Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council (Text with EEA relevance)

ANNEX

Appendix B

Flight performance calculations

B5 TAKEOFF GROUND ROLL

Take-off thrust accelerates the aeroplane along the runway until lift-off. Calibrated airspeed is then assumed to be constant throughout the initial part of the climbout. Landing gear, if retractable, is assumed to be retracted shortly after lift-off.

For the purpose of this document, the actual takeoff ground-roll is approximated by an equivalent take-off distance (into a default headwind of 8 kt), s_{TO8}, defined as shown in **Figure B-1**, as the distance along the runway from brake release to the point where a straight line extension of the initial landing-gear-retracted climb flight path intersects the runway.
Figure B-1

Equivalent takeoff distance

Aerodrome designation	Hypothetical Airport	
Coordinate system	UTM, Zone 15, Datum WGS-84	
Aerodrome reference point, ARP	3 600 000 m E Mid-point of runway 09L-27R	6 300 000 m N
Altitude of ARP	120 m /	
Average air temperature at ARP (*)	12,0 °C	
Average relative humidity at ARP (*)	60 %	
Average wind speed & direction (*)	5 kt	270 degrees
Source of topographical data	Unknown	
(*) Repeat for each time interval of interest (time of day, season, etc.)		

On a level runway, the equivalent takeoff ground-roll distance s_{TO8} in feet is determined from

$$S_{TO8} = \frac{B_8 \times \theta \times (W/\delta)^2}{N \times (F_n/\delta)} \quad \text{(B-9)}$$

where

B_8 is a coefficient appropriate to a specific aeroplane/flap-deflection combination for the ISA reference conditions, including the 8-knot headwind, ft/lbf
W is the aeroplane gross weight at brake release, lbf
N is the number of engines supplying thrust.

Note:

Since equation B-9 accounts for variation of thrust with airspeed and runway elevation, for a given aeroplane the coefficient B_8 depends only on flap deflection.

For headwind other than the default 8 kt, the takeoff ground-roll distance is corrected by using:

$S_{TOw} = S_{TOs} \times \frac{(V_C - w)^2}{(V_C - s)^2}$	(B-10)

where

S_{TOw}	is the ground-roll distance corrected for headwind w, ft
V_C	(in this equation) is the calibrated speed at takeoff rotation, kt
w	is the headwind, kt

The takeoff ground-roll distance is also corrected for runway gradient as follows:

$S_{TOG} = S_{TOw} \times \frac{a}{(a - g \times G_R)}$	(B-11)

where

S_{TOG}	is the ground-roll distance (ft) corrected for headwind and runway gradient,
a	is the average acceleration along the runway, equal to $(V_C \times \sqrt{\sigma})^2 / (2 \times s_{TOw})$, ft/s^2
G_R	is the runway gradient; positive when taking-off uphill