Airport Engineering

* **Aerodrome :** area on land or water used for the arrival and departure of an aircraft
* **Aircraft :** general term used to mean any machine for navigating the air
* **Aeroplane :** is a power driven heavier than air flying machine with fixed wing
* **Airfeild :** it is area used for landing and take off of an aircraft.
* **Airport :** it is an aerodrome principally intended for use of commercial services
* **Airport capacity :** no of aircraft movements an airport can handle specific period of time
* **Airship** : a power driven lighter than air aircraft
* **Balloon :** non power driven lighter than air aircraft
* **Blast pads :** shoulders provided at the take off ends of the runway and along taxiway
* **Boundary markers :** markers used to indicate the boundary of landing area
* **Hanger :** large shed used for housing services and repairs of aircraft
* **Helicopter :** machine equipped with 1 or 3 propellers rotating horizontally
* **Rudder :** major controller while aircraft is in flight
* **Runway :** long or comparatively narrow strip of land prepared for the landing and take off of aircraft
* **Taxiway :** path on land aerodrome paved for use of taxing aircraft to and from the runway and loading apron
* **Terminal area :** portion of airport other than landing area

Site selection

1. **Atmosphere and meteorological condition:** presence of fog, haze and smoke reduces the visibility and the poor visibility lower the traffic capacity of and aircraft. In industrial area these type of environment exists. The wind data also be studied site should be located on the windwards direction.
2. **Availability of land for future expansion:** it is necessary to acquire land in advance for the future expanding the airport. As the volume of traffic increases, it will be necessary lengthen runways, provide additional support facilities and to expand the terminal facilities.
3. **Availability of utilities:** specially larger airports has to be provided with the utilities like water, electric power, telephone, sewer etc. For electric power most of the major airports provide their own generating plants to be used in emergencies in the event when economical source fails. Sewage disposal plants may have ti be constructed if site located far away from sewers.
4. **Development of the surrounding area:** type of development of the surrounding area is very important. Proximity of airport site to the residential area, schools and hospitals should be avoided. Suitable zoning regulations should be imposed to the control the use of land adjacent to the airport so that conflicts in future are avoided.
5. **Economy of construction:** if alternative sites are available and equally well suited, the site which is more economical to construct should be given preference. Sites of water logged areas and reclaimed areas are very costly to develop than natural ground. Availability of construction material also have significant impact on the cost of construction/project.
6. **Ground accessibility:** introduction of jet aircraft, the air time is reduced, but many cases, ground access time exceeds the air time by a considerable margin. It may also noted that the access to airports is required not only by air passengers, but also by other users of the airport such as employees, visitors, spectators. All modes of transportation should be considered for an easy access to the airport
7. **Presence of other airports:** the airport should be located sufficient distance apart. It is necessary to prevent the aircrafts which are manoeuvring for a landing at one airport from interfering with the movement of the other airport. The minimum distance between airports depends upon the volume and type of air traffic, operating facilities.
8. **Regional plan:** airport site should be selected such a way that fits appropriately in the regional plan.
9. **Soil characteristics:** airport site with the favourable soil characteristics is desirable because it reduces the cost of grading and drainage to a considerable extent. The area should be self-drained as far as possible. Site having high water table may require costly subsoil drainage. An elevated site provides better drainage and visibility.
10. **Surrounding obstruction:** airport site should be cleared of the obstruction likely to interfere with the landing and taking off operations of the aircrafts. if they are existing, it should be possible to clear them easily. The obstruction may be like natural trees, sloping ground, etc or man made like buildings, grid towers etc.
11. **Topography:** topographical features like ground ground contours, tress, strems etc., should be studied while selecting the site for an airport. Raised ground like a hill top is usually considered to be an ideal site for an airport because

a) it grants better visibility due to less fog

b) it permits easy natural drainage

c) approach and turning zones are less effected

d) there is natural drainage

1. **Use of airport:** airport site also decided by the use of airport i.e., civil or military. In the acse of emergency like war, the civilian airports are taken over by military.

Aircraft characteristics

1. Aircraft capacity
2. Aircraft speed
3. Aircraft weight and wheel arrangement
4. Fuel spillage
5. Minimum circling radius
6. Maximum turning radius
7. Noise
8. range
9. Type of propulsion
10. Tyre pressure and contact area
11. Size of aircraft
12. Take off and landing distance

**Aircraft capacity:** The capacity of an airport will determine the number of passengers, baggage, cargo and fuel that can be accommodated in the aircraft.

**Aircraft speed:** Air speed is used to mean the speed of the aircraft relative to the medium in which it is travelling. There is a slight difference of about 2 present between the true air speed and indicated air speed.

**Aircraft weight and wheel arrangement:** Different types of weights Maximum gross take-off weight, Total amount of weight, when it is taking off from runway Maximum standard landing weight. Fuel consumed during transport will be deducted from take-off weight. Weight is one of the major factor which will govern the length and thickness of the runway.

**Different weights in airline operations:**

Maximum gross take off weight: it is maximum load which aircraft is certified to carry during take off and airport pavements are designed for this load.

Maximum structural loading weight: it is difference between the gross take off weight and the fuel consumed during the trip.

Operating empty weight: weight of aircraft including crew and all the necessary gear required for flight is known as the operating empty weight.

Pay load: the total revenue producing load and it includes the weight of passengers and their baggage, mail, and cargo.

**Fuel spillage:** Spilling of fuel is usually found in the loading aprons and hangers. It is difficult to avoid spilling completely but efforts are made it to bring minimum. The pavement of bituminous pavement below the fuel inlets, the engine and main landing gears are kept under constant watch by the airport authorities.

**Jet blast:** Aircrafts ejects hot exhaust gases at relatively high velocities. It may cause inconvenience to the passengers boarding the aircraft.

**Minimum circling radius:** A certain radius in space is provided to take smooth turn. It is known as minimum turning radius and it depends on the type of aircraft, traffic volume and weather condition. this helps in separating two nearby airport by an adequate distance so that the landing simultaneously on them do not interfere with each other.

**Minimum turning radius:** it is necessary to know the minimum turning radius of an aircraft to decide the radius of taxiways and to ascertain its position in the landing apron and hanger.

**Noise:** most serious problem facing aviation is the noise and efforts are made to bring it to the minimum possible level.

**Range:** distance that an aircraft can fly without refuelling is known as range. Important factor which influences the range of an aircraft is pay load.

**Type of propulsion:** type of propulsion of aircraft will decide the size, speed, weight carrying capacity, noise nuisance, circling radius etc.

**Tyre pressure and contact area:** tyre pressure and the wheel load will give an indication of the width, type and strength of pavement required for the different type of aircraft.

**Size of aircraft:** size of aircraft will helps to decide height of hanger, size of fuselage, taxiways length and width, size of apron etc.

**Take off and landing distance:** this helps us to determine the minimum runway length required for a particular type of aircraft.

Master plan:

Regional plan :it aims at the formation an effective network of airports on the national basis. Improper location leads to the wastage of th natural resources.

Advantages:

* Enable to implement the zoning laws in the areas where the new airports are coming up in future.
* Efficiency of airport in handling the air traffic is generally increased.
* There is proper coordination of the airports.
* Airports are not closely spaced.

Data collected for making the airport regional planning:

Air traffic: existing air transportation are studied and future expected volume of air traffic in terms of passengers, mails, goods etc is determined. It will enable to decide the number of aircraft movements required in future.

Existing airport: distance, population and economic character of the surrounding areas getting air service are studied. Two adjacent airports are located sufficiently away from each other so that encircling radii of the aircrafts landing do not overlap.

Population: tendency of population to save travel time should be studied alongwith other characteristics of population such as income, business activities.

Topographical features: topographical and geographical features of the locality dictate the suitability of an airport from the regional plan basis.

Terminal building

Key feature of any terminal area is terminal building. It is designed to cope up with the current traffic, but also to manage with the traffic likely to occur in future period of 20years or so. It is used for the passengers, airline staff and administrative management. For big commercial airports, I also provide accommodation for various operational activities like control tower, weather bureau.

* **Site selection**
* It should be centrally located with respect to runway
* It should have convenient and easy access to the highway
* It should have enough provision for future expansion
* It should have favourable orientation with respect to wind, topographical feature of area
* There should be adequate space available for the parking of vehicles
* Site should have easy facility of drainage
* Utilities like water, sewage and telephone should be easily available
* **Space requirements**
* Terminal building is strongly influenced by level of service desired
* Spacing requirements vary to a great extent depending on the specific design
* FAA has indicated that gross terminal area space requirement should vary between 7.43 to 11.15 m2 per 1000 annual enplaned passengers

Some percentages spacing among various purposes in a terminal building

Recommended by FAA is

Airline operations……………….38%

Airport administration………..17%

Public space………………………..30%

Utilities, shops, etc………………15%

Total…………………………………..100%

* **Noise control in terminal building**
* Due to presence of the passengers there will be a considerable noise in terminal building
* Some important rooms like control tower from where information is tobe sent outside, is build with noise proof ma
* **Facilities to be provided in terminal building**(refer textbook)
* **Design objectives**(refer textbook)
* **Planning considerations**

Passenger flow(refer textbook)

* **Arrival**
* **Check-in**
* **Waiting**
* **Security screening**
* **Departure**
* **Deplaning**

Parking of vehicles(refer textbook)

Passengers to reach airports generally prefer roadways. Most of large airports provide separate parking for the passengers, visitors, employees and taxies. In small airports, these facilities may be combined in one location.

* Short-term
* Long term
* remote

Size of apron(refer textbook)

Following 3 factors effect the size of an apron

1. Gate position
2. Number of gates
3. System of aircraft parking

**Gate position:** term gate is used to denote an aircraft parking space adjacent to a terminal building and used by a single aircraft for the loading and unloading of the passengers, language, cargo.

Size of gate depends on size of aircraft and type of aircraft paring

Size of aircraft: size of aircraft determines the

**Number of gates:**

**System of aircraft parking:**

**Gate position**(refer textbook)

1. Size of airport
2. Type of aircraft parking

**Number of gates**(refer textbook)

1. Estimated peak hour volume
2. Gate occupancy time
3. Gate capacity analysis
4. Gate utilization factor
5. Systems of aircraft parking

**System of aircraft**

Frontal or linear system

Open apron or transporter system

Pier or finger system

Satellite system

**Frontal or linear system**

Systems are parked along the face of the terminal building . this is simple system

But it is adaptable to airports with low airline activity.

It offers short walking distance and ease of access

Affords a high degree of flexibility for expansion

Doesn’t convenient for common facilities and also leads a higher operational costs .

**Open apron or transporter system**

**Pier or finger system**

1.

**Satellite system**

1.

Hangers(refer textbook)

1. Nose hanger
2. T-hanger

**Site selection requirements for hangers**

Protection from jet blast(refer textbook)

1. Blast fences
2. Erosion control

Typical airport layouts(refer textbook)

* Airport layout-singal runway
* Airport layout-two parallel runway
* Airport layout-three non intersecting runway
* Airport layout tangential runway