UNIT III

AIRPORT PLANNING:

AIR TRANSPORT CHARACTERISTICS:

* Rapidity
* Continuity
* Accessibility
* Fastest mode of Transport
* capable of navigating continuously over mountains and oceans without any break in journey.

* Accessing even remote locations such as forests, islands and snowy mountains
* Lesser carrying capacity
* Prohibitive costs
**Airport Classification:**

- Terminal Airport (Terminal Facilities & Felling stations)
- Intermediate landing points (To promote safety)

**Defence:**

- Commercial
  - Important characteristics of aircraft intended to use airport
  - Airport reference code
    - Letter code
    - Number code

**Ownership:**

- Public
- Joint
- Private

**Size:**

- Area of operation
  - Domestic
  - International
    - Large
    - Medium
    - Small

**Airport Planning:**

Airport planning refers to preparation of a scheme beforehand for development of airports. Requirement of airport is to ensure safe and speedy transport of air travel passengers. It has to facilitate reception & departure of aircrafts with least possible delays.
OBJECTIVES OF AIRPORT PLANNING

* Justify the need for an airport
* Formulate a layout plan for the airport and design of runways, taxiways and airport buildings.
* Prepare cost estimation
* Propose institutional arrangements.

COMPONENTS OF AIRPORT PLANNING:

* Assessment of Traffic potential
* Site selection
* Design and drawing of airport components
* Cost estimation
* Financial resources
* Evaluation of economic viability

ENGINEERING VISIBLE & ENVIRONMENTAL IMPACT

INSTITUTIONAL ARRANGEMENT

GOOD AIRFIELD LAYOUT CHARACTERISTICS:

* Landing, Takeoff, and Taxiing - Independent operation
* Shortest Taxiway
* Safe Runway Length
* Safe Approaches
* Excellent control Tower Visibility
* Adequate landing Apron space.
* Adequate Terminal Building facilities
* Land area for future expansion
* Cost effective construction, maintenance and operation

Socio Economic characteristics of catchment areas:

(i) Assessment of Traffic potential;
Assessment of Traffic potential for a proposed airport in terms of passengers and cargos is a crucial element in establishing the need for an airport. The first step in assessment of Traffic potential is to delineate catchment area of the proposed airport in the national network of airports. After demarcation of imaginary influence area, socio economic characteristics of population are studied.

(ii) Population:
* Total population
* Rate of growth of population
* Estimation of future population.
iii) Economic characteristics:


b. Income group - Composition of families under high income and middle income group.

c. Average per capita income of persons in income groups at HIM and MIM

d. Pattern of expenditure - Proportion of expenditure for different items and more particularly for travel.

iv) Travel characteristics:

* Frequency of air travel
* Modal choice

Site selection for airports:

Site selection is a critical element in airport planning. Efficiency, safety, and capacity of airports to a great extent depend on suitability of sites.
Factors influencing size of Airport:

* Type of an airport; i.e., domestic or international or defence. Size of an airport depends upon whether it is an international or domestic one.
* Traffic potential of an airport region
* Aircraft characteristics such as aircraft capacity, aircraft speed, minimum circling radius, minimum turning radius, noise level, and take-off and landing distances.
* Site characteristics such as topography and land availability

Design and drawing of Airport Components:

Airport Planning involves the preparation of following plans:

* Topographical Plan
* Layout Plan
* Design of Taxiway, runway & buildings
* Vehicular circulation and parking area plan.

Topographical Plan:

It includes all man made and natural features on a site, besides boundaries of the site.
Boundaries of cleared and graded area, contour lines and access roads are marked on the topographical plans. Width for which features are incorporated depends upon the type & size of airport.

Layout plan:

It is the process of laying out various elements in a system. It is the manner in which various elements are arranged. An airport layout plan shows the various positioning of components of airport.

- Airport landing area - Approach zone
- Airport Terminal area - Runway, Taxiway, Apron, Airport building, vehicular parking area, Airport road network.

Design of Runway:

- Runway orientation
- Length of runway
- Runway width
- Width & length of safety area
- Transverse gradients
- Longitudinal & effective gradient
- Rate of change of long. gradient
- Sight distance
- Design of runway pavement
ICAO stipulations

Federal Aviation agency (FAA) and International Civil Aviation organisation (ICAO) have stipulated norms for various parameters.

1) Regional plan:

A region is a larger area consisting of cities, towns and villages. The ICAO stipulates a min. distance of separation b/w airports.

Regional plan is studied to ensure that the proposed airport forms part of the regional network of airports. Min. separation is essential from operational & effective potential consideration.

Minimum spacing as per FAA:

- Smaller airports under VFR conditions - 3km
- Bigger airports - 6km
- Airports operating Piston Engine aircrafts - 25km
- " Jet " - 160km

2) Types of airports:

The site suitability depends upon the type of proposed airports such as commercial, domestic, international or defence. In case of
Airports for defense, special requirements are provided such as natural cover from air raids, sites with thick bushes.

Ground Accessibility:
Location of a site should be such that it is easily accessible by different modes - road, rail and water.

The site should have strategic locations abutting national highways/arterials, close to railway stations and harbours/ports. This provides quick access and reduces the time taken for surface travel.

Topography:
It is the description of natural and man-made features. It refers to natural features such as ground contours, water bodies, hillocks, forests, bushes, trees and man-made features such as pattern of land use, intensity and height of building. An elevated site is considered ideal for an airport.
Advantages of Elevated site:

- Less obstruction in approach & turning zones
- Natural Drainage
- Uniform wind intensity
- Better visibility.

Soil characteristics:

A site with better soil characteristics is preferable because it reduces cost of grading, drainage, construction and maintenance. Soil containing reasonable composition of...
Pervious materials like gravel or sand with a suitable natural binder is considered desirable. A site with expansive soil like clay is considered unsuitable.

Properties of runw soil as runway material:

* Stability
* Strength
* Minimum change in volume & stability under adverse condition.

Index Properties

* Grain size distribution
* Liquid limit
* Plasticity index.

Meteorological Factors:

1) Wind:

Landing & Take off operations take place in head wind.

Wind data greatly influence the site selection.

Wind data on direction, duration & intensity are collected at least for 10 years for available sites and favourable place which has favourable wind has chosen.
Frost and Fog:

Any site selected should be free from fog, frost and smoke.

Fog generally settles in areas like valley where wind blow is less.

Smoke exists at sites nearer to industrial areas.

The site located on the leeward direction should be preferred than that on windward direction.

Trend of future development of industries should also be studied and sites should be chosen accordingly.

Temperature:

Temperature influences runway length. Increase in temperature results in decrease in air density.

Aircraft requires longer runway in a particular direction.

Sites with temperature at or closed to standard temperature are preferred.
Noise nuisance:

The proximity of airports to areas of human habitation, residential areas and institutional areas such as schools, hospitals should be avoided.

The intensity of noise nuisance depends upon climb-out paths of aircrafts, type of engine propulsion and gross weights of aircrafts.

A site which is not marked by any developments in general and residential developments in particular is preferred.

It is practically not possible to provide a buffer zone, acoustic barriers have to be installed.

Buffer zone for noise mitigation.
Onsite and off site infrastructures:

- It refers to basic facilities such as water supply, sewer networks, electricity, communication and roads.

- In case, these facilities are not available onsite or offsite, they may have to be developed exclusively for airports, it may add to the cost of projects.

- Sites for which facilities are already available should be selected than those which are in isolation or away from existing cities.

Shape and dimension of a site:

Shape of an airport depends upon the type and class of an airport, prevailing wind direction and configuration of runways.

The shape of the site should conform to regular geometries such as rectangular, square and trapezoidal.
Scope for future expansion:

Area of a site selected for an airport should be more than that stipulated by ICAO.

It should be adequate not only to meet present demand but also future requirements by way of more number of runways, aprons, terminal buildings, vehicular parking and horizontal expansion to meet future air travel demand.

Comprehensive Evaluation:

A comparative analysis of alternate sites is done with reference to economic viability, environmental impact, technical feasibility, social & political acceptability. A multi criteria technique is adopted to integrate various evaluation elements such as and arrive at a composite score.

Based on composite score, the best site among alternatives is chosen.
Typical airport layout:

- Runway is the principal element of an airport.
- All other components of airports should have good co-relation with runway.

Integration of all elements makes efficient and effective airports.
Requirements of well planned airports are:

* Optimal route from the apron to the runway, through the taxiway.
* Control tower with a command over entire airfield.
* Optimal service to air passengers.
* Cost effective construction & maintenance.
* Scope for future expansion.
a) Single Runway layout.

b) Open Runway concept.

c) Offset Parallel concept.
Tangential Runway layout:

Conceptual layout pattern:

Pattern of airport layouts is determined by configuration of runways. Secondary elements such as apron, taxiway, terminal building are positioned based on orientation of runway.
Airport capacity:

It refers the ability of an airport to offer services for landing / take off operation in a given time.

It is expressed in terms of number of landing or taking off in the airport.

It depends on following characters:

- Runway configuration
- Skyline & surrounding development
- Loading apron space
- Type of Instrument - landing system

Layout of airport:

Chennai Airport handled around 120 landings a day. The breakup was 95 on St. Thomas mount end of the main runway and 25 on Pallavaram side based on wind conditions. With the installation of ILS on Pallavaram end, 48 landings could be handled.
Heliport:

It is prepared ground used for landing and take off of helicopters. It have all facilities to that of airports but to smaller scale. landing area may be range blw 0.5 to 0.75 hectares.

Parking and circulation area:
Parking may be defined as leaving of a car or other personal vehicle in a particular place for certain place time.

According to FAA for each peak hour air passenger 1.5 to 2 cars are assumed as peak hour parking demand.
ii) Access and circulation standards:
* An important consideration is parking lot should be easily accessible.
* Should ensure least possible delay during entry and exit.

![Diagram of parking lot]

Driveway standards:
* One-way driveway for parking spaces shall have a min. width of 3.75 m.
* Two-way driveways for a small width of 6.25 m.
* Driveways or turnaround aisles shall not be dead-end.
* Parking lots must be located close to arrival and departure halls.
Parking slots and drive aisle:

Standards for parking bays:

Maximum Aisle length:

maximum length of aisle should not exceed 100 m, without a break in circulation.

An aisle width should be sufficient to allow a driver to couple parking and unparking manoeuvres in a single, convenient and smooth turn.
Employees Parking:

It is desirable to segregate employee's parking from that of passengers' parking. Employees' parking are normally long-term parking. Based on size and shape of parking lots, the best parking angle is decided.

- Parallel parking
- 30° angular parking
- 45° " 
- 60° " 
- Right angle parking.

Surface parking lots are provided close to airport buildings. If sufficient space are not available, multi-storeyed car parking is provided.

- Vehicles parked parallel to kerb is parallel parking
- If vehicles are parked making angles with a kerb, it is called angular parking

Operation of parking and unparking is difficult in parallel parking. Parking with 60° is practicable while 45° parking yield best results.
Right angled parking is adopted only under exceptional conditions.

At airports parking for short hours or less is termed as short term parking.

Short term parking accounts to 80% of the total parking at airports.

Diagram:

- Length: 27.5m
- Width: 6.25m
- Parking space: 5m
- Total number of cars: 33 cars
- Total length of parking area: 26.55m