology shown in A5 Example Risk Assessment for Helideck below should be considered as a minimum.

A3 Analysis Personnel

The RA should be performed by (a) person(s) knowledgeable in engineering, aviation operations, platform operations, design, safety, environmental, and other specialties as appropriate. At least one person should be proficient in the RA methodologies. If only one person performs the hazard analysis, that person should not have participated in the original design of or modifications to the facility. Appropriate subject matter experts, technical authorities, and stakeholders should participate in the RA as needed.

A4 Analysis Report

The facility management program should require that the findings of the RA are presented in a written report which have been reviewed with the helicopter operator. This report should describe the risks that have been identified and recommended steps to be taken to mitigate them to ALARP. Qualitative assessments of the severity of the findings may be made as appropriate. The facility management program should require the communication of all identified risks and follow-up actions to the appropriate personnel. A complete RA report, including any updates, should be kept on file for the life of the facility.

A5 Example Risk Assessment for Helideck

This assessment may be considered for any helideck on an offshore facility. An assessment for a floating installation or vessel should include factors related to deck motions which should be maintained within limits as determined by helicopter operator. The table below should be used to form the basis of an RA along with the guidance in HSAC RP 161 and this document

A5.1 TLOF 1.0D to 0.83D.

For a helideck that provides a load bearing surface, represented by the touchdown and liftoff area (TLOF) between 0.83D and 1.0D, a minimum 1.0D circle representing the final approach and takeoff area (FATO) should be assured for the containment of the helicopter. From the periphery of the FATO (not the TLOF) the limited obstacle sector (LOS) extends. The non-loadbearing area between the TLOF perimeter and the FATO perimeter should be entirely free of 'non-permitted' obstacles, and those permitted should not exceed the obstruction height criteria set out in Section 2 of this document.

Figure 2 illustrates a 0.83D TLOF. The inner blue dotted line bounded by the square helideck represents the a 0.83D TLOF load bearing surface. The outer red dotted line illustrates the 1.0D FATO which provides containment of the helicopter and from which the apex of the LOS is determined. Where practical, the chevron denoting the origin of the LOS should be physically marked at the periphery of the FATO, but when this cannot be achieved then the chevron must be marked as displaced. The diameter of the FATO is the declared D-value.

A Touch-Down Positioning Marking (TDPM) of 0.5D provides the necessary obstacle clearances and acceptable visual cues.

A5.2 TLOF less than 0.83 but not less than 0.62D.

For helidecks with a TLOF less than 0.83D but not less than 0.62D, with a 150º or less LOS, the FATO must be 1.33D (see Figure 3). A TDPM reduced in size to 0.2D provides required obstacle clearances but with restricted visual cues.

For helidecks with the same size TLOF noted above with a 180º OS, a 1.33D FATO containment is not provided and a minimal 0.25D (approximately 1/3 RD) rotor clearance is required. As a result containment of the helicopter necessitates restrictions in landing/takeoff direction and severely limits maneuvering on the helideck (no 'turn' allowed). A TDPM reduced in size to 0.2D with flight path and maneuvering restrictions provides required obstacle clearances but with restricted visual cues. (See Figure 15)

Risks to be Evaluated	Considerations/Mitigations to be Reviewed
1. Potential impacts of decreasing the size of the TLOF to less than 0.83D and using a smaller TDPM.	1.A. It is essential that clearance from obstacles in the LOS/OS are maintained as discussed in A5.1 and A5.2. If this cannot be assured, mitigation must be provided. 1.B. To ensure that obstacle clearances are maintained for the helicopter, the properly sized TDPM provides the required obstacle clearances, and is located at the center of the TLOF. 1.C. Where obstacle clearances cannot be achieved it may be possible to do so with an offset TDPM and "H" (See 4.4.1.1). 1.D. Can obstacles be removed, relocated or lowered in height?
2. Reduction in suitable and sufficient visual references required for the pilot during all flight phases. See Section 3	2.A. Adequate visual cues provided for aircrew are essential for the conduct of safe operations to helidecks. On helidecks less than 0.83D, these will to some degree be compromised. An aeronautical study should ensure that visual cues, within the field of view are adequate for aircrew to perform the following visual tasks: ▪ Identification of helideck location early on in the approach ▪ Visual cues to help maintain the sight picture during approach ▪ Visual cues on final approach to hover position ▪ Visual cues for landing ▪ Visual references on liftoff and hover 2.B. It is important that helideck markings and deck mounted lighting (where provided) remain uncontaminated at all times (e.g. deposits of guano on the surface of a helideck may compromise markings and/or deck-mounted lighting). 2.A. A windsock should be provided to facilitate an accurate indication of wind direction/ speed over the helideck. 2.D. For night operations lighting systems should include effective obstruction lighting in addition to helideck lighting and an illuminated windsock. 2.E. For helidecks less than 1.0D a solid safety shelf shall be provided, and to improve visual cues the safety shelf should be painted in a color contrasting to the helideck surface . 2.F. Marking of obstacles in red to improve visibility is recommended. 2.G. Maneuvering restrictions on the helideck may need to be considered and are required if a 180º OS is in place and so marked.
3. With a reduction in the helideck size, the space available for passengers and crew to safely disembark/embark the helicopter and to transit to and from the helideck safely is reduced.	3.A. The reduction in the operating TLOF area restricts clearances between passengers/crew moving around the helideck avoiding the helicopter's rotor systems by a safe margin. This reduction should be considered on a helicopter-type specific basis. It should be ensured that sufficient access points are available to avoid the situation where passengers and crew have to pass close to helicopter 'no-go' areas (e.g. in relation to main and tail rotor systems). 3.B. Where personnel are required to transit close to the deck edge, procedures should be considered to assure the safe movement of passengers.

Risks to be Evaluated	Considerations/Mitigations to be Reviewed
4. Reduction in the space available for securing helicopters, for the conduct of safe and efficient refueling operations (where provided) and for post-crash teams to provide effective fire and rescue intervention in the event of an incident or accident.	4.A. The surface area available should accommodate an adequate tie-down pattern arrangement to allow helicopter(s) to be fully tied-down (where required). 4.B. Where refueling operations are required, the area available around the helicopter should allow this to occur safely and efficiently at all times. 4.C. Sufficient access points should be provided to allow helideck fire and rescue teams to move to the scene of an incident or accident from an upwind location and to allow passengers to escape downwind to safety.
5. Parts of the helicopter fuselage will be over the top of allowed essential objects at the edge of the TLOF.	5.A. Assure the permitted height for essential objects located around the TLOF in the 210° obstacle free sector and in the 1st segment of the 150° limited obstacle sector for a TLOF less than 0.83D is 2 in. (5 cm) 5.B. Can essential objects be reduced in height if too tall?
6. Reduction in TLOF size results in reduced margin to allow for touchdown/positioning inaccuracies during landing.	6.A. It should be assumed that there will inevitably be some degree of variability in the actual point of touchdown within the landing area. The TDPM provides an effective visual reference to guide the handling pilot to the point of touchdown, but landing scatter has potential to occur, particularly when external factors beyond a pilot's control come into play. This may include the influences of prevailing meteorological conditions at the time of landing (e.g. wind, precipitation etc.), and/or any helideck environmental effects encountered (e.g. turbulence, thermal effects). Especially in the case of TLOFs with a TDPM of 0.2D the visual cues will require evaluation. 6.B. It is essential that a good visual means of assessing wind speed and direction is always provided for the pilot by day and by night (if used). 6.C. Markings should be clearly visible and kept free of contamination which may reduce a pilot's ability to touchdown accurately. The TDPM and "H" should be illuminated for night operations.
7. Reduction in Ground Effect available from rotor downwash	7.A. The TLOF should provide ground effect. The reduction in the load bearing area (TLOF) for TLOFs less than 0.83D means that operations that benefit from Ground Effect will likely suffer significant reduction in Ground Effect. 7.B. Use of a safety shelf enhances the available ground effect. 7.C. Restrictions in helicopter payload may be required to minimize the negative effect of the reduced ground effect.

Table 5: Risk Assessment Considerations

10. TABLE OF FIGURES

11. LIST OF TABLES

12. INDEX

HELICOPTER SAFETY ADVISORY CONFERENCE
SAFETY THROUGH COOPERATION
SINCE 1978

International Association of Oil & Gas Producers

HeliOffshore
Safety Through Collaboration