DOC 9261 PART II
ONSHORE HELIPORT MANUAL

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Heliport Manual – Part II (contents)

Mirrors the Annex 14 Volume II format

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Chapter 3 – Physical Characteristics (principal defined areas)

FATO

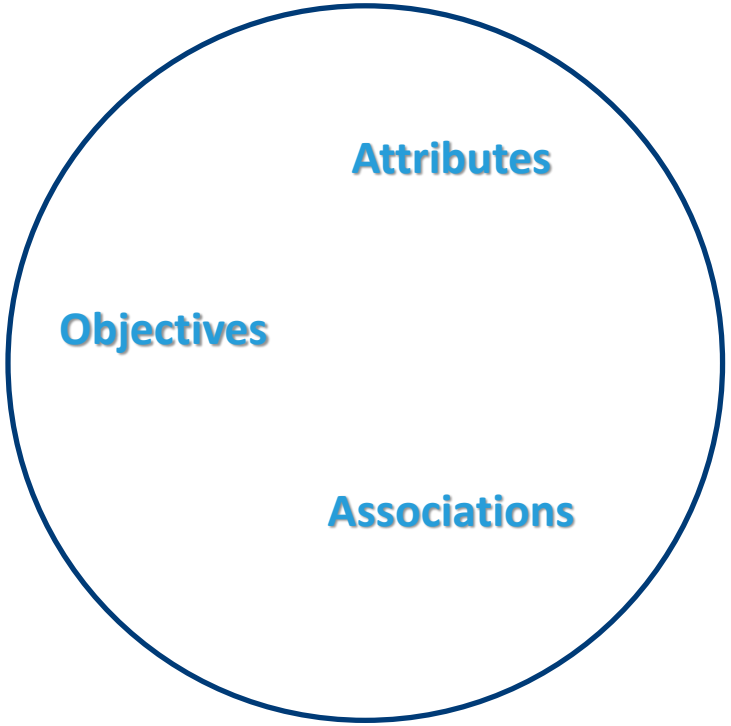
TLOF

Helicopter Stand

Helicopter Taxiway

Ground Taxi-route

Air Taxi-route



Chapter 3 – Physical Characteristics (FATO – objective, attributes and associations)

3.1.1 A FATO shall:

a) provide:

1) an area free of obstacles, except for essential objects which because of their function are located on it, and [illegible] **ent of every part of the design helicopter** [illegible] of take-off in accordance with the intended procedures;

Attribute - Containment

2) when solid, a surface which is resistant to the effects of rotor downwash; and

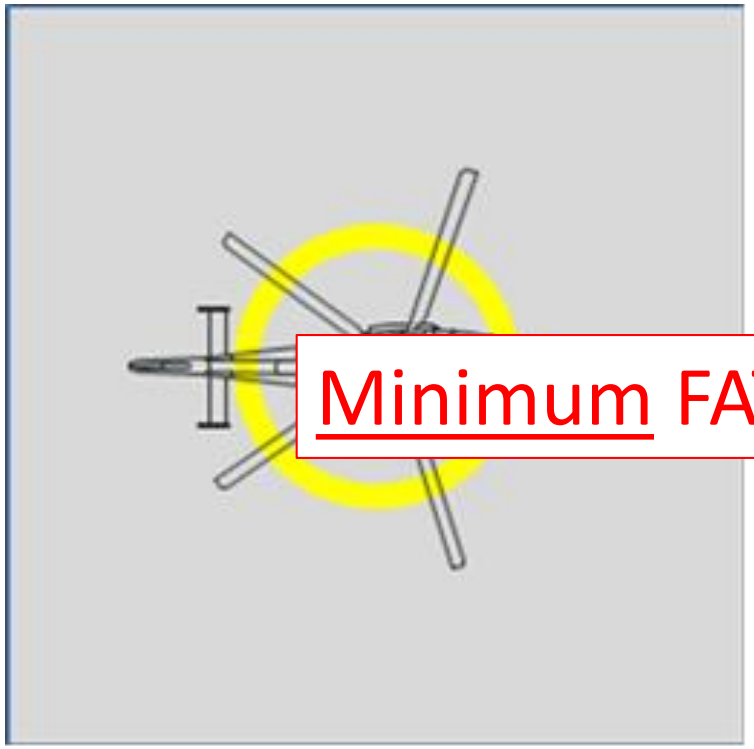
i) when collocated with a TLOF, is contiguous and flush with the TLOF, has bearing [illegible] res effective [illegible]

Attribute - Surface Conditions

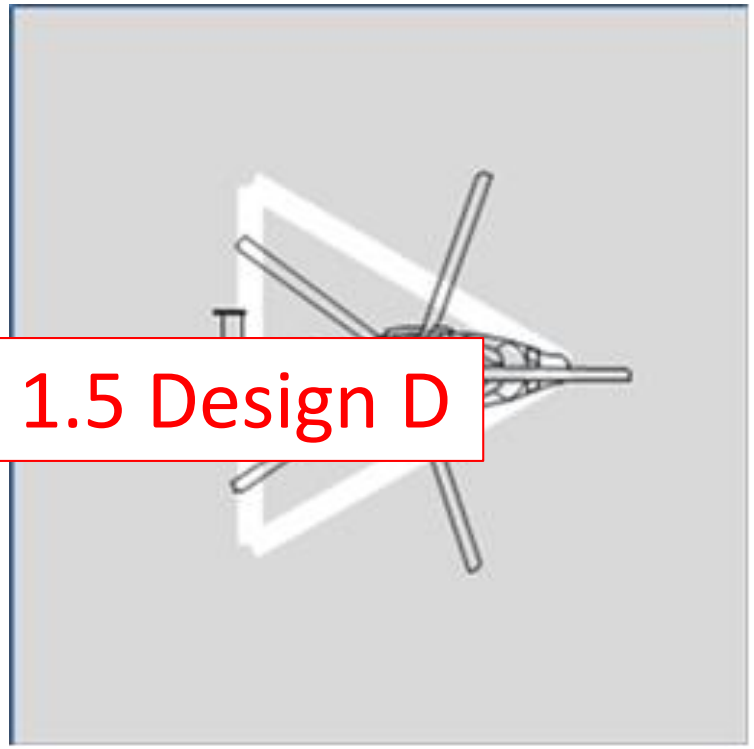
ii) when not collocated with a TLOF, is free of hazards should a forced landing be required; and

b) be associated with a safety area.

Chapter 3 – Physical Characteristics (PC 2/3 FATO)



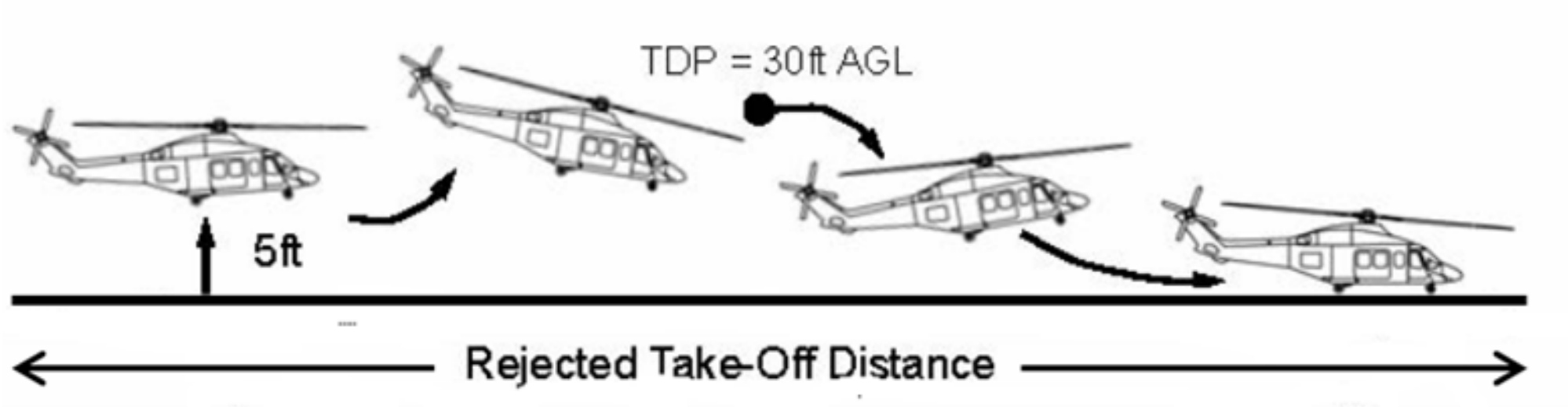
FATO with TLOF

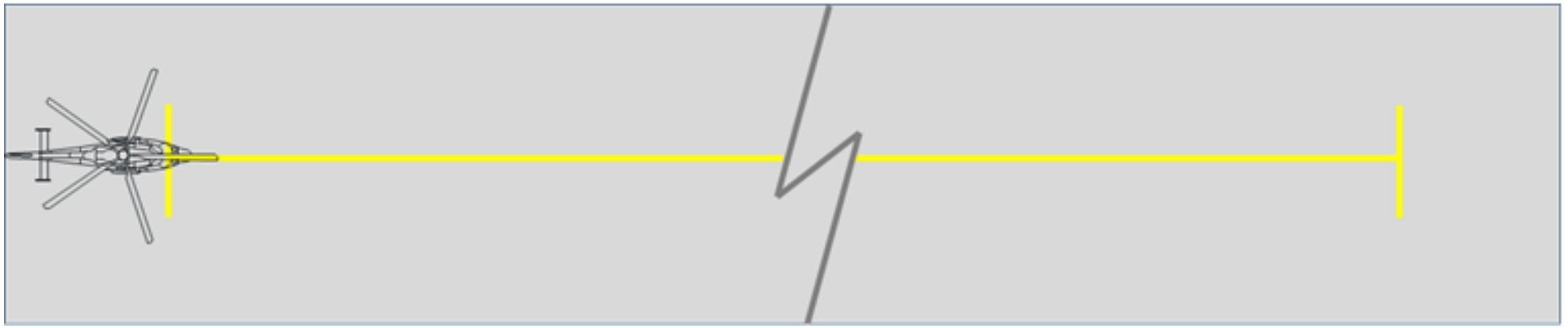


FATO with Aiming Point

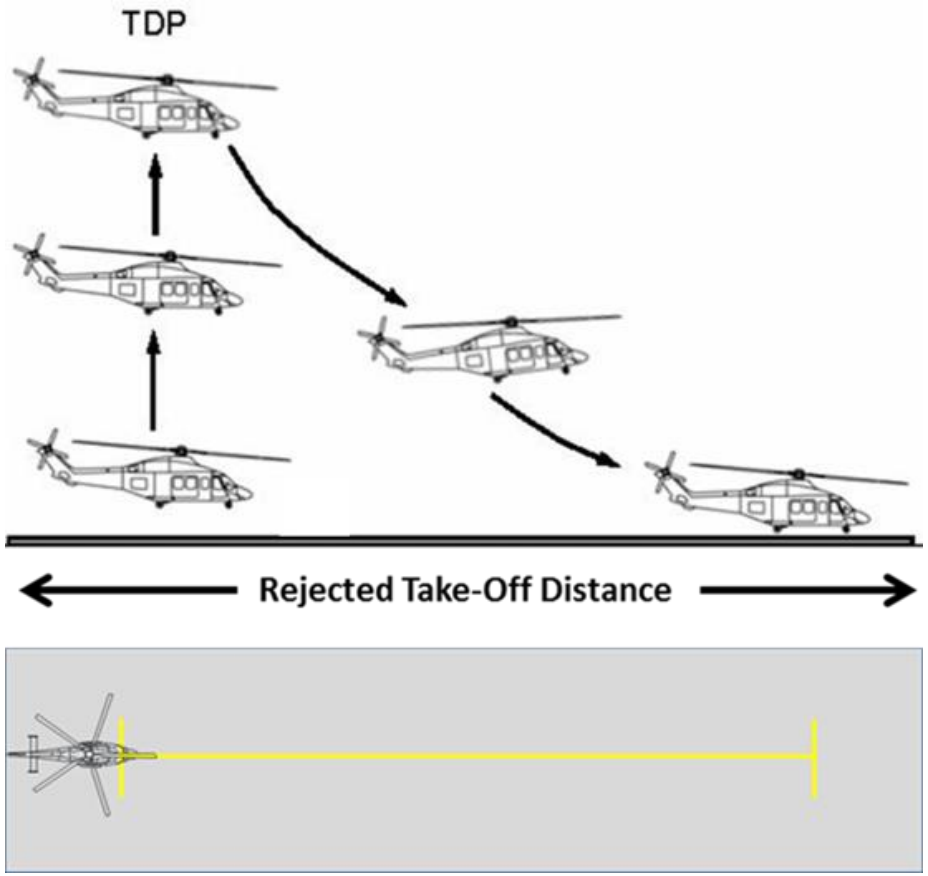
Minimum FATO size = 1.5 Design D

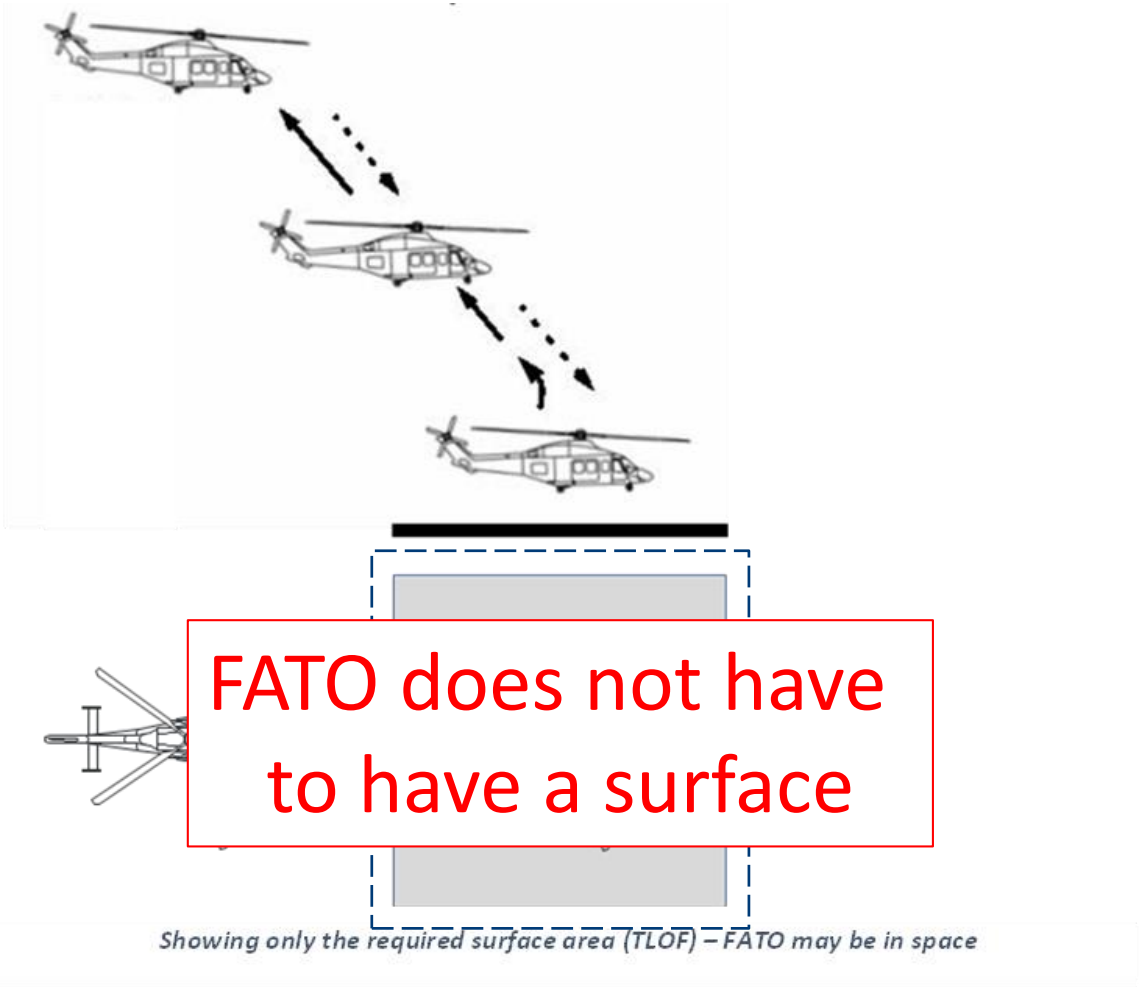
Chapter 3 – Physical Characteristics (PC1 FATO with rejected take-off area)



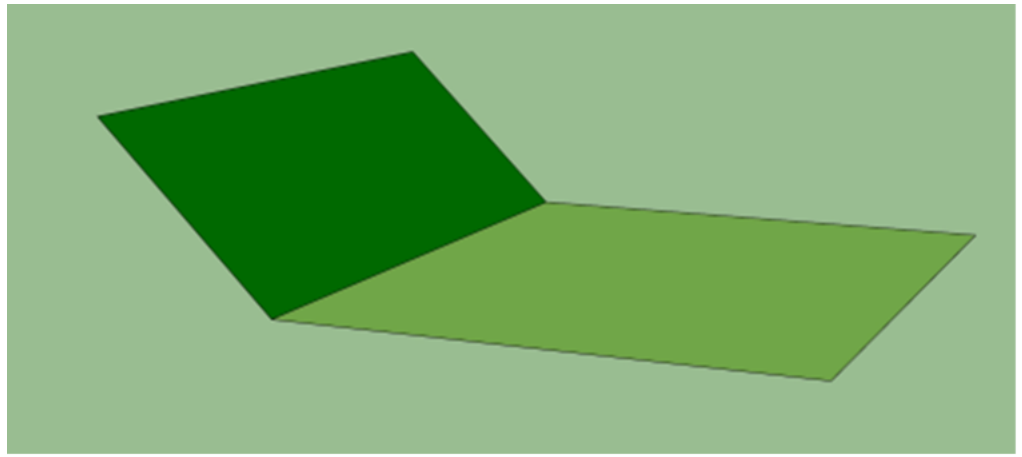


Chapter 3 – Physical Characteristics (PC1 restricted and helipad FATO with rejected take-off areas)

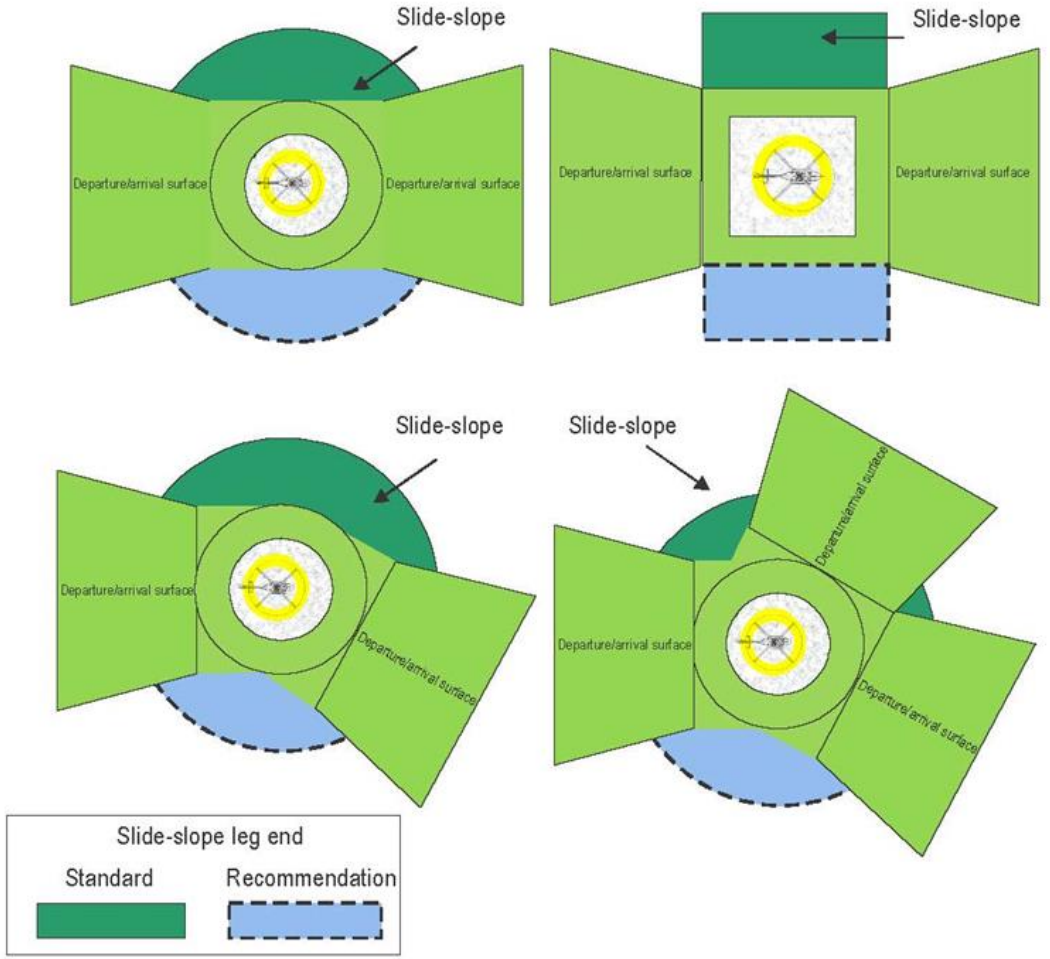




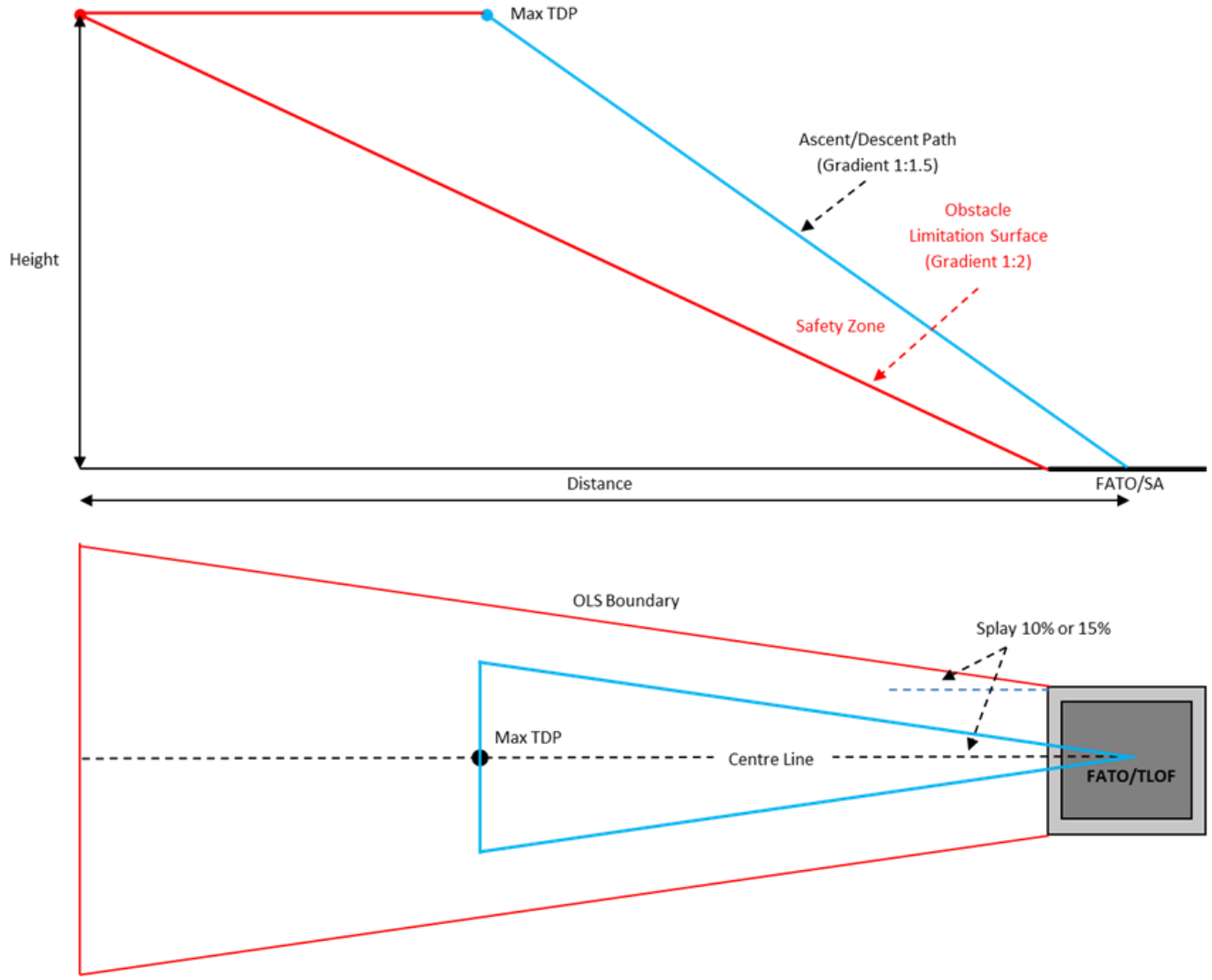
Chapter 3 – Physical Characteristics Associations (side slope at 45 degrees to 10 m)



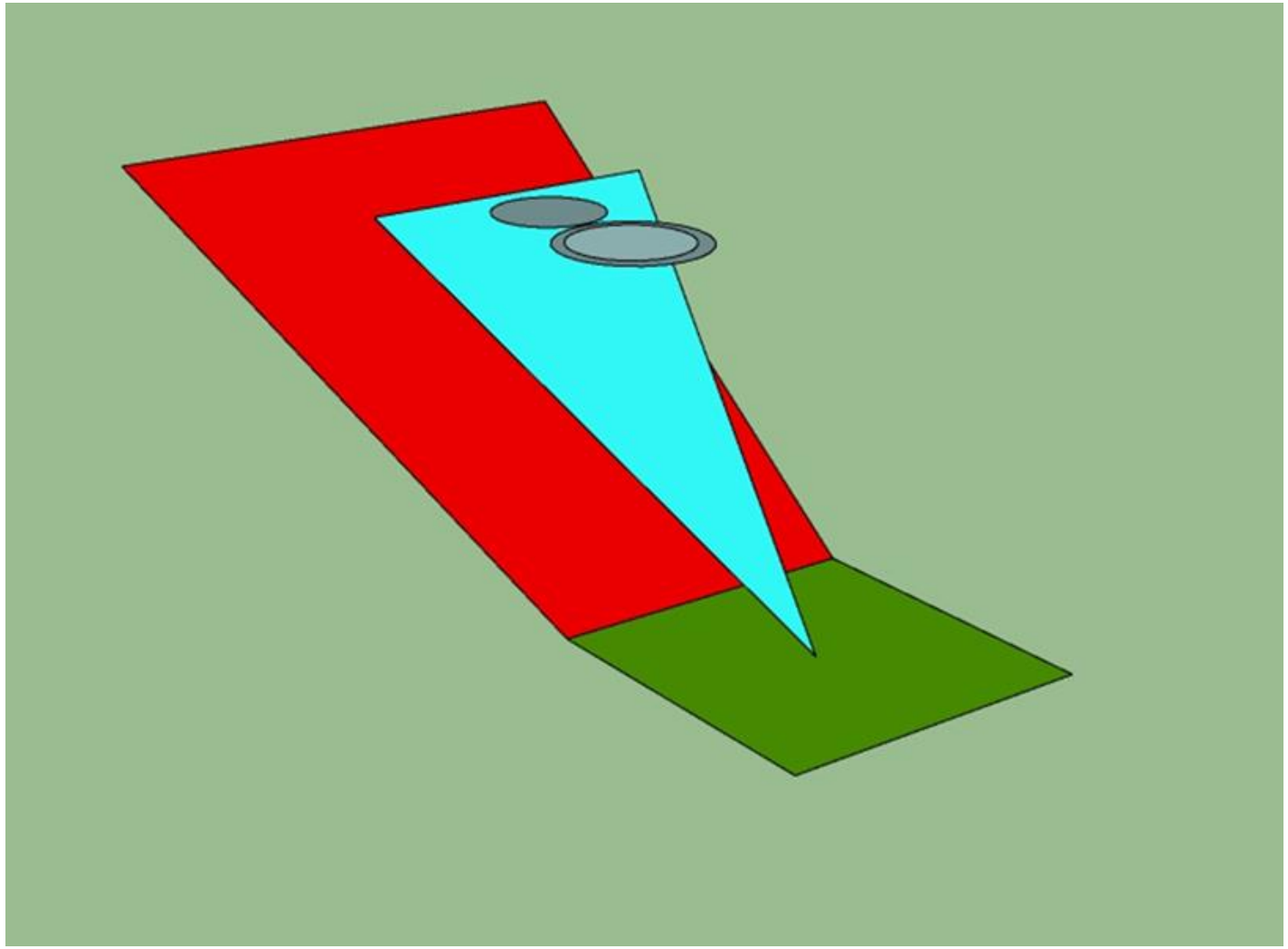
Side-slope with a 30 m FATO/SA



Chapter 3 – Physical Characteristics Associations (PC1 back-up area - schematic)



Chapter 3 – Physical Characteristics Associations (Back-up area – 3D visualisation)



Chapter 3 – Physical Characteristics (TLOF – objective, attributes and associations)

3.1.21 A TLOF shall:

a) provide:

1) an area free of obstacles and of sufficient size and shape to ensure **containment of the undercarriage of the most demanding helicopter the TLOF is intended to serve** in accordance with the intended orientation;

2) **a surface** which:

i) has sufficient bearing strength to accommodate the dynamic loads associated with the anticipated type of arrival of the helicopter at the designated TLOF;

ii) is free of irregularities that would adversely affect the touchdown or lift-off of helicopters;

iii) has sufficient friction to avoid skidding of helicopters or slipping of persons;

iv) is resistant to the effects of rotor downwash; and

v) ensures effective drainage while having no adverse effect on the control or stability of a helicopter during touchdown and lift-off, or when stationary;

and

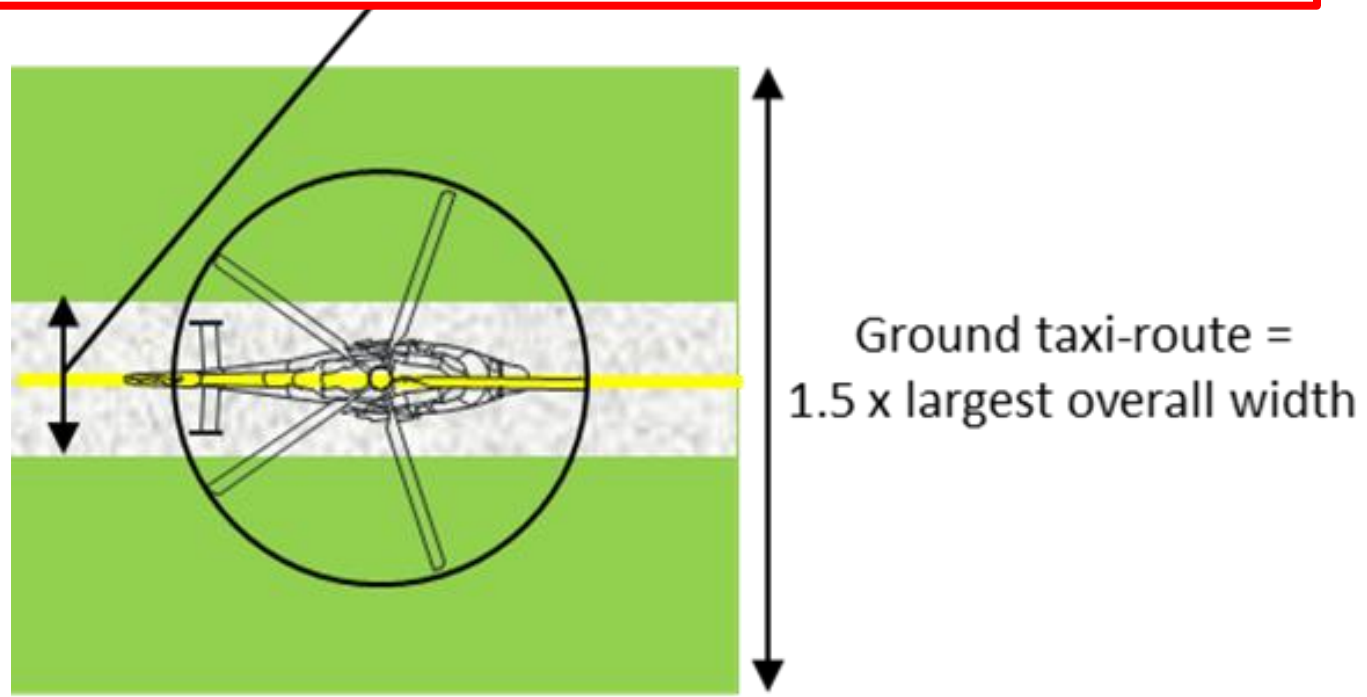
b) be associated with a FATO or a stand.

Chapter 3 – Physical Characteristics (Helicopter Taxiways and Taxi-routes)

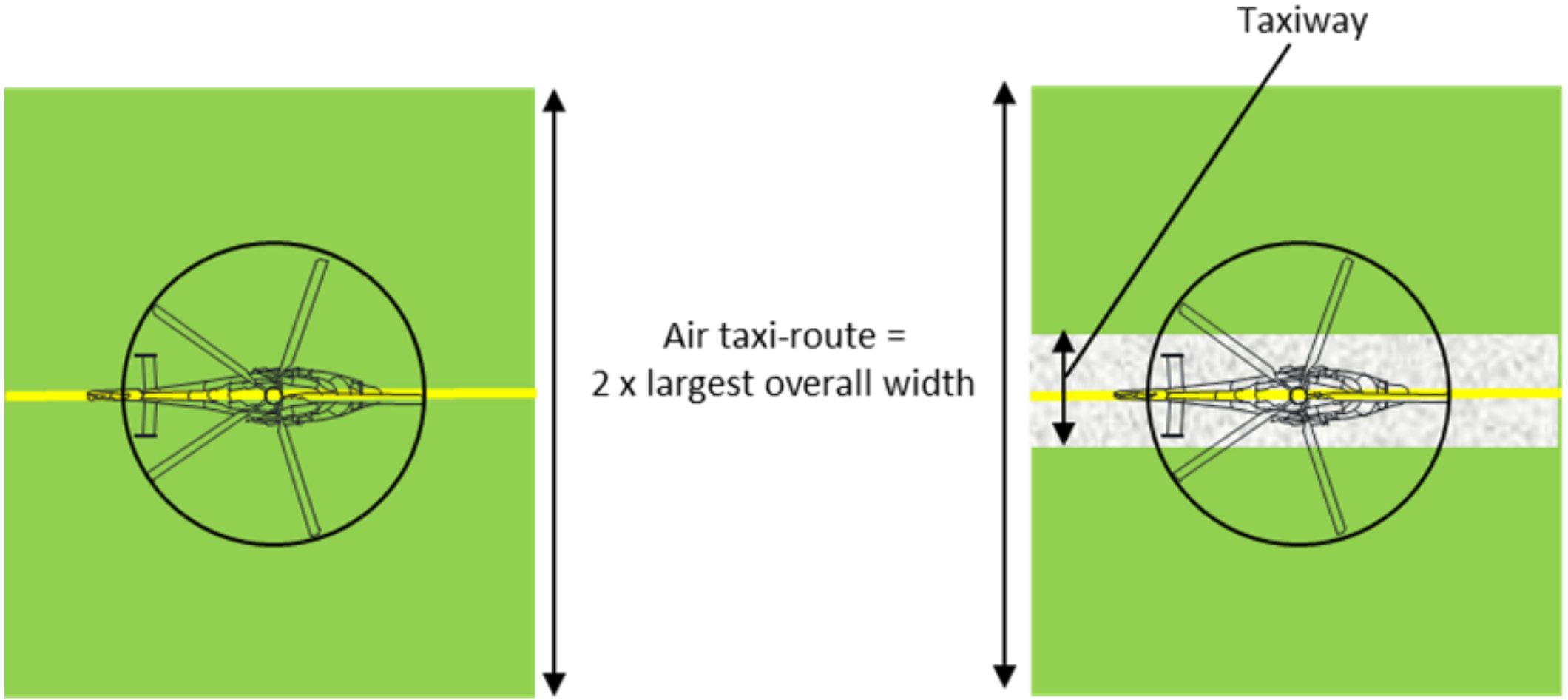
Taxiway Attributes – Containment (wheels) and Surface Loading

Taxi-route Attributes –Containment (helicopter)

Note.- the taxiway is <u>always</u> associated with a taxi-route – either ground or air



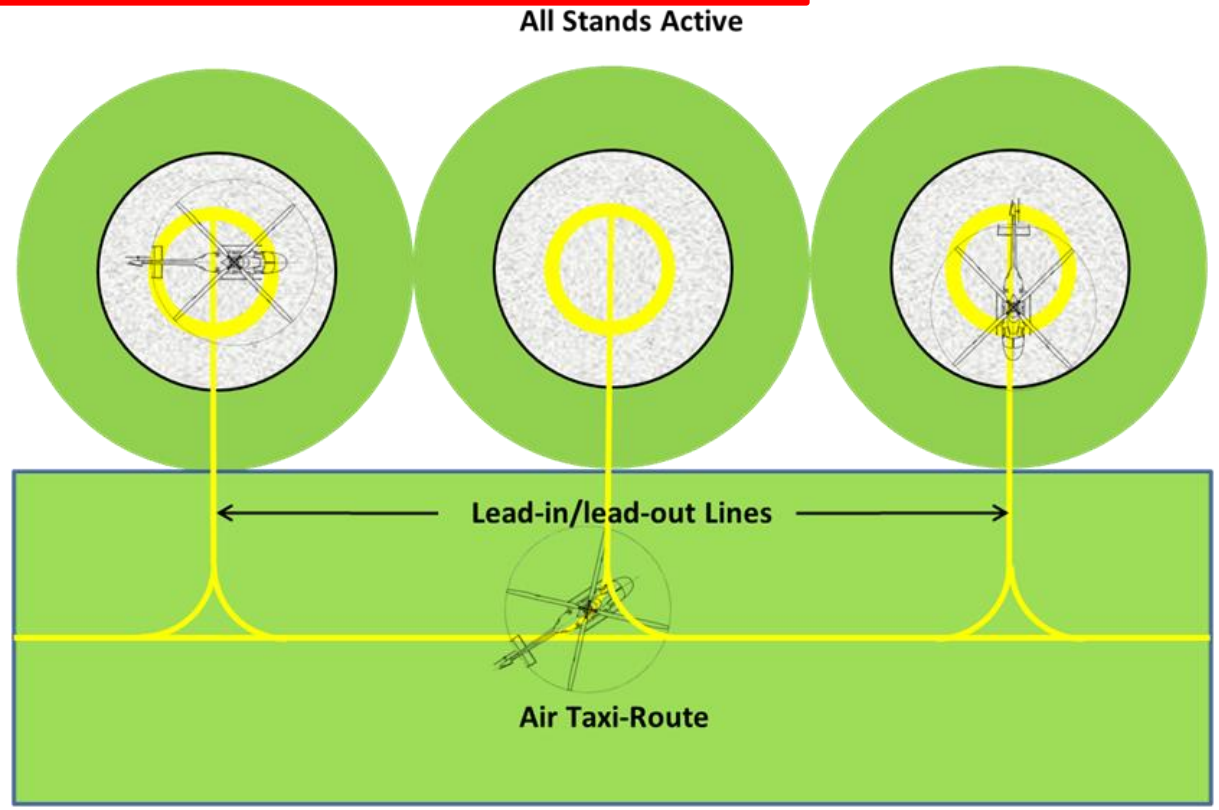
Chapter 3 – Physical Characteristics (Helicopter Taxiways and Taxi-routes)



Chapter 3 – Physical Characteristics (stand – shown in context)

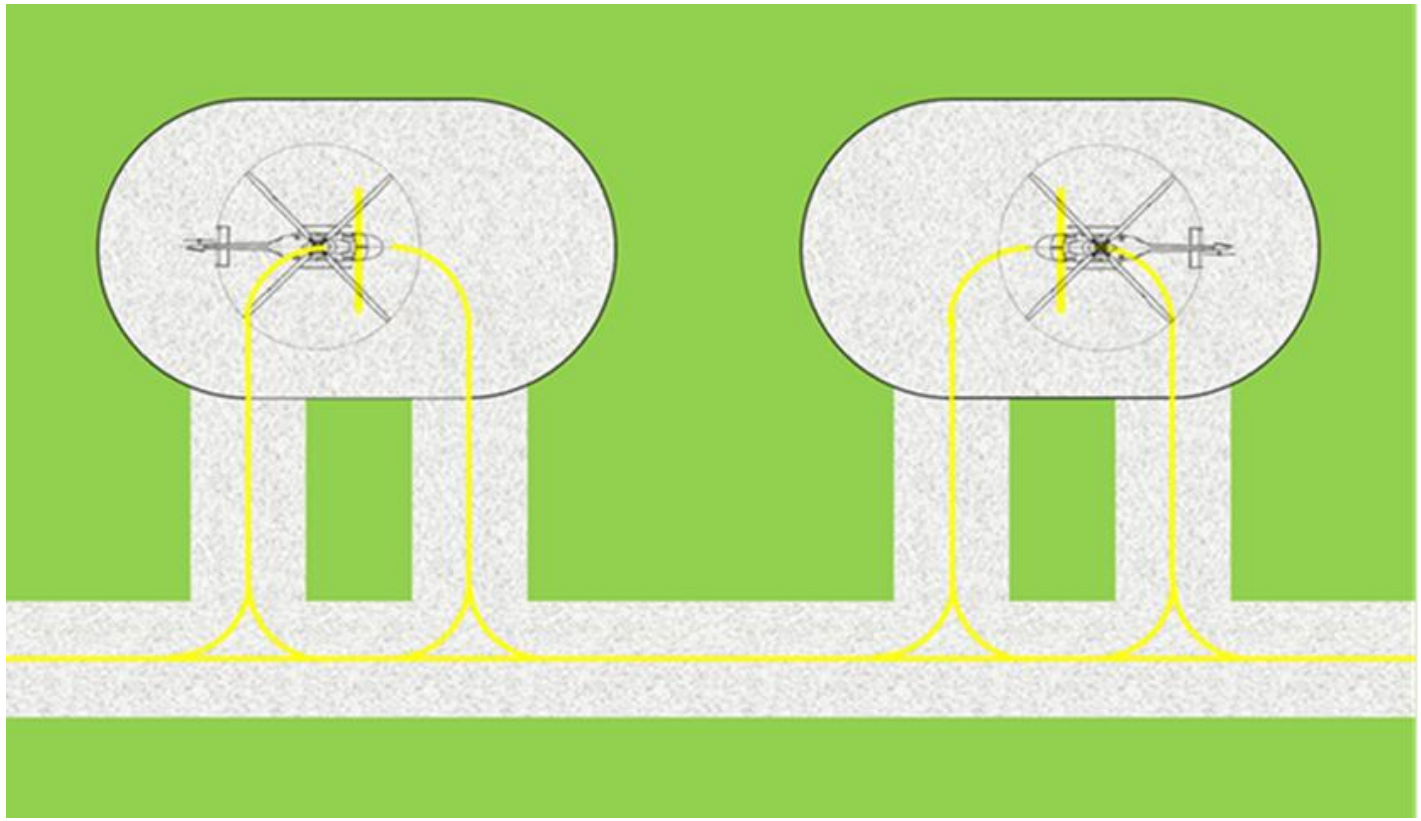
Stand Attributes – Containment (helicopter)

Note.- the stand is <u>always</u> associated with a TLOF (which provides wheel containment and surface loading attributes)



Chapter 3 – Physical Characteristics (Stand)

A more complex stand – for ground taxiing



Chapter 3 – Physical Characteristics (Appendix A – the design helicopter)

1.3 In order to define the critical design helicopter, the following elements have to be established:

a) MTOM;

b) largest dimension of the helicopter with the rotors turning (D);

c) largest width of the helicopter (which is generally accepted to be RD);

d) largest UCW;

e) largest containment area for all undercarriages (length and width (TLOF));

f) largest distance between the Main Rotor Centroid and the mid-point of the D;

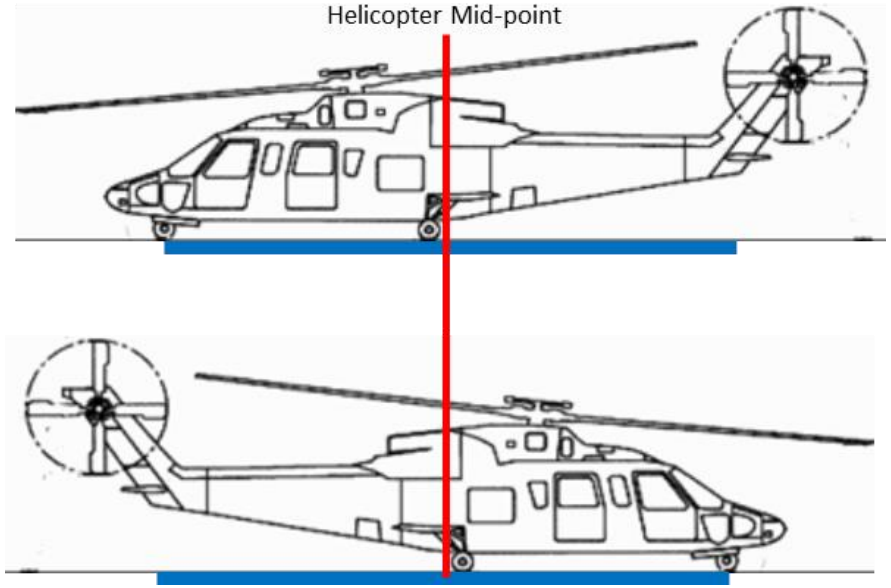
g) required dimensions for hover and, if applicable, ground turning;

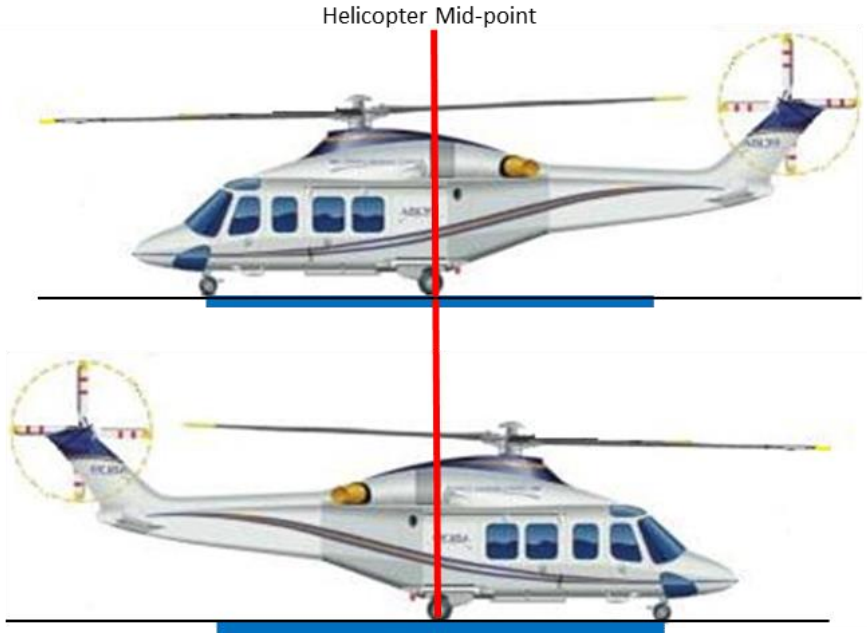
h) wheel/skid loading (to establish the surface loading requirements);

i) fuselage length/width (for the RFFS calculations); and

j) critical obstacle avoidance criteria for obstacle limitation surfaces.

Chapter 3 – Physical Characteristics (Appendix A – establishing minimum undercarriage containment)





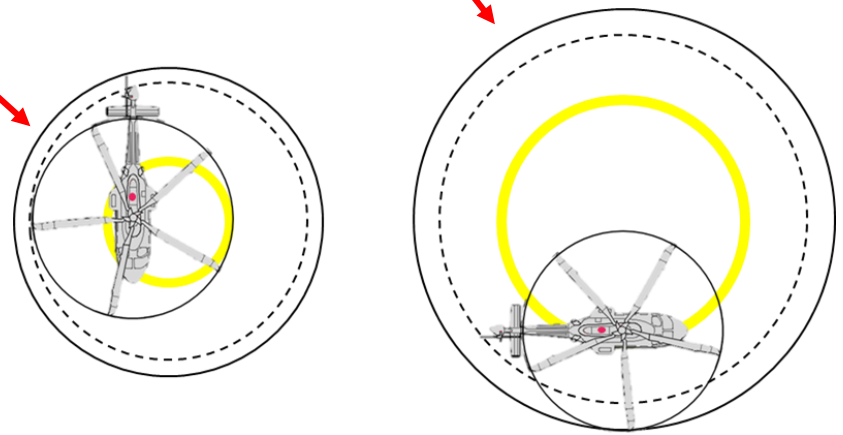
Chapter 3 – Physical Characteristics (Appendix A – establishing minimum turning circle)

3.5.2 Turning on the ground (wheeled undercarriage)

3.5.2.1 Theoretically, a wheeled helicopter can be turned around its rotor centroid; however, it can place an unacceptable strain on the undercarriage if the helicopter is forced to rotate in its own length. In addition, a short run along the longitudinal axis may be required for the releasing and setting of wheel locks.

3.5.2.2 If a helicopter is precisely manoeuvred around a radius-of-turn of 0.25D, it will be contained within a circle of 1.25D; and for a radius of turn of 0.5D, 1.75D, as shown in Figure II-3-A-6.

3.5.2.3 In practice, most wheeled helicopters will have a minimum radius of turn established by the manufacturer which should be used in the design process. In the absence of data, the minimum radius of turn should be 0.5D.

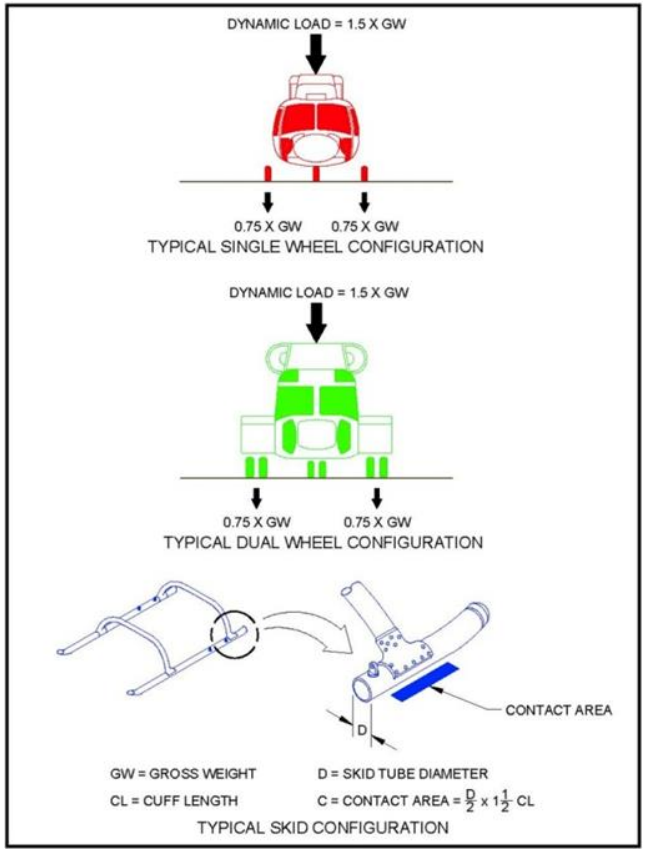


Chapter 3 – Physical Characteristics (Appendix B – surface loading)

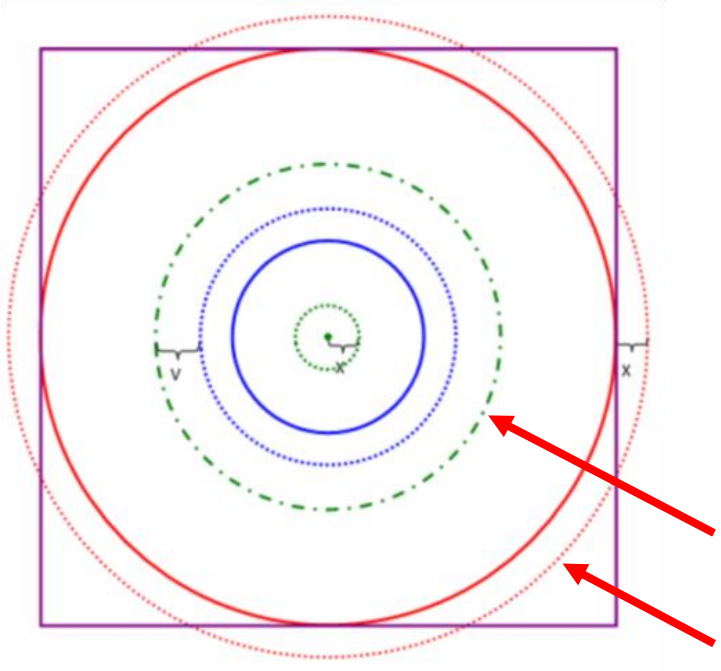
Surface loading has a substantial effect on the requirements for heliport design. Two terms commonly used in the provision of surface loading are defined in common language:

a) static: having no motion; being at rest; quiescent; and

b) dynamic: of, or relating to, energy or objects in motion.



Chapter 3 – Physical Characteristics (Appendix C – rejected take-off distance *vis-a-vis* TLOF and FATO)

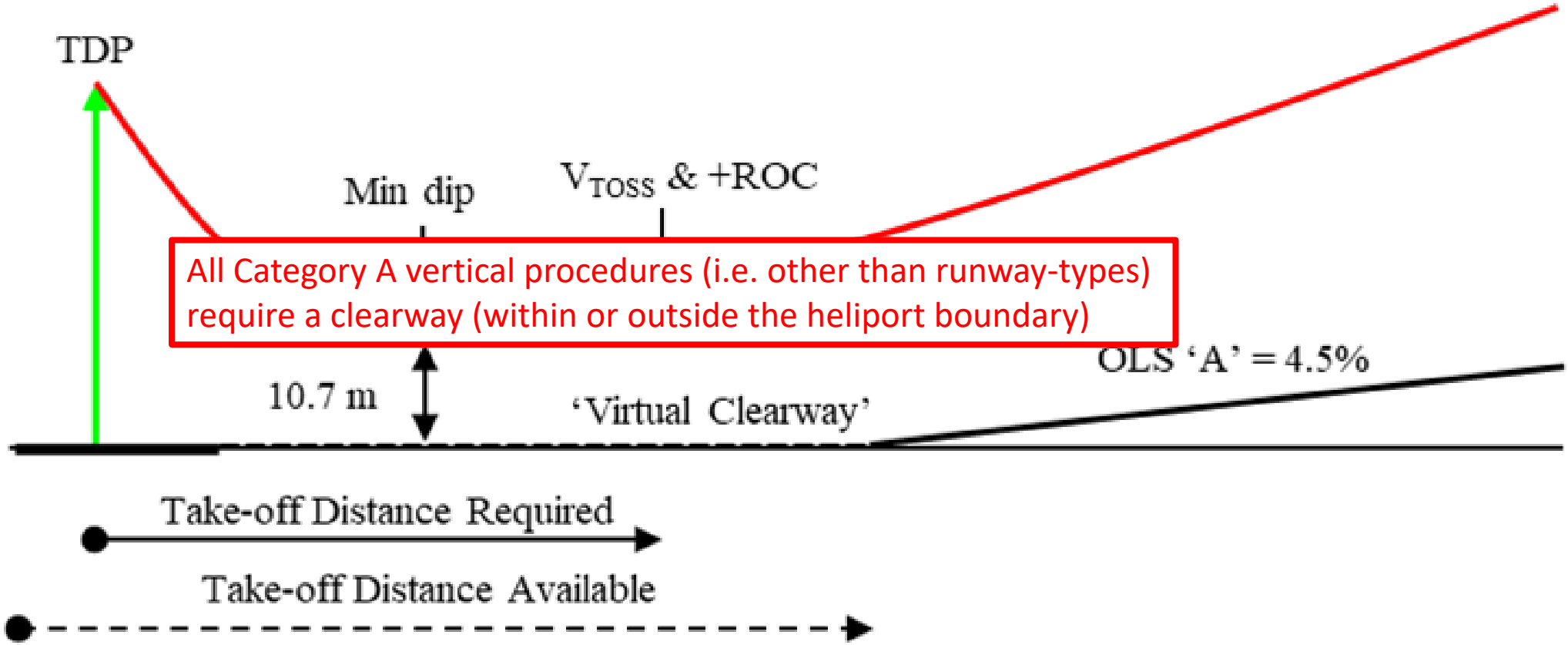


	Physical dimensions
	Undercarriage containment area (UC)/width/length
	Rotorcraft overall length (D)
	Reference area of 1D
	Touchdown reference point
	Performance/measured information
	Touchdown performance scatter (aircraft reference point scatter – 2X)
	Undercarriage containment area plus two times the touchdown performance scatter
	Minimum elevated heliport size (a 29-75(b)(2)(viii) – includes UC + two times visual cues (2V) plus t ance scatter (2X))
	Minimum rotorcraft containment n (D) plus the touchdown performance scatter (2X)

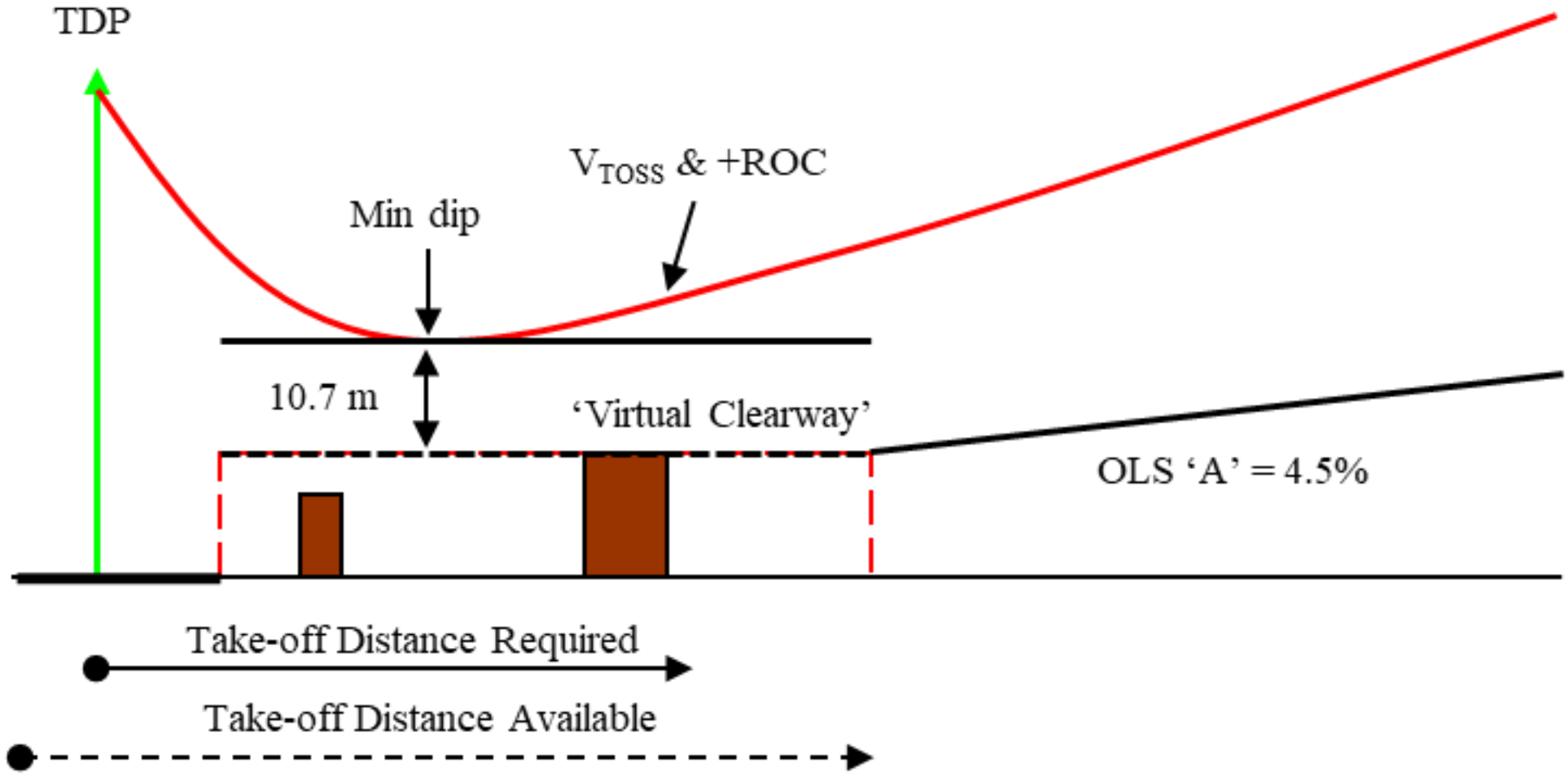
Minimum TLOF size

Minimum FATO size

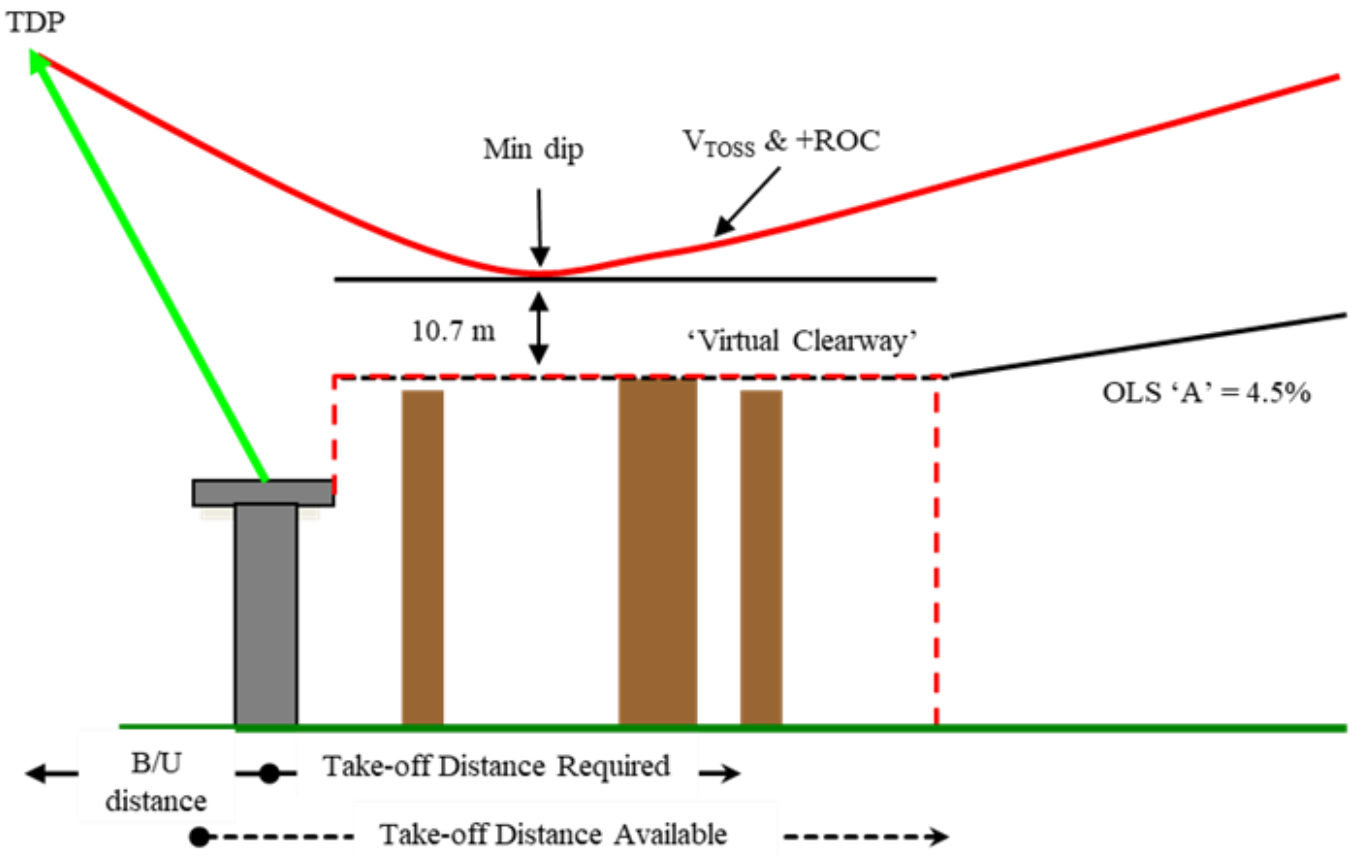
Chapter 3 – Physical Characteristics (Appendix D – establishing a virtual clearway outside heliport)



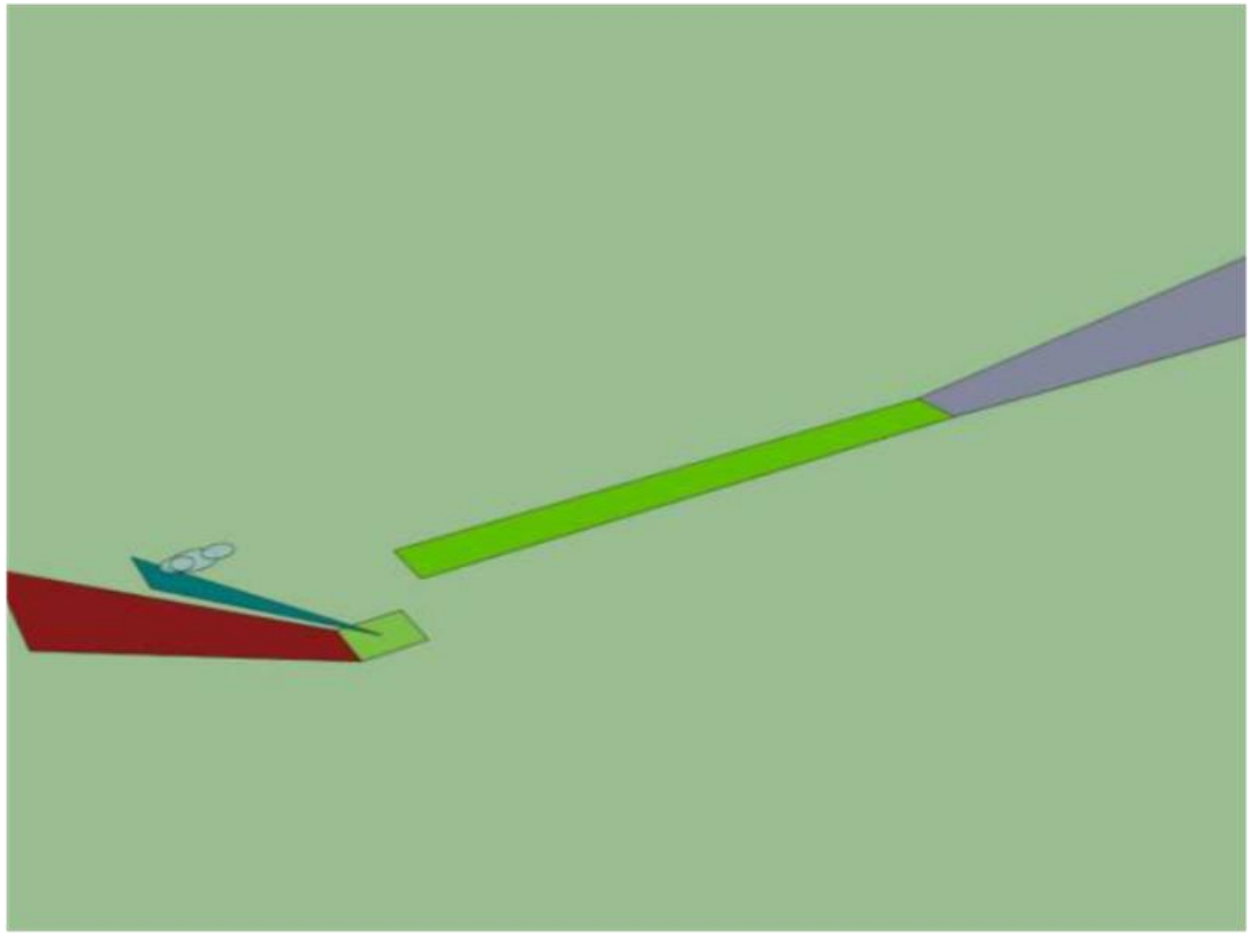
Chapter 3 – Physical Characteristics (Appendix D – establishing a virtual clearway outside heliport)



Chapter 3 – Physical Characteristics (Appendix D – establishing a virtual clearway outside heliport)

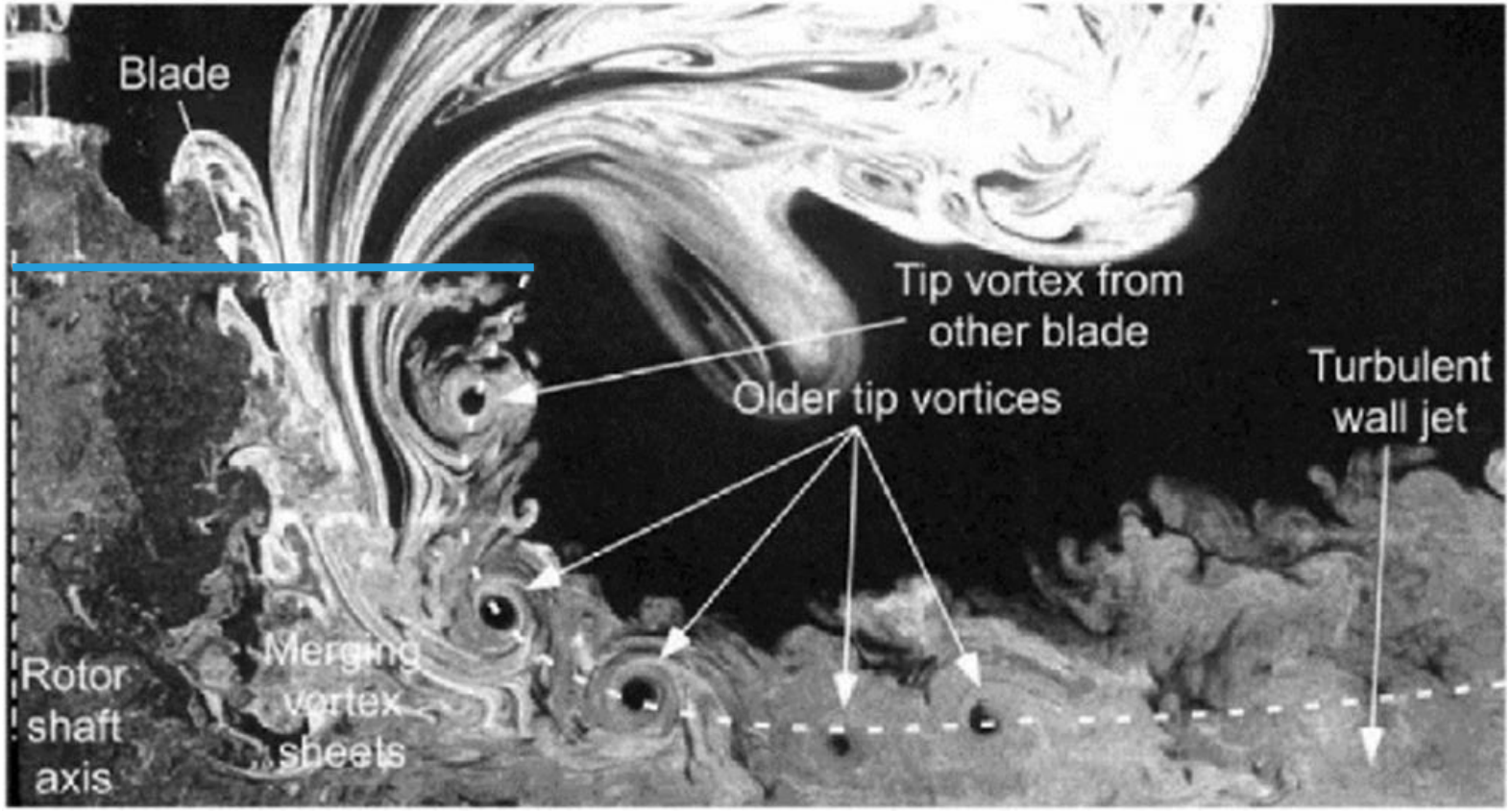


Chapter 3 – Physical Characteristics (Appendix D – establishing a virtual clearway outside heliport)

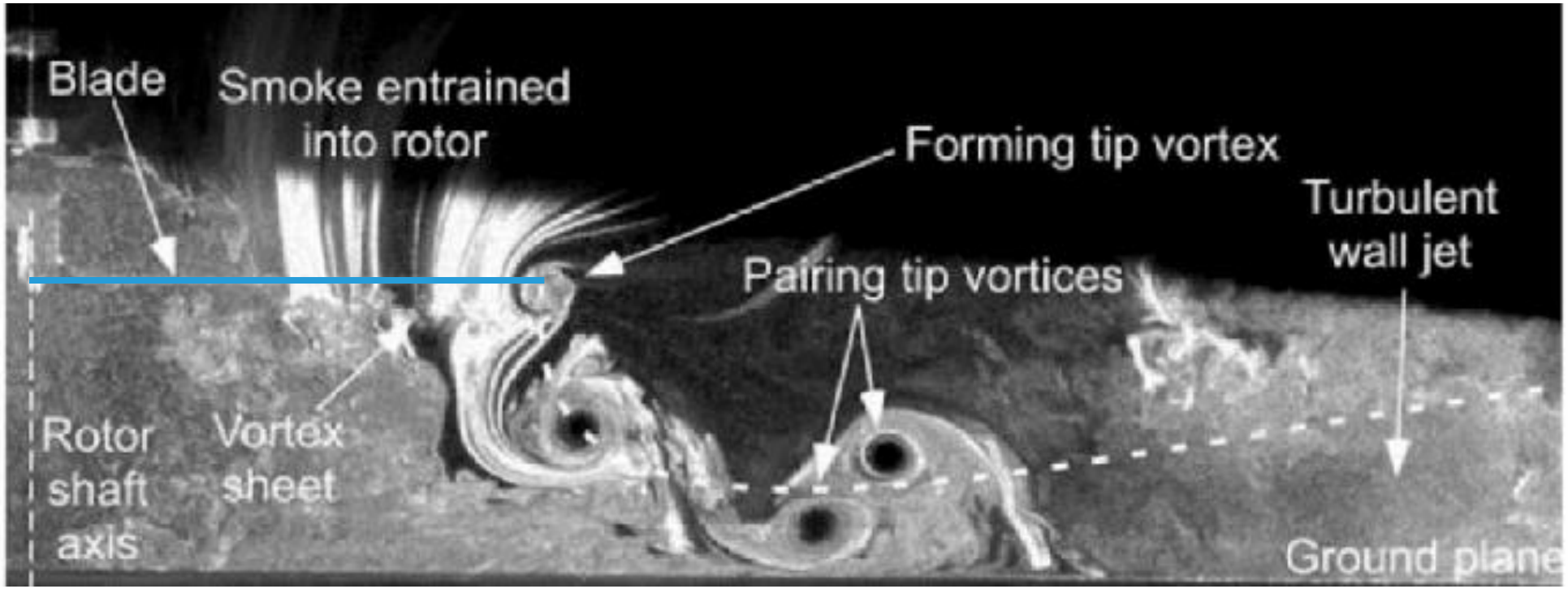


Elevating the take-off surfaces (3D visualisation)

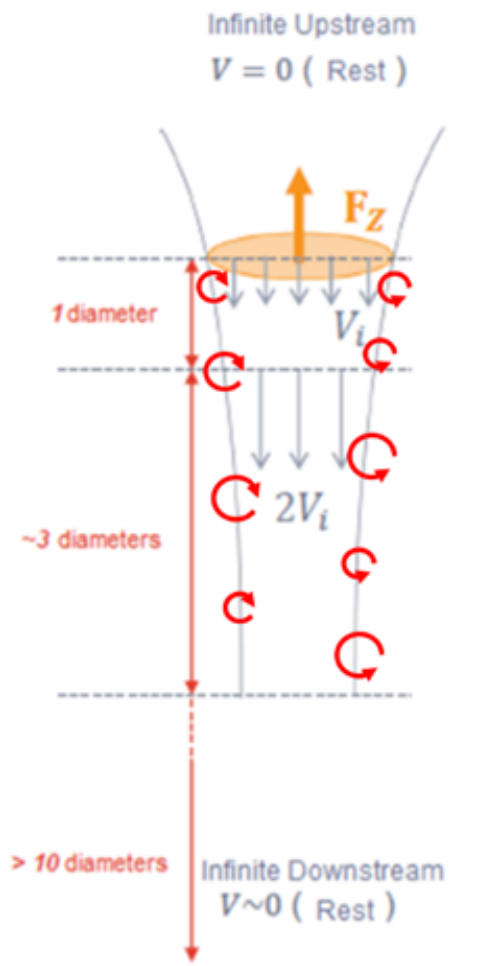
Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)



Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)



Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)

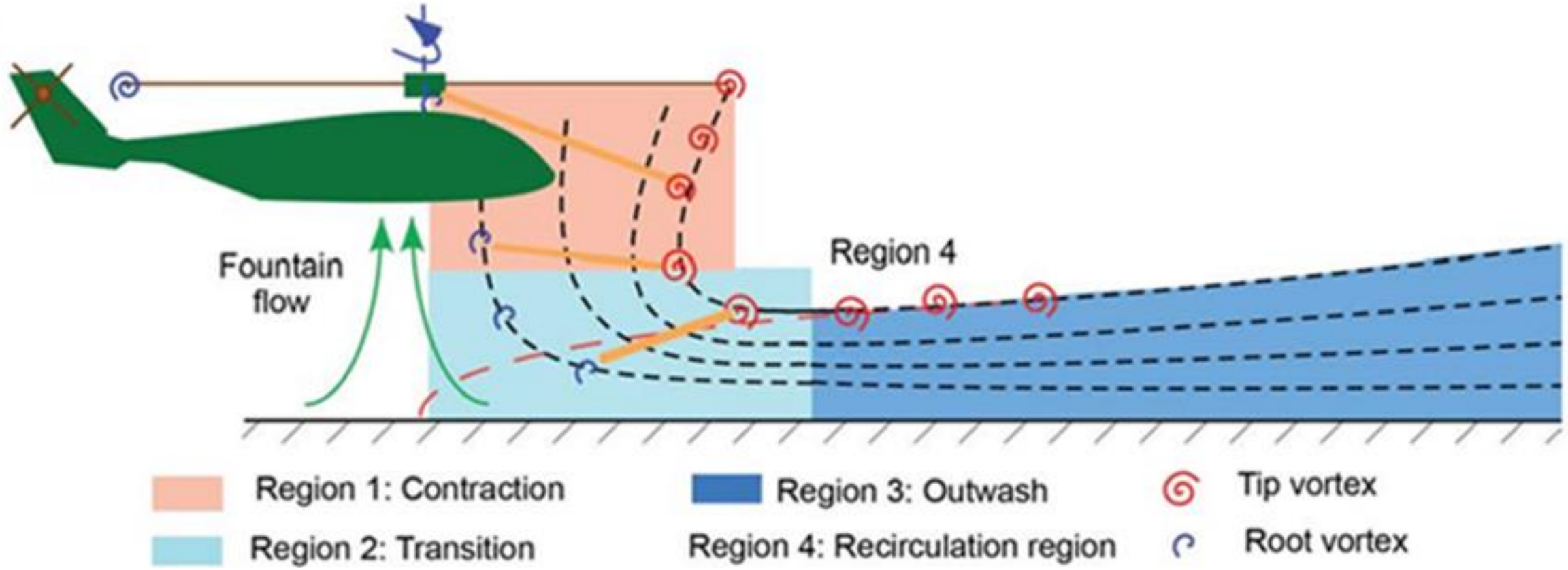


V = velocity of airflow
V_i = induced velocity
F_z = force required for hover at a given height

Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)

Type	MTOM	Rotor		Disc	Air	Downwash		
		Diameter	Area - RA	Loading	Density- ρ	2 (√(MTOM.g)/(2.RA.ρ))		
	(kg)	(m)	(m^2)	(kg/m^2)	(kg/m^3)	m/s	knots	kph
AW101	15600	18.6	271.42	57.47	1.225	30	59	109
S92	12565	17.2	231.54	54.27	1.225	29	57	106
H225	11200	16.2	206.12	54.34	1.225	30	57	106
B525	9299	16.6	216.69	42.91	1.225	26	51	94
AW189	8300	14.6	167.42	49.58	1.225	28	55	101
H175	7800	14.8	172.03	45.34	1.225	27	52	97
AW139	6800	13.8	149.57	45.46	1.225	27	52	97
H160	6050	13.4	141.03	42.90	1.225	26	51	94
Bell 412	5398	14.0	154.38	34.97	1.225	24	46	85
S76	5306	13.4	141.24	37.57	1.225	25	48	88
AW169	4800	12.1	115.37	41.61	1.225	26	50	93
H145	3800	11.0	95.03	39.99	1.225	25	49	91
Bell 429	3175	11.0	95.03	33.41	1.225	23	45	83
EC135	2980	10.4	84.95	35.08	1.225	24	46	85
Bell 407	2722	10.7	89.42	30.44	1.225	22	43	79
H130	2427	10.7	89.75	27.04	1.225	21	40	75
H500	1361	8.0	50.27	27.08	1.225	21	40	75
R22	621	7.7	46.34	13.40	1.225	15	28	53
AW609	7620	7.9	98.03	77.73	1.225	35	69	127
V22	21000	12.0	226.19	92.84	1.225	39	75	139
SH 60B	9298	16.4	209.95	44.29	1.225	27	52	96
CH 53E	31751	24.0	452.39	70.19	1.225	34	65	121
Mil 26	56000	32.0	804.25	69.63	1.225	33	65	120

Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)



Chapter 3 – Physical Characteristics (Appendix E – rotorcraft downwash and outwash)

Helicopter Data				Peak Wind Velocity					
Type	RD	Mass	D/L	Radius at 72 (km/h)		Radius at 54 (km/h)		Radius at 40 (km/h)	
	(m)	(kg)	(kg/m^2)	R/r (radii)	(m)	R/r (radii)	(m)	R/r (radii)	(m)
AW101	18.6	15600	57.47	5.4	51	7.2	67	8.9	83
S92	17.2	12565	54.27	5.2	45	7.0	60	8.8	75
H225	16.2	11200	54.34	5.2	42	7.0	57	8.8	71
B525	16.6	9299	42.91	4.5	37	6.4	53	8.3	69
AW189	14.6	8300	49.58	4.9	36	6.8	49	8.6	63
H175	14.8	7800	45.34	4.7	34	6.5	48	8.4	62
AW139	13.8	6800	45.46	4.7	32	6.5	45	8.4	58
H160	13.4	6050	42.90	4.5	30	6.4	43	8.3	55
Bell 412	14.0	5398	34.97	4.0	28	5.9	41	7.9	55
S76	13.4	5306	37.57	4.1	28	6.0	40	8.0	54
AW169	12.1	4800	41.61	4.4	27	6.3	38	8.2	50
H145	11.0	3800	39.99	4.3	24	6.2	34	8.1	45
Bell 429	11.0	3175	33.41	3.9	21	5.7	32	7.8	43
EC135	10.4	2980	35.08	4.0	21	5.9	30	7.9	41

Chapter 4 – Obstacle Environment

Obstacle limitations surfaces and sectors

- Approach surface
- Transitional surface
- Take-off surface
- Surface with and without PinS

Application of obstacle limitations

Appendix A – Elevating the origin of take-off and or approach surfaces and utilizing PC1 vertical procedures

Chapter 4 – Obstacle Environment (slope design categories)

This table contains the required surface and dimension for any Obstacle Limitation Surface (OLS) but each, in accordance with the notes, can be modified by elevating the surfaces - when vertical procedures are in place.

The specific case of elevating the clearway, OLS and protection surfaces is addressed in Appendix A.

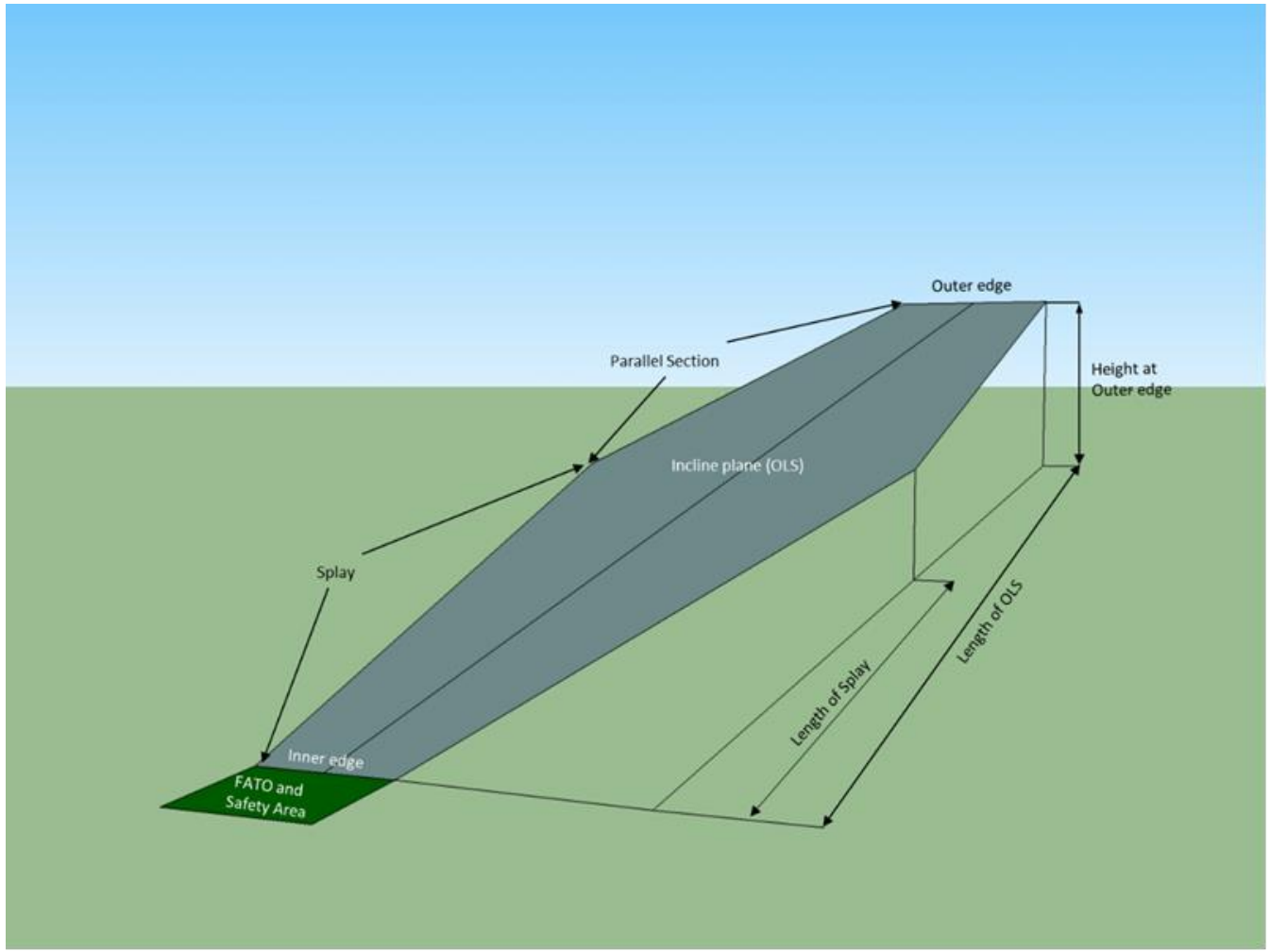
Surface and dimensions	*Slope design categories*		
	A	*B*	*C*
Approach and take-off climb surface:			
Length of inner edge	Width of safety area	Width of safety area	Width of safety area
Location of inner edge	Safety area boundary (Clearway boundary if provided)	Safety area boundary	Safety area boundary
Divergence: (1st and 2nd section)			
Day use only	10%	10%	10%
Night use	15%	15%	15%
First section:			
Length	3 386 m	245 m	1 220 m
Slope	4.5% (1:22.2)	8% (1:12.5)	12.5% (1:8)
Outer width	(b)	N/A	(b)
Second section:			
Length	N/A	830 m	N/A
Slope	N/A	16% (1:6.25)	N/A
Outer width	N/A	(b)	N/A
Total length from inner edge (a)	3 386 m[c]	1 075 m[c]	1 220 m[c]
Transitional surface:			
Slope	50% (1:2)	50% (1:2)	50% (1:2)
Height	45 m[d]	45 m[d]	45 m[d]

a. The approach and take-off climb surface lengths of 3 386 m, 1 075 m and 1 220 m associated with the respective slopes brings the helicopter to 152 m (500 ft) above FATO elevation.

b. Seven rotor diameters overall width for day operations or 10 rotor diameters overall width for night operations.

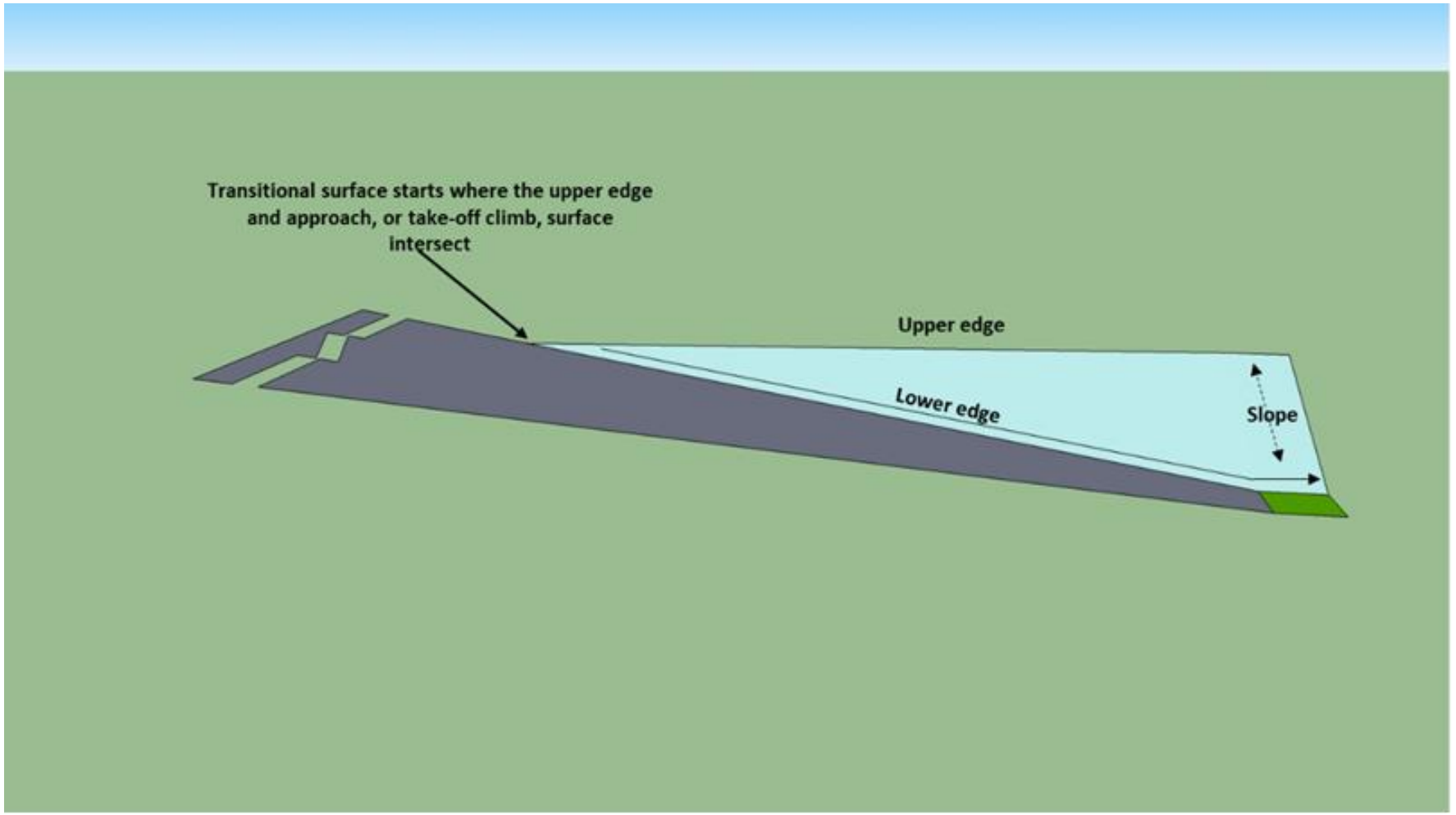
c. This length may be reduced if vertical procedures are in place or increased if the approach surface is extended to meet the OCS of the PinS arrival/departure procedure.

Chapter 4 – Obstacle Environment (approach surface – type C)



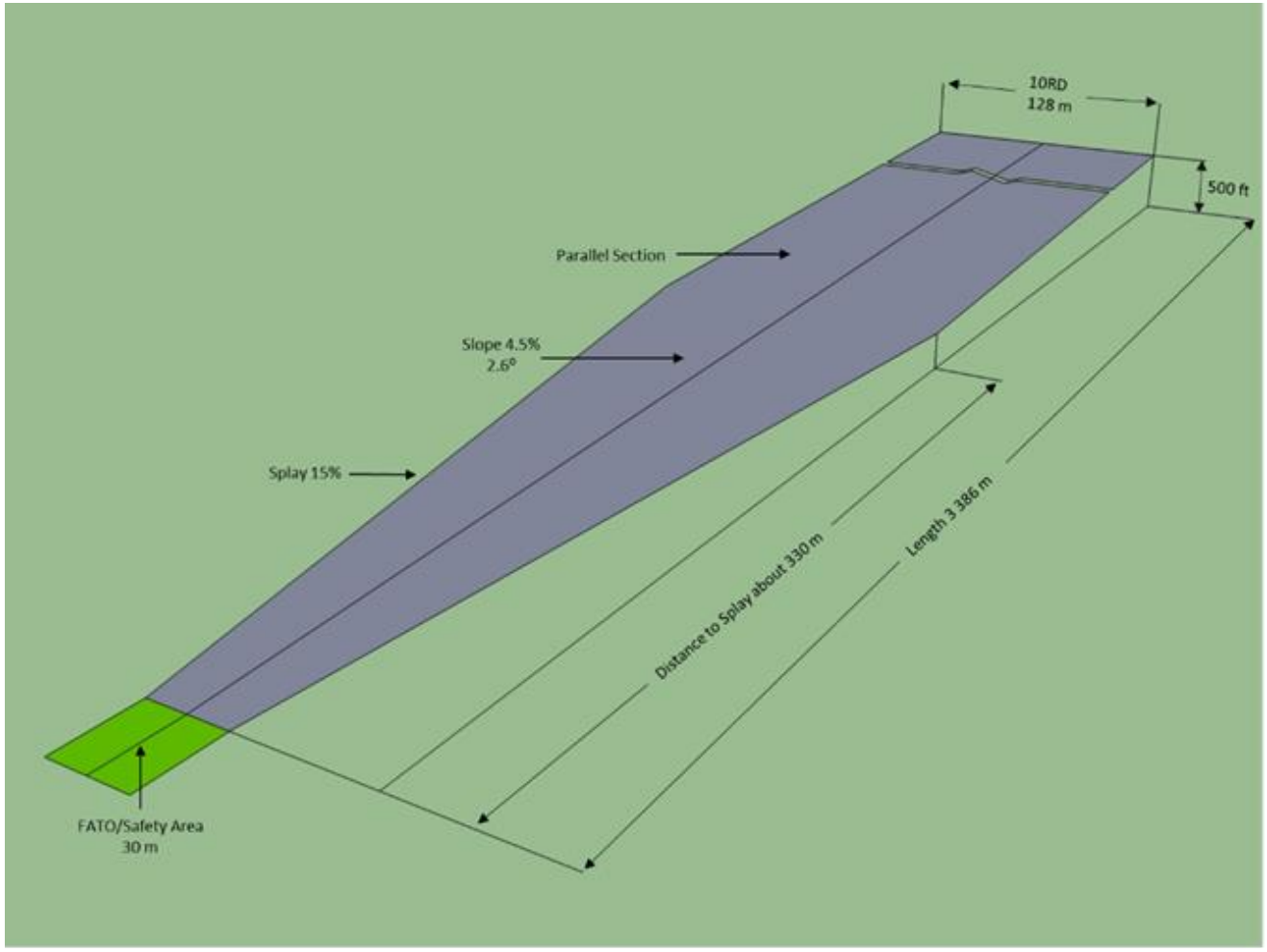
Approach Surface (12.5%)

Chapter 4 – Obstacle Environment (transitional surface - for limited visibility procedures)



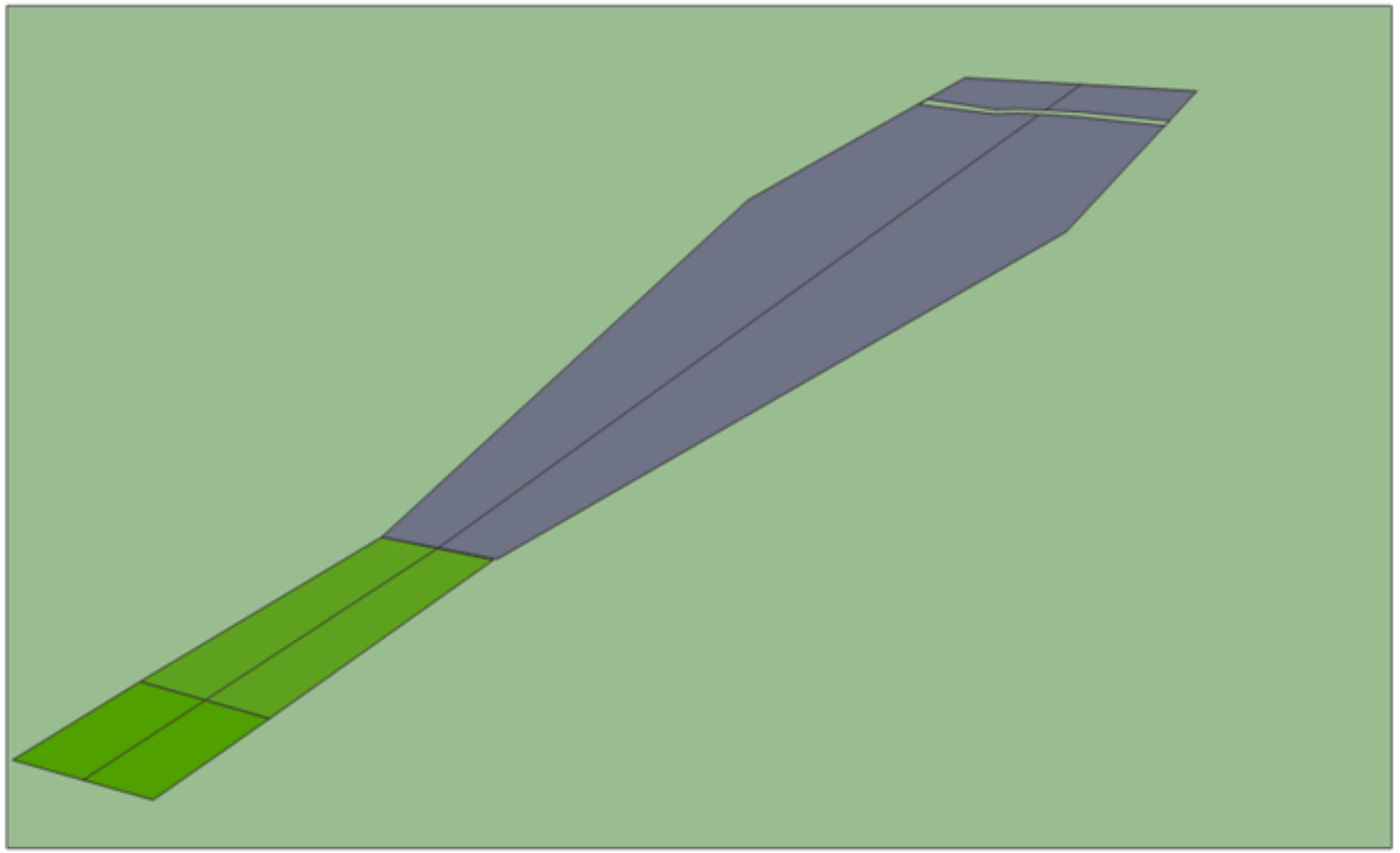
Transitional surface

Chapter 4 – Obstacle Environment (take-off climb surface – type A)



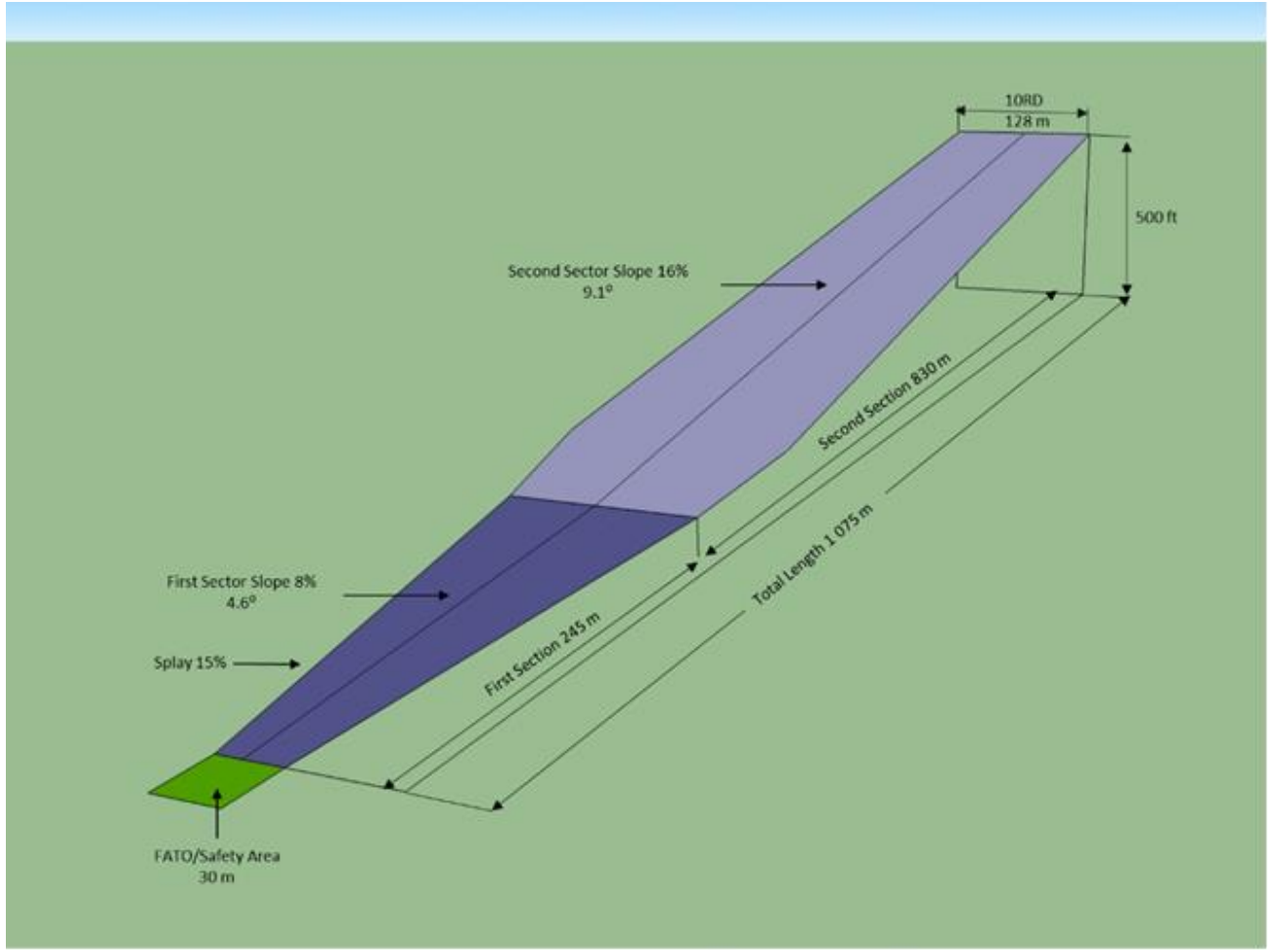
Category A slope

Chapter 4 – Obstacle Environment (take-off climb surface – type A with clearway)



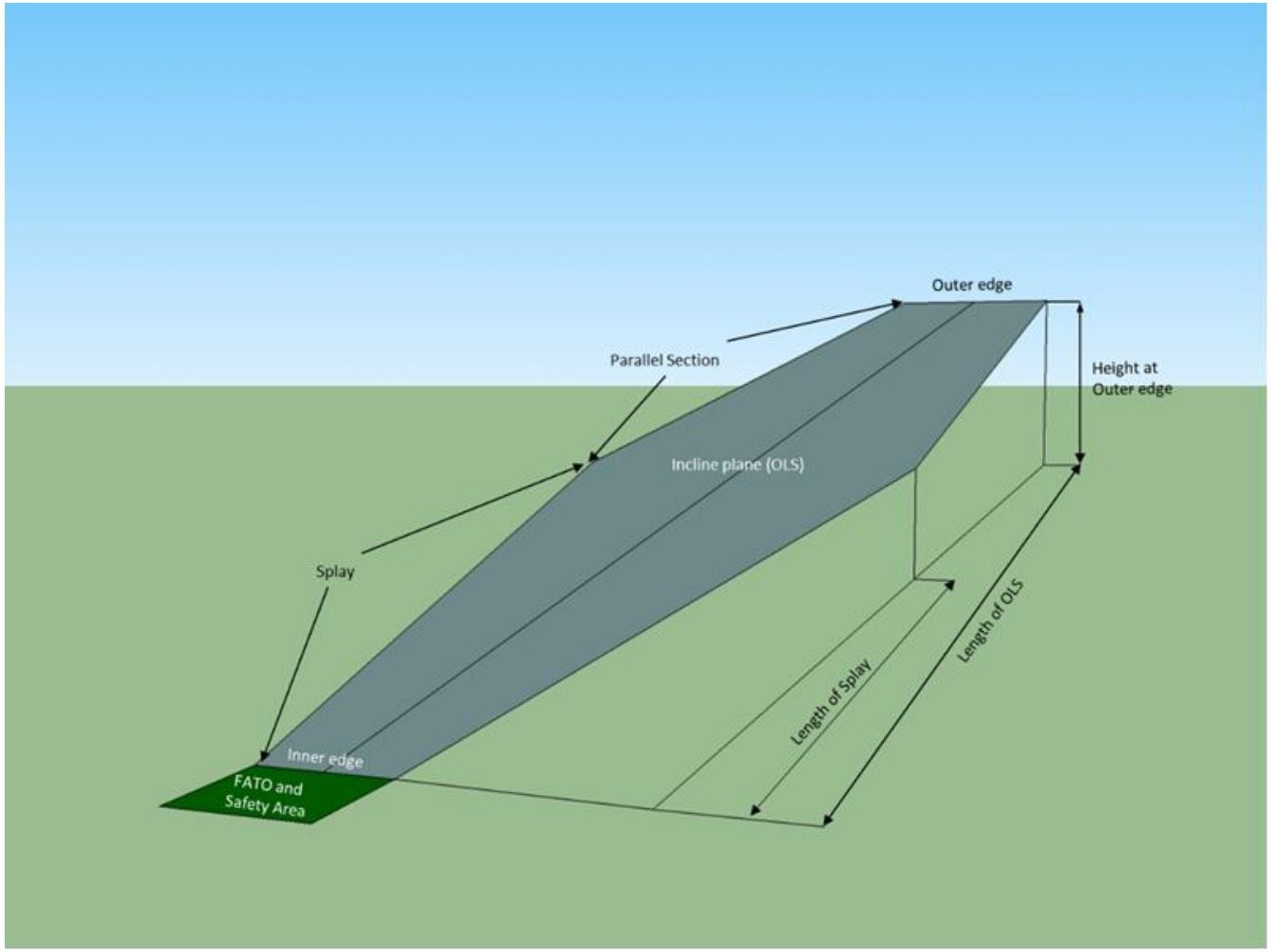
Category A slope with helicopter clearway

Chapter 4 – Obstacle Environment (take-off climb surface – type B)



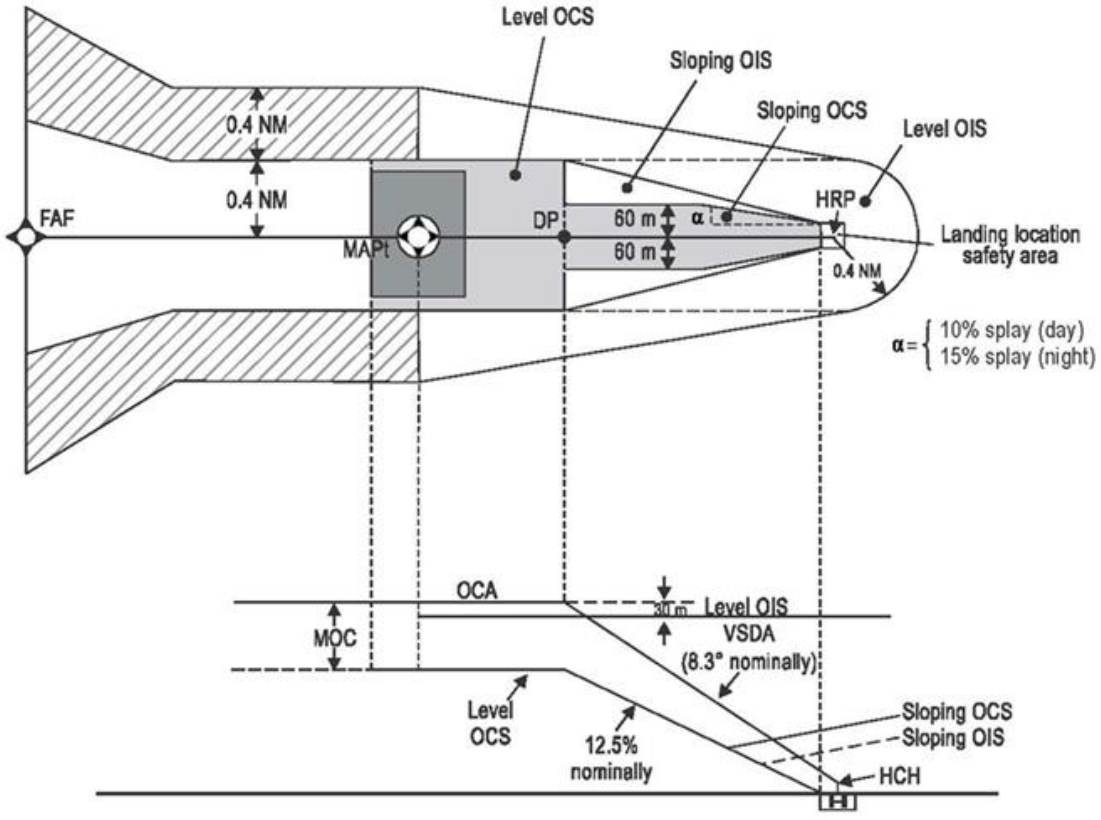
Night Category B slope (15 m D-value)

Chapter 4 – Obstacle Environment (take-off climb surface – type C)



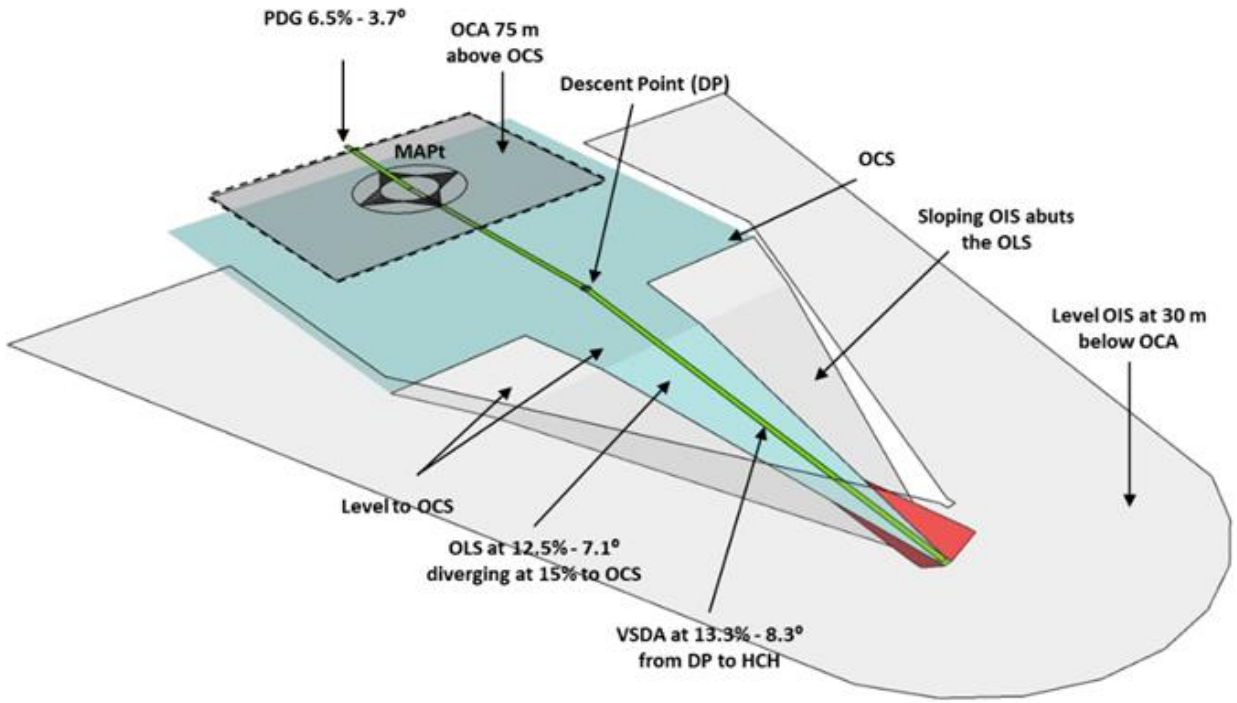
Approach Surface (12.5%)

Chapter 4 – Obstacle Environment (example of PinS – proceed visually with DP)



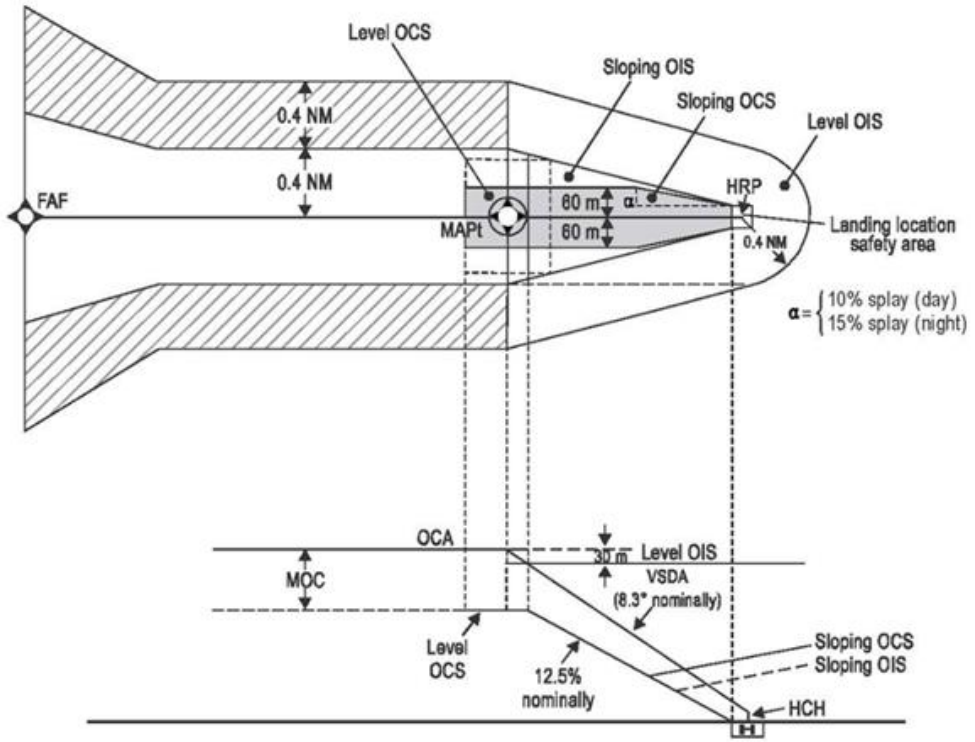
PinS approach to a DP (schematic)

Chapter 4 – Obstacle Environment (example of PinS – with proceed visually DP)



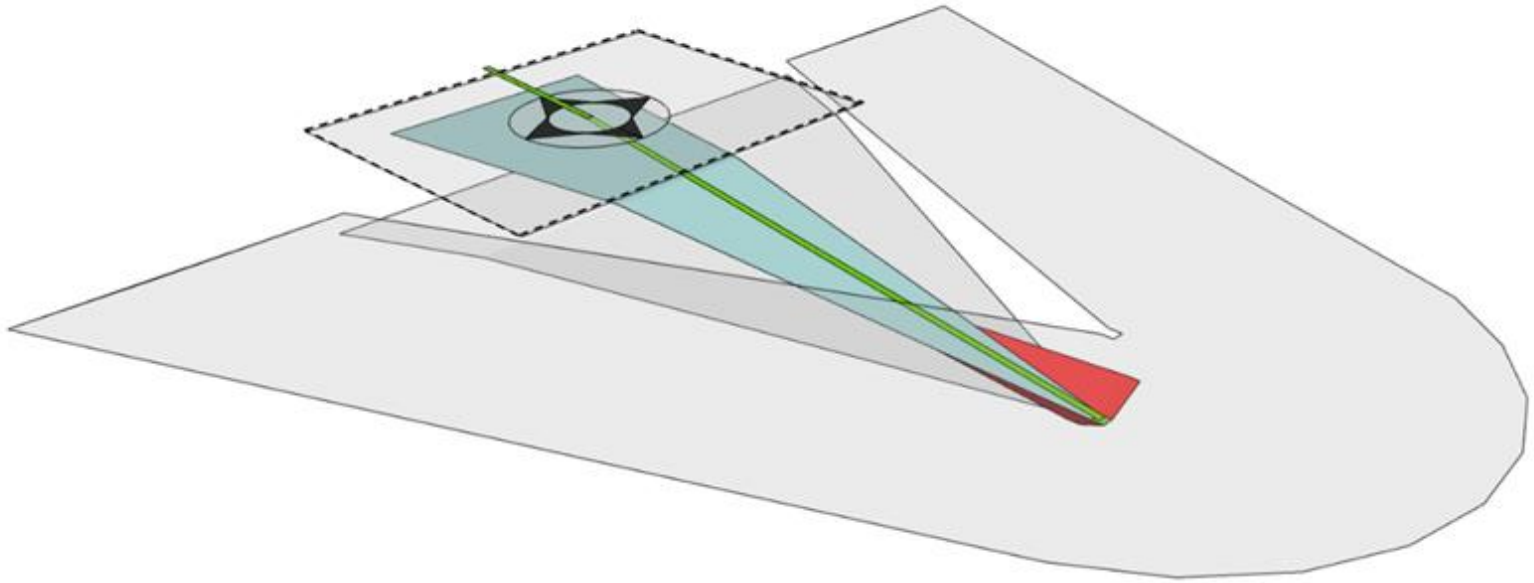
Pins Approach to a DP (3D visualisation)

Chapter 4 – Obstacle Environment (example of PinS – proceed visually)



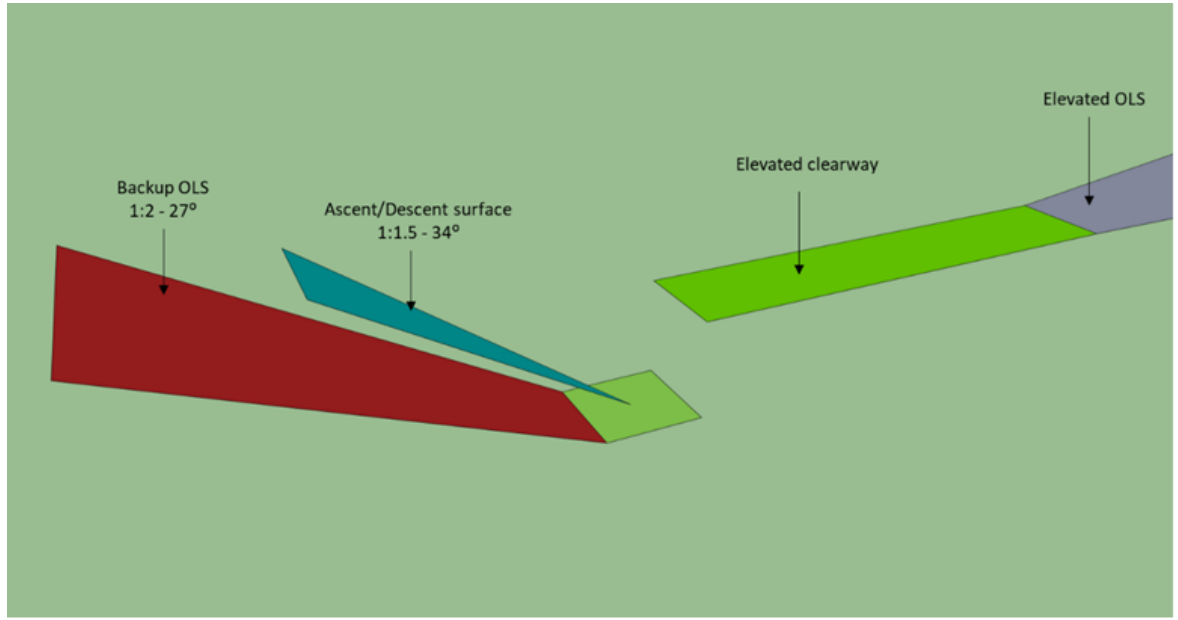
PinS direct approach (schematic – Doc 8168)

Chapter 4 – Obstacle Environment (example of PinS – proceed visually)

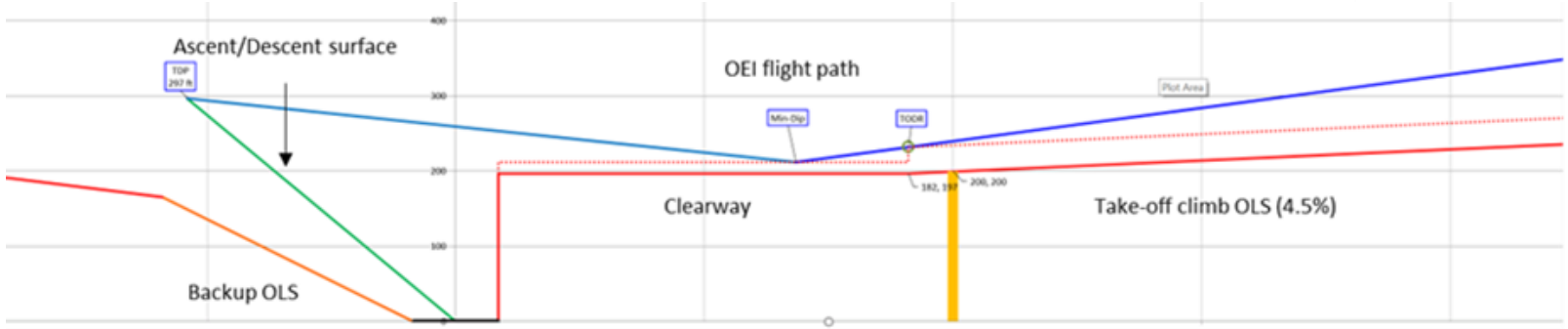


PinS direct approach (3D visualisation – Doc 8168)

Chapter 4 – Appendix A - elevating the origin of the take-off climb surface

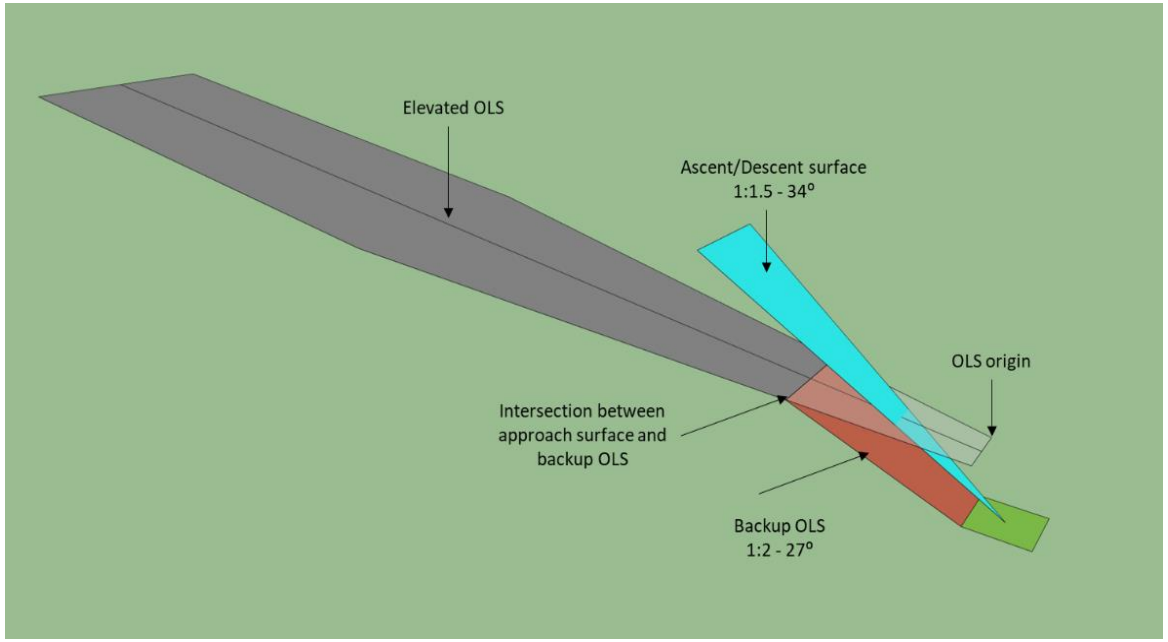


Elevating surfaces for take-off

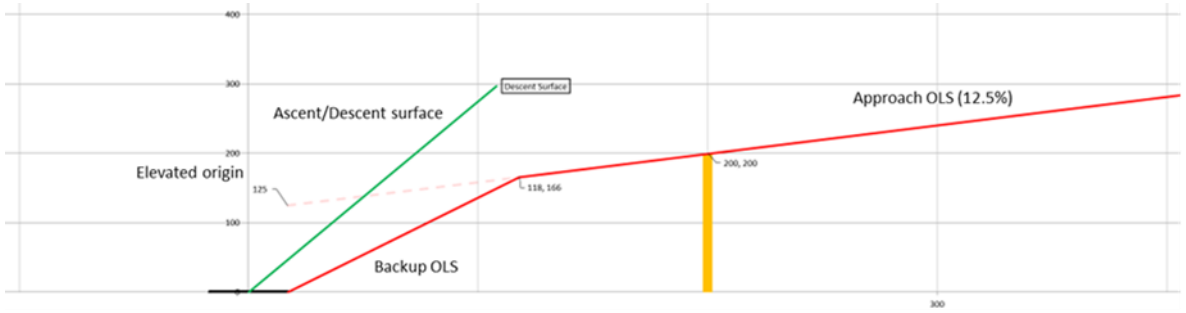


Calculating elevation for departure (4.5% slope)

Chapter 4 – Appendix A - elevating the origin of the approach surface

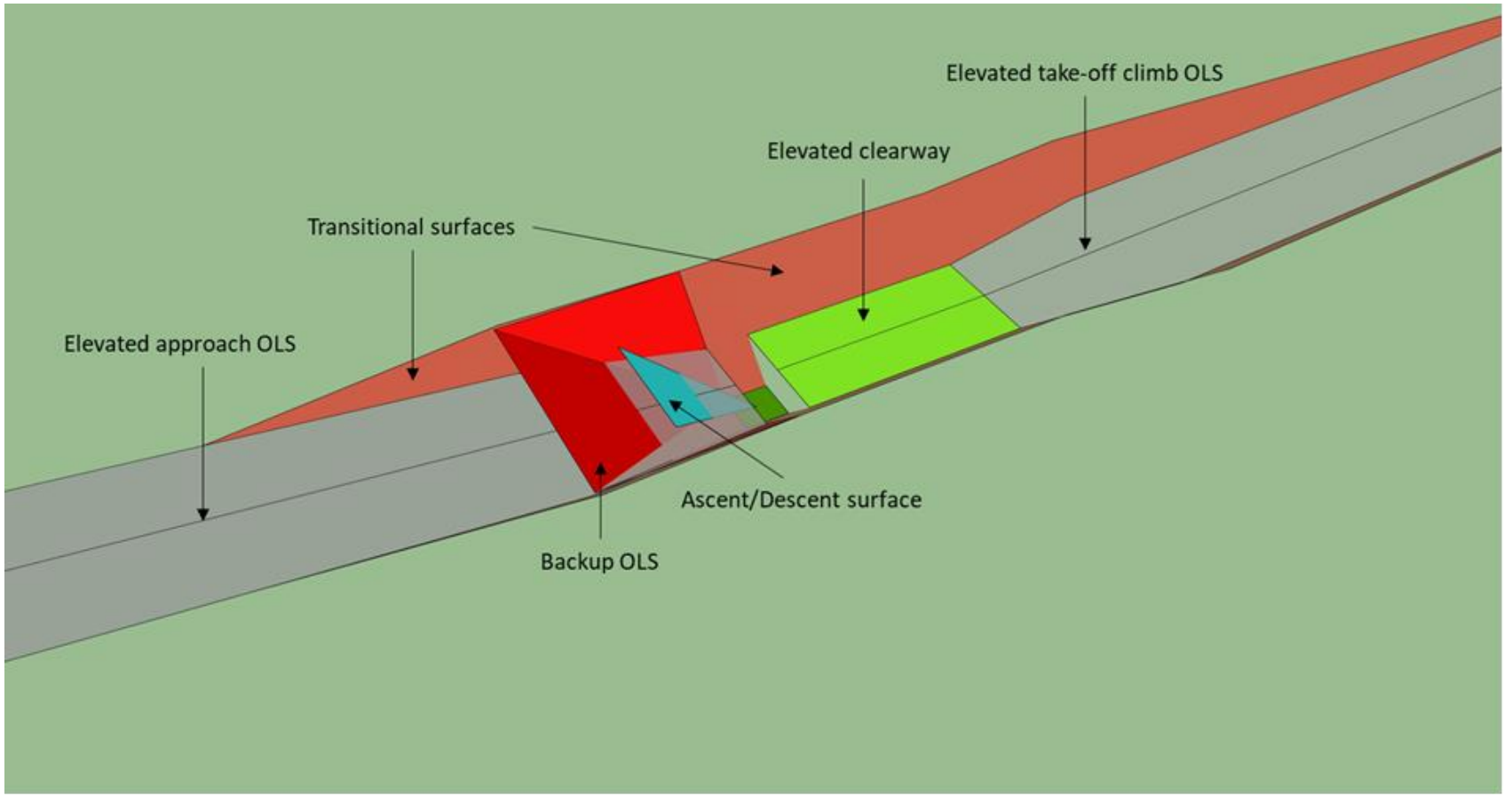


Elevating surfaces for landing



Calculating elevation for arrival (12.5% slope)

Chapter 4 – Appendix A - elevating the take-off climb/approach surfaces (with side-slope protection)



Elevating surfaces for take-off and landing (with lateral protection using transitional area/side-slope)

Chapter 5 – Visual Aids

Indicators

Marking Aids

Lights

Appendix A – Visual alignment guidance systems

Appendix B – Helicopter rapproach path indicator (HAPI)

Appendix C – Example of the UK specifications for a hospital heliport lighting system

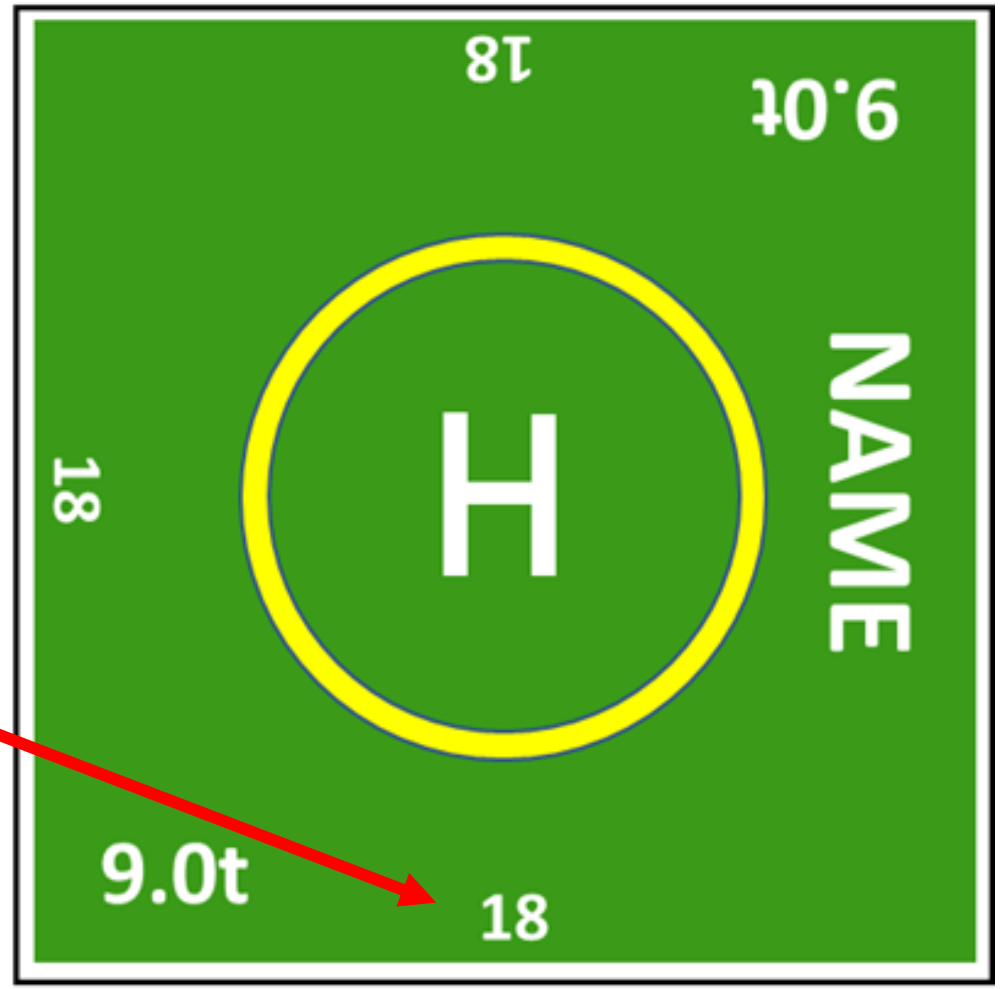
Chapter 5 – Visual aids (TLOF markings)

Markings

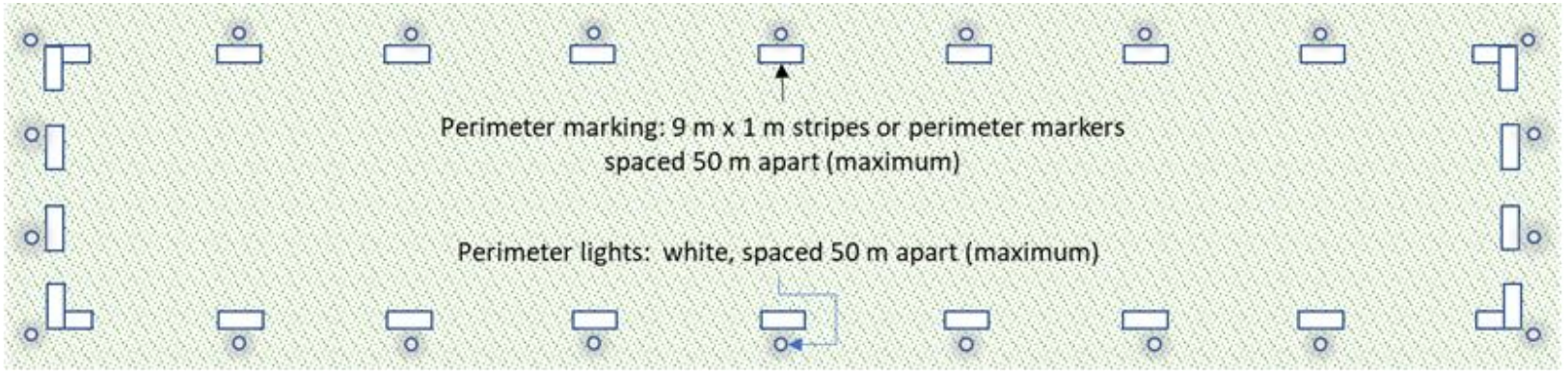
- TLOF perimeter marking
- Heliport identification marking
- Maximum allowable mass marking
- **D-Value marking**

Defines the D-Value (limiting size)

not the TLOF or FATO dimensions



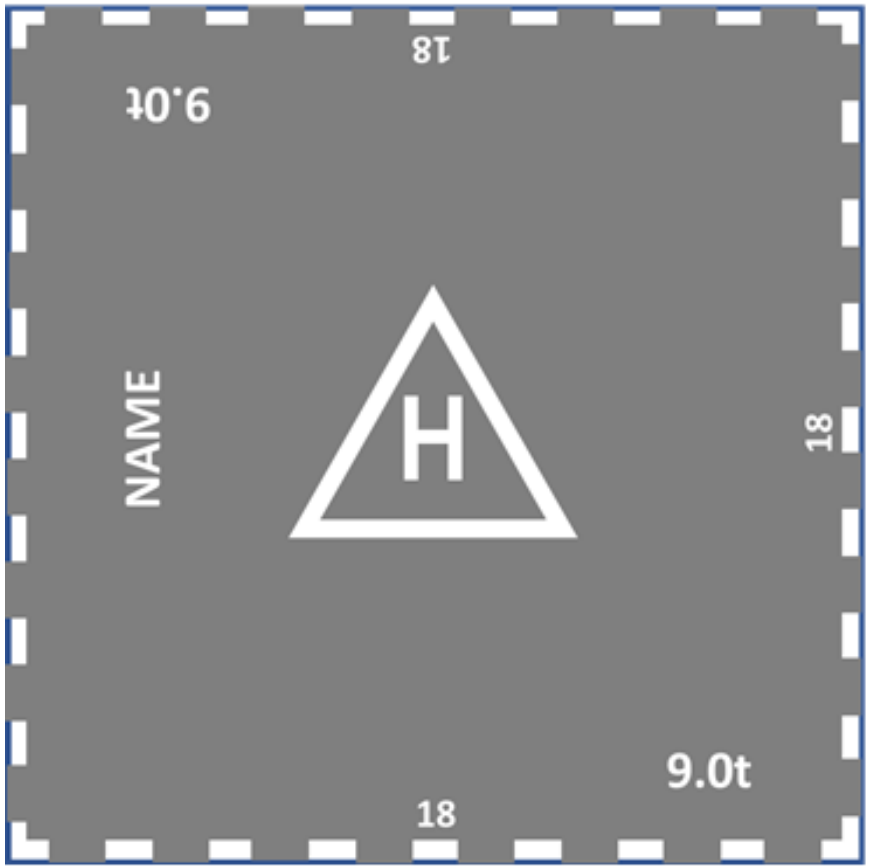
Chapter 5 – Visual aids (runway-type FATO markings and lights)



Permimeter marking or markers for surface level runway-type FATO

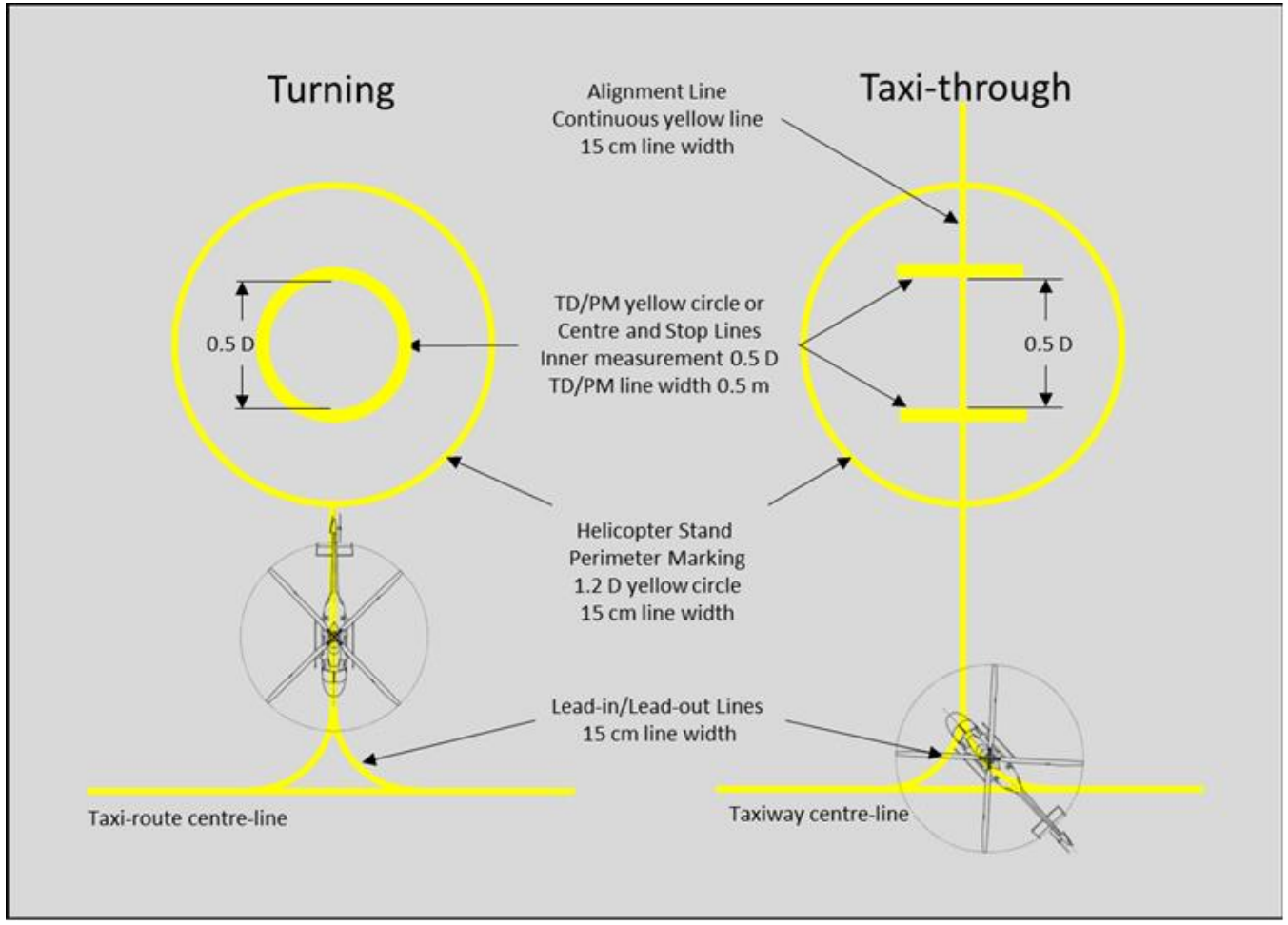
Designation marking for runway-type FATOs

Chapter 5 – Visual aids (FATO with aiming point - markings)



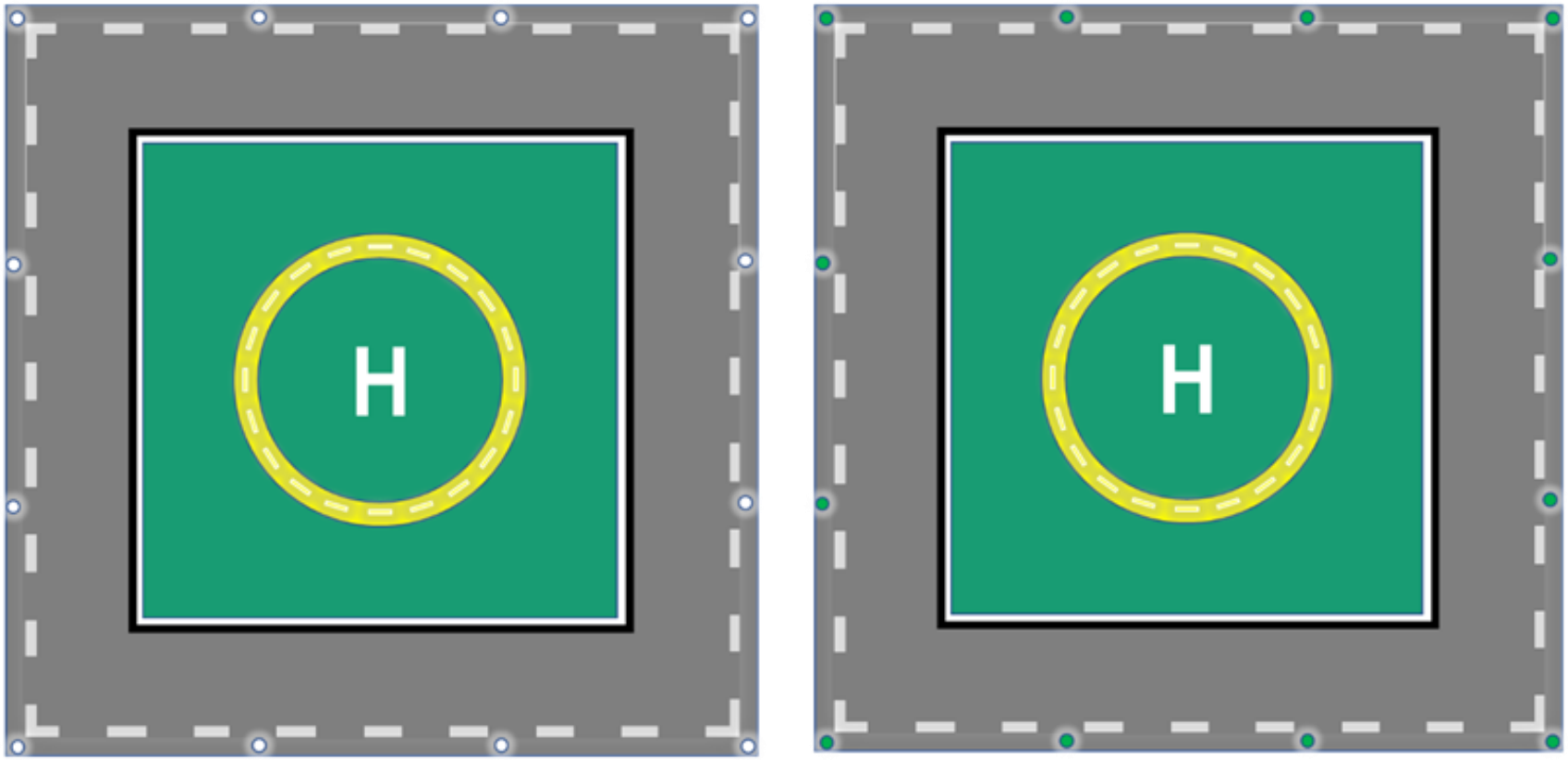
Aiming point marking

Chapter 5 – Visual aids (stand markings with taxiway taxi-route and lead-in lines)



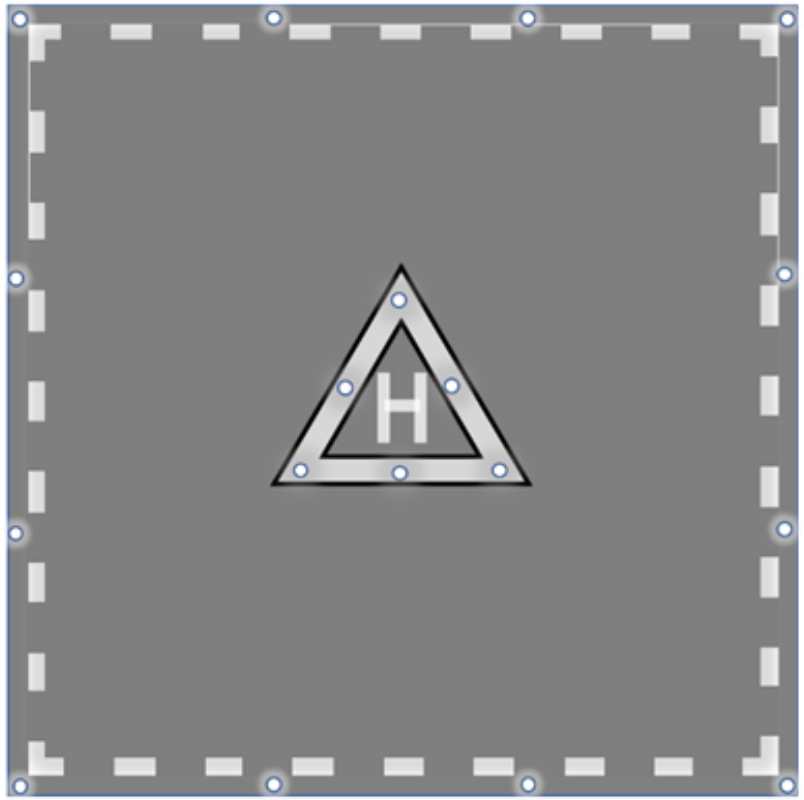
Helicopter stand marking

Chapter 5 – Visual aids (lights – green or white FATO lighting)



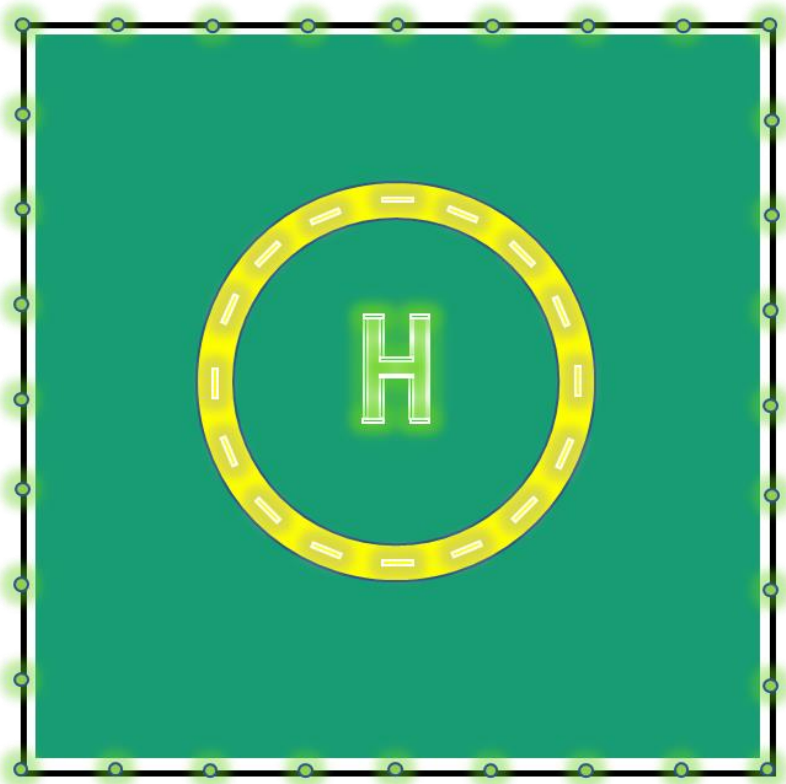
FATO perimeter lights (white or green)

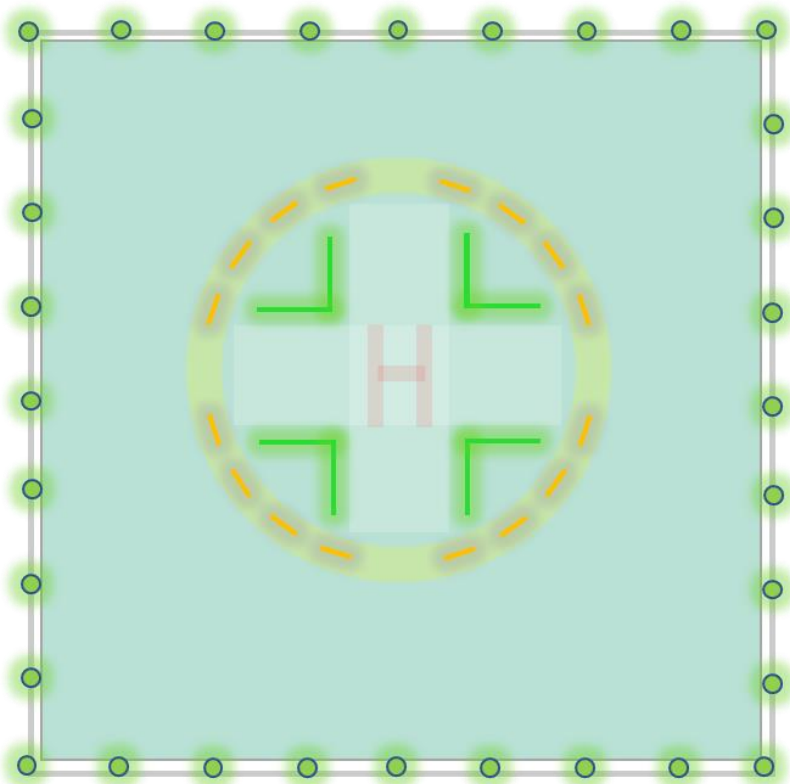
Chapter 5 – Visual aids (lights – FATO with aiming point lighting)



FATO and aiming point lights

Chapter 5 – Visual aids (lights – three examples of TLOF lighting)





Chapter 6 – Heliport Emergency Response

- Heliport emergency planning
  - General
  - Content of plan
- Rescue and fire fighting service (RFFS)
  - Required level of RFFS
  - Staffing levels
  - Level and method of protection
  - Meeting response time objective
  - Rescue arrangements
  - Comms and alerting system
  - RFFS personnel
  - Means of escape
- Appendix A – Example of a task/resource analysis (TRA)
- Appendix B – Certification status

Chapter 6 – Heliport emergency response (rescue and fire-fighting service (RFFS))

Fire hydrants

DIFFs

Chapter 6 – Heliport emergency response (rescue and fire-fighting service (RFFS))

DIFFs

THANK YOU