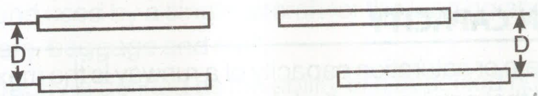
3. AIRPORT CAPACITY AND TUNNELING AREA

AIRPORT CAPACITY

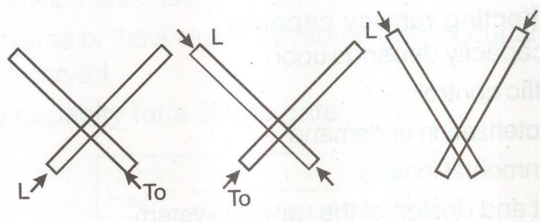
- The number of aircraft movements which an airport can process within a specified period of time with an average delay to the departing aircraft within the acceptable time limit is defined as airport capacity.
- The following factors affect the airport operating capacity:

Runway configurations and the connected taxiways

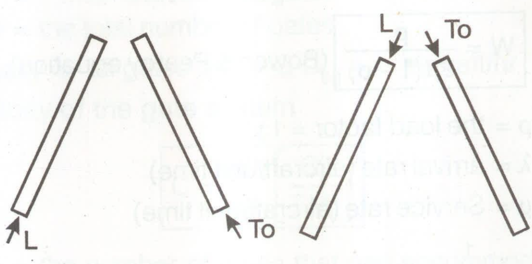
(i) Single runway



(ii) Parallel runway



(iii) Intersecting runways



L = Landing T.o. = Taking off.

- **Single Runway:** is usually adopted when the wind blows in one direction for most of the time in a year and air traffic requirement does not exceed the capacity of such pattern.

- **Parallel Runway:** The capacity of this pattern depends upon the lateral spacing between the two runways, the weather conditions and the navigational aids available at the airport.
- **Intersecting Runways:** is usually adopted when wind in a particular direction does not provide the required coverage. Whether both the runways can be used for simultaneous landing and take off, depends upon the cross wind component on each runway.
- **Non-intersecting Runways:** Capacity depends upon the wind conditions and visibility.

RUNWAY CAPACITY

- It is defined as the ability of a runway system to accommodate aircraft landings and take offs.
- Expressed as operations/hour or operations per year.

SATURATION CAPACITY

- The ultimate or saturation capacity of a runway is the maximum number of aircraft that can be handled during a given period under conditions of continuous demand.
- **Factors affecting runway capacity**
  Runway capacity depends upon
  1. Air traffic control
  2. Characterization of demand
  3. Environmental factors
  4. Layout and design of the runway system
- **Average landing delay (Steady State)**

$$W = \frac{\rho}{2\mu(1-\rho)}$$ (Bowen & Pearcy equation).

where, ρ = the load factor = 1μ

λ = arrival rate (aircraft/unit time)

μ = Service rate (aircraft/unit time)

$= \frac{1}{b}$

b = mean service time.

$$W = \frac{\rho(1+C_b^2)}{2\mu(1-\rho)}$$ (Pollaczek-Khinchin formula)

where, C_b = coefficient of variation of service time = $\frac{\sigma_b}{b}$

σ_b = Standard deviation of service time

- **The weighted hourly capacity (WHC)**

$$\frac{\Sigma \text{capacity} \times \% \text{ use} \times \text{weighting factor}}{\Sigma \% \text{ use} \times \text{weighting factor}}$$

- **Practical Annual Capacity**

$$PAC = WHC \times \text{annual utilization} \times \text{percentage use of airport}$$

GATE CAPACITY

- **Gate:** is defined by an aircraft parking space, adjacent to a terminal building and used by a single aircraft for the loading and unloading of passengers, baggage and mail.
- **Gate capacity** is defined as the ability of a specified number of gates to accommodate aircraft loading and unloading operations under conditions of continuous demand.
- It is the inverse of the weighted average gate occupancy time for all the aircraft served.

The gate capacity for a single gate

$$C_{sg} = \frac{1}{\text{weight service time}}$$

= ....aircraft/minute/gate.

If G = the total number of gates

The capacity for all gates is $C = G\, C_{sg}$ = ... aircraft/hr

The capacity of the gate system

$$C = \min_{\text{all}} \left[\frac{G_i}{T_i M_i}\right]$$

where, G_i = the number of gates that can accommodate aircraft of class i.

T_i = mean gate occupancy time of aircraft of class i

M_i = fraction of aircraft class *i* demanding service.

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