APPENDIX D: RUNWAY LENGTH ANALYSIS

Purpose

A runway length analysis was completed to FAA standards identified in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design* in this airport master plan study for the Dawson Community Airport. Due to the technical nature of this analysis, a separate appendix has been prepared to calculate recommended runway lengths for the design aircraft identified in the aviation forecasts.

A runway length analysis was performed using the FAA's current methodology found in FAA AC 150/5325-4B. The design approach identifies a recommended runway length based on a family grouping of design aircraft.

GDV is designed for smaller aircraft. This includes the overall design aircraft that are large aircraft greater than 12,500 pounds but less than 60,000 pounds. This includes the typical design aircraft fleet of a Beechcraft 1900C operated by Alpine Air. The length of the primary Runway 12-30 will be driven by the length needs of the critical design aircraft fleet mix. Other airfield surfaces at GDV are designed for small general aviation aircraft with approach speeds of 50 knots or greater and maximum certified takeoff weight of 12,500 pounds or less. The complete design aircraft fleet mix is identified in **Chapter 1: Airport, Community & Aviation Activity**.

Small Airplanes Up to 12,500 Pounds

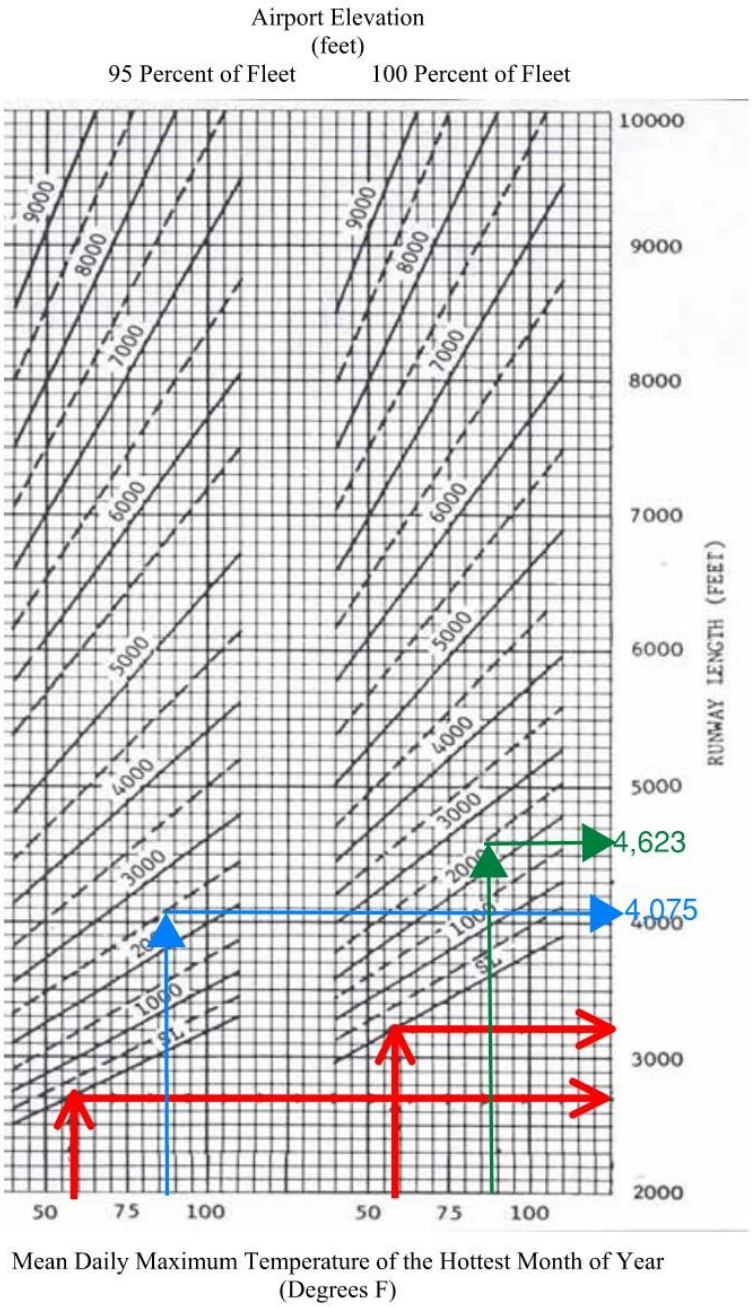
FAA Design Curves

The FAA design approach identified in Chapter 2 of FAA AC 150/5325-4B for most small aircraft less than 12,500 pounds requires several steps to be performed to determine runway length:

1. **Identify Number of Passenger Seats:** Classify design aircraft as one of two categories; "Less than 10 Passenger Seats" and "10 Passenger Seats or Greater"
2. **Select Percentage of Fleet:** Airplanes classified as "Less than 10 Passenger Seats" are grouped into two percentage categories based on the airport's location and the amount of existing or planned aviation activities. The categories include "95 Percent of Fleet" and "100 Percent of Fleet".
3. **Consider Future Airport Expansion:** Consider runway length requirements during Instrument Meteorological Conditions (IMC) or expansions to accommodate airplanes more than 12,500 pounds.
4. **Determine Airport Data:** Evaluate the airport elevation, mean daily temperature in hottest month and runway condition to adjust runway length.
5. **Calculate Runway Length Based on Curves:** Utilize FAA runway length curves published in AC 150/5325-4B.

Figure D-1 - FAA Figure 2-1: Small Airplanes with Fewer than 10 Passenger Seats (Excludes Pilot and Co-pilot)

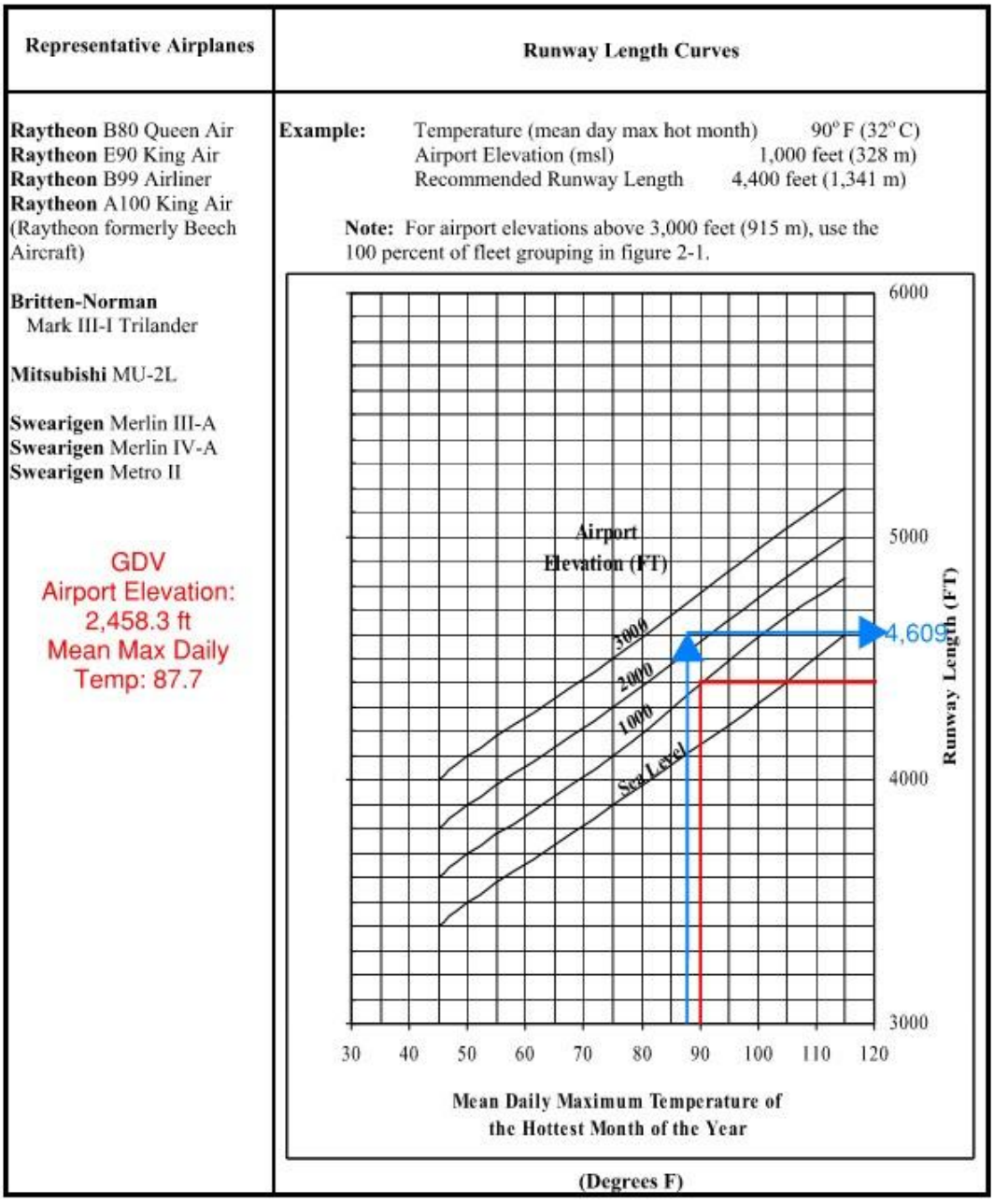
Dawson Community Airport
Temperature: 87.7°F / 30.9°C - Airport Elevation: 2,458.3' MSL



Runway Length @ 95 Percent of Fleet: **4,075 feet**
Runway Length @ 100 Percent of Fleet: **4,623 feet**

Figure D-2 - FAA Figure 2-2: Small Airplanes Having 10 or More Passenger Seats (Excludes Pilot and Co-pilot)

Dawson Community Airport
Temperature: 87.7°F / 30.9°C - Airport Elevation: 2,458.3' MSL



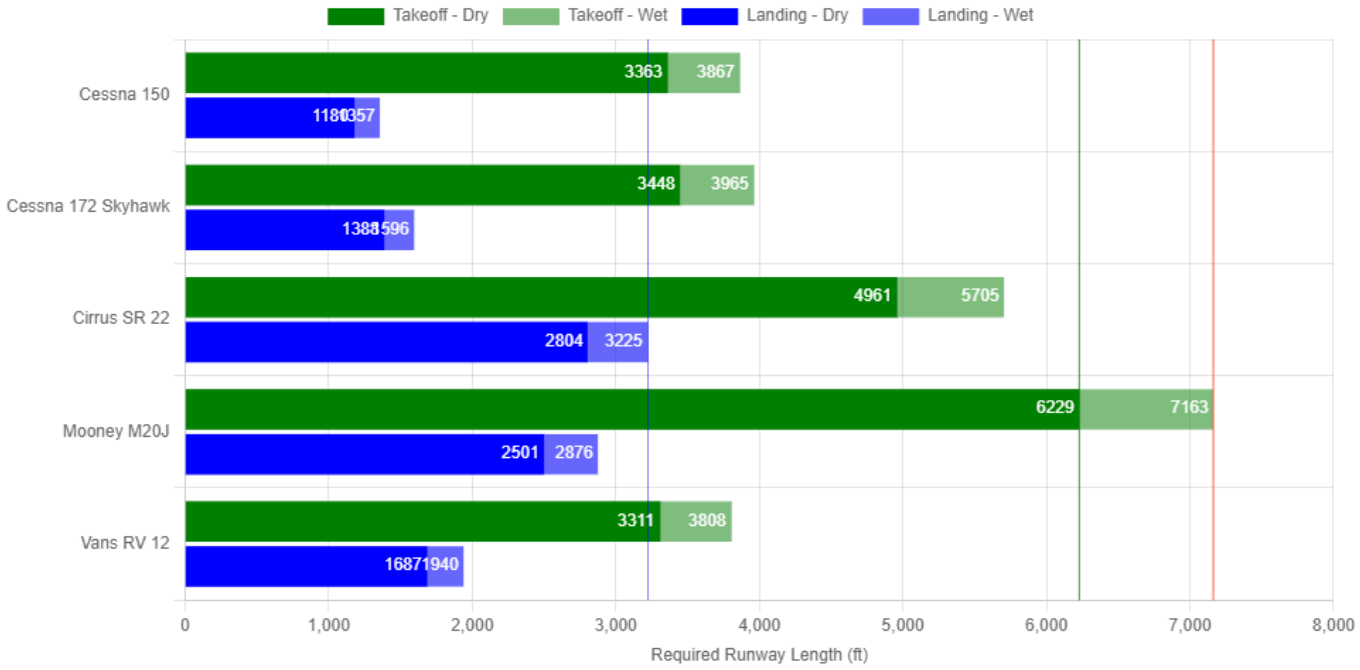
Recommended Runway Length: **4,609 feet**

Individual Aircraft

FAA AC 150/5325-4B states airport planners can "determine the recommended runway length from airplane flight manuals for the airplanes to be accommodated by the airport in lieu of the runway length curves depicted in **Figures D-1** or **D-2**.".

KLJ utilizes the Airport Cooperative Research Program (ACRP) release of the Small Aircraft Runway Length Analysis Tool (SARLAT) in late 2022. This tool allows multiple general aviation aircraft to be applied to the airport environment to evaluate the runway length needed for said airport. It is also recommended to use airplane flight manuals in lieu of FAA Figure 2-1 or 2-2 (shown below).We applied the operations aircraft of based aircraft tenants, along with some other frequent aircraft seen at GDV, and the SARLAT calculated the takeoff and landing length needed in wet and dry conditions.

Figure D-3 – STARLAT Data for A/B-I(S)



Source: Small Aircraft Runway Length Analysis Tool (SARLAT)

The table below summarizes the findings for aircraft weighing less than 12,500 pounds.

Table D-1 – Runway Length Requirements (≤ 12,500 lbs.)

Airport and Runway Data	
Runway 12-30 Length	5,704 feet
Airport Elevation	2,458.3 feet
Mean Daily Maximum Temperature of Hottest Month	87.7°F
Aircraft Classification	**Recommended Runway Length**
Small Airplanes 12,500 Pounds or less	
10 or more passenger seats	4,609 feet
Less than 10 passenger seats at 100 percent of fleet	4,623 feet
Less than 10 passenger seats at 95 percent of fleet	4,075 feet
SARLAT*	
Cessna 150	3,363 feet

Cessna 172	3,448 feet
Cirrus SR 22	4,961 feet
Moony M20J	6,229 feet
Vans RV12	3,311 feet

Source: FAA AC 150/5325-4B, SARLAT, KLJ Analysis
*Note: Runway length requirements estimated based on charts for airport planning purposes only. * Recommended dry takeoff length*

Large Airplanes Up to 60,000 Pounds

FAA Design Curves

The FAA design approach identified in Chapter 3 of FAA AC 150/5325-4B for aircraft greater than 12,500 pounds and less than 60,000 pounds requires the following steps to be performed to determine runway length.

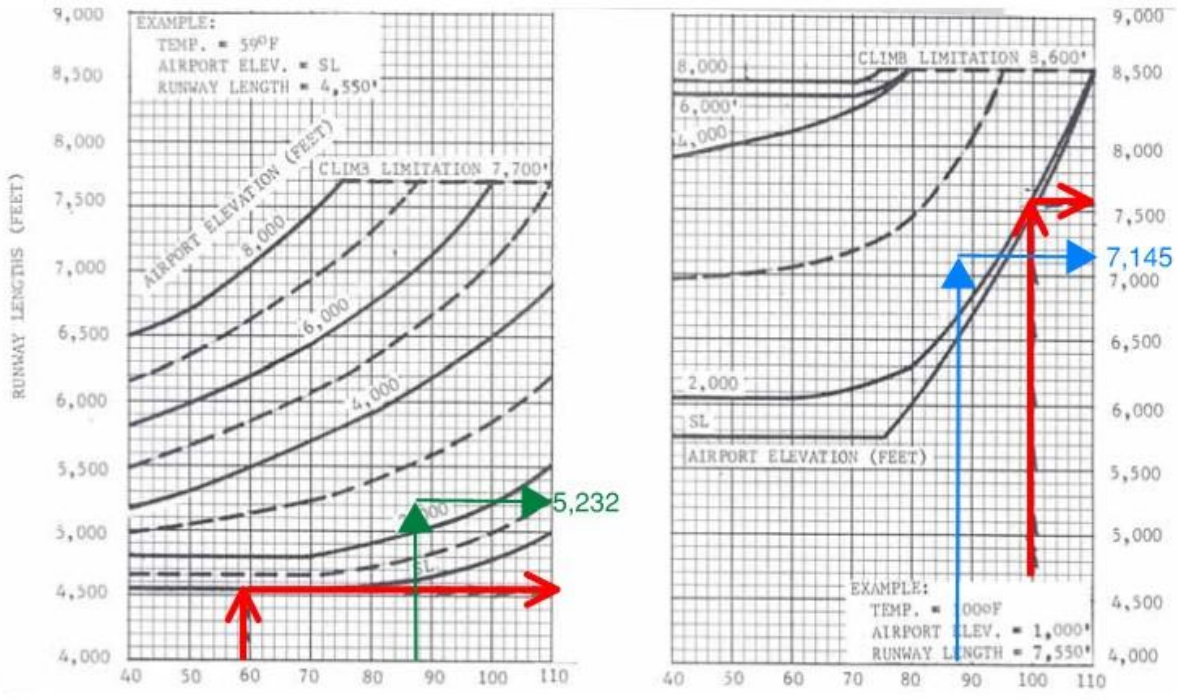
1. **Select Percentage of Fleet:** Group the design airplane into one of two percentage categories based on performance. The categories include "75 Percent of Fleet" and "100 Percent of Fleet".
2. **Identify Useful Load Factor:** Determine the useful load factor for the design aircraft based on the difference in maximum gross weight and the basic operating weight. Useful load consists of passengers, cargo, and usable fuel. The categories include "60 percent useful load" and "90 percent useful load".
3. **Determine Airport Data:** Evaluate the airport elevation, mean daily temperature in hottest month and runway condition to adjust runway length.
4. **Calculate Runway Length:** Utilize FAA runway length curves published in AC 150/5325-4B.
5. **Apply Adjustments:** The effective runway gradient affects the aircraft's takeoff length. Wet and slippery runways for turbojet airplanes allow for runway length curves to be increased by 15 percent up to 5,500 feet for "60 percent useful load" and 7,000 feet for "90 percent useful load".

FAA Figure 3-1: 75 Percent of Fleet at 60 or 90 Percent Useful Load

Dawson Community Airport
Temperature: 87.7°F / 30.9°C - Airport Elevation: 2,458.3' MSL
Maximum Difference in Runway Centerline Elevation: 4 feet = 40 feet in Distance (added)

AC 150/5325-4B 7/1/2005

Figure 3-1. 75 Percent of Fleet at 60 or 90 Percent Useful Load



Mean Daily Maximum Temperature of Hottest Month of the Year in Degrees Fahrenheit

75 percent of feet at 60 percent useful load **75 percent of feet at 90 percent useful load**

Runway Length @ 60 useful load (Dry Runway): 5,232' + 40' = **5,272 feet**
Runway Length @ 60 useful load (Wet Runway): **5,500 feet**

Runway Length @ 90 useful load (Dry Runway): 7,145' + 40' = **7,185 feet**
Runway Length @ 90 useful load (Wet Runway): **7,000 feet**

FAA Table 3-1: Airplanes that Make Up 75 Percent of Fleet

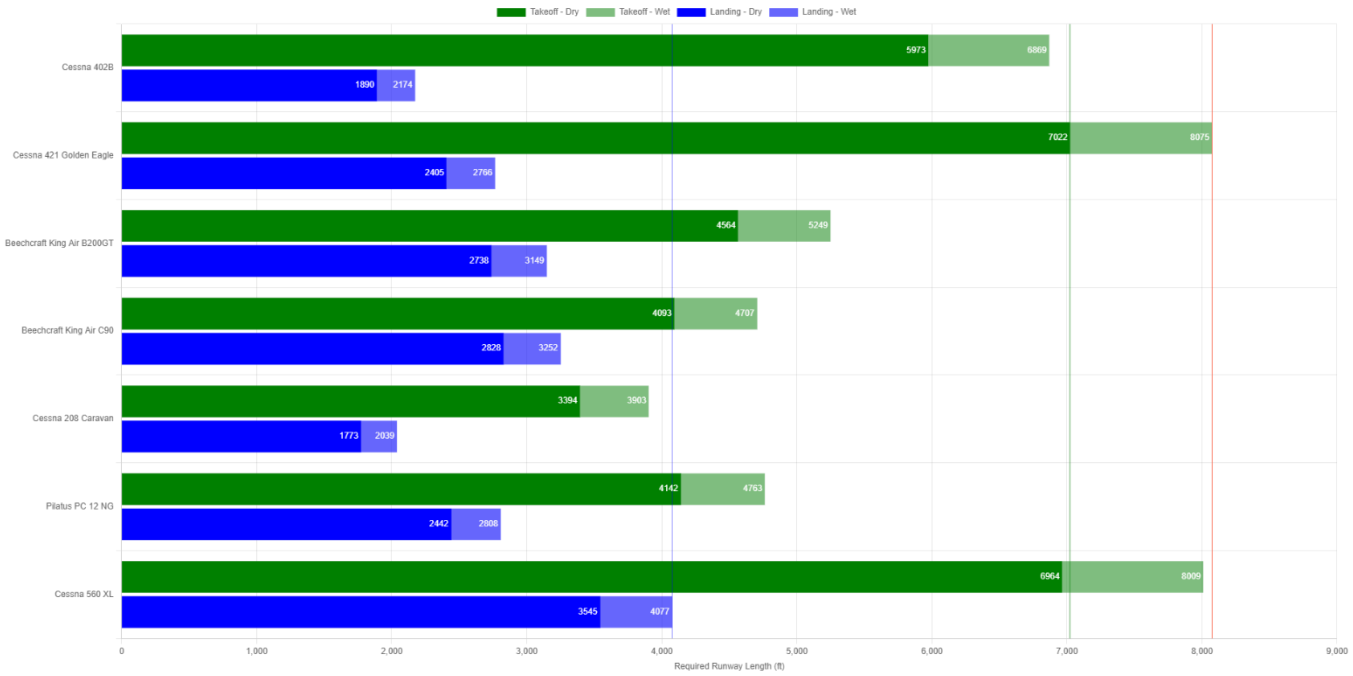
Manufacturer	Model
Aerospatiale	Sn-601 Corvette
Bae	125-700
Beech Jet	400A
Beech Jet	Premier I
Beech Jet	2000 Starship
Bombardier	Challenger 300
Cessna	500 Citation/501Citation Sp
Cessna	Citation I/II/III
Cessna	525A Citation II (CJ-2)
Cessna	550 Citation Bravo
Cessna	550 Citation II
Cessna	551 Citation II/Special
Cessna	552 Citation
Cessna	560 Citation Encore
Cessna	560/560 XL Citation Excel
Cessna	560 Citation V Ultra
Cessna	650 Citation VII
Cessna	680 Citation Sovereign

Manufacturer	Model
Dassault	Falcon 10
Dassault	Falcon 20
Dassault	Falcon 50/50 EX
Dassault	Falcon 900/900B
Israel Aircraft Industries (IAI)	Jet Commander 1121
IAI	Westwind 1123/1124
Learjet	20 Series
Learjet	31/31A/31A ER
Learjet	35/35A/36/36A
Learjet	40/45
Mitsubishi	Mu-300 Diamond
Raytheon	390 Premier
Raytheon Hawker	400/400 XP
Raytheon Hawker	600
Sabreliner	40/60
Sabreliner	75A
Sabreliner	80
Sabreliner	T-39

Individual Aircraft

The results from the SARLAT tool provides can be seen in **Figure D-4**. Aircraft chosen were from total annual operations, see **Table 1-22 in Chapter 1** to compare the various runway lengths recommended. The piston aircraft (Cessna 402B and Cessna 421) have an AAC of A/B and an ADG-I and maximum takeoff weight (MTOW) between 2,712 lbs. and 7,450 lbs. The turboprop aircraft (Beechcraft King Air 200GT, Beechcraft King Air C90, Cessna 208 Caravan, and Pilatus PC 12 NG) have an AAC-B and ADG-II with MTOW of 9,000 lbs. to 12,500 lbs. The jet aircraft (Cessna 560 XL) has an AAC-B and ADG-II with a MTOW of 20,200 lbs. The longest takeoff runway length shown is for a Cessna 421 Golden Eagle at 7,022 feet long with the shortest takeoff length of 2,057 feet long.

Figure D-4 – SARLAT Data



Source: Small Aircraft Runway Length Analysis Tool (SARLAT)

When large transport category airplanes are operated under *FAR Part 135, Operating Requirements: Commuter and On-Demand Operations*, operators are required to follow FAR Part 135.385 to calculate runway length during landing operations. This standard requires a full-stop landing within 60 percent of the effective length of the runway. An additional 15 percent factor is added for wet or slippery runways.

Alpine Air is a frequent operator at GDV making regular trips to other cities in Montana. They operate the Beechcraft 1900C (ARC B-II) that is certified for up to 19 passenger seats of 800-960 cubic feet of cargo space. It is important to evaluate the landing and takeoff distance for the Beech1900C is the design aircraft for GDV. Unfortunately, there was no access to the "C" model chart so the 1900D model was used instead. A length of 4,300 feet is required for a Beechcraft 1900D operated under FAR Part 135 (see **Figure D-5**) for takeoff, and 2,400 feet for landing, 2,760 feet for a wet or slippery runway. These lengths are all well within the current length of Runway 12-30.

Figure D-5 – Beechcraft 1900D

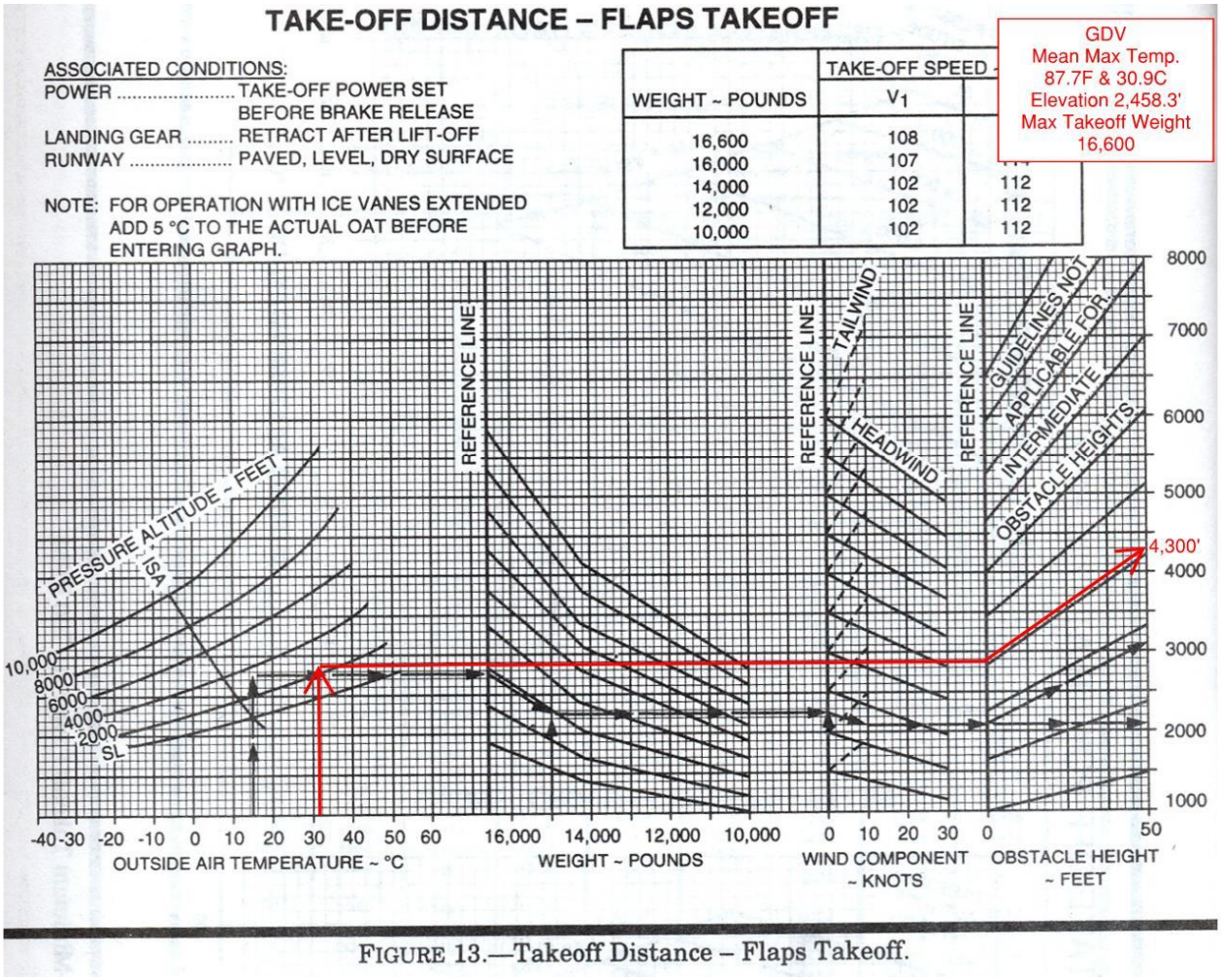


FIGURE 13.—Takeoff Distance – Flaps Takeoff.

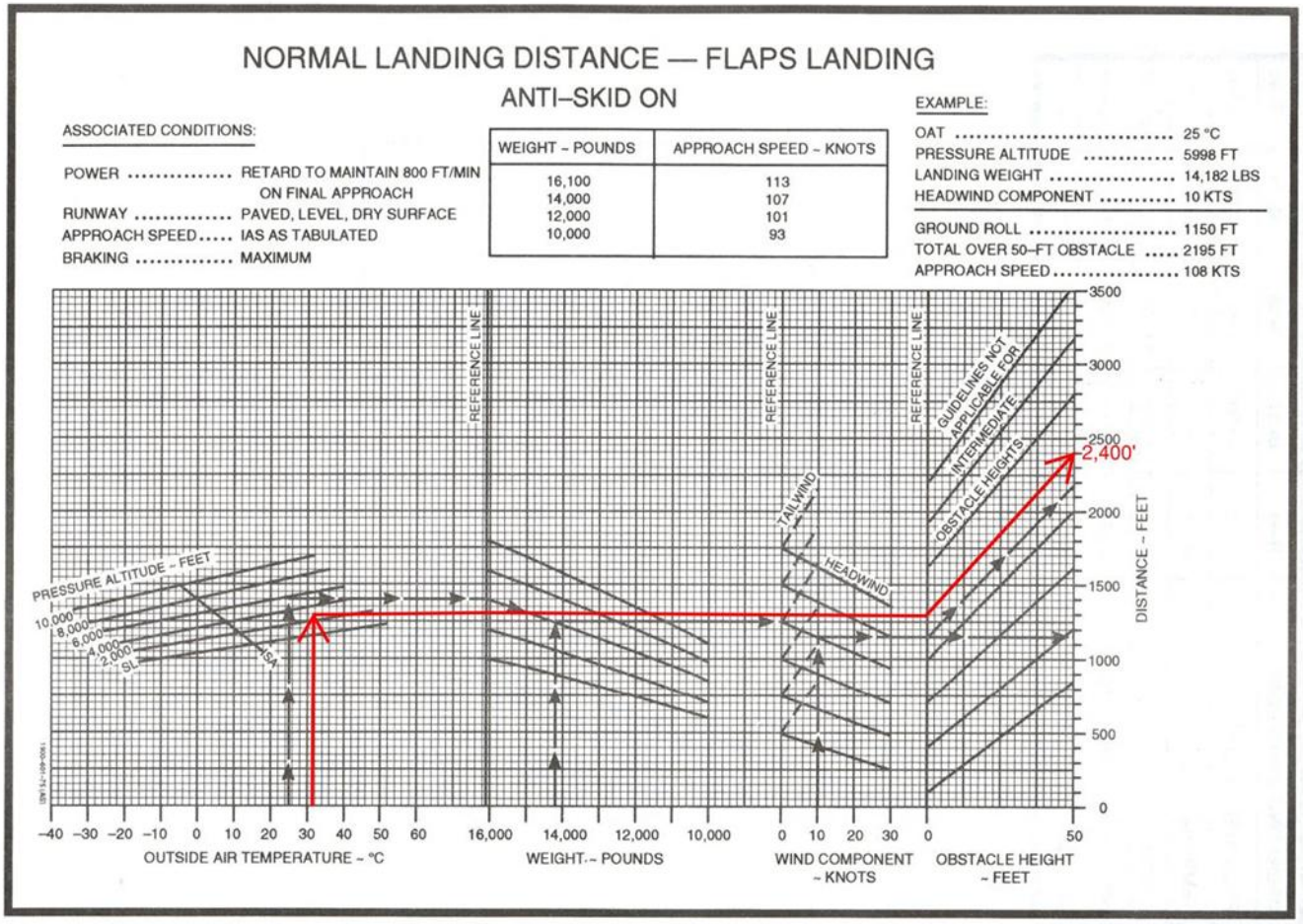


FIGURE 28.—Normal Landing Distance – Flaps Landing.

The selected percentage of fleet is 75 percent of fleet, and the useful load factor was determined to be 60 percent useful load. The recommended runway length calculations at GDV for large aircraft up to 60,000 pounds are summarized below.

Table D-2 – Runway Length Requirements (>12,500 but < 60,000 lbs.)

Airport and Runway Data	
Runway 12-30 Length	5,704 feet
Airport Elevation	2,458.3 feet
Mean Daily Maximum Temperature of Hottest Month	87.7°F
Maximum Difference in Runway Centerline Elevation	4 feet (+40 feet)
Runway Condition	Wet and Slippery Runways
Aircraft Classification	**Recommended Runway Length**
Large Airplanes more than 12,500 Pounds but less than 60,000 Pounds	
75 percent of fleet at 90 percent useful load (Wet)	7,000 feet
75 percent of fleet at 90 percent useful load (Dry)	7,185 feet
75 percent of fleet at 60 percent useful load (Wet)	5,500 feet
75 percent of fleet at 60 percent useful load (Dry)	5,272 feet
SARLAT*	
Cessna 402B	5,973 feet

Cessna 421	7,022 feet
Beechcraft King Air B200GT	4,564 feet
Beechcraft King Air C90	4,093 feet
Cessna 208 Caravan	3,394 feet
Pilatus PC 12 NG	4,142 feet
Cessna 560 XL	6,964 feet

Source: FAA AC 150/5325-4B, KLJ Analysis
*Note: Runway length requirements estimated based on charts for airport planning purposes only. *Recommended dry takeoff length.*

Crosswind Runway

The current crosswind runway at GDV is Runway 2-20 which is an A/B-I(S) runway 3,002 feet long and 65 feet wide. To meet the FAA standards of 95% wind coverage, a crosswind runway is needed for aircraft with an allowable crosswind component of 10.5 knots which includes A/B-I aircraft. For A/B-II aircraft and higher, the 95% wind coverage is met, please see **Chapter 2** for more details.

The needed crosswind runway length would include a grouping of individual aircraft with and ARC of A/B-I(S). **Figure D-3** shows the needed runway lengths for that grouping of aircraft utilizing STARLAT. **It is recommended to utilize the runway lengths shown of the Cessna 150 for most of the based aircraft average around the same specifications. The recommended runway length for Runway 2-20 is 3,363 feet which is 361 feet shorter than the current runway length.**