$$n = \frac{vt}{u}$$

where

$v$ = design hour volume for departures *or* arrivals, aircraft/hr
$t$ = weighted mean stand occupancy, hr
$u$ = utilization factor, suggested to be 0.6 to 0.8 where stands are shared

$t = (.2)(70) + (.1)(50) + .7(57)$

$t = \frac{58.9 \text{ min}}{60} = .982 \text{ hr}$

Another deterministic formula that has been calibrated on European traffic is

$$n = mqt$$

$.2 \times 100$ | $t_1 = 70$ min
$.1 \times 50$ | $t_2 = 50$ min
$.7 \times 350$ | $t_3 = 57$ min

where

$m$ = design hour volume for arrivals *and* departures, aircraft/hr
$q$ = proportion of arrivals to total movements
$t$ = mean stand occupancy, hr

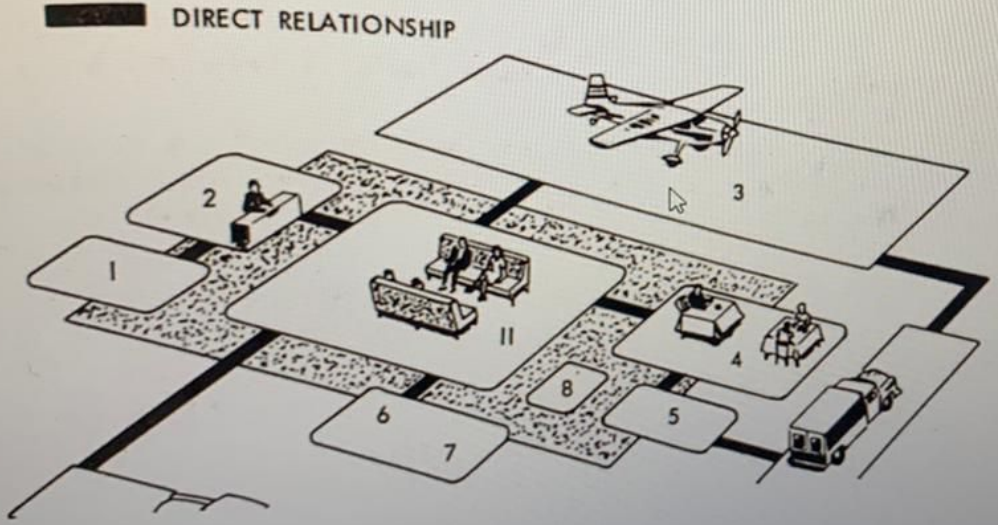
$$\text{Future stands} = \left\lceil (\text{present stands} - 2) \times \frac{\text{future passengers}}{\text{present passengers}} \right\rceil + 2$$

## Terminal Building Required Facilities

- Airline operations: tickets, baggage, boarding lounges, crew operation room, communication center, offices, rest areas for crew and employees
- Airport Operation and maintenance: list p. 537
- Passenger Service: (tickets & baggage/ airline operation), waiting areas, shops, information centers, restaurants, car rentals, communications, rest rooms, bank, medical service, etc.,

# General Aviation Terminals: small, business and private aircrafts

**Figure 17-9** Apron terminal area at a general aviation airport. (Courtesy Federal Aviation Administration.)



# Ch. 18: Airport Design Standards

**Runway length**: function of

- Design aircraft/s
- Air density
  - Elevation of airport
  - Average maximum air temperature of airport
- Runway gradient

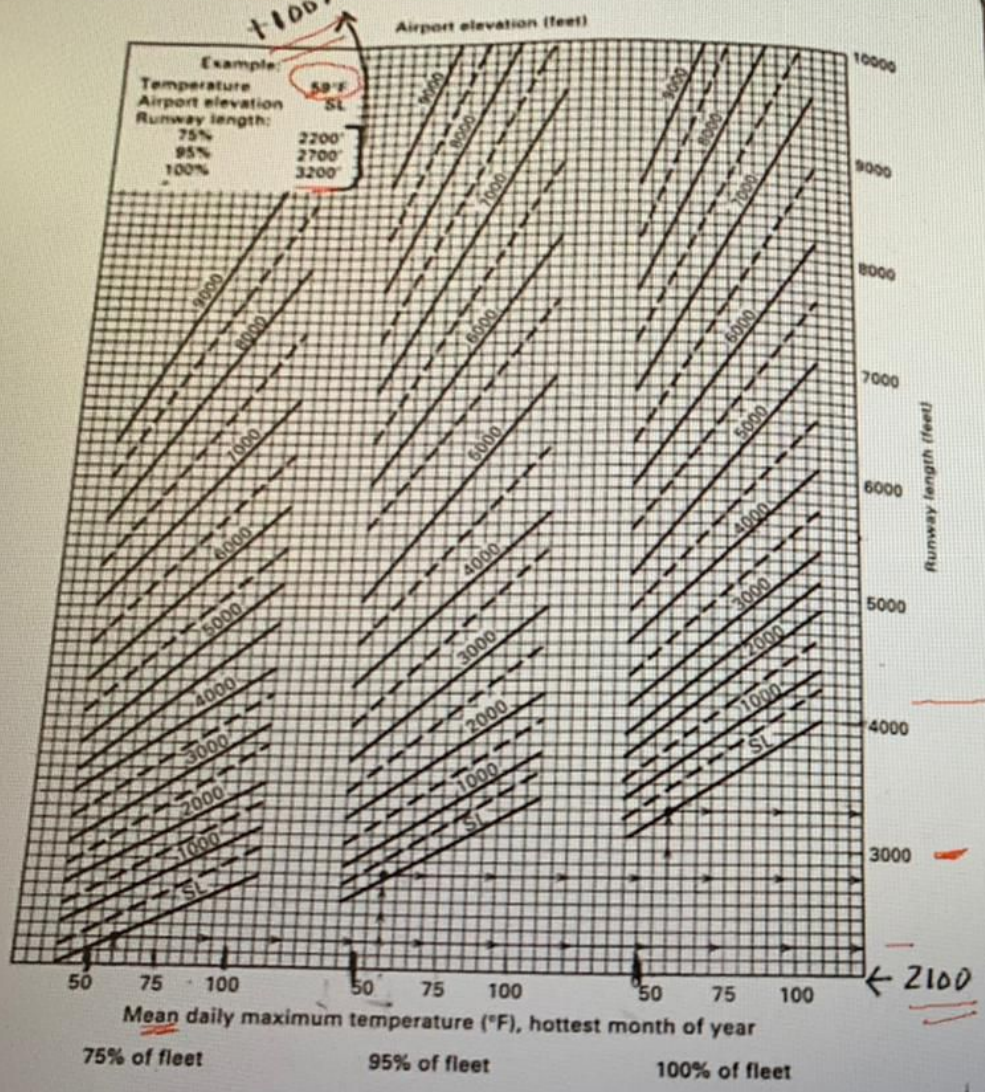
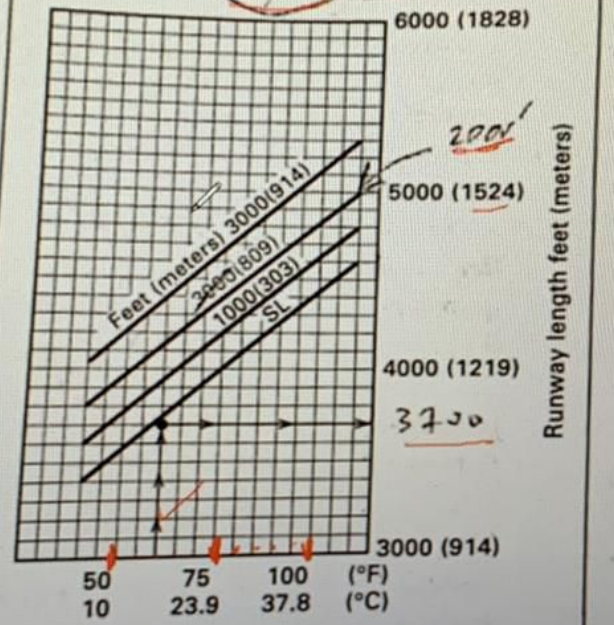



Figure 18-1 Runway lengths required to ...

| Representative airplanes | | | Runway length curves |
|---|---|---|---|
| Beech | B80 | Queen Air | Example: → Beach B80 |
| Beech | E90 | King Air | Temperature 59°F (15°C) |
| Beech | B99 | Airliner | Airport elevation Sea level |
| Beech | A100 | King Air | ~~Gen. utility~~ RW length 3700' (1 128 m) |
| Britten-Norman Mark III-I Trilander | | | Note: For airport elevations above 3000 feet (914m) use the 100% curve, figure 3. |
| Mitsubishi | MU-2L | | |
| Swearigen | Merlin III-A | | |
| Swearigen | Merlin IV-A | | |
| Swearigen | Metro II | | |




18-2 Runway lengths required to serve small airplanes having 10 passenger

## LE 18-3

Compute the runway length requirements for a Boeing 757-232 series aircraft landing and taking off at an airport at an elevation of 500 m (1640 ft) at a normal maximum temperature of 30°C (86°F). Assume 25° flaps for landing and 5° flaps for take-off. Maximum operational take-off weight is 102,000 kg (224,686 lb) and maximum operational landing weight is 84,000 kg (185,035 lb). The airplane has two Pratt & Whitney 2037 engines.

84000 kg ≤ 89800 kg

elev 500 m = 1640 ft

5.50 + (640/1000) × .13 = 5.58

length of runway for landing requirement

1640 − 1000 / 2100 − 1000 = x / 5.63 − 5.5

x = 5.583

**Table 18-1** Runway Length Table: Aircraft Performance, Landing (Boeing 757-232 Series) PW 2037 Engine, 25° Flaps

| Temperature (°C) | By Airport Elevation in Meters | | | | | |
|---|---|---|---|---|---|---|
| | 0 m | 500 m | 1000 m | 1500 m | 2000 m | 2500 m |
| | Maximum Allowable Landing Weight (1000 kg) | | | | | |
| 10 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 12 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 14 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 16 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 18 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 20 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 22 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 24 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 26 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 28 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 30 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 32 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 34 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 |
| 36 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 89.0 |
| 38 | 89.8 | 89.8 | 89.8 | 89.8 | 89.8 | 86.9 |
| 40 | 89.8 | 89.8 | 89.8 | 89.8 | 87.5 | 84.9 |
| 42 | 89.8 | 89.8 | 89.8 | 89.8 | 85.2 | 82.9 |
| 44 | | | | | | 81.0 |

| Weight (1000 lb) | By Airport Elevation in Feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 ft | 1000 ft | 2000 ft | 3000 ft | 4000 ft | 5000 ft | 6000 ft | 7000 ft | 8000 ft |
| | Runway Length (1000 ft) | | | | | | | | |
| 125 | 3.65 | 3.72 | 3.79 | 3.85 | 3.92 | 3.98 | 4.05 | 4.11 | 4.18 |
| 130 | 3.89 | 3.96 | 4.04 | 4.12 | 4.21 | 4.30 | 4.39 | 4.49 | 4.60 |
| 135 | 4.08 | 4.17 | 4.26 | 4.35 | 4.45 | 4.56 | 4.67 | 4.80 | 4.94 |
| 140 | 4.24 | 4.33 | 4.43 | 4.54 | 4.65 | 4.77 | 4.90 | 5.04 | 5.20 |
| 145 | 4.37 | 4.48 | 4.58 | 4.69 | 4.81 | 4.94 | 5.08 | 5.24 | 5.41 |
| 150 | 4.49 | 4.60 | 4.71 | 4.83 | 4.95 | 5.09 | 5.23 | 5.39 | 5.56 |
| 155 | 4.60 | 4.71 | 4.82 | 4.95 | 5.08 | 5.22 | 5.36 | 5.52 | 5.69 |
| 160 | 4.70 | 4.81 | 4.93 | 5.06 | 5.19 | 5.33 | 5.48 | 5.64 | 5.81 |
| 165 | 4.80 | 4.92 | 5.04 | 5.17 | 5.30 | 5.45 | 5.60 | 5.76 | 5.92 |
| 170 | 4.92 | 5.03 | 5.16 | 5.29 | 5.43 | 5.57 | 5.72 | 5.88 | 6.04 |
| 175 | 5.04 | 5.16 | 5.29 | 5.42 | 5.57 | 5.71 | 5.87 | 6.03 | 6.20 |
| 180 | 5.19 | 5.32 | 5.44 | 5.58 | 5.73 | 5.88 | 6.04 | 6.22 | 6.39 |
| 185 | 5.37 | 5.50 | 5.63 | 5.77 | 5.92 | 6.09 | 6.26 | 6.45 | 6.65 |
| 190 | 5.59 | 5.72 | 5.86 | 6.00 | 6.16 | 6.33 | 6.53 | 6.74 | 6.97 |
| 195 | 5.85 | 5.98 | 6.13 | 6.28 | 6.45 | 6.64 | 6.85 | 7.10 | 7.38 |
| 200 | 6.15 | 6.30 | 6.45 | 6.61 | 6.79 | 7.00 | 7.25 | 7.54 | 7.89 |

**Table 18-2** Runway Length Table: Aircraft Performance, Takeoff (Boeing 757-232 Series) PW 2037 Engine, 5° Flaps

| Temperature (°C) | By Airport Elevation in Meters | | | | | |
|---|---|---|---|---|---|---|
| | 0 m | 500 m | 1000 m | 1500 m | 2000 m | 2500 m |
| | Maximum Allowable Takeoff Weight (1000 kg) | | | | | |
| 10 | 108.9 | 108.9 | 108.9 | 108.9 | 108.9 | 106.4 |
| 12 | 108.9 | 108.9 | 108.9 | 108.9 | 108.9 | 104.9 |
| 14 | 108.9 | 108.9 | 108.9 | 108.9 | 108.8 | 103.4 |
| 16 | 108.9 | 108.9 | 108.9 | 108.9 | 107.7 | 101.9 |
| 18 | 108.9 | 108.9 | 108.9 | 108.9 | 106.4 | 100.3 |
| 20 | 108.9 | 108.9 | 108.9 | 108.9 | 105.0 | 98.6 |
| 22 | 108.9 | 108.9 | 108.9 | 108.9 | 103.4 | 97.0 |
| 24 | 108.9 | 108.9 | 108.9 | 107.9 | 101.7 | 95.3 |
| 26 | 108.9 | 108.9 | 108.9 | 106.0 | 100.0 | 93.5 |
| 28 | 108.9 | 108.9 | 108.9 | 104.1 | 98.1 | 91.7 |
| 30 | 108.9 | 108.9 | 107.5 | 102.1 | 96.1 | 89.9 |
| 32 | 108.9 | 108.9 | 105.5 | 100.0 | 94.1 | 88.0 |
| 34 | 108.9 | 108.4 | 103.4 | 97.8 | 91.9 | 86.1 |
| 36 | 108.9 | 106.5 | 101.3 | 95.6 | 89.7 | 84.1 |
| 38 | 108.9 | 104.5 | 99.0 | 93.2 | 87.4 | 82.1 |
| 40 | 104.5 | 106.5 | 96.7 | 90.8 | 85.1 | 80.0 |
| 42 | 105.3 | 99.9 | 94.1 | 88.3 | 82.7 | 77.8 |
| 44 | 103.0 | 97.3 | 91.4 | 85.7 | 80.3 | 75.6 |

| Temperature (°C) | By Airport Elevation in Meters | | | | | |
|---|---|---|---|---|---|---|
| | 0 m | 500 m | 1000 m | 1500 m | 2000 m | 2500 m |
| | Reference Factor *R* | | | | | |
| 10 | 52.1 | 54.8 | 58.2 | 62.7 | 68.5 | 76.1 |
| 12 | 52.2 | 54.7 | 58.2 | 62.9 | 69.1 | 77.0 |
| 14 | 52.3 | 54.8 | 58.3 | 63.2 | 69.8 | 78.2 |
| 16 | 52.4 | 54.9 | 58.6 | 63.7 | 70.6 | 79.6 |
| 18 | 52.6 | 55.2 | 59.0 | 64.4 | 71.7 | 81.2 |
| 20 | 52.8 | 55.6 | 59.6 | 65.3 | 72.9 | 82.9 |
| 22 | 53.1 | 56.2 | 60.4 | 66.3 | 74.4 | 84.9 |
| 24 | 53.5 | 56.8 | 61.4 | 67.6 | 76.0 | 87.2 |
| 26 | 53.9 | 57.6 | 62.5 | 69.1 | 78.0 | 89.6 |
| 28 | 54.5 | 58.6 | 63.8 | 70.8 | 80.1 | 92.4 |
| 30 | 55.1 | 59.7 | 65.4 | 72.8 | 82.6 | 95.3 |
| 32 | 56.0 | 61.0 | 67.1 | 75.0 | 85.3 | 98.5 |
| 34 | 56.9 | 62.4 | 69.0 | 77.5 | 88.3 | 102.0 |
| 36 | 58.0 | 64.0 | 71.2 | 80.2 | 91.6 | 105.8 |
| 38 | 59.3 | 65.7 | 73.6 | 83.3 | 95.2 | 109.9 |
| 40 | 60.7 | 67.7 | 76.2 | 86.6 | 99.1 | 114.2 |
| 42 | 62.4 | 69.8 | 79.0 | 90.2 | 103.4 | 118.8 |
| 44 | 64.2 | 72.1 | 82.1 | 94.1 | 108.1 | 123.8 |

| Weight (1000 kg) | Runway Length in Meters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Reference Factor *R* | | | | | | | | |
| | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |
| 60 | 941 | 1087 | 1245 | 1401 | 1540 | 1648 | 1711 | 1715 | 1646 |
| 65 | 1093 | 1259 | 1418 | 1569 | 1711 | 1844 | 1966 | 2076 | 2173 |



**Table 18-2** Runway Length Table: Aircraft Performance, Takeoff (Boeing 757-232 Series) PW 2037 Engine, 5° Flaps *(Continued)*

| Weight (1000 kg) | Runway Length in Meters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Reference Factor *R* | | | | | | | | |
| | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |
| 70 | 1247 | 1438 | 1617 | 1786 | 1951 | 2114 | 2279 | 2451 | 2632 |
| 75 | 1409 | 1630 | 1843 | 2048 | 2249 | 2448 | 2646 | 2846 | 3051 |
| 80 | 1581 | 1838 | 2096 | 2350 | 2599 | 2837 | 3062 | 3271 | 3460 |
| 85 | 1769 | 2067 | 2377 | 2688 | 2990 | 3271 | 3522 | 3731 | 3888 |
| 90 | 1975 | 2319 | 2685 | 3056 | 3414 | 3742 | 4021 | 4234 | 4364 |
| 95 | 2205 | 2599 | 3022 | 3451 | 3864 | 4239 | 4554 | 4788 | 4917 |
| 100 | 2462 | 2912 | 3388 | 3868 | 4330 | 4754 | 5117 | | |
| 105 | 2750 | 3261 | 3782 | 4301 | 4804 | 5276 | | | |
| 110 | 3074 | 3650 | 4207 | 4748 | | | | | |