Australian Government
Civil Aviation Safety Authority

ANNEX A TO AC 133-01 V4.2

Performance class operations - Instructions for use of flight profile spreadsheets

March 2025

Contents

Acknowledgement of Country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to Elders past, present and emerging.

Artwork: James Baban.

Introduction

These Excel spreadsheets are used to assist heliport operators to determine the parameters for a virtual clearway, as dictated by obstacles which may impact on the heliport's operations and the performance of their chosen 'design helicopter.' The spreadsheets also assist the helicopter operator and/or pilot to determine take-off decision point (TDP) or rotate point (RP) heights to ensure appropriate obstacle clearance is maintained throughout the take-off and initial climb.

Spreadsheets are available for the following aircraft types and models:

a. AW139
b. Bell 412EP
c. EC135 P2
d. BK117 B2
e. BK117 850D2 (STC conversion)
f. A109E

The AW139 spreadsheet has five worksheets and each other aircraft type's spreadsheet has four worksheets. They provide a method for determining obstacle avoidance for the following take-off procedures:

a. Category A Heliport back-up take-off in compliance with PC1 or PC2 requirements.
b. Heliport vertical take-off when below the applicable Category A weight limit, and in compliance with PC2WE. RP represents the end of the exposure period and defined point after take-off (DPATO).
c. Heliport vertical take-off when above the applicable Category A weight limit, and in compliance with PC2WE. VTOSS represents the end of the exposure period and DPATO.
d. For the AW139 only - Heliport vertical take-off when above the applicable Category A weight limit, and in compliance with PC2WE. RP represents the end of the exposure period and DPATO.
e. Clear Heliport take-off in compliance with PC1.

Applicable rotorcraft flight manual (RFM) data is used within the worksheets to support the calculations of aircraft flight path.

NOTE: OPERATORS MUST CONFIRM THE FLIGHT MANUAL DATA, ENVIRONMENTAL AND OPERATIONAL CONSIDERATIONS ARE CORRECT AND APPLICABLE TO THEIR AIRCRAFT AND OERATIONAL SITUATIONS WHEN CONSULTING THE SPREADSHEETS.

General instructions

Green and pink shaded boxes are the only cells that should be adjusted. All other cells are protected. Data and formulae in other cells will help the understanding of the construction of the worksheets.

Green shaded boxes are for inputs relating to computing the obstacle limitation surface (OLS) — often known as the obstacle-free gradient—and the minimum flight path for maintaining the mandated obstacle clearance margin. The OLS line is in solid red. Minimum flight path line is in dotted red (refer to Figure 1).

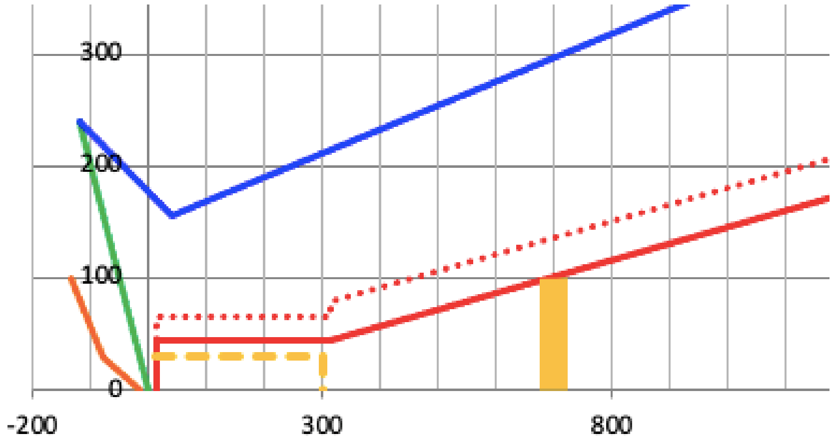


Figure 1. Sample output of flight profile spreadsheets.

Pink shaded boxes are for inputs relating to the aircraft flight path. A solid green line reflects the all engines operating (AEO) flight path. A solid blue line represents the one engine inoperative (OEI) flight path following an engine power loss.

The orange line represents the back-up safety zone for a rearwards Category A take-off. This is based on rotorcraft flight manual (RFM) data, or if no data is available it is constructed to remain 35 ft below the AEO back-up flight path.

The amber column represents an obstacle beyond the end of the virtual clearway relevant to the OLS. The dashed amber line represents an obstacle anywhere within the virtual clearway.

The initial horizontal dotted red line represents 15 ft clearance from the virtual clearway (solid red line) when there is no obstacle within 20 ft below the virtual clearway. If there is an obstacle within 20 ft below, this dotted red line is raised to ensure 35 ft clearance from the obstacle is always maintained. From the end of the virtual clearway the dotted red line adjusts to reflect a constant 35 ft clearance from the OLS.

Entering heliport data

An option is provided to enter the following heliport data into the green cells (refer to Figure 2):

a. *Length of Virtual Clearway.* This cell indicates the desired length of the virtual clearway. This must be specified to be longer than the 'design helicopter' longest anticipated take-off distance required - rotorcraft (TODRR).

b. *Obstacle-free OLS gradient.* The standard requirements for PC1 heliports is 4.5%, but if obstacles allow this may be reduced if the 'design helicopter' is unable to climb at 4.5% when OEI.

c. *Distance of OLS obstacle from safety area* (this is the amber column in Figure. 1). This box gives an option to select the distance, from the edge of the safety area, of the obstacle most critical for the segment one climb. Only enter distances greater than the length of the virtual clearway from (a) above.

d. *Height of OLS obstacle above heliport.* This is the option to select the height of the OLS obstacle, beyond the virtual clearway, most critical for the initial climb.

e. *Height of clearway obstacle above heliport.* This gives an option to enter the height of any obstacle within the virtual clearway, i.e. within the distance from the safety area to the end of the clearway from (a) above. This obstacle is shown by a dashed blue line.

Helipad(25x25m):	
Elevation of Virtual Clearway (ft):	44
Length of Virtual Clearway (m):	300
Obstacle-free OLS Gradient (%):	4.5
Distance of OLS obstacle from safety area (m)	700
Height of OLS obstacle above heliport (ft)	100
Height of clearway obstacle above heliport (ft)	30

Figure 2. Sample Heliport input data

The insertion of a critical obstacle, for example, 100 ft at 700 m in Figure. 2) or an obstacle within the virtual clearway, for example 30 ft in Figure. 2, will automatically raise the virtual clearway height if necessary. If the critical obstacle beyond the virtual clearway is more limiting, it will be raised until the 4.5 % gradient touches the critical obstacle. If the obstacle within the virtual clearway is more limiting, the virtual clearway will be aligned with the height of that obstacle. The lowest permitted elevation of the virtual clearway is driven by the height of the OLS gradient at the end of the clearway, as if the origin of the OLS was at the edge of, and level with, the safety area. For example, from Figure 2, the lowest elevation is 300x4.5/100=13.5 m (44 ft).

The heliport designer may also look at Cells C51 and C52 to determine how far above the entered OLS slope the virtual clearway needs to be raised in order to avoid the OLS or clearway obstacle.

Inputs for the Clear Heliport worksheet vary slightly and may be sourced from the ERSA Runway Distance Supplement (RDS) or from the heliport operator. Inputs include:

a. *RTODAR (ASDA)* – This is the input for the 'Rejected Take-Off Distance Available – Rotorcraft', and is also called the 'Accelerate-Stop Distance Available' in the RDS.

b. *TODAR* – 'Take-Off Distance Available – Rotorcraft' may also be sourced from TODA or STODA data in the RDS.

c. *Obstacle-free OLS Gradient* – For runways this may be sourced from the RDS, or if requiring a shallower gradient, it can be combined with critical obstacle information to create an elevated OLS origin.

d. *Distance of OLS obstacle from end of TODAR* – Gives an option to enter an obstacle distance.

e. *Height of OLS obstacle above heliport* – Gives an option to enter an obstacle height, which when combined with obstacle distance may require an elevation of the OLS origin to maintain a specified OLS gradient.

With these heliport inputs completed, and appropriate aircraft data inserted, a visual representation of the aircraft flight path compared to the minimum flight path can be seen.

Entering Aircraft Data

Pink cells for heliport elevation, temperature, CAT A weight limit and aircraft take-off weight have no inputs to the calculations, so are for recording purposes only. An option is provided to enter the following data, which is then used for calculating the aircraft flight path:

a. *Factored headwind* – 50% of the observed or reported headwind may be inserted here. This automatically adjusts the aircraft climb gradients and acceleration distance for the EC135 (B412 acceleration distance requires a manual look-up from the charts).

b. *Height loss from TDP* – Depending on the aircraft, this may require a manual entry (if pink box), may be a constant figure, or may be adjusted automatically. Only adjust if cell is pink.

c. *Take-off distance required* - Depending on the aircraft, this may require a manual entry (if pink box), may be a constant figure, or may be adjusted automatically. Only adjust if cell is pink. This marks the commencement of the Segment One VTOSS climb and is usually 15-20ft above the min-dip, depending on the aircraft.

d. *Segment 1 climb 0 to 200 ft* – Input the OEI climb gradient at take-off power and VTOSS from the RFM charts.

e. *Acceleration distance* – This is only present in some aircraft and represents the acceleration from VTOSS to VY. It may be fixed (EC135), or it may vary (Bell 412).

f. *Segment 2 climb 200 to 100 0ft* – Input the OEI climb gradient at maximum continuous power and VY from the RFM charts.

g. *Planned TDP or RP* – Manually adjust the TDP/RP until the aircraft flight path (solid blue line) always remains above the minimum flight path (dotted red line).

Vertical PC2WE <CAT A worksheet

This worksheet suggests a technique if obstacles to the rear do not allow a back-up procedure. In such cases, and depending on the aircraft, PC2WE will usually be required.

Once the heliport virtual clearway and OLS data is established, the rotate point should be raised to the point where the flight path remains above the minimum flight path (Figure 3).

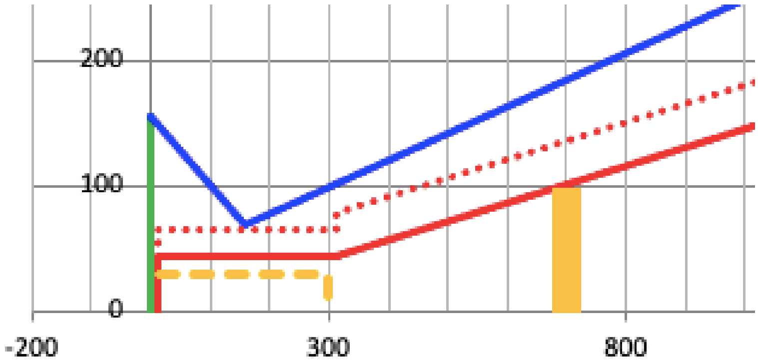


Figure 3. Vertical PC2WE <CAT A

However, due to the exposure time limits of PC2WE, the extent of the vertical climb may be limited. This time limit will be indicated on the worksheets by a maximum height for the rotate point and is derived from an approximate AEO vertical rate of climb for the aircraft. DPATO will be at the rotate point.

Unless supported by other RFM data, an assumption is made that the height loss from the rotate point is the same as the height loss from the back-up procedure. It is also assumed that the TODRR is the same as the back-up procedure rearwards distance plus take-off distance. Both assumptions will produce conservative results.

Vertical PC2WE >CAT A worksheet

This worksheet suggests the technique if aircraft operating weight is above the Category A weight limits.

Once the heliport virtual clearway and OLS data is established, the rotate point should be raised to the point where the flight path remains above the minimum flight path (Figure 4). In this case, and due to the aircraft weight, aircraft height loss data is often not available. For this reason, the suggested technique is to take-off vertically until at least above the dotted line, then accelerate level AEO to achieve VTOSS.

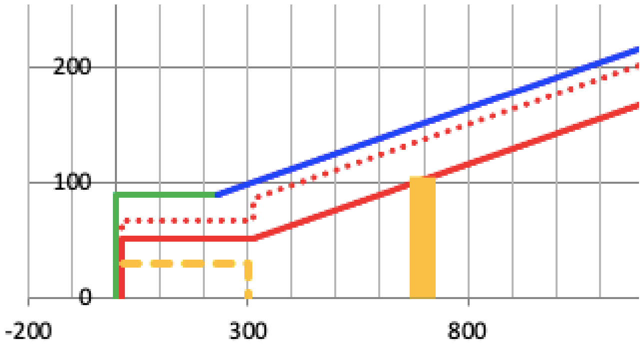


Figure 4. Vertical PC2WE >CAT A

As mentioned earlier, due to the exposure time limits of PC2WE, the extent of the vertical climb may be limited to allow acceleration to VTOSS within the time limits. This is indicated on the worksheets by a maximum height for the rotate point. DPATO will be at VTOSS.

Because PC2WE operations normally remain within the Category A Clear Heliport (Runway) weight limits (so VTOSS can be used), an assumption is made that the AEO acceleration to VTOSS can always be achieved within the Clear Heliport TODRR.

Clear Heliport PC1 worksheet

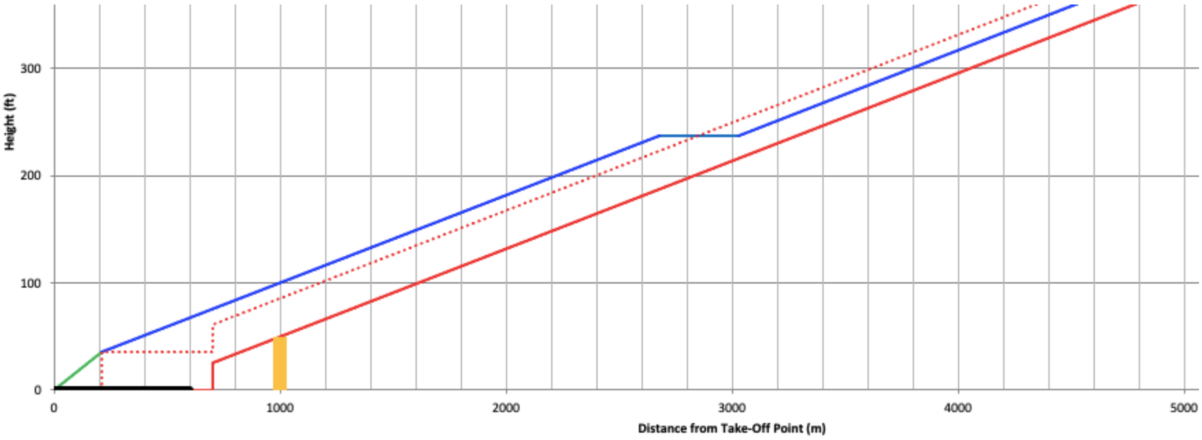
This worksheet shows the OLS and flight profile if the aircraft is operating PC1 from a Clear Heliport, for example, a runway.

In this case, the TDP is not shown, and the end of the green line represents 35 ft at the end of the TODRR for a Clear Heliport Category A take-off (Figure 5). From this point the aircraft is in a positive rate of climb at VTOSS. This example shows a 600 m long clear heliport with a 100 m clearway beyond the runway end, making the TODAR 700 m.

It should be noted that from the end of the TODRR the aircraft is required to clear all obstacles by 35 ft, so the minimum flight path (horizontal dotted red line) is shown as being 35 ft above the runway and clearway surfaces.

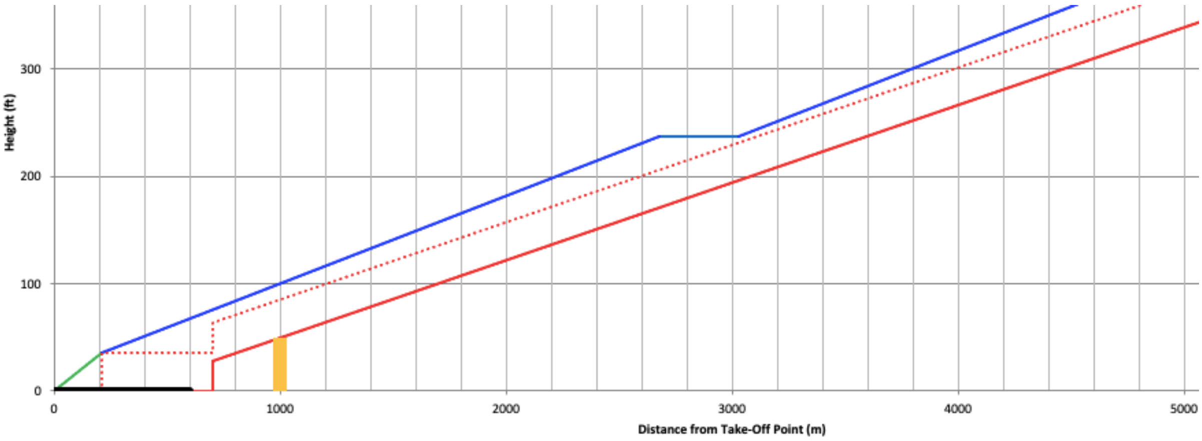
In Figure 5 the segment one climb gradient remains 35 ft clear of the OLS but following an acceleration the segment two climb does not. However, if the heliport designer reduces the OLS gradient down to 2.2 % by raising the OLS origin from 25 ft to 28 ft, sufficient margin from the OLS can always be maintained (Figure 6).

Heliport designers should adjust the OLS gradient and OLS origin as necessary to cater for the limitations of their 'design helicopter'.



Clear Heliport:			**Aircraft:**	
RTODAR (ASDA) (ft):	600		Take-off Weight (kg)	2950
Elevation of OLS Origin (ft):	25			
TODAR (m):	700	Degrees	Take-Off Distance Required (m):	210
Obstacle-free OLS Gradient (%):	2.5	1.43		
Distance of OLS obstacle from end of TODAR (m)	300		Segment 1 Climb 0 to 200ft (%)	2.5
Height of OLS obstacle above heliport (ft)	50		Acceleration Distance	350
			Segment 2 Climb 200-1000ft(%)	2.5

Figure 5. Clear Heliport PC1 – insufficient obstacle clearance



Clear Heliport:			**Aircraft:**	
RTODAR (ASDA) (ft):	600		Take-off Weight (kg)	2950
Elevation of OLS Origin (ft):	28			
TODAR (m):	700	Degrees	Take-Off Distance Required (m):	210
Obstacle-free OLS Gradient (%):	2.2	1.26		
Distance of OLS obstacle from end of TODAR (m)	300		Segment 1 Climb 0 to 200ft (%)	2.5
Height of OLS obstacle above heliport (ft)	50		Acceleration Distance	350
			Segment 2 Climb 200-1000ft(%)	2.5

Figure 6. Clear Heliport PC1 – sufficient obstacle clearance