5.3.5 Landing Distance

On approach, the engine power levers are close to idle, and landing distance is independent of *T/W*. Landing distance is a function of approach speed which in turn is a function only of $C_{L_{max}}$ in the approach condition, wing loading, and air density ratio. For commercial aircraft, the use of thrust reversers is not included in the calculation of required landing distance, but it may be included for military airplanes.

Required wing loading to meet a given landing distance requirement can therefore be estimated from Raymer Eq. (5.11), using an estimate of $C_{L_{max}}$ from Fig. 5.3.3.1.

For commercial turbine-powered aircraft, FAR 121.195(b) requires that a safety factor must be applied to the required FAR landing field length so that

$$S_{landing} = 0.6 \left(FAR\ landing\ field\ length \right) \tag{5.3.5.1}$$

$S_{landing}$ is the total distance from the runway threshold to the stopping point that must be achievable in flight test. The landing wing loading to achieve this can be calculated from

$$\left(\frac{W}{S} \right)_{land} = \frac{\left(S_{landing} - S_{air} \right) \sigma\, C_{L_{max}}}{80} \tag{5.3.5.2}$$

for the case where distances are in feet. S_{air} is the distance between the runway threshold and the touch-down point. For commercial aircraft S_{air} is approximately 1000 ft, although there is a fairly large dispersion in this value. Values of S_{air} for other classes of aircraft are in Raymer's text.

To calculate *(W/S)$_{ref}$*, remember to factor the landing wing loading by the ratio of maximum takeoff weight (*MTOGW*) to maximum landing weight (*MLW*), i.e.:

$$\left(\frac{W}{S} \right)_{ref} = \left(\frac{W}{S} \right)_{land} \left(\frac{MTOGW}{MLW} \right) \tag{5.3.5.3}$$
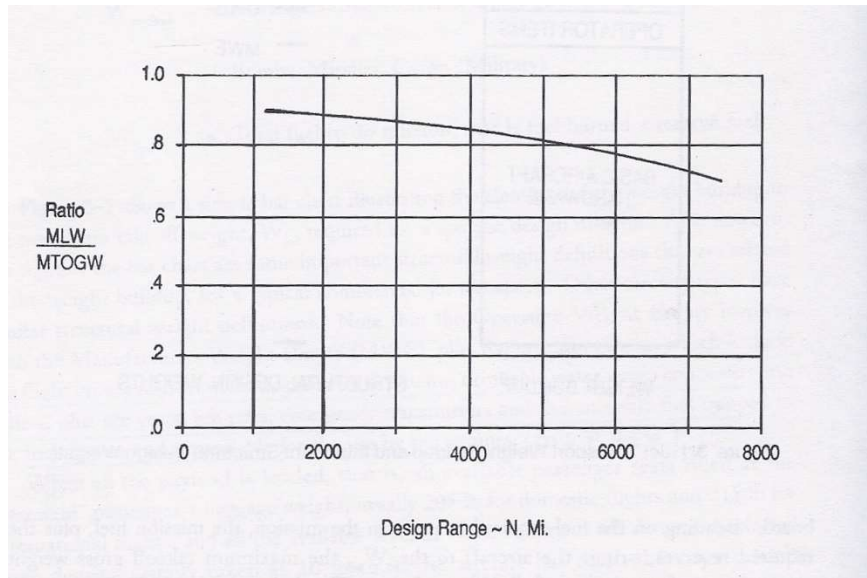
Source: Schaufele

Fig. 5.3.5.1 Ratio of Maximum Landing Weight to MTOGW

Typical values of the inverse of this ratio are in Fig. (5.3.5.1). The design specifications may require that the landing distance be calculated at a weight which is less than the maximum landing weight. If not specified, the maximum landing weight is a reasonable value to use.

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