DENSITY ALTITUDE

CALCULATING FOR SAFETY

Use the following sample charts from a Pilot's Operating Handbook (POH) to calculate the takeoff and landing ground rolls and associated distances over a 50-ft obstacle for a Cessna 172 in the following scenarios. Answer several questions at the end of the activity related to the relationship between altitude and temperature change and its effect on aircraft performance.

SCENARIO 1

Outside Air Temperature: 10 °C

Pressure Altitude: 1,000 ft

Takeoff Ground Roll: 1,010 feet

Total to Clear 50-ft Obstacle: 1,720 feet

Landing Ground Roll: 585 feet

Total to Clear 50-ft Obstacle: 1,350 feet

SCENARIO 2

Outside Air Temperature: 40 °C

Pressure Altitude: 7,000 ft

Takeoff Ground Roll: 2,215 feet

Total to Clear 50-ft Obstacle: 4,045 feet

Landing Ground Roll: 810 feet

Total to Clear 50-ft Obstacle: 1,705 feet

SCENARIO 3

Outside Air Temperature: 0 °C

Pressure Altitude: 6,000 ft

Takeoff Ground Roll: 1,495 feet

Total to Clear 50-ft Obstacle: 2,605 feet

Landing Ground Roll: 680 feet

Total to Clear 50-ft Obstacle: 1,500 feet

©2018 Aircraft Owners and Pilots Association. All Rights Reserved.

SHORT FIELD TAKEOFF DISTANCE AT 2550 POUNDS

CONDITIONS:

Flaps 10°
Full Throttle Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift Off: 51 KIAS
Speed at 50 Ft: 56 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	860	1465	925	1575	995	1690	1070	1810	1150	1945
1000	940	1600	1010	1720	1090	1850	1170	1990	1260	2135
2000	1025	1755	1110	1890	1195	2035	1285	2190	1380	2355
3000	1125	1925	1215	2080	1310	2240	1410	2420	1515	2605
4000	1235	2120	1335	2295	1440	2480	1550	2685	1660	2880
5000	1355	2345	1465	2545	1585	2755	1705	2975	1825	3205
6000	1495	2605	1615	2830	1745	3075	1875	3320	2010	3585
7000	1645	2910	1785	3170	1920	3440	2065	3730	2215	4045
8000	1820	3265	1970	3575	2120	3880	2280	4225	2450	4615

SHORT FIELD LANDING DISTANCE AT 2550 POUNDS

CONDITIONS:

Flaps 30°
Power Off
Maximum Braking
Paved, level, dry runway
Zero Wind
Speed at 50 Ft: 61 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	545	1290	565	1320	585	1350	605	1380	625	1415
1000	565	1320	585	1350	605	1385	625	1420	650	1450
2000	585	1355	610	1385	630	1420	650	1455	670	1490
3000	610	1385	630	1425	655	1460	675	1495	695	1530
4000	630	1425	655	1460	675	1495	700	1535	725	1570
5000	655	1460	680	1500	705	1535	725	1575	750	1615
6000	680	1500	705	1540	730	1580	755	1620	780	1660
7000	705	1545	730	1585	760	1625	785	1665	810	1705
8000	735	1585	760	1630	790	1670	815	1715	840	1755

©2018 Aircraft Owners and Pilots Association. All Rights Reserved.

QUESTIONS

How must pilots consider performance calculations to be safe when flying? In your answer be sure to include the relationship between altitude and temperature change and the affect on aircraft performance.

Pilots must understand how their aircraft will fly in different temperatures and pressure situations, at different altitudes. They must understand that as altitude increases, air density decreases, which negatively affects aircraft performance. However, they must also understand that air density will be lower at airports located at higher altitudes or on hot days (higher density altitude), and these factors also negatively affect aircraft performance. If they have not accounted for these factors in their calculations, they may attempt to fly off or land on a runway that is not long enough for their aircraft.

Why do you think variations in temperature and altitude affect the aircraft more during takeoff than during landing?

When the aircraft is landing, it isn't having to overcome gravity by producing more power or travelling faster through the air. The airplane is actually allowing gravity to bring it down to land. Because more power and speed (and certainly lift) are necessary to allow the airplane to takeoff, density altitude effects are more pronounced during that phase of flight and the aircraft performance changes are more noticeable.

©2018 Aircraft Owners and Pilots Association. All Rights Reserved.