3.3 BASIC RUNWAY LENGTH

It refers to the length of an airport runway under the following assumptions:

Related to runway:

No wind is blowing on runway

Runway is levelled (No effective gradient)

Related to Airport:

Airport is at sea level C (Standard Temperature)°

The temperature at the airport is 15

Related to aircraft:

Aircraft is loaded to its capacity

Related to route to destination:

No wind is blowing on the way to destination Standard temperature prevails along the way

Factors Affecting Basic Runway Length

The following factors affect the calculation of basic runway length:

• Aircraft characteristics

• Airport environmental conditions

• Safety requirements

Aircraft Characteristics

• Power and propulsion system

• Critical aircraft: The aircraft that requires longest runway length for landing and take-off operations. The length of runways for both the operations may be determined from the flight manual of aircraft performance.

• Gross landing and take-off weight of the aircraft

- Aerodynamic and mechanical characteristics

Airport Environment

- Atmosphere
- Temperature
- Surface wind
- Altitude
- Runway Gradient

Safety requirements

- Normal landing case
- Normal take-off case
- Engine Failure Case

Standard Atmospheric Parameters: C°

- Temperature at MSL = 15
- Pressure at MSL – 760mm of Hg
- Air Density = 1.225kg/m3 If the standard atmospheric conditions vary due to any reason - corrections are applied to the basic runway length to calculate the actual runway length.

Corrections to basic runway length

There are three main corrections to be applied to basic runway length to determine the actual length of runway for an airport. These are:

- Elevation Correction
- Temperature Correction
- Gradient Correction

Elevation Correction

Change in elevation affects air density, atmospheric pressure and temperature. Correction should be applied for change in altitude. The Elevation Correction is as shown below: Correction for Altitude: Increase runway length by 7% per 300m altitude above MSL

Temperature Correction

If standard temperature varies, correction to runway length should be applied:1. Compute Airport Reference Temperature (ART) 2. Compute Standard Temperature at the given Elevation (STE) 3. Compute Increase in ART above STE= ART- STE 4. Apply Correction based on the value obtained in Step-3

Airport Reference Temperature (ART)

ART = ♦♦1 + 1/3(♦♦2 − ♦♦1) Where,

1 = Monthly mean of average daily temperature for the C (°hottest month of the year)

2 = Monthly mean of maximum daily temperature for the C)°same month

Standard Temperature at Elevation (STE)

STE = Temperature at MSL +/- (rate of change of temperature x elevation) Rate of change of temperature with height is given as: C / km

height ---------- Up to 11km height from MSL°-6.5 C

height--------- 11-20km height (Stratosphere)°Constant at -56.5 C / km

height ---------- 20-32km height (Troposphere)°+1

Temperature Correction C°

Increase basic runway length by 1% for every 1 rise in Airport Reference Temperature (ART).

Longitudinal Gradient:

• If the gradient is steep, it may cause pre-mature liftoff or may cause structural damage

• It will consume more energy and will need longer runway to attain desired ground speed

Effective Longitudinal Gradient:

It refers of the average gradient computed by subtracting maximum and minimum elevations along the runway divided by the total length of runway.

Gradient Correction

Runway length is increased at a rate of 20% for every 1% of the effective gradient Note: This correction is applied only if the combined correction for Elevation and Temperature remains less than 35%