AIRCRAFT ACCIDENT SHORT REPORT

CA18/2/3/9754: The aircraft failed to climb during take-off and impacted with the ground.

Date and time	:	25 November 2018, 0635Z
Location	:	Marble Hall Aerodrome, Limpopo
Aircraft registration	:	ZS-NRX
Aircraft manufacturer and model	:	Cessna Aircraft Company and Cessna 150L
Last point of departure	:	Marble Hall Aerodrome, Limpopo Province
Next point of intended landing	:	Rand Aerodrome (FAGM), Gauteng Province
Location of incident site with reference to easily defined geographical points (GPS readings if possible)	:	S24°59'47.5" E29°16'37.3" at an elevation of 2 979ft
Meteorological information	:	Surface wind: 040°/4kts; temperature: 22 °C; dew point: 16 °C; visibility: 10km CAVOK QNH: 1020h Pa
Type of operation	:	Air Transport Operations – Carriage of less than 20 passengers of cargo (Part 135)
Persons on board	:	1 + 1
Injuries	:	No injuries were sustained
Damage to aircraft	:	Substantial damage

All times given in this report are Coordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (2011), this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to apportion blame or liability.***

Disclaimer:

Figure 1*:* The Cessna 150L
(Source: https://goo.gl/images/J4xEop)

1. SYNOPSIS

1.1. On 17 November 2018 at 0635Z, the pilot and a passenger departed from Marble Hall Aerodrome on a flight to the Rand Aerodrome.

1.2. The pilot stated that at 35 feet (ft) above ground level (AGL), the aircraft could not gain any more height after taking off from Marble Hall Aerodrome and, thus, collided with a tree before crashing shortly thereafter. The pilot applied full flaps during this phase which is an unconventional action.

1.3. The pilot and the passenger left the accident scene after they declined medical treatment following the initial assessment by the paramedics on-site. No injuries were reported.

1.4. The accident was a result of the miscalculating of the take-off distance required to clear a 50ft obstacle and the required performance for a safe climb out, resulting in the aircraft impacting with trees after take-off. To conduct a departure to clear a 50ft obstacle ahead, the aircraft needed more runway, which was available, however, half the runway was used on take-off and the aircraft could not attain a positive rate of climb to clear the trees.

2. FACTUAL INFORMATION

2.1. HISTORY OF FLIGHT

2.1.1. On 17 November 2018 at 0615Z, a pilot, accompanied by a passenger, arrived at Marble Hall airfield (FAMI) in Limpopo Province from Syferfontein Aerodrome in Gauteng in a Piper Cherokee Six (ZS-OMJ). The pilot parked the aircraft and shut down the engine; both occupants disembarked.

2.1.2. They swapped aircraft and left for Rand Aerodrome (FAGM) in Gauteng at 0635Z in a Cessna 150L (ZS-NRX) using Runway 22. According to the pilot, the take-off roll began at midway point of the runway and the aircraft was rotated at 60 knots (kts). The aircraft climbed up to 10 metres (35 feet), however, it failed to gain height to clear the trees. The rotation point could not be confirmed. As the aircraft passed the end of the runway, the pilot selected full flaps to increase the lift; however, this induced a large amount of drag, causing the aircraft to descend before impacting with trees to the left of the extended centre line of Runway 22. The aircraft swung around approximately 90° before impacting the ground at a distance of about 300 metres from the threshold of Runway 22.

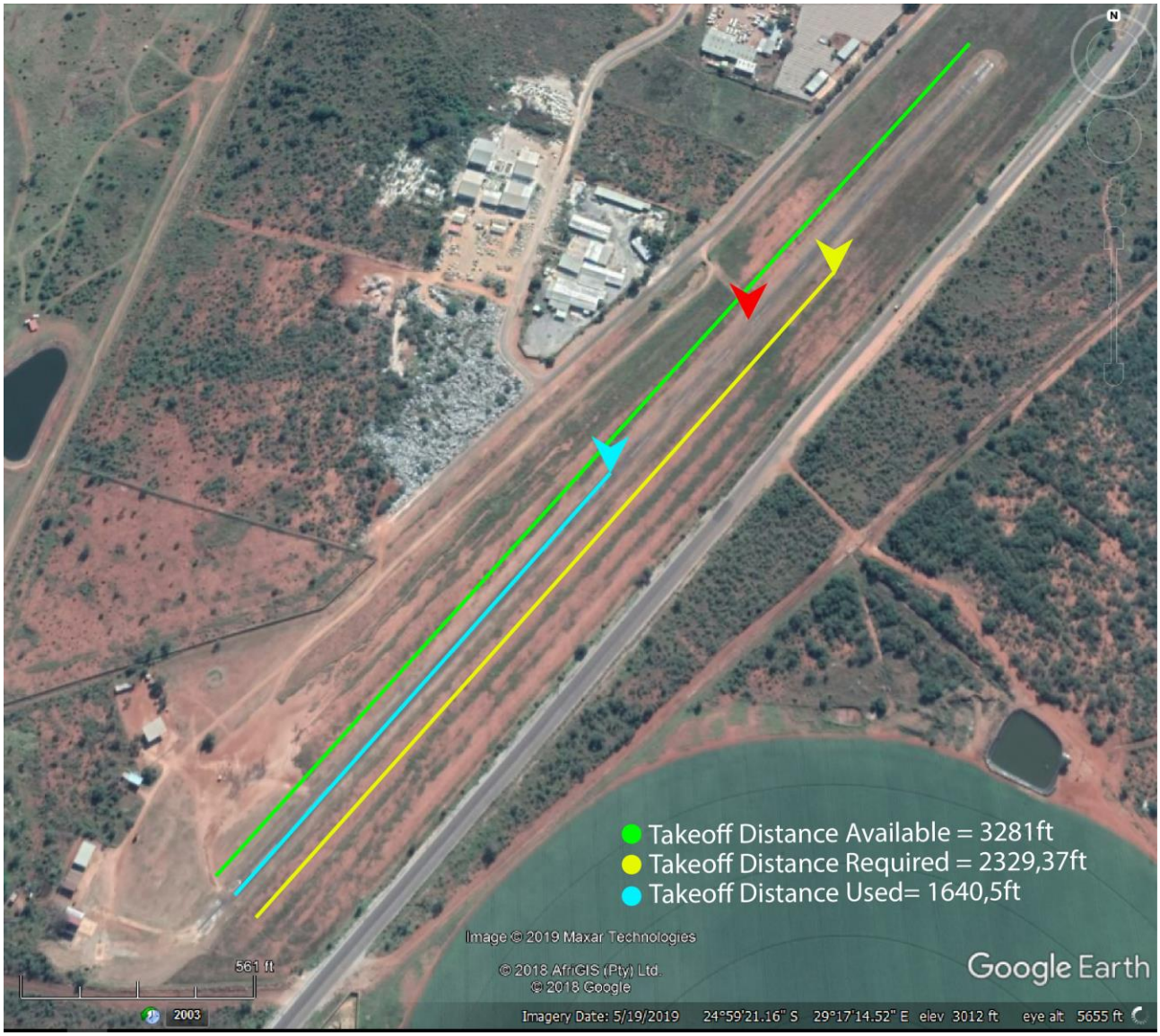

Figure 2: Google Earth image of the take-off distance available (green), take-off distance required (yellow) and take-off distance used (blue) by the pilot at Marble Hall Aerodrome

2.1.3. Considering the departure, the pilot had a take-off distance available of 3 281ft (green line) – Appendix B. The required take-off distance was 2 329.37ft (yellow line) – Appendix A. The pilot only used 1 640.5ft to conduct the take-off after joining the active runway from the taxiway (red arrow).

2.1.4. The aircraft was destroyed by the impact sequence and both occupants sustained no injuries. The pilot and passenger were attended to by paramedics on site and they both decided it was not necessary to be hospitalised. No mechanical malfunctions with the aircraft were reported by the pilot.

Figure 3: Damage to the aircraft

2.1.5. In an interview with the pilot, he stated that immediately after the crash, 45 litres of fuel was drained from the fuel tanks.

2.1.6. The accident occurred during daylight conditions at a geographical position that was determined to be S24˚59'47,5" E29˚16'37.3" at an elevation of 2 979ft above mean sea level (AMSL).

2.2. ADDITIONAL INFORMATION

2.2.1. The right wing hit a tree top 490m south of threshold 04 before impacting the ground. The aircraft came to rest facing 260° magnetic in an upright position. The distance between the tree and the first point of impact with the ground was 36.6m and the distance between this point and the location of the wreckage was 12m.

2.2.2. A continuity check was carried out on all flight controls and it was confirmed. There were no reported defects recorded on all airframe and engine systems prior to this accident.

2.2.3 The runway at Marble Hall Aerodrome is 1000m X 10m (3 281ft X 33ft). The take-off roll started at midpoint of the runway (1 640.5ft) and the aircraft was rotated below 60kts. The runway distance used was 688.87ft less then what was required for this take-off to avoid colliding with terrain (tree) after take-off. The amount of runway needed to clear a 50ft obstacle was 2 329.37ft.

3. FINDINGS

3.1. The pilot was issued with a private pilot licence (PPL) on 20 October 2018 with an expiry date of 31 October 2019; the aircraft type was endorsed on it. The pilot was issued with a class 2 medical certificate, with corrective lenses restriction, on 8 September 2017 and expiring on 30 September 2019. The pilot's total experience was 535.0 hours and 76.4 hours on type. The pilot flew 0.7 hours 90 days prior to the accident.

3.2. The aircraft was properly maintained and had a certificate of airworthiness which was issued on 25 April 2003, with an expiry date of 30 April 2019.

3.3. The last annual inspection was carried out on 30 November 2017 at 10582 flying hours by an approved aircraft maintenance organisation that issued a certificate of release to service which lapsed on 30 November 2018 at 10682 hours. The aircraft only accrued 45.3 hours since the last annual inspection.

3.4. No malfunctions were reported by the pilot.

3.5. In the absence of a surface weather observation station at the Marble Hall Aerodrome, an examination of prevailing weather from nearby stations yielded no indication of hazardous weather. Very light surface winds of 04 to 05kts were prevalent over Ellisras (FAER) between 0500Z and 0700Z. In Polokwane (FAPP), CAVOK conditions were reported for the same period, also with light winds (03 and 07kts). This confirms the satellite observation of clear skies and a dry atmosphere as indicated by a high dew point depression (dew point depression: difference between air temperature and dew point temperature). A weather report requested for the Marble Hall Aerodrome at the time of the accident was as follows:

METAR FAER

250500Z AUTO 04004knt //// // ////// 22/16 Q1020=

04004KT – 04 knot wind

Temperature – 22 ˚C

Dew Point – 16 ˚C

QNH – 1020 Pa (estimated using the station level pressure)

3.6. Total airframe hours at the time of the accident were 10627.3 hours.

3.7. The on-site investigation revealed that CAR 2011 Part 12.04.1 was infringed.

> ***12.04.1*** *Where an accident occurs within the Republic, the* ***PIC*** *of the aircraft involved in the accident, or if he or she is killed or incapacitated, a flight crew member, or if there are no surviving flight crew members, or if they are incapacitated, the operator or owner of such aircraft or where the accident occurs on an aerodrome, the aerodrome manager, shall—*
>
> *(a) pending the arrival of a police guard, take such steps which may be necessary to prevent any interference with the aircraft, the wreck or wreckage and anything transported therein and any marks resulting from the accident which may be of assistance in an investigation;*
>
> *(b) forthwith arrange with a member of the South African Police Service to guard the aircraft, the wreck or wreckage and anything transported therein and any marks resulting from the accident which may be of assistance in an investigation.*[1]

All individual removable items from the aircraft were removed. Both fuel tanks were found empty on arrival of the investigator. The persons involved in this flight had left the wreckage site for unknown reasons. Medical assistance arrived at the accident site, however, their service was not required.

4. PROBABLE CAUSE/CONTRIBUTING FACTOR

4.1. The miscalculating of the take-off distance required to clear a 50ft obstacle and the required performance for a safe climb out, resulting in the aircraft impacting with trees after take-off. The aircraft needed more runway, which was available, however, half the runway was used on take-off and the aircraft could not attain a positive rate of climb to clear the trees.

5. REFERENCES USED IN THE REPORT

1 http://caa.mylexisnexis.co.za/#

6. SAFETY RECOMMENDATION

6.1. None.

APPENDIX A

AIRCRAFT PERFORMANCE AND LIMITATIONS

(Extracted from the POH)

Maximum Take-off Weight: 1600 lbs (725,75 kgs)

Basic Empty Weight: 1106,71 lbs (Last weighed on 14 February 2013)

(Submitted by Pilot)

Take-off Weight **1572 lbs** with an arm of 35,1"

(Pressure Altitude Calculations)

QNH = 1020 hPa

OAT = 22 ˚C

ELEVATION = 2979 ft

PRESSURE ALTITUDE = 2769 ft

(Take-off Distance – Extracted from the Cessna 150L POH 5-11)

TAKEOFF DISTANCE

SHORT FIELD

CONDITIONS:
Flaps Up
Full Throttle Prior to Brake Release
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 5000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
4. Where distance value has been deleted, climb performance after lift-off is less than 150 fpm at takeoff speed.
5. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
1600	53	60	S.L	655	1245	710	1335	765	1435	820	1540	880	1650
			1000	720	1365	775	1465	835	1575	900	1690	970	1815
			2000	790	1500	855	1615	920	1735	990	1865	1065	2005
			3000	870	1650	935	1780	1010	1915	1090	2065	1170	2225
			4000	955	1820	1030	1965	1115	2125	1200	2290	1290	2475
			5000	1050	2015	1140	2185	1230	2360	1325	2555	1430	2770
			6000	1160	2245	1255	2435	1360	2640	1465	2870	1580	3120
			7000	1285	2510	1390	2730	1505	2970	1625	3240	---	---
			8000	1420	2820	1540	3080	1670	3370	---	---	---	---

The above table allows the PIC (Pilot-in-command) to determine how much available runway is needed to conduct a successful short field take-off in a Cessna 150L. Considering the Outside Air Temperature (OAT) at 22˚C and the pressure altitude calculated to be 2 769ft, these values in the highlighted red blocks are around the value we are looking for in the table above.

Using interpolation, the short field take-off distance required for (e) can be determined:

	20 ˚C	22 ˚C	30 ˚C
2000 ft	1735	(c) = 1716	1865
2979 ft	(a) = 1911,2	(e) = 1941,14 ft	(b) = 2060,8
3000 ft	1915	(d) = 1945	2065

(a) $= \frac{1915-1735}{1000} \times 979$ = 1 911,2ft (x 979 being the distance from 2 000ft)

(b) $= \frac{2065-1865}{1000} \times 979$ = 2 060,8ft (x 979 being the distance from 2 000ft)

(c) $= \frac{1895-1735}{10} \times 2$ = 1 761ft (x 2 being the temperature from 20 ˚C)

(d) $= \frac{2065-1915}{10} \times 2$ = 1 945ft (x 2 being the temperature from 20 ˚C)

(e) $= \frac{2060,8-1911,2}{10} \times 2$ = 1941,14 ft (x 2 being the temperature from 20 ˚C)

The wind indicated from the meteorological report was 4kts heading 040˚. Considering note 3 in the take-off table, that would be an increase of 20% of the runway required due to the tail wind conditions. 20% of 1 941.14ft = 2329,37ft.

Runways

FAMI Airport Runway Summary

Runways:	06/24
Longest Runway:	06/24 is 3281 ft (1000 m) long
Runways with an Instrument Approach:	

FAMI Airport Runway Details

Runway 06/24	3281 ft x 33 ft (1000 m x 10 m)
Runway Length Source:	as of
Surface:	Asphalt -
Runway Pavement Class:	
Runway Edge Lights:	Intensity
Runway Weight Bearing Capacity (in thousands of pounds)	
Single Wheel Landing Gear:	
Dual Wheel Landing Gear:	
Dual Tandem Wheel Landing Gear:	
Dual Dual Tandem Wheel Landing Gear:	

https://airportguide.com/airport/info/FAMI#runways