

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 Warren Municipal Airport (D37). 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.

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.

Table D-1 – FAA AC 150/5345-4B Runway Length Requirements (≤ 12,500 lbs.)

Airport and Runway Data	
Airport Elevation	888 feet
Mean Daily Maximum Temperature of Hottest Month	80.6°F
Runway 12-30 Current Length	3,199 feet
Runway 4-22 Current Length	2,578 feet
Aircraft Classification	Recommended Runway Length
Small Airplanes 12,500 Pounds or less	
10 or more passenger seats	4,140 feet
Less than 10 passenger seats at 100 percent of fleet	3,800 feet
Less than 10 passenger seats at 95 percent of fleet	3,190 feet

Source: [FAA AC 150/5325-4B](#), KLJ Analysis

Note: Runway length requirements estimated based on charts for airport planning purposes only.

For other small general aviation aircraft, the FAA runway length requirements of 100 percent of fleet would apply at D37 due to its lack of wind coverage provided by the paved Runway 12-30 and turf crosswind Runway 4-22. The recommended runway length for small general aviation aircraft is 3,800

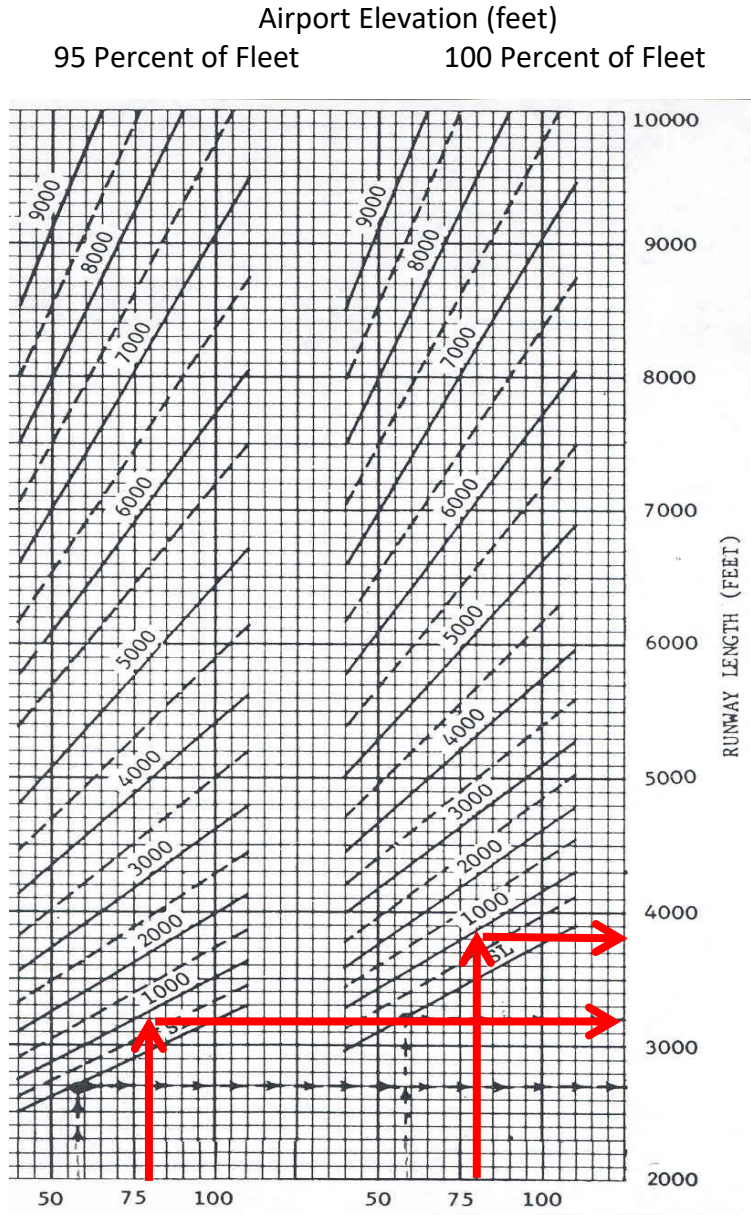
feet. This does not match the existing runway length of Runway 12-30 at 3,199 feet long (600 feet short).

For small general aviation flight training aircraft from the University of North Dakota, the FAA runway length requirements of 95 percent of fleet would apply at D37. The recommended runway length to accommodate flight training aircraft is 3,190 feet. This matches the existing runway length for Runway 12-30 length.

With the displaced threshold on the Runway 12 End the landing distance available (LDA) is 3,003 feet long landing on that end.

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

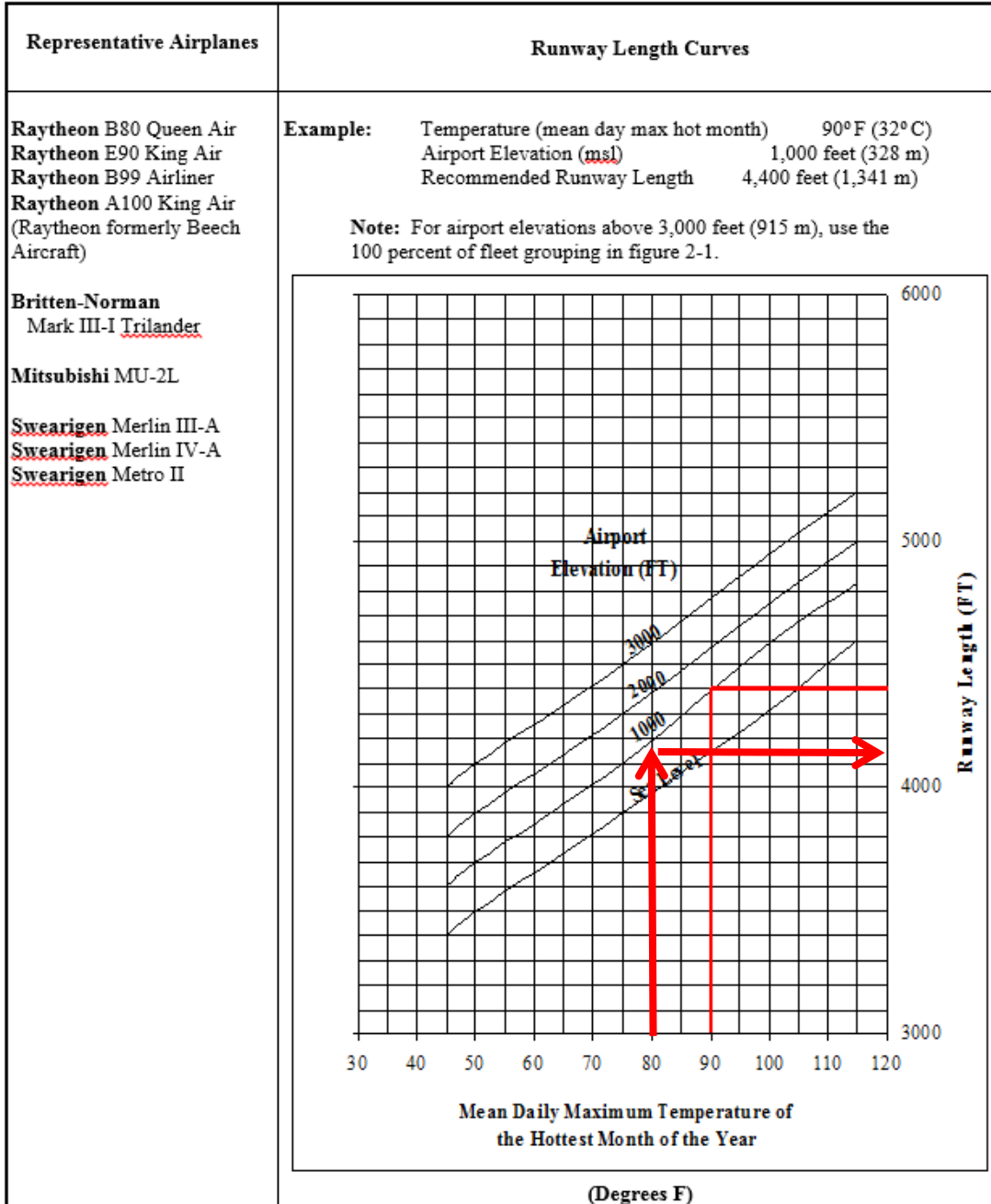
Warren Municipal Airport
Temperature: 80.6°F / 27°C - Airport Elevation: 888' MSL



Runway Length @ 95 Percent of Fleet: **3,190 feet**
Runway Length @ 100 Percent of Fleet: **3,800 feet**

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

Warren Municipal Airport
 Temperature: 80.6°F / 27°C - Airport Elevation: 888' MSL



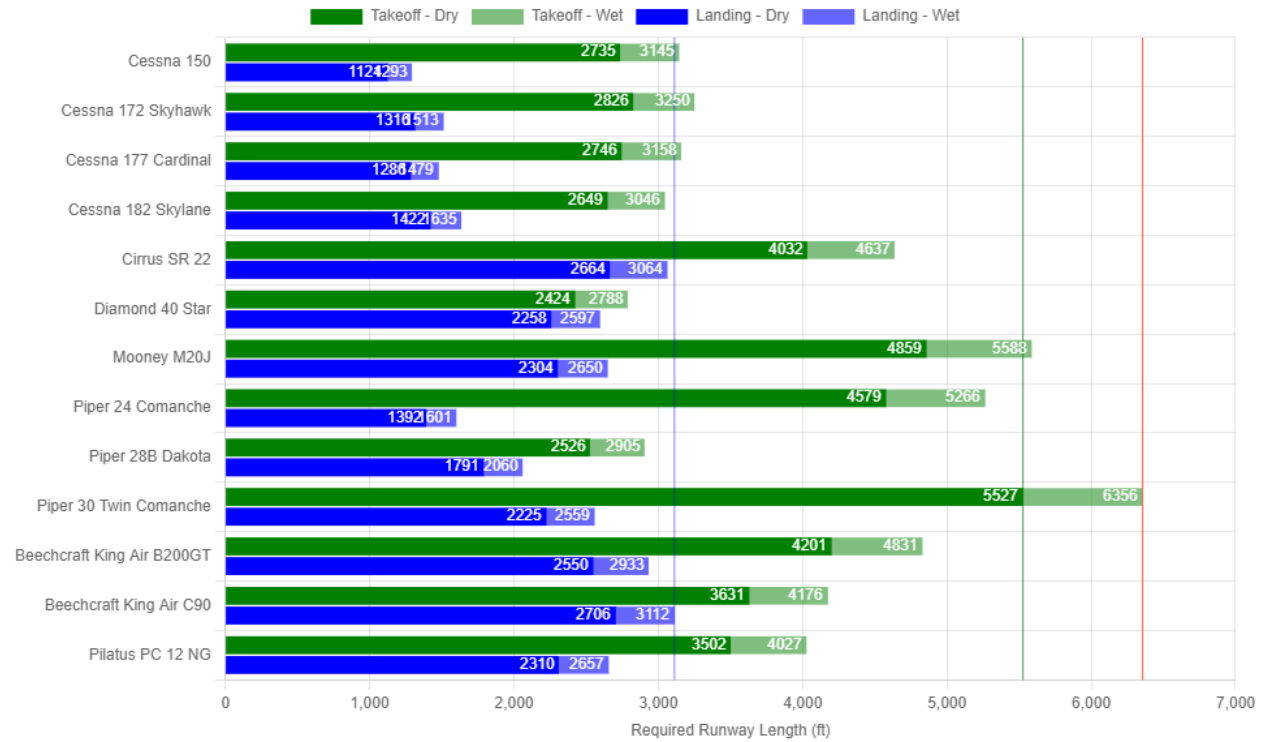
Runway Length Requirements: **4,140 feet**

Individual Aircraft

The Airport Cooperative Research Program (ACRP) released the Small Aircraft Runway Length Analysis Tool (SARLAT) in late 2022 as a means to evaluate the most used general aviation aircraft. This tool allows multiple general aviation aircraft to be examined from pilots operating handbooks that previously were not readily available. We selected aircraft frequently operating at Warren and the SARLAT calculated the takeoff and landing length needed in wet and dry conditions.

The results the tool provides can be seen in **Figure D-1**.

Figure D-1 – SARLAT Runway Design Analysis for D37

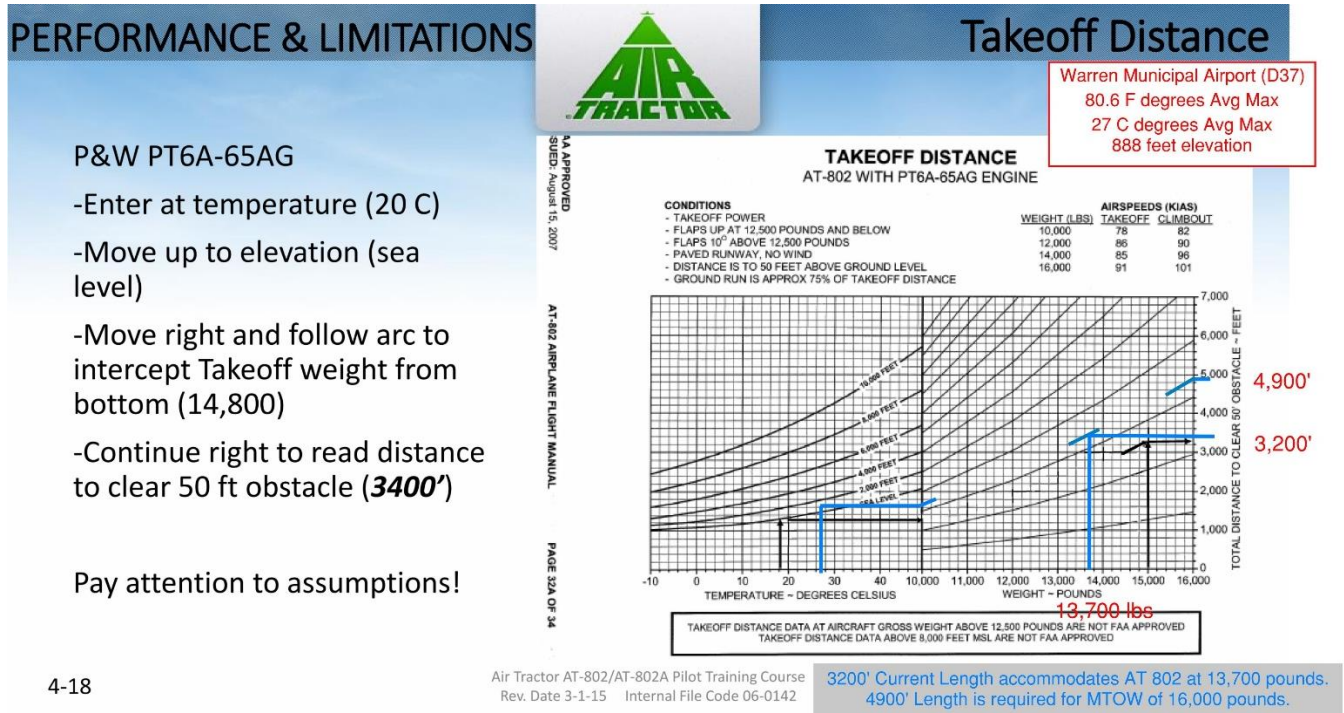


Source: Small Aircraft Runway Length Analysis Tool (SARLAT) Version 1.2.8 & KLJ Analysis

SARLAT does not have all general aviation listed in the program and it was important to evaluate the Air Tractor 802's landing and takeoff distance requirements since these aircraft are based at the airport. It was determined that the AT-802 is limited to 13,700 pounds with the current 3,200' runway length and 4,900' is needed for the 16,000 pound MTOW. See **Figure D-2** for more details.

Figure D-2 – Air Tractor 802 Takeoff Performance at D37

Warren Municipal Airport
 Temperature: 80.6° F / 27° C - Airport Elevation: 888' MSL



Source: Air Tractor Training Course, Pilot Operating Handbook & KLI Analysis

Turf Crosswind Runway

At times, certain airplanes with lower crosswind capabilities are unable to utilize the primary runway. The design objective for the length of crosswind runways at general aviation airports is to provide a length equal to 100 percent of the recommended runway length determine for the lower crosswind capable airplanes using the primary runway. [FAA AC 150/5300-13B](#) design standards recommend that distances for aircraft (landing, takeoff, and accelerate-stop) be increased by a factor of 20% for turf runways. This resulted in turf runway length of 3,360 feet using the requirements of 2,800 feet takeoff distance for the smaller aircraft in the SARLAT analysis.