UNIT-3
AIRPORT PLANNING AND DESIGN

Airport Planning

- Airport planning requires more intensive study an9 fore thought as compared to planning of other modes of transport.
- This is because aviation is the most dynamic industry and its forecast is quite complex.
- Unlike rail, road and water transportation, air transportation has yet not reached a steady state in design. it is very difficult to predict for the airport.

Airport Master Plan

- Airport master plan refers the planner's idealized concept of the form and structure of the ultimate development of the airport.
- This plan is not simply the physical from of ultimate development but a description of the st
- Master planning can apply to the construction of new airports as well as to significant expansion of existing facilities.

The objectives of the master plan according to FAA are:

- To provide an effective graphical presentation of the ultimate development of the airport are of the anticipated land uses adjacent to the airport.
- To establish a schedule of priorities and phasing for the various improvements proposed in the plan.
- To present the pertinent back-up information and data which were essential to the development of the master plan.
- To describe the various concepts and alternatives which were considered in the establishment of the proposed plan.

Planning of a new airport:

Step 1

- The most important item in a airport planning is to estimate the future volume of air traffic.
- Peak hoar volumes of passenger cargo and mail are required for proper allocation of space in the terminal building and for determining the size of the building. Peak hour aircraft movements assist in the design of runways, taxi and loading aprons.

<u>Following data is collected for the traffic forecast</u>

- Area to be served
- Origin and destination of the residents and non residents of the area
- Population growth in the area
- Economic character of the area
- Income level per capita
- Types of business activities and the labour employed
- Trends in existing local traffic
- Trends in national air traffic volume
- Population, growth and economic standards of adjacent areas

- Having collected the above data, the forecast of the traffic for some future years, say 15 years is carried out reviewing past trends of the local air traffic and future anticipated trends of the national air traffic.
- It may be pointed out that the process employed in making the forecast of air traffic is, however not a precise science.
- It requires considerable experience and judgment.

Step 2

The next step is to ascertain whether the existing airport can handle the amount anticipated air traffic.

Following points are considered in this respect

- Suitability of approaches for the type of airports.
- Capacity of runways and taxiways to handle the peak hour traffic (see chapter 7 for airport capacity
- Adequacy of terminal building of handling 4 passengers and cargo.
- Adequacy of aprons and servicing facilities.

Step 3

- If the foregoing considerations prove that the existing airport is inadequate to handle the anticipated traffic, the possible method for improving the capacity of the present airport should then be investigated.

The improvement can be done in the following ways

- Runway extensions, new or parallel runway' and high speed exit taxiways.
- Rearranging or increasing the size of terminal building and/or loading apron.
- Improving the traffic control devices

Step 4

- Inspite of all the possible ways as listed above, if it is worked out that the present airport cannot handle the air traffic, the designer thus arrives at the obvious answer, i.e to propose a new airport.

AIRPORT SITE SELECTION

- The selection of a suitable site for an airport depends upon the class of airport under consideration.

The factors listed below are for the selection of a suitable site for a major airport installation

- Regional plan
- Airport use
- Proximity to other airports
- Ground accessibility
- Topography
- Obstructions
- Visibility
- Wind
- Noise nuisance
- Grading, drainage and soil characteristics
- Future development
- Availability of utilities from town
- Economic considerations

Above factors are briefly discussed as follows

Regional Plan

- The site selected should fit well into the regional plan. there by forming it an integral part of the national network of airport.

Airport Use

- The selection of site depends upon the use of an airport i.e. whether for civilian or for military operations.
- Therefore, the airport site selected should he such that it provides natural protection to the area from air raids.
- This consideration is of prime importance for the airfields to be located in combat zones
- If the site provides thick bushes, the planes can be stored inside unnoticed. Sometimes the topography is such that the planes can be hidden by the underground installations.

Proximity to Other Airports

- The site should be selected at a considerable distance from the existing airports so that the aircraft landing in one airport does not interfere with the movement of aircraft at other airport.
- The required separation between the airports mainly depends upon the volume of air traffic, the type of aircraft and the air traffic control, i e. whether the airports are equipped with instrumental landing facilities or not.

The following minimum spacing have been suggested as a guide for planning

- For airports serving small general aviation aircrafts
- under VFR conditions 3 2 km (2 miles)
- For airports serving bigger aircrafts, say two piston engine, under VFR conditions 64 km (4 miles)
- For airports operating piston engine aircrafts under IFR conditions — 25.6 km (16 miles)
- For aircrafts operating jet engine aircrafts under IFR conditions — 160 km (100 miles)

Ground Accessibility

- The site should be so selected that it is readily accessible to the users.
- The airline passenger is more concerned with his door.to.door time rather than the actual time in air travel
- The time to reach the airport is, therefore, an important consideration specially for short-haul operations.
- The time required to reach an airport in a passenger car, from the business or - residential centre, should normally not exceed 30 minutes.
- The best location is a site adjacent to the main highway. This provides a quick access and minimizes the cost of an entrance road.
- Availability of public transportation facilities, e.g., bus, taxi dc, further qualifies the suitability of the site and may also improve the business potentiality at the airport.

Topography

- This includes natural features like ground contours, trees; streams etc.
- A raised ground e.g. a bill top, is usually considered to be an ideal site for an airport.

The reasons are:

- Less obstruction in approach zones and turning zones
- Natural drainage, low land may result in flooding
- More uniform wind
- Better visibility due to less fog

Obstructions

- When aircraft is landing or taking off, it loses or gains altitude very slowly as compared to the forward speed.
- For this reason, long clearance areas are provided on either side of runway known as approach areas over which the aircraft can safely gain or lose altitude.
- The areas should be kept free of obstructions.
- The obstructions may consist of fences, trees, pole lines, building and other natural or man made objects.
- Sometimes the ground itself may slope upwards from the end of the runways to such an extent that it forms an obstruction to the aircraft operation. If obstruction exists around a site over which an airport is to be built, the removal is imperative at any cost.

Visibility

- Poor visibility lowers the traffic capacity of the airport. The site selected should therefore be -free from visibility reducing conditions, such as fog, smoke and haze.
- Fog generally settles in the area where wind blow is minimum, e.g. in a valley, Smoke and haze nuisance exist at sites nearer to the industrial areas.
- Therefore, trend of the future development of industrial area should also be studied and the site should be selected accordingly.

Noise Nuisance

- The extent of noise nuisance depends upon the limb-out path of aircraft, type of engine propulsion nd the gross weight or aircraft.
- The problem becomes more acute with jet engine aircrafts.
- Therefore, the site shoulu be so selected that the landing and take off paths of the aircraft pass over the land which is free from residential or industrial development.
- Sometimes buffer zone may have to be provided between the tike off end of a runway and a nearby residential area.
- If buffer zone cannot be provided, some acoustical barrier may have to be installed.

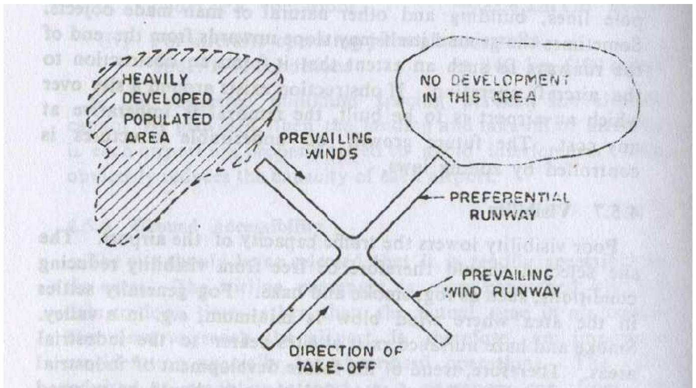


Figure 4.1 Area Recommended for Non-Residential Development

SURVEYS FOR SITE SELECTION

Traffic survey

To determine the amount of air traffic including the anticipated traffic for future.

Meteorological survey:

To determine direction, duration and intensity of wind, rainfall, fog, temperature and barometric pressure etc

Topographical survey

- To prepare contour map showing other natural features such as trees, streams etc.
- To prepare a map showing such constructed objects aspole lines, building, roads etc.

These maps will be helpful in the jobs of clearing, grading and drainage.

Soil survey

- To determine soil type and ground water table.
- This assists in the design of runway, taxiway, terminal building and the drainage system.

Drainage survey

- To determine the quantity of storm water for drainage. This can be obtained from the rainfall intensity and the contour maps
- To locate possible outlets for drain water in the vicinity of he site.
- To study the possibility of intercepting or diverting the natural streams of nallas flowing towards the site under consideration.

Material survey

- To ascertain the availability of suitable construction materials at a reasonable cost and the mode of transportation of these materials to the site.

ground contours and the cross-sections and longitudinal profiles

ZONING LAWS

- The permissible height of structures depends upon the airport and the aircraft types which would use the airport.
- The use of land for manufacture of certain items which may result in smoke

nuisance, foul odour etc. is also controlled by the zoning laws; It should, however, be con that all zoning ordinances are reasonable and the application is fair; otherwise they are likely to create resentment from t public and may result in mass disobedience.

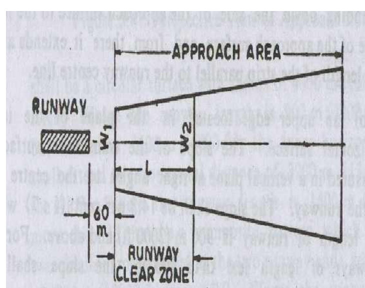
- Whenever it is felt that the zoning laws are provocative, sufficient compensation should be announced in order to ascertain its effective implementation.

APPROACH ZONE

- During landing, the glide path of an aircraft varies from a steep to fiat slope. But during take-off, the rate of climb of aircraft is limited by its wing loading and engine power.
- As such wide clearance areas, known as approach zones are required on either side of runway along the direction of landing and take-off of aircraft.
- Over this area, the aircraft can safety gain or loose altitude.
- The whole of this area has to be kept free of obstructions and as such zoning laws are implemented in this area.
- The plan of approach zone is the same as that of the approach surface. , The only difference between the two is that while approach surface is an imaginary surface, the approach area indicates the actual ground area.

Clear Zone

- The inner most portion of approach zone which is the most critical portion from obstruction view-point is known as clear zone.
- Its configuration and dimensions are shown in Figure



	W_1	W_2	L
Instrument runway	300 m	525 m	750 m
Non-instrument runway			
(a) Large airport	150 m	270 m	600 m
(b) Small airport	75 m	135 m	300 m

RUNWAY DESIGN

- Runway is usually oriented in the direction of prevailing winds.
- The head wind. i.e. the direction of wind opposite to the direction of landing and take-off, provides greater lift on the wings of the aircraft when it is taking-off.

- As such the aircraft rises above the ground much earlier and in a shorter length of runway.
- During landing, the head wind provides a braking effect and the aircraft comes to a stop in a smaller length of runway Landing and take-off operate if done along the wind direction, would require longer runway.

Wind Rose

- The wind data, ie., direction, duration and intensity are graphically represented by a diagram called wind rose.
- The wind data should usually bi collected for a period of at least 5 years and preferably of to years, so as to obtain in average data with sufficient accuracy.
- As far as possible, these observations should be taken at or near 'site selected, since the wind conditions may vary considerably with location particularly in hilly regions.

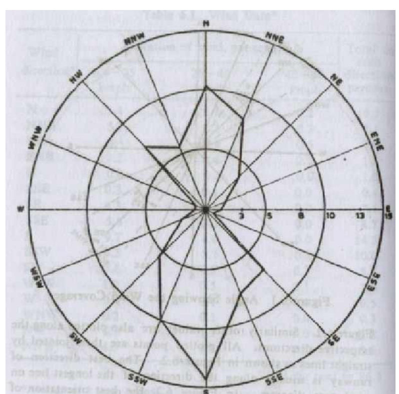
Wind rose diagrams can be plotted in two types as follows:

Type I Showing direction and duration of wind

Type 11: Showing direction, duration and intensity of wind

Type I Wind Rose

- This type of wind rose is illustrated in Figure
- The radial lines indicate the wind direction and each circle represents the duration of wind.
- From the Table, it is observed that the total percentage of time in a year during which the wind blows from north direction is 10.3 percent. 'Ibis value is plotted along the north direction in



- Similarly other values are also plotted along the respective directions,
- All plotted points are then jointed by straight lines as shown in Figure
- The best direction of runway is usually along the direction of the longest line on wind rose diagram.
- In Figure the best orientation of runway is thus along NS direction.
- If deviation of wind direction up to (22.5'+ I 1.25') from the direction of landing

and take-off is permissible, the percentage of time in a year during which the runway can safely be used for landing and take-off, will be obtained by summing the percentages of time along NNW. N. NNE, SSE. S and SSW directions.

- This comes to 57.0 per cent. Calm period, i.e., the percentage of time during which wind intensity is less than 6.4 kmph is also added to the above period.
- The total percentage of the time therefore comes to 57.0 + 13.5 705. This type of wind rose does nut account for the effect of cross wind component.

<u>Type II Wind Rose</u>

- This type wind data is used for of wind rose is illustrated in Figure
- The wind data as in the previous type. i.e. of Table 6.1 is used for this case.
- Each circle represents the wind intensity to some scale.
- The values entered in each segment represent the percentage of time in a year during which the wind, having particular intensity, blows from the respective direction.
- The procedure for determining the orientation of runway is described below
- Draw three equi-spaced parallel lines on a transparent paper strip in such a way that the distance between the two near by parallel lines is equal to the permissible cross wind component.
- This distance is measured with the same scale with which the wind rose diagram is drawn.
- In Figure, the permissible cross wind component is 25 kmph.
- Place the transparent paper strip over the wind rose diagram in such a way that the central line passes through the centre of the diagram.

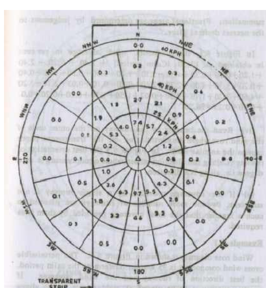


Figure 6.3 Wind Rose Diagram. Type II

- With the centre of wind rose, rotate the tracing paper and place it in such a position that the sum of all the values indicating the duration of wind, within the two outer parallel lines, is the maximum.
- The runway should be thus oriented along the direction indicated by the central line.
- The wind coverage can be calculated by summing up all the percentages shown in segment.
- The percentage value is assumed to be equally distributed over the entire area of the segment.

- When of the outer parallel lines of the transparent strip crosses a segment, a fractional part of the percentage appearing in that segment within the outside lines is also counted in the summation.
- Fractional areas are determined by judgment to the nearest decimal place.
- In Figure 6.3, the maximum wind coverage in per cent is obtained as (Calm period) + 7.40 + 5.70 + 2.40+1.20+0.80+0.30+4.30+5.50*9.70+6.30+3.60-.00+0.40-4-0.20+5.30+4.00 -f-2.70+2.l0+0.50+0.I0+0.03+2.lO+3.20

+4.60+3.20+ 0.30+ 0.25

- Read the bearing of the runway on the outer scale of wind rose where the central line on the transparent paper crosses the angular scale.
- In Figure the best orientation of runway is along the direction whose whole circle bearing is zero degree i.e. along NS direction.
- If the coverage provided by a single runway is not sufficient, two or more number of runways are planned in such a manner that the total coverage provided by them is as required.

Correction for Gradient

- Steeper gradient results in greater consumption of energy and as such longer length of runway is required to attain the desired ground speed. ICAO does not recommend any specific correction for the gradient.
- FAA recommends that the runway length after having been corrected for elevation and temperature should be further increased at the rate of 20% for every I per cent of effective gradient.
- Effective gradient is defined as the maximum difference in elevation between the highest and lowest points of runway divided by the total length of runway.

RUNWAY GEOMETRIC DESIGN

Runway Length

- The basic runway lengths as recommended by ICAOfor different types of airports are given in Table
- To obtain the actual length of runway, corrections for elevation, temperature and gradient are applied to the basic runway length

Runway Width

- ICAO recommends the pavement width varying from 45 m (150 ft to 18 m (60 ft) for different types of airports.
- The typical transverse distribution of traffic on a runway is shown in Figure
- The figure indicates that the aircraft traffic is more concentrated in the central 24 m (80 ft) width of the runway pavement.
- Another consideration in determining the runway width is that the outermost machine of large jet aircraft using the airport should not extend off the pavement to the shoulders.
- This is because the shoulder is usually of loose soil or established soil etc. which is likely to get into the engine and damage it;

- The outer engines of a large jet transport are about 13.5 m (45 feet) from the longitudinal axis of the aircraft.
- As such a pavement width of 45 m t provide adequate protection to the engine from the shoulder material during normal operations.

<u>TERMINAL AREA</u>

- It is the portion of an airport other than the landing area.
- It serves as a focal point for activities on the airport. It includes terminal and operational buildings, vehicle parking area aircraft service hangars etc.
- The terminal and operational buildings usually house all managerial and operational activities for the aircrafts.
- Vehicular circulation and parking also require careful study, if congestion and inconvenience to the airport users have to be avoided.
- The airport entrance or ac road from a highway must be located in such a way that it will avoid conflict with airport future development.
- Vehicle parking facilities should also be designed with a view to accommodate future expansion.
- The terminal apron is the loading and unloading area for passengers and cargo. Aircraft may also be fueled and parked here.
- At every airport provision of hangers for servicing and maintenance of aircrafts is planned.
- The size of these facilities is determined by the expected type and volume of airport activities.

<u>BUILDING AND BUILDING AREA</u>

- The purpose of airport building is to provide shelter for various surface activities related to the air transportation.
- As such they are planned for the maximum efficiency, convenience and economy. The extent of the building area in relation to the landing area depends upon the present and future anticipated u of airport.
- Location of building area with respect to runway and taxiway should provide adequate space for future expansion of all structures.

<u>Building Functions</u>

<u>The various facilities provided in the airport buildings are as follows</u>

- Passengers bud baggage handling counters for booking
- Baggage claim section
- Enquiry counter
- Space for handling and processing mail, express and light cargo
- Public telephone booth

- Waiting hall for passengers and visitors
- Toilet facilities
- Restaurants and bars
- First aid room
- General store and gift shops
- Space for magazines, news display etc.
- Office space for airport staff
- Weather bureau
- Post office and banking facilities
- Custom control
- Passport and health controls
- Control tower

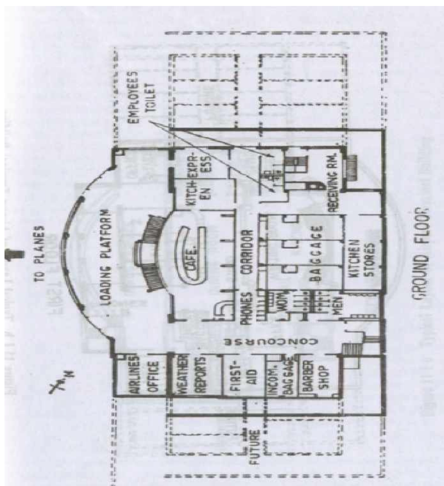


Figure 11.1 a Typical Layout of Airport Terminal Building

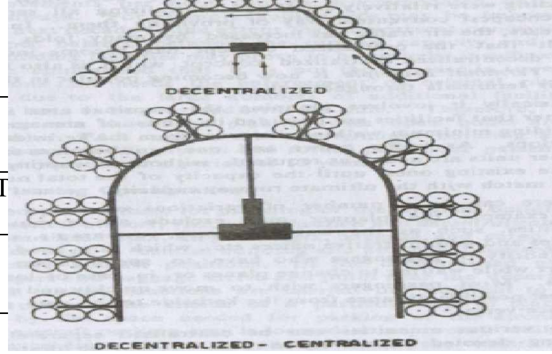
Site Location

- The correct placement of the terminal building with respect. to the runways and loading aprons result in a more rational approach for the airport development.
- As the planning of runway proceeds, the requirements of building sites are also kept constantly in view.
- The location of the runways are finalized with proper designation of adequate building area.
- The suitability of an area, as a site for terminal building development, is evolved in accordance with the following requirements
  - Sufficient area for the first stage of building development with possibility of future expansion
  - Sufficient area for roadways
  - Adequate area for car parking
  - Layout of above items providing functional relationship with each other
  - Convenient access of the main highway
  - Central location with respect to runway

- Proximity and easy installation of utilities, e.g.telephone electricity, water, sewage, etc.
- papers, advertisement

Planning Considerations

- Two concepts are there for planning of the terminal buildings for a commercial airport, viz., centralization and decentralization.
- In the centralized plan, all passengers, baggage and cargo are funneled through a central building and are then dispersed to the respective aircraft positions.
- In the decentralised plan, the passengers and baggage arrive at a point near the departing plane.
- All airline functions are carried out adjacent to the departing plane.
- The choice of a particular type of plan is governed by the space needed for parking of the aircrafts.
- When the aircraft parking area is located at an overall walking distance exceeding 180 m. a change from the centralized system becomes necessary.
- Further, when the number of gate positions (loading area required for each aircraft) required for the individual airliner at one airport exceeds the decentralized plan also becomes operationally uneconomical.
- At this situation, another shift towards the ceatralization of each individual airline Operation becomes essential.
- This results in a series of centralized airline spaces, arranged in a decentralized pattern.
- The concept of an airport from the centralization to decentralization and finally decentralization to centralization is illustrated in Figure
- In the past, passenger terminal facilities at almost all airport in the world have been in the form of a single central terminal building containing all the required facilities and amenities.



- This was satisfactor3i when the number of aeroplanes used and the gate positions required were few; and when terminal building were relatively small and centralizing all services are the cheapest convenient way of providing them.
- In the last 20 years, the air traffic has increased by many folds with the result that the centralized concept has become inoperative.
- The decentralized-centralized concept which is also known as Unit Terminal Principle is now becoming popular in the design of air terminals.
- There can be a number of variations of such a concept.
- For example the planner may exclude all or most of the amenities, such as the waiting rooms, restaurants, shopping arcades and administrative offices etc., which are used only by a minority of passengers who have to spend some time at airport while waiting to change planes or in case of long flight delays.
- Most passengers wish to move quickly and over the shortest possible distance from the kerb side to the gate position and vice-versa.
- The various amenities can be centralized separately in a building, devoted exclusively to them.
- It may be located close and connected with the operating units and may serve a single Unit, or a group of them.
- The operating or handling units Would be purely functional with only such essential amenities as book stall, money changer, flight insurance booths and toilets.
- This concept of a separate building for amenities would lend itself conveniently to the separation of domestic and international.
- The principle of a separate structure connected with the handling Units should be applied wherever possible, leaving space for additional units to meet later expansion needs.
- The unit terminal principle fits in exceptionally well with the modern concept of parallel runway patterns at large airports.
- Finally, the unit terminal concept automatically minimizes initial capital expenditure, while ensuring that addition can easily be made later, without rendering any of the previous expenditure as waste.
- The International Airport Committee, has recommended that full consideration be given to the adoption of the unit terminal principle for the new terminal facilities to be constructed at the international airports in India.

<u>Vehicular Circulation and Parking Area</u>

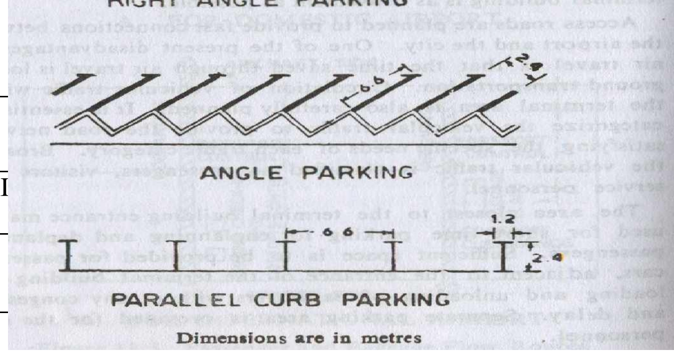
- Since the airport users normally active at the airport in automobiles, access roads and parking facilities are of vital importance in the airport design
- The circulation of traffic and location of parking lots should be such that access to the terminal building is as convenient as possible.
- Access roads are planned to provide fast connections between the airport and the city.
- One of the present disadvantages of air travel is that the time saved the air travel

is lost in ground transportation.

- Circulation of vehicular traffic within the terminal area is also carefully planned. 1i is essential to categorize she vehicular traffic to provide the road network satisfying the specific needs of each traffic category.
- Broadly, the vehicular traffic is classified as passengers, visitors and service personnel.
- The area closest to the terminal building entrance may be used for short time parking for enplanning and deplanning passengers.
- Sufficient space is to be provided for passenger cars, adjacent to the entrance of the terminal building for loading and unloading of passengers without any congestion and delay.
- Separate parking area is provided for the staff personnel for the most efficient airport vehicular circulation and parking system,

<u>The following points are considered</u>

- Ease of passenger unloading and loading at the terminal building
- One way traffic wherever possible.
- A minimum of driveway intersection.
- Adequate driveway width to permit overtaking.
- Sufficiently and clearly defined parking and circulation routes
- Well lighted routes for pedestrians and vehicles.
    - For determining the size and type of parking facility necessary, a traffic survey should be conducted. IAA suggests that the size of the public parking facility should be based on 1.5 to 2 cars for each peak hour passenger.
    - The pattern of parking is dictated by the shape and size of the parking area available.
    - The basic parking patterns usually adopted are shown in Figure 11.4.



Nose-in and angled nose-in

The advantages of this configuration are:

- Less noise while taxing in because no turning is required.
- Hot blast is not directed towards the terminal building.
- The aircraft forward door is close to the terminal building.

The disadvantages are:

- The aircraft rear loading door is far away from terminal building

Nose-in and angled nose-out

The advantages of this configuration are as follows:

- Less power is required while maneuvering the aircraft out of its gate position.
- The rear loading door is close to the terminal building.
- Overall apron area required is generally small.

The main disadvantage is:

- The hot blast is directed towards the terminal building.

Parallel System

The main advantage of this system is:

- Both, the front and the rear doors are adjacent to the terminal building.
- But this type of. parking configuration requires more space.
- Further, the noise and the hot blast are directed towards the adjacent gale position.
- Thus, it is evident that no single parking configuration can be considered as an ideal one.

Aircrafts can be grouped adjacent to terminal building in various ways

- Frontal system
- Open apron .system
- Finger system
- Satellite system

These parking systems are illustrated in Figure and are discussed below

Frontal system

- It is very simple and economical 5 But its use is limited only to small airports requiring few gate positions.

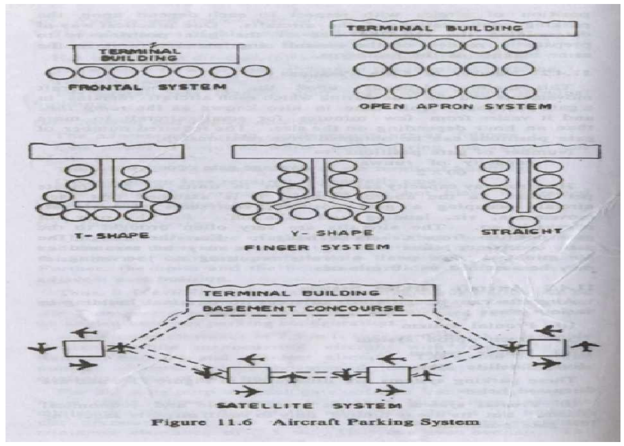


Figure 11.6 Aircraft Parking System

Open apron system

- In this system the aircrafts are parked in rows.
- If the number of aircrafts is too large, passengers may have to walk long distances or reach the aircrafts parked in the outermost row.
- They are thus exposed to weather, noise and hot blast of the jet aircrafts.
- To protect the passengers front such nuisance, some sort of closed vehicle conveyance for the passengers may be essential.

Finger system

- Processing of passengers and their baggage is mainly done within the terminal building.
- But the facilities for passengers, for entering and leaving the aircraft, often require extensions of the terminal building.
- Such extension is known as pier finger.
- A typical arrangement is shown in Figure
- The pier finger can be fenced open walkway or a closed structure, single or multistoried.
- It can be a straight, 1-shaped or Y-shaped.

Its main advantages are

- If enclosed, it provides adequate protection to the passengers from weather, noise, fumes etc. even when they come out of the terminal building.
- Future expansion is easier.
- All aircrafts remain close to the terminal building.
- It permits the installation of a short nose loading bridge or a swinging gang plank for the convenience of the passengers.

Satellite system

- Satellites are small buildings located on the apron.
- Aircrafts are parked around the satellite buildings which are connected to the main terminal building by underground tunnel.

- This system is in use at the International airport of Los Angeles.
- It is advantageous, compared to the pier finger system only when the connections to satellite buildings are through the tunnels.
- In such an arrangement, the aircrafts are parked near the satellite as shown in Figure
- Less turning is required to maneuver the aircraft in and out of the gate position.

The disadvantages of this system are

- Large construct cost.
- Passengers have to change the levels several times as they leave the terminal building for boarding the aircraft.

TYPICAL AIRPORT LAYOUTS

The typical airport layouts for the basic runway configuration are illustrated in fig

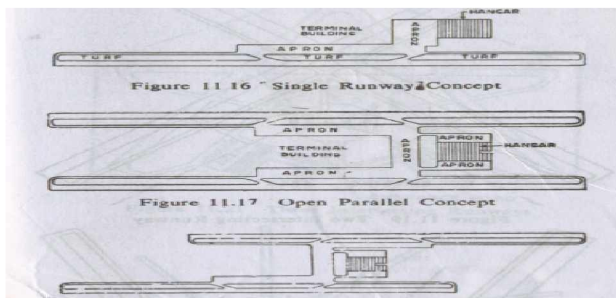
e 

Figure 11.16 Single Runway Concept

Figure 11.17 Open Parallel Concept

Figure 11.18 Offset Parallel Concept

- The first step in the airfield design is the selection of suitable runway configuration.
- There should be a good correlation between the runway and other airport elements, viz. taxiway terminal building, apron, hangar etc.
- The integration of all the elements of an airport provides a smooth flow of traffic, keeps the taxi distances to a minimum and provides the shortest route for passengers.
- A proper airport layout provides full functional efficiency with the minimum 5 utilization.
- An engineer should attempt to provide the simplest design which yields the optimum service to air passengers.

A good airfield layout should possess the following Characteristics

- Landing, taxiing and taking off a independent operations without interference.
- Shortest taxiway distances from loading apron to runway end.
- Safe runway length
- Safe approaches
- Excellent control tower visibility
- Adequate loading apron space
- Sufficient terminal building facilities
- Sufficient land area to permit subsequent expansion
- Lowest possible cost of construction.