UNIT-3

Airport Planning

Air Transport Characteristics

- Unbroken journey
- Rapidity
- Expensive
- Special preparation

Air Transportation

Advantages

- High speed
- Comfortable and quick services
- No investment in construction of track
- Emergency services
- National defence
- Space exploration

Disadvantages

- Very costly
- Small carrying capacity
- Uncertain and unreliable
- Breakdowns and accidents
- Large investment
- Unsuitable for bulky goods

Airport classification

- Based on take off & landing
- Based on geometric design
- Based on function
- ICAO(International Aviation Authority Organization) classification
  - Based on the length of runway
  - Based on using span & outer main gear wheel span
- FAA(Fedaration Aviation Administration) classification
- Aerodomes in india

Based on take off & landing

- **Conventional take off & landing airport** runway length of <1500m
- **Reduced take off & landing airport** runway length of 1000 to 1500 m
- **Short take off & landing airport** runway length of 500 to 1000 m
- **Vehicle take off & landing airport** operational area 25 to 500 Sq. m generally used for the operation of helicopter

Based on Geometric Design

- Done using code letters
- A to E
- A type airport – longest runway length
- E type airport – shortest runway length

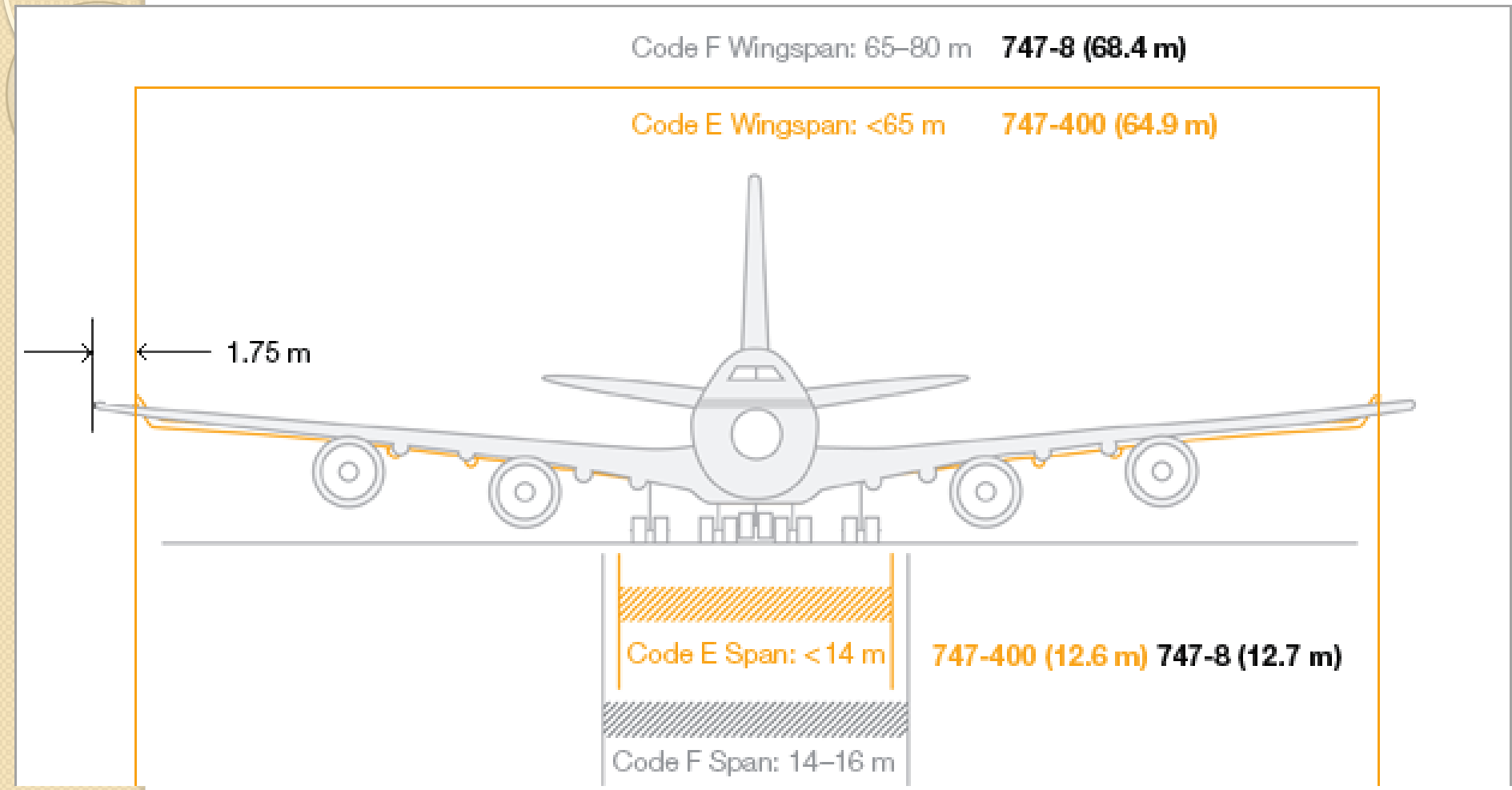
ICAO(International Aviation Authority Organization) classification

Based on the length of runway

NUMBER	LENGTH IN 'm'
1	Greater than 800 m
2	800 m upto but not including 1200 m
3	1200 m upto but not including 1800 m
4	1800 m and over

Based on using span & outer main gear wheel span

Code letter	Wing span	Outer main gear
A	Upto but including 15 m	Upto but including 15 m
B	15 m upto but not including 20 m	15 m upto but not including 20 m
C	24 m upto but not including 36 m	24 m upto but not including 36 m
D	36 m upto but not including 52 m	36 m upto but not including 52 m
E	52 m upto but not including 65 m	52 m upto but not including 65 m


Code F Wingspan: 65–80 m
747-8 (68.4 m)
Code E Wingspan: <65 m
747-400 (64.9 m)
1.75 m
Code E Span: < 14 m
747-400 (12.6 m)
747-8 (12.7 m)
Code F Span: 14–16 m

FAA (Federation Aviation Administration) classification

Based on aircraft approach speed

APPROACH CATEGORY	AIR CRAFT SPEED in Knots
A	<91
B	91-120
C	121-140
D	141-165
E	165 or >

Based on Function

Aviation Organizations

- ICAO
- IATA
- FAA
- DCA/DGCA
- IAAI
- NAA
- AAI

Aviation Organizations

1. International Civil Aviation Organization (ICAO)
2. International Air Transport Association (IATA)
3. Federal Aviation Administration (FAA)
4. Directorate of Civil Aviation (DCA) (or) Director General of Civil Aviation (DGCA)
5. International Airports Authority of India (IAAI)
6. National Airports Authority (NAA)
7. Airports Authority of India (AAI)

The International Civil Aviation Organization (ICAO)

- The International Civil Aviation Organization (ICAO) serves as an agency through which the necessary international understanding and agreement between nations in all the technical, economical and legal issues and codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth.
- It was created in1944 and it became a special UN agency in1947. It has membership of 151 countries.
- ICAO is headquartered at Montreal in Canada and is headed by a Secretary General
- It has 7 regional offices at 1) Paris 2) Mexico city 3) Bangkok 4) Cairo 5) Dakar 6) Lima 7) Nairobi

International Air Transport Association (IATA)

- The **International Air Transport Association (IATA)** is a trade association of the world's airlines with a membership of 250 major carriers in the world. They carry approximately 84% of total available seat kilometers of air traffic.
- IATA supports airline activity and helps formulate industry policy and standards.
- It is headquartered in Montreal, Canada with Executive Office at Geneva in Switzerland.

Federal Aviation Administration (FAA)

- The **Federal Aviation Administration** (**FAA**) is the national aviation authority of the United States.
- An agency of the United States Department of Transportation, it has authority to regulate and oversee all aspects of American civil aviation.

Functions of FAA include:

1. Regulating U.S. commercial space transportation
2. Regulating air navigation facilities' geometry and flight inspection standards
3. Encouraging and developing civil aeronautics, including new aviation technology
4. Issuing, suspending, or revoking pilot certificates
5. Researching and developing the National Airspace System and civil aeronautics
6. Developing and carrying out programs to control aircraft noise and other environmental effects of civil aviation

Director General of Civil Aviation (DGCA)

- Directorate of Civil Aviation (DCA) was set up in 1927. Subsequently it was upgraded as Director General of Civil Aviation (DGCA) in 1945)
- The functions of DGCA are

1. Regulatory functions such as airworthiness of aircraft, licensing of personal, investigation of incidents/accidents, bilateral matters, approval of tariffs/schedules etc.
2. Administering the domestic airports other than 4 international airports run by IAAI
3. Providing navigation/communication facilities and air traffic services
4. Functions 2 and 3 are transferred to NAA subsequently formed.

International Airports Authority of India (IAAI) (not existing now)

- International Airports Authority of India (IAAI) (set up in April, 1972) to plan, develop, construct and maintain 4 airports at Bombay, Calcutta, Madras and New Delhi
- Manages these 4 international airports
- Finally merged with NAA to form AAI on 1st April, 1995.

National Airports Authority (NAA) (not existing now)

1. National Airports Authority (NAA) was established on June 1, 1986 by carving out DGCA for managing domestic Airports
2. Functions 2 and 3 of DGCA are transferred to NAA
3. NAA is finally merged with IAAI to form Airports Authority of India on 1st April, 1995.

Airports Authority of India (AAI)

- Airports Authority of India (AAI) is formed on 1st April 1995 by merging IAAI and NAA for operating and managing a total of 115 Airports, including 11 International Airports, 8 Customs Airports, 81 Domestic Airports and 25 Civil enclaves at Military Airfields.

Functions of AAI

1. Design, Development, Operation and Maintenance of international and domestic airports and civil enclaves.
2. Control and Management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO.
3. Construction, Modification and Management of passenger terminals.
4. Development and Management of cargo terminals at international and domestic airports.
5. Provision of passenger facilities and information system at the passenger terminals at airports.
6. Expansion and strengthening of operation area, viz. Runways, Aprons, Taxiway etc.
7. Provision of visual aids.
8. Provision of Communication and Navigation aids, viz. ILS, DVOR, DME, Radar etc.

Other Organizations

In addition there are other associations

1. International Civil Airports Association (ICAA) - An association of airport authorities
2. Institute of Air Transport (IAT) – an association of individuals and organizations with an interest in civil aviation.
3. International Federation of Airline Pilots Association (IFAPA)
4. International Council of Aircraft Owner and Pilot Association (ICAOPA)

Training organizations in India

1. The Civil Aviation Training College (CATC), Allahabad
2. Institute of Aviation Management (IAM), New Delhi

Components of Air Transportation

1. Airports and Airways
2. Airlines and Air Passengers
3. Operating Environment

Components of Air Transportation

- Aircraft Characteristics
- Any machine which finds its support in the atmosphere due to reactions of the air is defined as an aircraft.
- Aircraft can be heavier or lighter than air or power driven or non-power driven.
- For example, airships are lighter than air and are power driven.
- Similarly, Balloons are lighter than air and are non-power driven
- Aeroplanes and Helicopters are are heavier than air and are power driven.

Aero plane and Helicopter

- The land airplane is the most practical type of machine to navigate in the air and thousands of them are in daily use.
- They are designed to take off and land on runways with much steeper angles than the helicopters.
- The helicopter can rise vertically off the ground and can also hover stationary in the air.
- Helicopters have inferior performance compared to the aeroplanes as their load capacity is extremely small and their top speed is very low.
- Airplanes can also be designed to operate on water. They are called float planes.
- Float planes have long pontoon floats on which it rests when it is on water
- Amphibian planes can have both floats and wheels.

Airports and Airways

- An **airport** is an aerodrome with facilities for commercial aviation flights to take off and land Airports often have facilities to store and maintain aircraft, and a control tower.

- An **airway** is a legally defined corridor that connects one specified location to another at a specified altitude, along which an aircraft that meets the requirements of the airway may be flown

Types of Airports

- There are three types of Airports

1. International Airports
2. Domestic Airports
3. Regional Airports

International Airports

- An international airport has direct service to many other airports.
- Handle scheduled commercial airlines both for **passengers and cargo.**
- Many international airports also serve as "HUBS", or places where non-direct flights may land and passengers switch planes.
- Typically equipped with customs and immigration facilities to handle international flights to and from other countries.

Domestic Airports

- A domestic airport is an airport which handles only domestic flights or flights within the same country.
- Domestic airports don't have customs and immigration facilities and are therefore incapable of handling flights to or from a foreign airport.
- These airports normally have short runways which are sufficient to handle short/medium haul aircraft.

Regional Airports

- A regional airport is an airport serving traffic within a relatively small or lightly populated geographical area.
- A regional airport usually does not have customs and immigration facilities to process traffic between countries.
- Aircraft using these airports tend to be small business jets or private aircraft (general aviation)

Airlines and Air Passengers

- An organization providing a regular public service of air transport on one or more routes with its equipment and operating personnel is called Airlines.
- Persons who are travelling in any public transport aircraft other than its pilot and airline staff members are called Air Passengers.

Operating Environment

- Airlines must be aware of and operate within a framework of regulations, standards and guidelines, international agreements and programs that shape the operating environment for commercial aviation.

Airport Planning

1. Types of Airport Planning Studies
2. Forecasting in Aviation and Airport Planning

Airport Planning

- Airport Planning involves

1. Preparation of Master Plan
2. Layout Plans

Types of Airport Planning Studies

There are various types of airport planning studies which are to be carried out before carrying out construction of an airport

1. Technical feasibility studies
2. Forecasting requirement studies
3. Facilities Planning
4. Financial Planning
5. Economic Planning
6. Organizational Planning
7. Strategic planning
8. Environmental Planning

Types of Airport Planning Studies

1. **Engineering and Technical Planning Studies:**

   These studies involve various activities like Approach zone surveys, Drainage surveys, Meteorological Surveys, Natural Resources Surveys, Soil Surveys, Topographical Surveys and Traffic Surveys.

2. **Forecasting Requirement Studies:**

   These studies involve determining parameters like Annual Passenger Volume, Annual volume of aircrafts, Peak day and peak hour volume of passengers and aircrafts, Air Cargo, Air mail and General Aviation etc.

Types of Airport Planning Studies

3. **Facilities planning**, which focuses on future needs for airfield infrastructure such as runways, taxiways, aircraft parking facilities, associated lighting, communication and navigational systems, terminal buildings.
4. **Financial planning**, which is concerned with predicting future revenues and expenses, budgeting resources, and planning for financial assistance through grant programs, bond issues, or private investment.
5. **Economic planning**, which considers the future of economic activity, such as trade and commerce, and the activity of industries that exist on airport.

Types of Airport Planning Studies

6. **Organizational planning**, which entails the management of future labour requirements and organizational structures for the airport administration, staff, and associated labor force.

7. **Strategic planning**, which encompasses all other planning activities into a coordinated effort to maximize the future potential of the airport to the community.

Types of Airport Planning Studies

8. **Environmental planning**, which concentrates on maintaining or improving existing environmental conditions in the face of changes in future airport activity. Environmental planning includes land use planning, noise mitigation, wetland reclamation, and wildlife preservation.

   The environmental factors must be carefully considered in the development of a new airport or the expansion of an existing one.

   1. Environmental Impact Assessment (EIA)
   2. Environmental Impact Statement (EIS)
   3. Environmental Management plan (EMP)

Forecasting in Aviation and Airport Planning

The reliable predictions of the airport activity in respect of the following parameters are to be made.

1. Annual Passenger Volume
2. Annual volume of aircrafts
3. Peak day and peak hour volume of passengers and aircrafts
4. Air Cargo
5. Air mail
6. General Aviation


Secondary runway
N
Adyar river
Apron
Fire station
Primary runway
Taxiways
Car parking
International terminal
Domestic terminal
Metro station
Car parking
LAYOUT

Important Components of an Airport are given below.

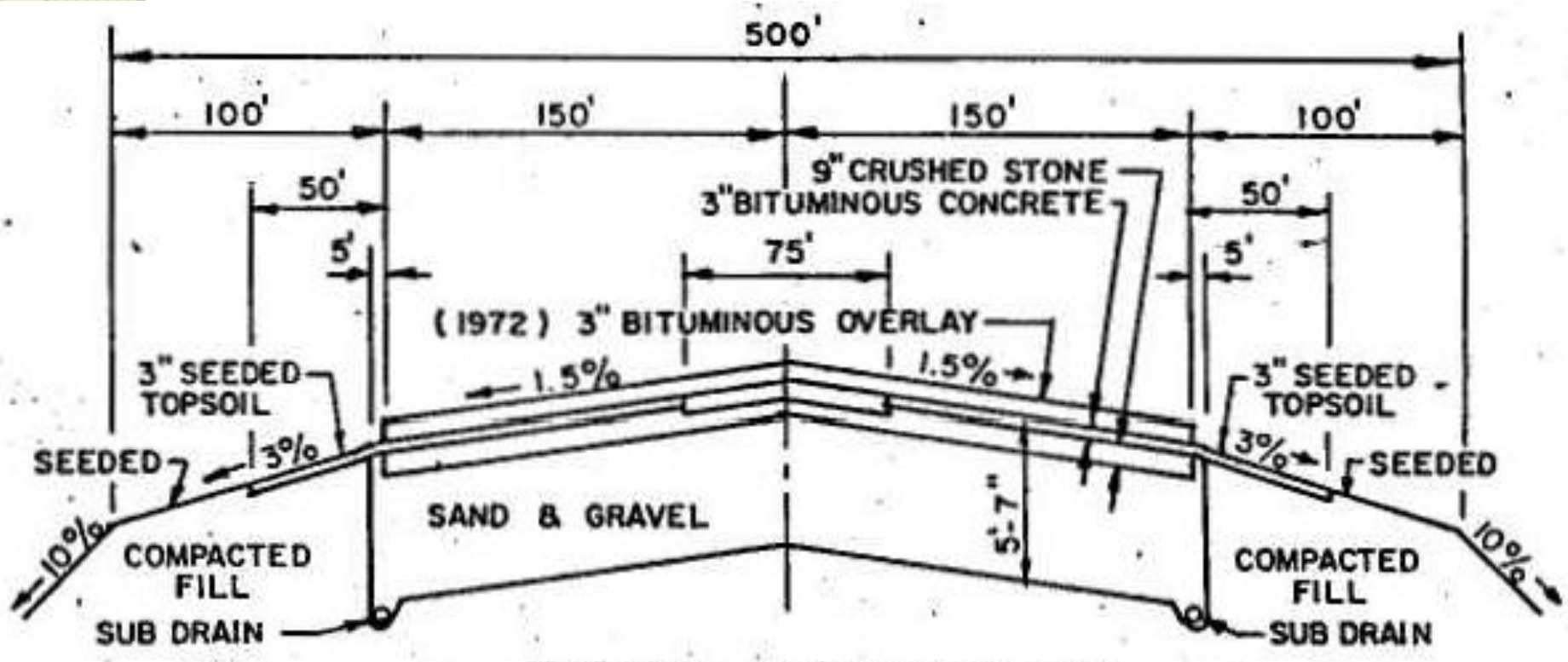
1. Runway
2. Terminal Building
3. Apron
4. Taxiway
5. Aircraft Stand
6. . Hangar
7. Control Tower
8. Parking

Runways

A runway is the area or a platform where an aircraft lands or takes off.

It can be grass, or packed dirt, or a hard surface such as asphalt or concrete. Runways have special markings on them to help a pilot in the air to tell that it is a runway (and not a road) and to help them when they are landing or taking off. Runway markings are white.

Runway



TYPICAL R/W SECTION

IDENTIFICATION NUMBER — (1)

* STA. 28 + 30 TO 109 + 90 NEW 4" KEEL STRIP 75' WIDE

Terminal Buildings

- Spaces where passengers board or alight from flights.
- passengers to check-in their luggage, clear the customs and have lounges to wait before disembarking.
- The terminals can house **cafes**, lounges and **bars** to serve as waiting areas for passengers.

Terminal Building

Aprons

Aircraft aprons are the areas where the aircrafts are parked, unloaded, refueled or boarded. Aprons are also sometimes called ramps. They vary in size, from areas that may hold five or ten small planes, to the very large areas that the major airports have.`

4. Taxiway

A taxiway is a path on an airport connecting runways with ramps, hangars, terminals and other facilities. They mostly have hard surface such as asphalt or concrete, although smaller airports sometimes use gravel or grass.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Google

5. Aircraft Stand

A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

6. Hangar

- A **hangar** is a closed building structure to hold aircraft in protective storage. Most hangars are built of metal, but other materials such as wood and concrete are also used.
- Hangars are used for protection from the weather, protection from direct sunlight, maintenance, repair, manufacture, assembly and storage of aircraft on airfields, aircraft carriers and ships.

7. Air Traffic Control Tower

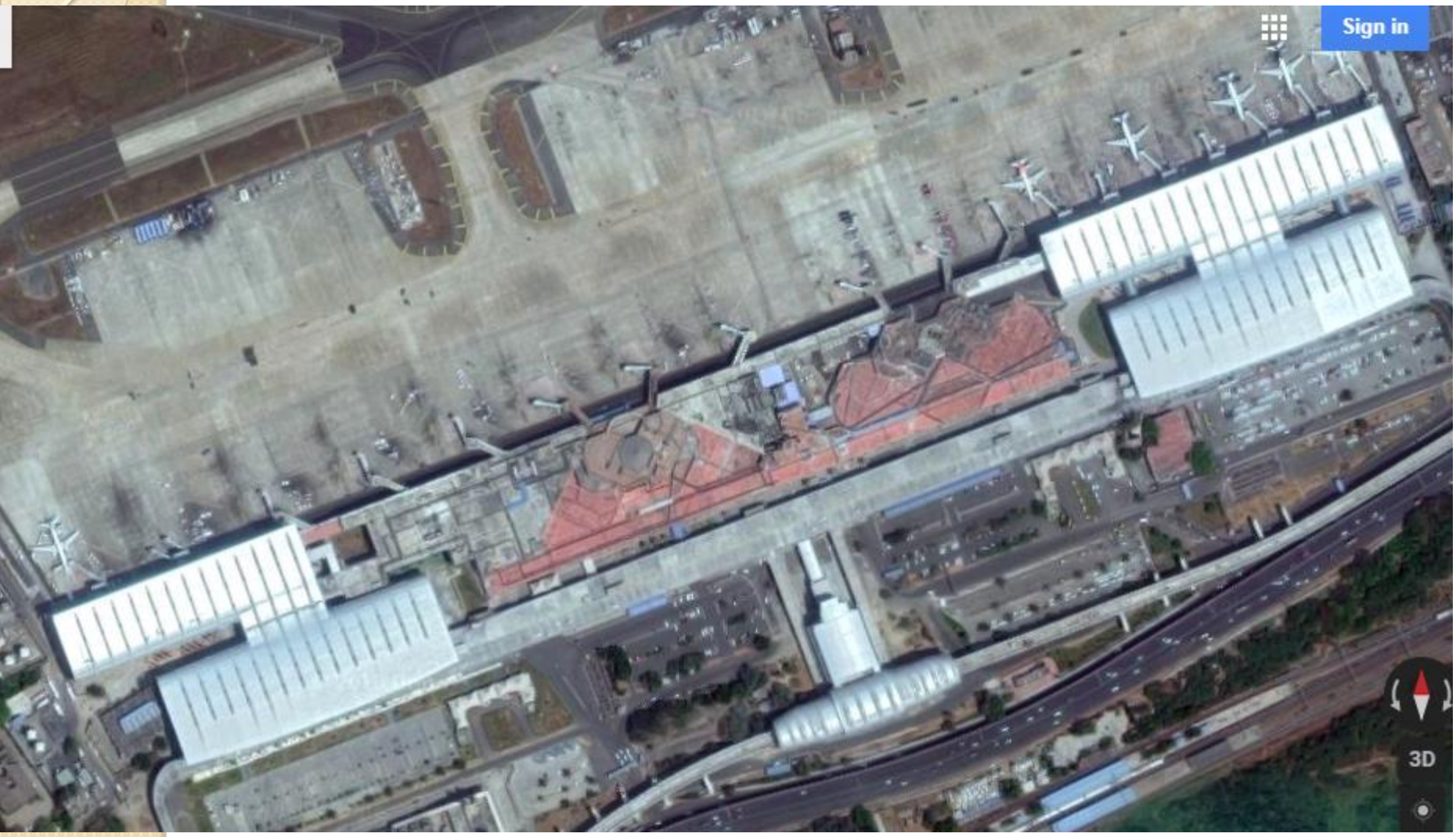
A tower at an airfield from which air traffic is controlled by radio and observed physically and by radar.

8. Parking

- Parking is a specific area of airport at which vehicles park.


Rudset Institute madurai
Old Power House
பழைய பவர்
ஹவுஸ்
Sri Muni


Sign in
3D
Google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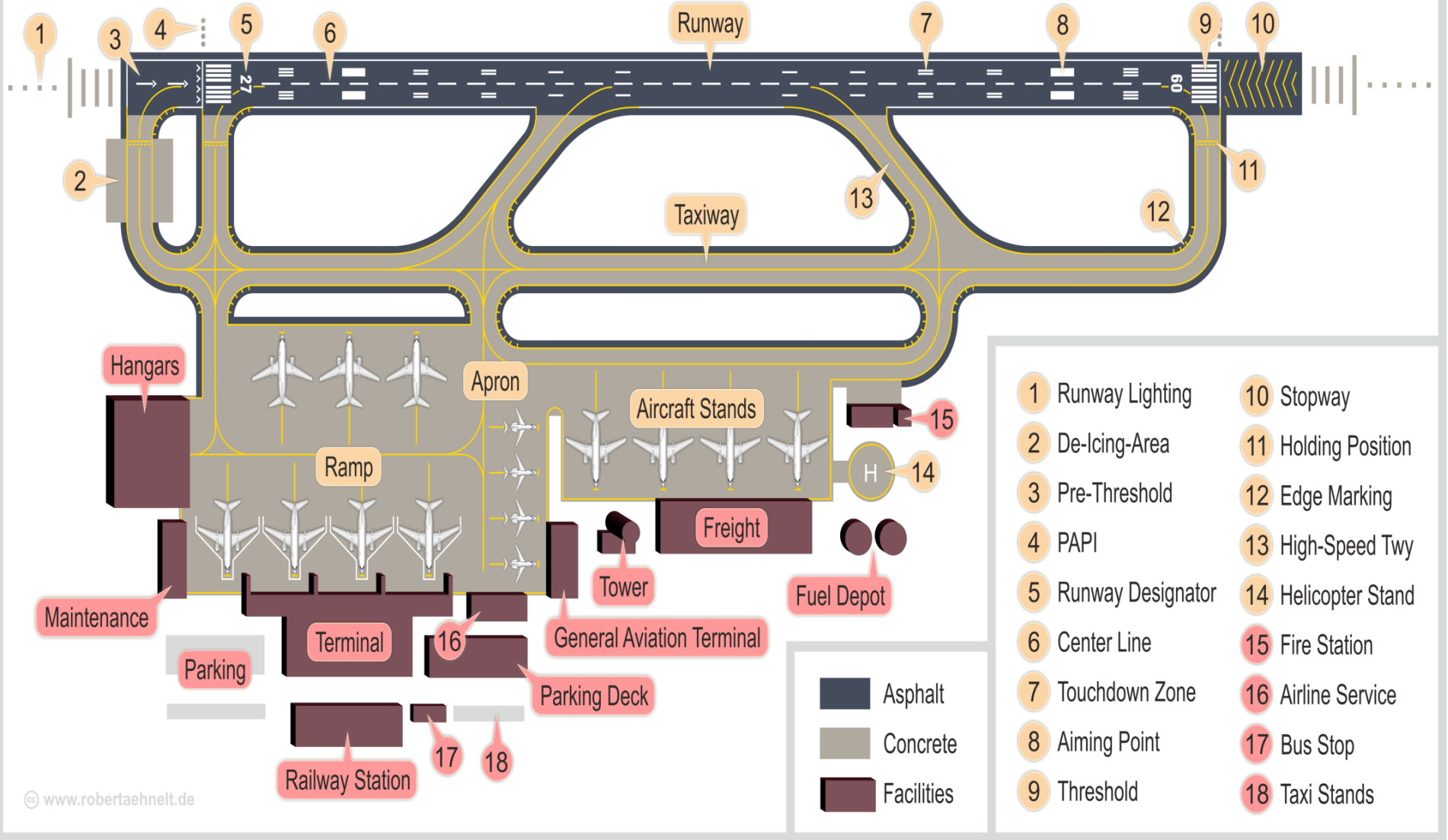
Typical Layout of an Airport



1. Runway Configurations
2. Taxiway Configurations

FACTORS AFFECTING RUNWAY ORIENTATION

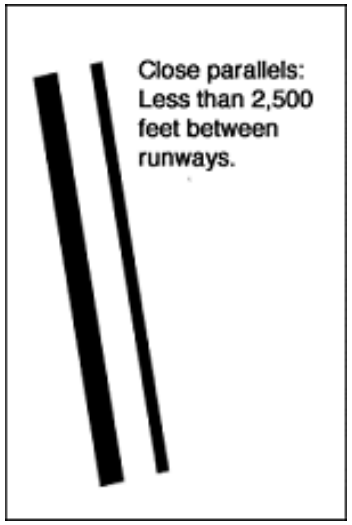
- WIND
- AIRSPACE AVAILABILITY
- ENVIRONMENTAL FACTORS
- OBSTRUCTIONS TO NAVIGATION
- AIR TRAFFIC CONTROL VISIBILITY
- WILD LIFE HAZARDS
- TERRAIN AND SOIL CONSIDERATION

Runway Configurations

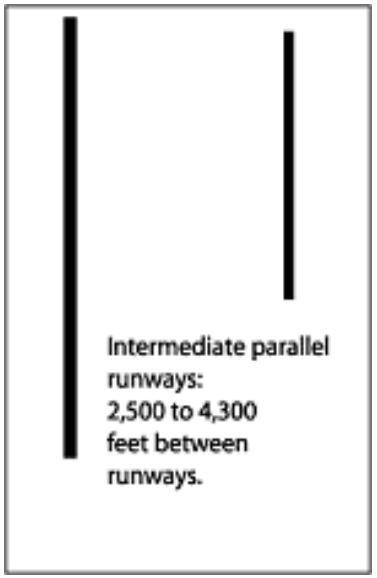
- Many runway configurations are existing.
- Most of them are combinations of the following basic configurations:
  - Single runway
  - Parallel Runways
    - Two parallel runways
    - Two parallel runways with staggered thresholds
    - Four parallel runways
  - Open-V Runways
  - Intersecting runways

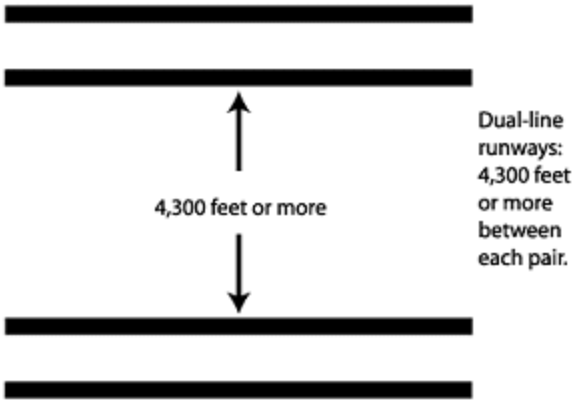
Single Runway

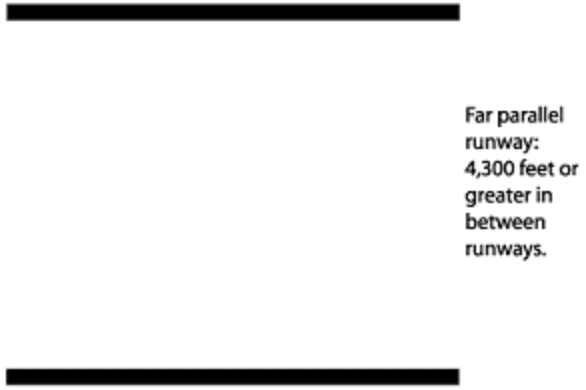
PARALLEL RUNWAYS



There are 4 types of parallel runways

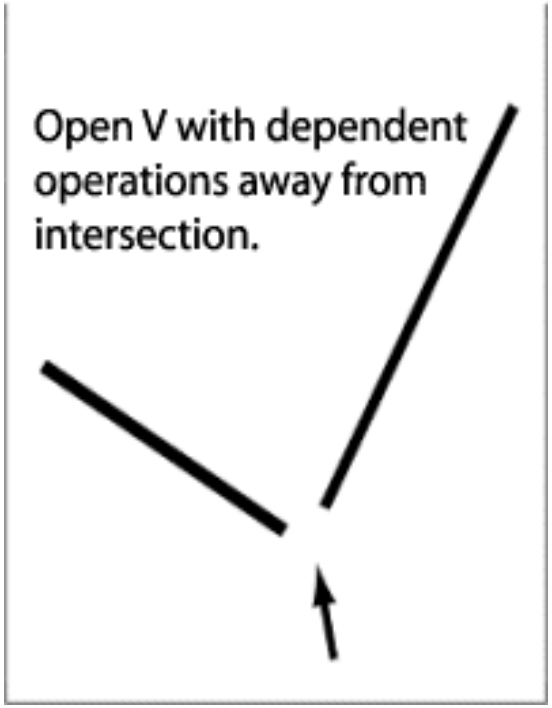


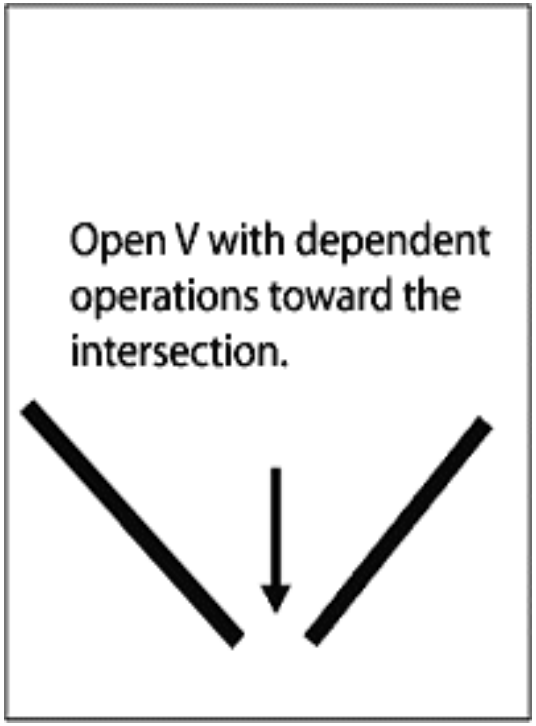




OPEN-V RUNWAYS

Runways diverging from different directions but do not intersect and form an open-V shape are ‘OPEN-V runways’

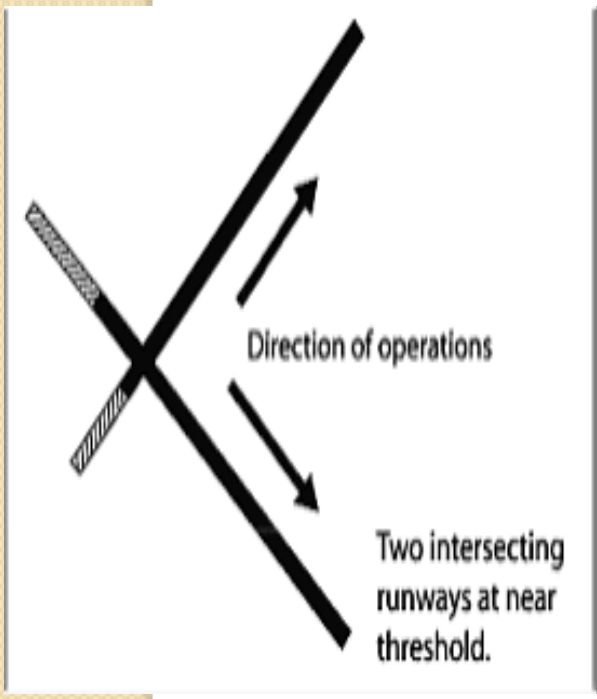


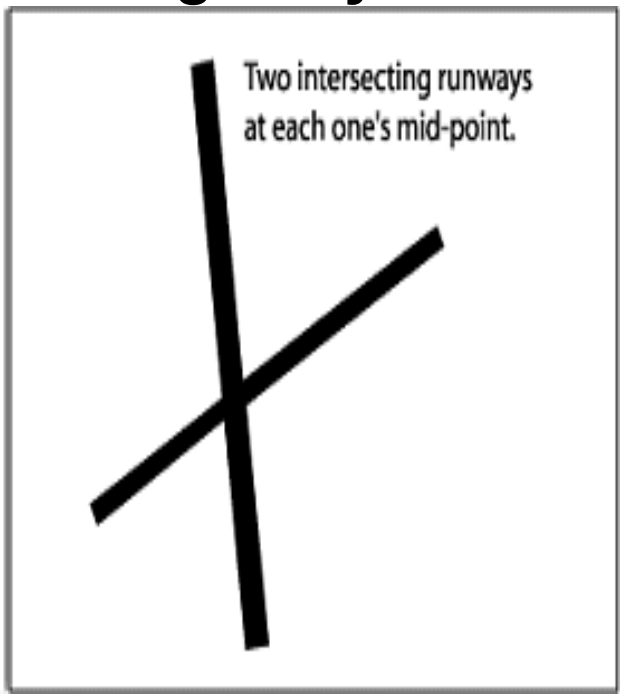


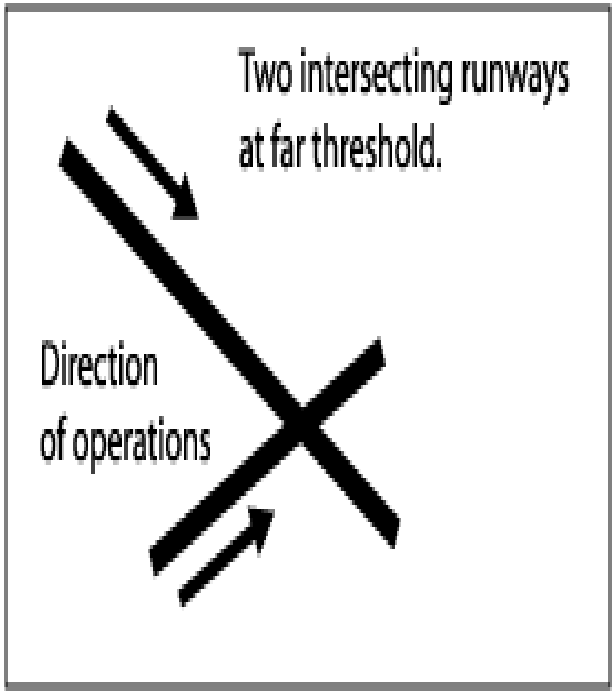
INTERSECTING RUNWAYS

Two or more runways that cross each other are classified as intersecting runways.

This type of runway is used when there are relatively strong prevailing winds from more than one direction during the year.







Taxiway Configurations

- Studies based on empirical results show that the capacity of a taxiway system generally far exceeds the capacities of runways.

Taxiway Configuration

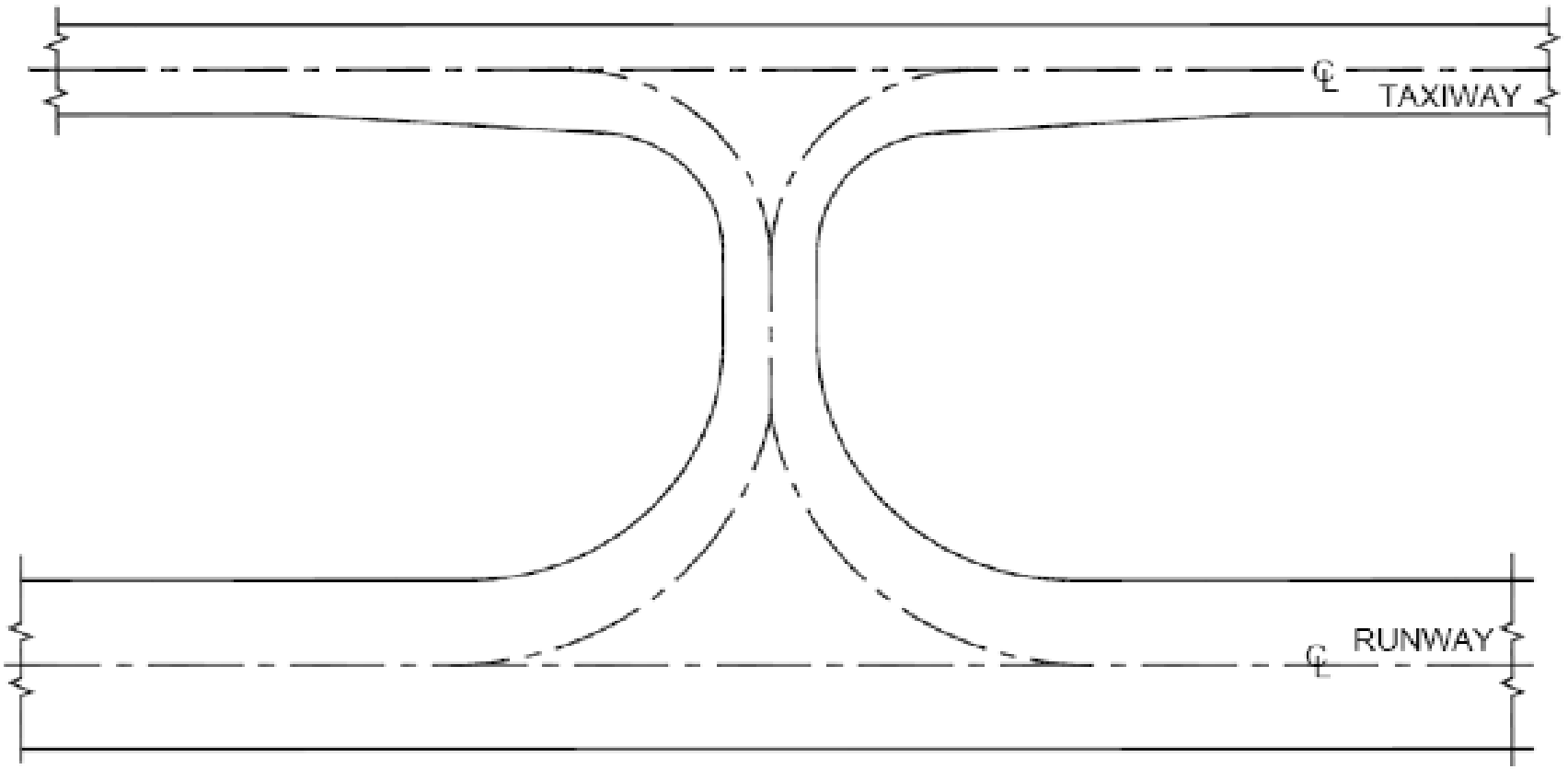
- The movement of aircrafts to and from the runways and the terminal/cargo, and parking areas is provided by a system of **taxiways**.

- This system of taxiways includes
  - *Entrance and exit taxiways*
  - *Parallel taxiways*
  - *Bypass taxiways*

Exit Taxiways

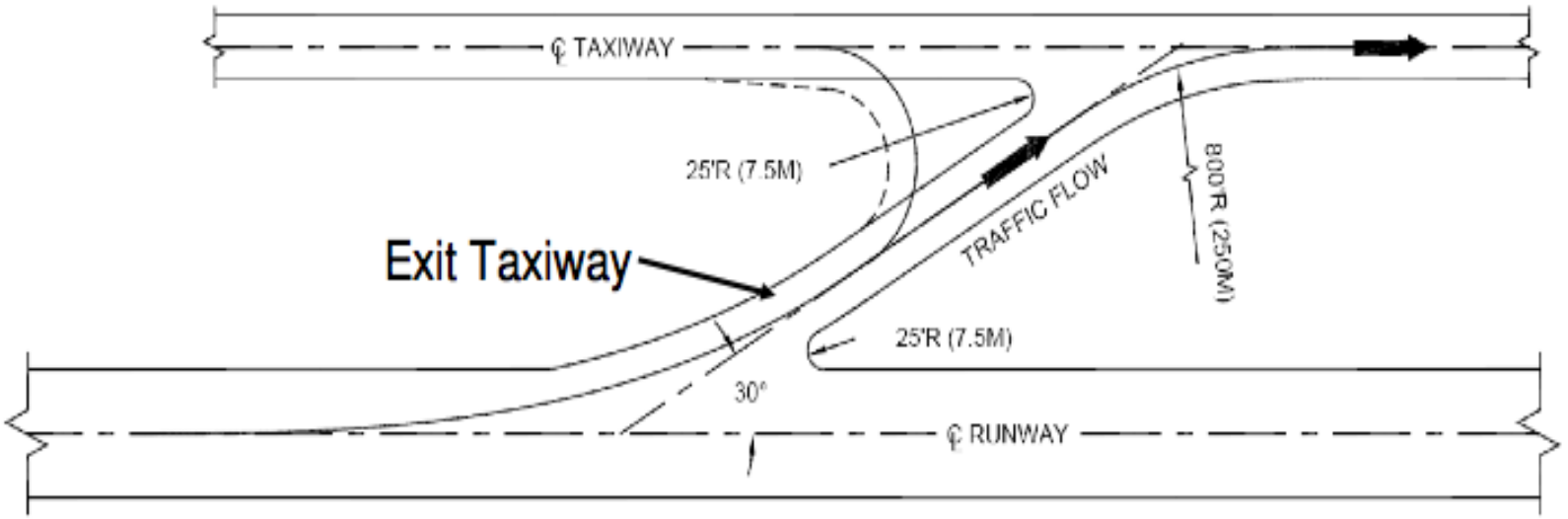
- These are taxiways provided at appropriate locations along the length of runway so that the landing aircrafts can maneuver out of the runway minimising their runway occupancy time.
- Right angled exit taxiways:
  - These are exit taxiways placed at right angles to the runway. When the design peak hour traffic is less than 30 operations (landings and takeoffs), a properly located right- angled exit taxiway will achieve an efficient flow of traffic.
- High speed exit taxiways:
  - These exit taxiways are placed at acute angle to the runway and are designed to provide high exit (turnoff) speeds. These high speed exit taxiways when properly designed in terms of their number, location and exit speed can enhance the capacity of the runway.

Typical Right Angled Exit Taxiway



Source: FAA AC: 150/5300-13 (1989)

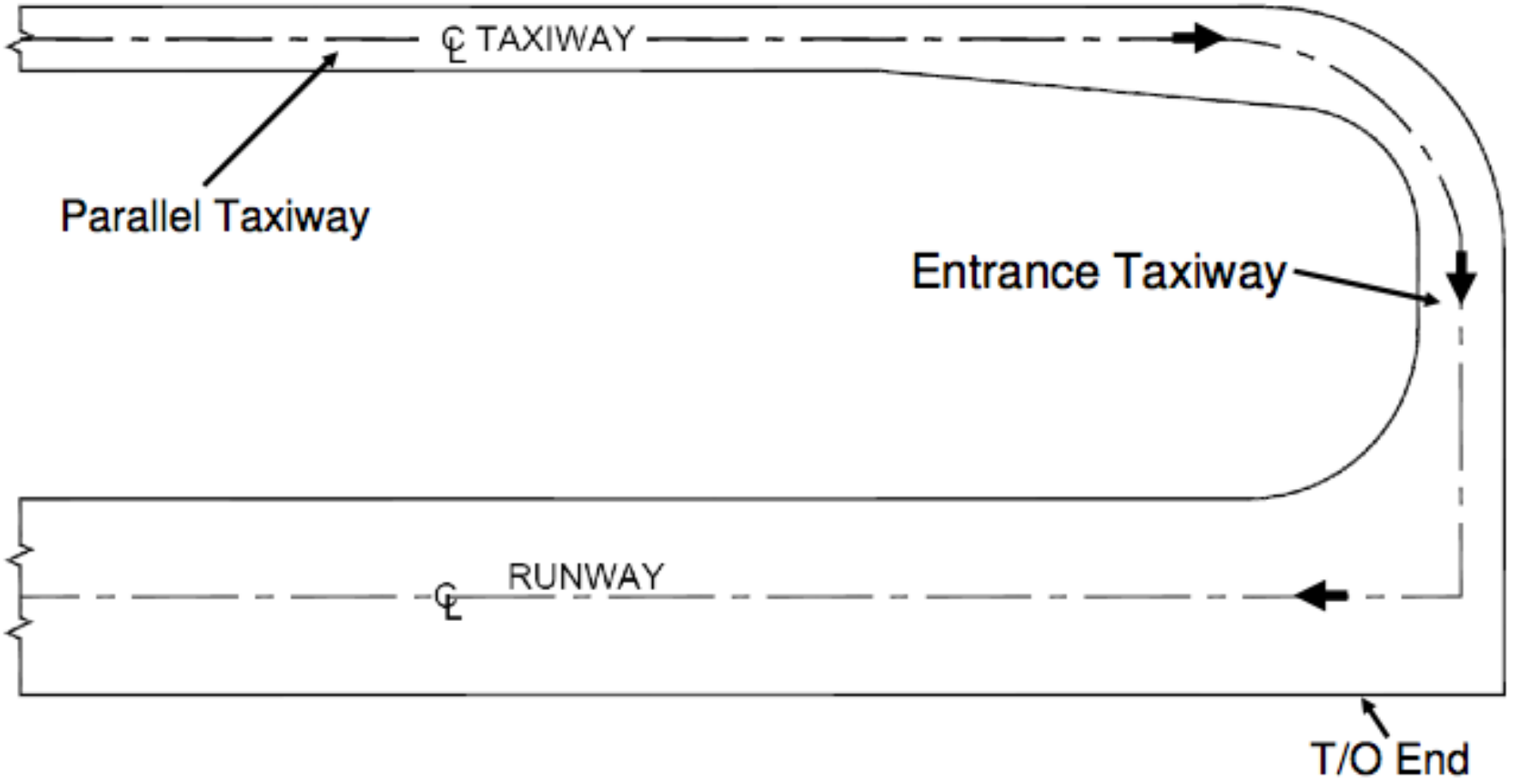
Typical High Speed Exit Taxiway



Entrance & Parallel Taxiways

- Entrance Taxiway:
  - Entrance taxiways provide access to the takeoff end of the runway for the departing aircrafts and it also serves as the final exit taxiway for landing aircrafts on a bidirectional runway. It is normally in the form of an "L" taxiway intersection with a right angle connection to the runway.
- Parallel Taxiway:
  - The taxiway running parallel to the runway connecting all the exit and entrance taxiways is called *parallel taxiway*.

Entrance Taxiway



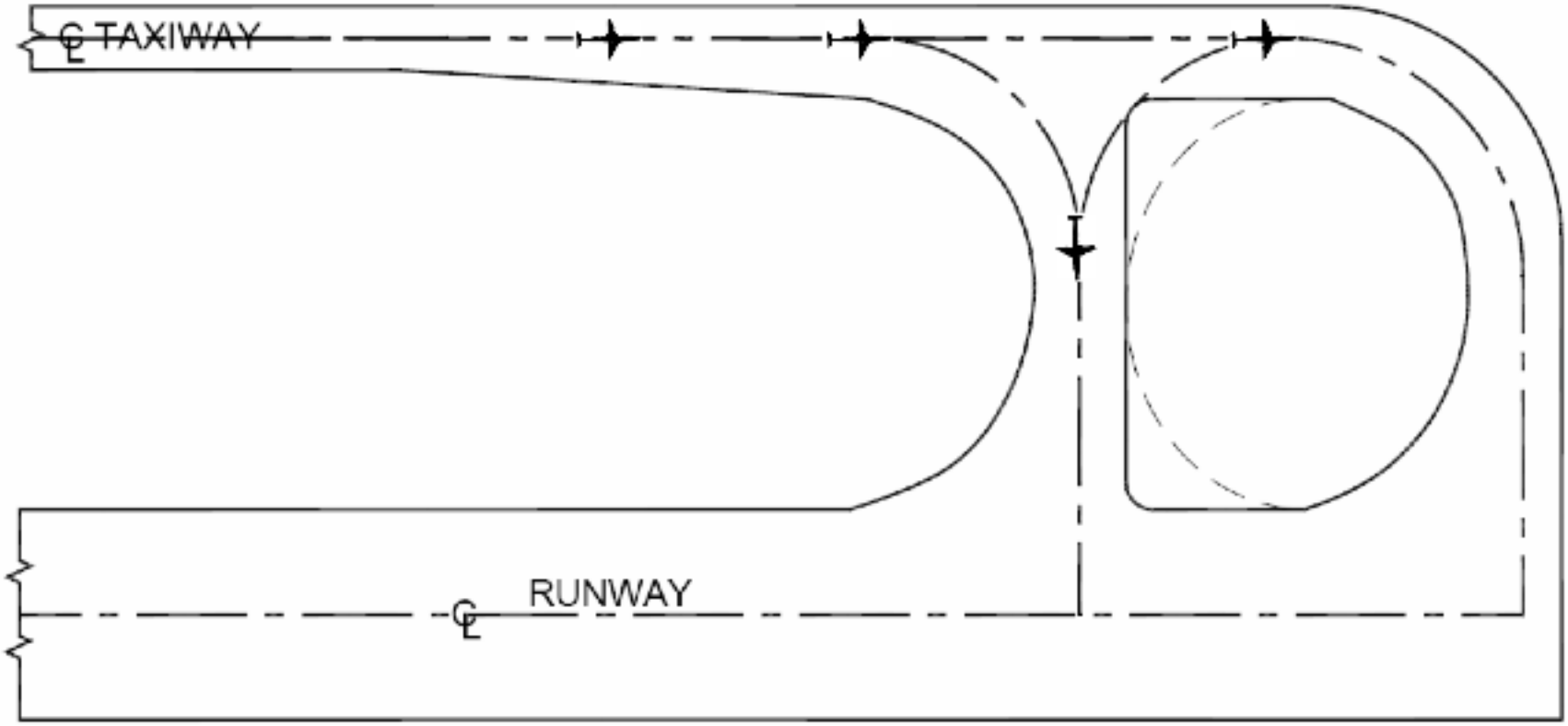
Source: FAA AC: 150/5300-13 (1989)

Bypass Taxiway

- As an alternative to holding bay a bypass taxiway parallel to the entrance taxiway leading to the runway end are generally provided.

- When a preceding aircraft is not ready for takeoff and blocks the entrance taxiway, other aircrafts in the queue can use the bypass taxiway.• Bypass taxiways provide flexibility in runway use by permitting ground maneuvering of steady streams of departing airplanes

Bypass Taxiway



Source: FAA AC: 150/5300-13 (1989)

1. Introduction of Airport Configurations
2. Analysis of wind
3. Site Selection Approach

Introduction of Airport Configurations

- A major determinant of airport capacity is the overall layout and design of the system
- Airport configuration is the most important factor and defined as the general arrangement of the various parts or components of the airport system

Airport Configuration

- Airport configuration is defined as the number and orientation of runways and the location of the terminal area relative to the runways.
  - Number of runways depends on air traffic volume.
  - Orientation of runways depends on the direction of wind, size and shape of the area and land use and airspace use restrictions in the vicinity of airport.
  - The terminal building should be located so as to provide easy and timely access to runways.

Analysis of Wind for Orienting Runways

- Runways are oriented in the direction of prevailing winds.
- The data on the parameters of wind namely, intensity (speed), direction and duration are essential to determine the orientation of runways.
  - High intensity winds perpendicular to the direction of runway cause problems during landing and takeoff of aircrafts.
  - Smaller aircrafts are particularly effected by these crosswinds.

Factors affecting selection of site for Airport

- Availability of adequate area
- Accessibility
- Topography, soil condition and drainage
- Availability of construction materials
- Cost of development
- Cost of maintenance
- Traffic volume and type of traffic
- Cross-wind component
- Proximity of airways
- Safety factors
- Revenues

Factors Influencing Airport Size

- Performance characteristics and size of aircraft expected to use the airport.
- Anticipated volume of traffic.
- Meteorological conditions.
- Elevation of site.

Factors for site selection..

1. 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.
2. Airport use: the selection of site depends upon the use of an airport. Whether for civilian or for military operations. During the emergency civilian airports are taken over by the defense. Therefore the airport site selected should provide natural protection to the area from air roads.

Factors for site selection…

3. Proximity to other airport:

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.

Factors for site selection…

4. 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 especially for short haul operations.

Factors for site selection…

5. Topography:

This includes natural features like ground contours trees streams etc. A raised ground a hill top is usually considered to be an ideal site for an airport.

6. 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.

Factors for site selection…

7. 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 blows minimum in a valley.

8. Wind:

Runway is so oriented that landing and take off is done by heading into the wind should be collected over a minimum period of about five years.

Factors for site selection…

9. Noise nuisance:

The extent of noise nuisance depends upon the climb out path of aircraft type of engine propulsion and the gross weight of aircraft. Therefore the site should be so selected that the landing and take off paths of the aircrafts pass over the land which is free from residential or industrial developments.

10. Future development:

Considering that the air traffic volume will continue to increase in future more member of runways may have to be provided for an increased traffic.

Factors for site selection…

11. Grading, drainage and soil characteristics:

It plays an important role in the construction and maintenance of airport which in turn influences the site selection.

The possibility of floods at the valley sites should be investigated. Sites with high water tables which may require costly subsoil drainage should be avoided.

Planning and Design of the Terminal Area

1. The Passenger Terminal System
2. The Terminal Planning Process
3. The Apron Gate System

The Passenger Terminal System

- The passenger terminal refers to a building which is mainly used for the passengers, airline staff, cargo and administrative management, control tower, weather bureau etc.
- Passenger terminals provide the first and last impressions for visitors to the airport.
- The terminals are the 'front door' to the Airport and serve as the public interface between the landside and airside elements.
- The main aim of the airport is to provide high quality terminal facilities that effectively handle the projected traffic flows and provide a quality experience for customers.

The Terminal Planning Process

There are three components of Planning

1. Airside Terminal facilities planning
2. Terminal building facilities planning
3. Land side facilities planning

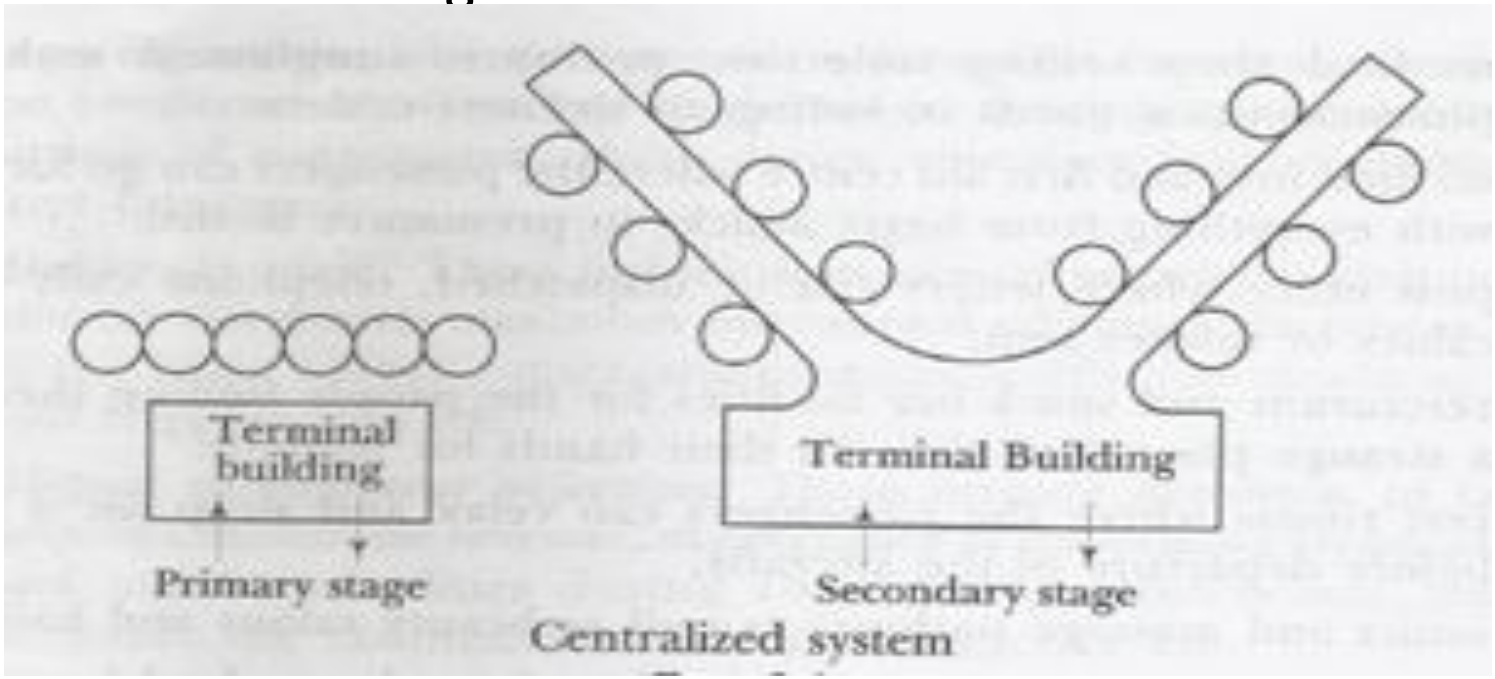
Terminal building facilities planning

- There are 3 concepts of planning the terminal building.

1. Centralized system
2. Decentralized system
3. De-centralized – centralized system

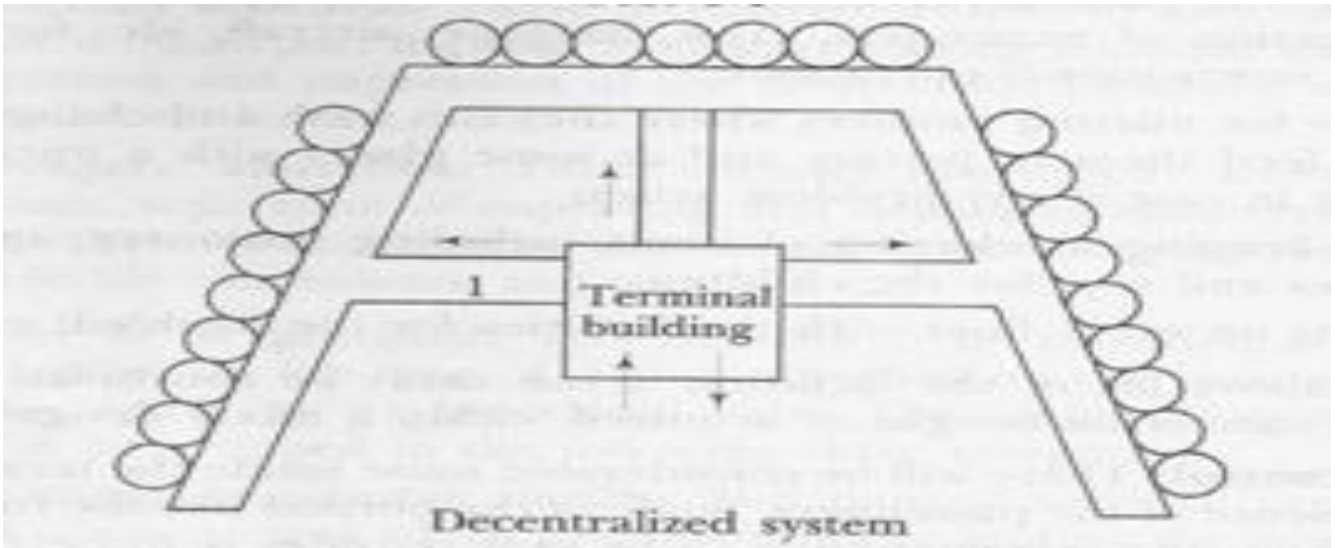
Centralized system

- In this system, all the passengers, baggage and cargo are routed through a central location and then passed on to the respective aircraft positions.
- It is economical
- This system is convenient when the aircraft parking area is within the walking distance of 180 m.



Decentralized system

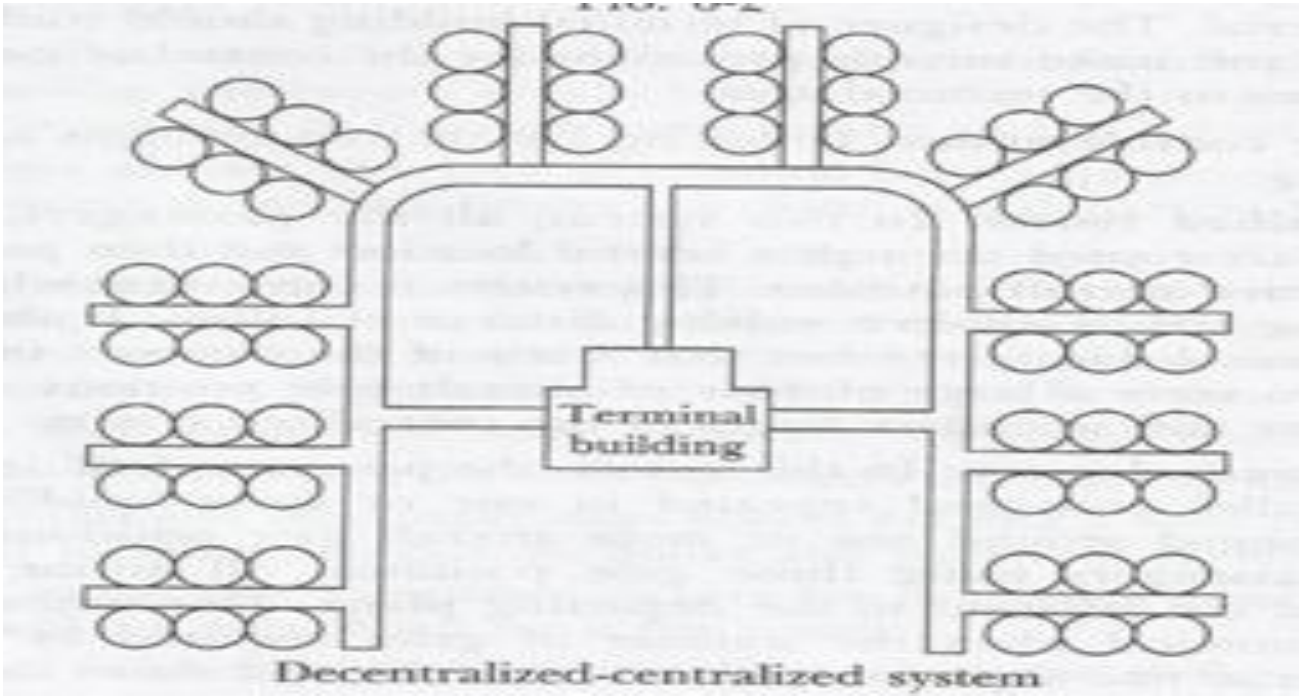
- In this system, the passenger facilities are arranged in smaller units and repeated in one or more buildings.
- Each unit is arranged around one or more aircraft gate positions
- All the airline functions are carried out adjacent to the departing plane.
- This system proves to be uneconomical when the number of gates required by the individual airliner are more than 6.



Decentralized system

De-centralized – centralized system

- It is a combination of the above two systems
- In this system, each individual airliner operation is centralized.
- This kind of system more suitable at major airports where the volume of air traffic is too high.



Decentralized-centralized system

The Apron-Gate System

- Apron

It is a paved area for parking of aircrafts, loading and unloading of passengers and cargo.

It is usually located close to the terminal building or hangars

The size of the apron depends upon:

1. Gate position
2. Number of gates
3. Aircraft parking system

Gate position

- The 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, baggage and cargo.
- The size of the gate depends on

1. **Size of aircraft**

The size of aircraft to be accommodated determines the space required for parking as well as for maneuvering. It also determines the extent and size of the servicing equipment required to be provided to service the aircraft.

2. **Type of aircraft parking**

The type of aircraft parking used at the gates affects the gate size because the area required to maneuver in and out of a gate varies depending on the way aircraft is parked.

Type of Aircraft Parking

- There are 5 types of aircraft parkings.
    1. Nose-in-parking
    2. Angled nose-in parking
    3. Nose-out parking
    4. Angled nose-out parking
    5. Parallel parking.

Types of aircraft parking at gate

The Apron-Gate System

2. **The number of gates:**

- The number of gates is determined in such a way that a predetermined hourly flow of aircraft can be easily and conveniently accommodated.
- The number of gates required will depend on the following factors.

1. Estimated peak hour volume
2. Gate occupancy time
3. Gate capacity analysis
4. Gate utilization factor
5. Formula for calculating gate capacity

$$G = C T / U$$

where G = Number of gates

C= Design volume or capacity of gate in aircraft per hour for arrivals or departures

T = Weighted average gate occupancy time in hours

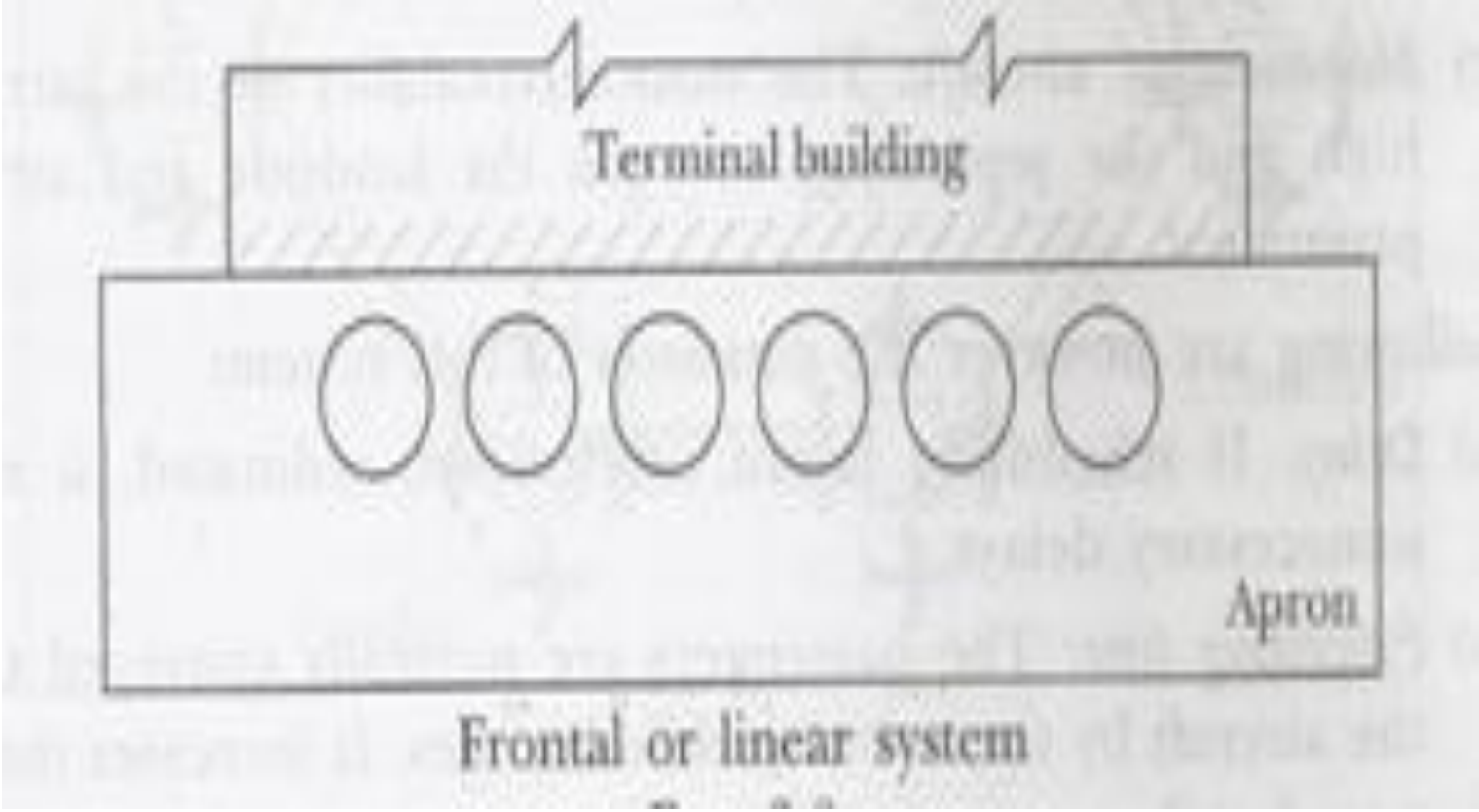
U = Coefficient indicating gate utilization factor

The Apron-Gate System

3. Aircraft parking system:

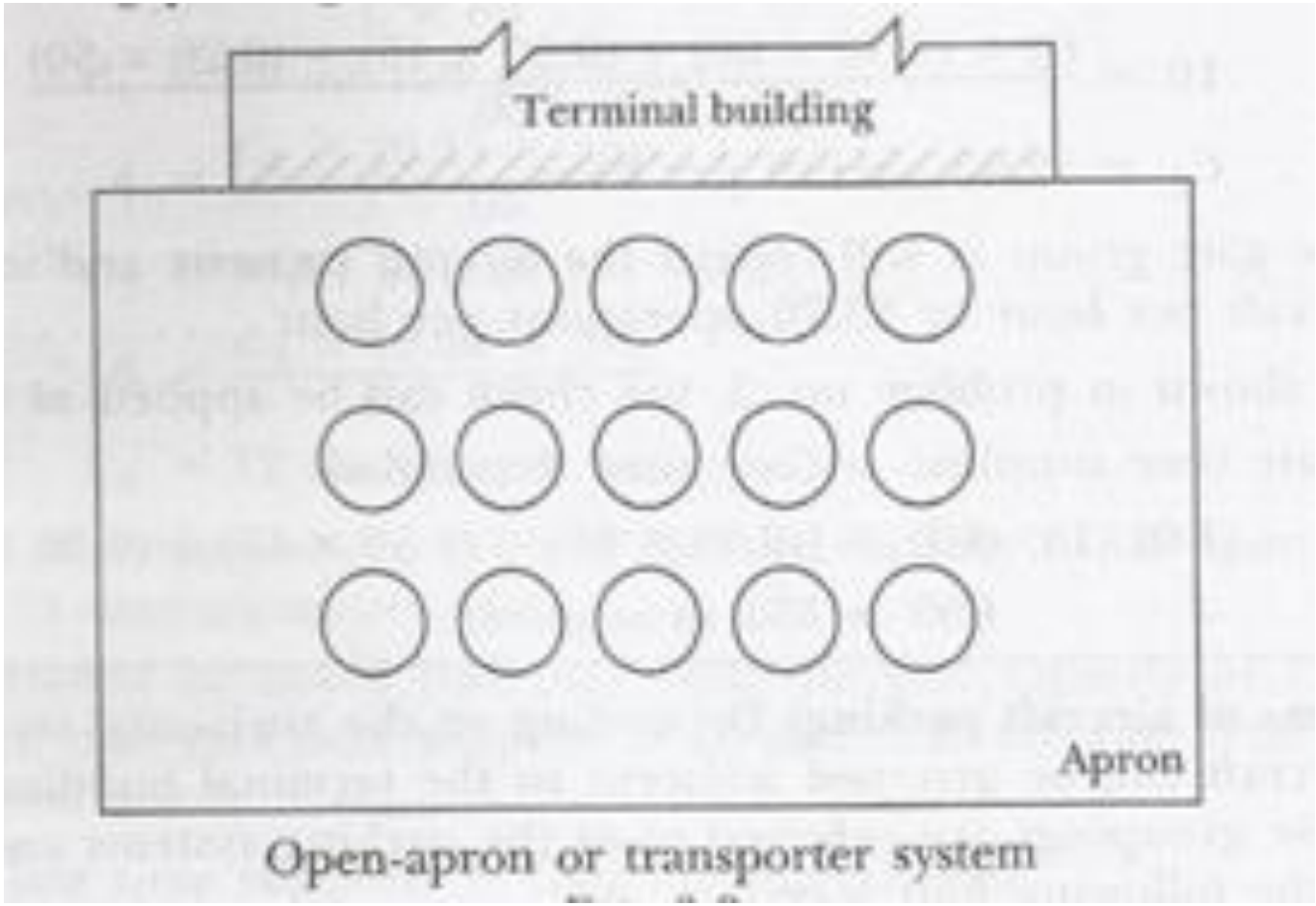
- Depending on the horizontal terminal concept used, the aircraft can be grouped adjacent to the terminal building in a variety of ways.
- Thee groupings are referred to as parking systems and they can be classified in to the following 4 ways.
  - 1. Frontal or linear system
    2. Open- apron or transport system
    3. Pier or finger system
    4. Satellite System

Frontal or linear system



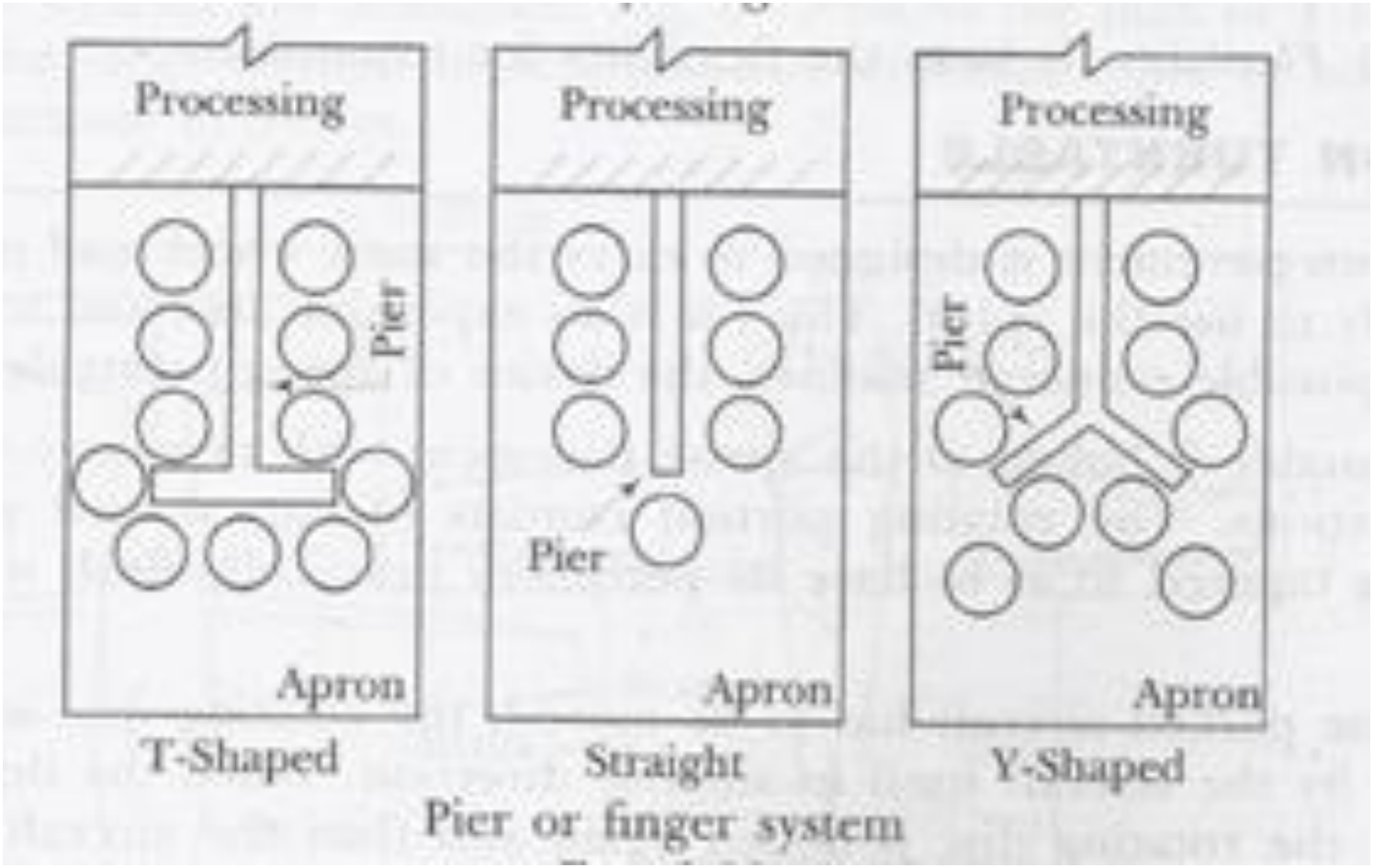
Frontal or linear system

Open- apron or transport system



Open-apron or transporter system

Pier or finger system



Pier or finger system

Satellite System

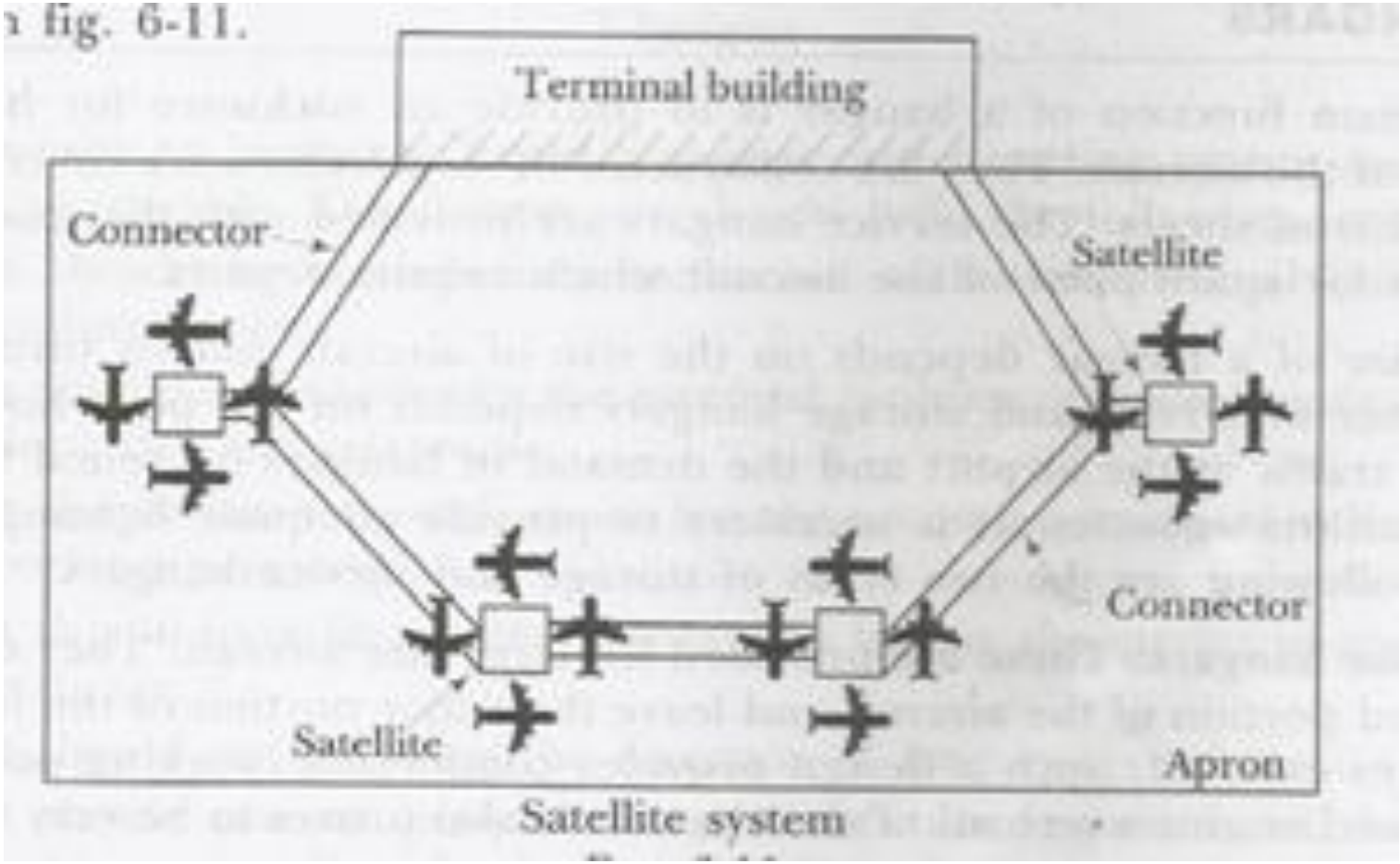


fig. 6-11.

Satellite system

JNTUH – R09 SYLLABUS
AIRPORT PLANNING AND DESIGN

UNIT – VII Airport Space Traffic Control

1. Airways
2. Navigation Aids

JNTUH – R09 SYLLABUS
AIRPORT PLANNING AND DESIGN

UNIT – VIII

1. Air Traffic Control
2. Air Traffic Control Facilities
3. Air Safety and Regulation Issues

Air Traffic Control (ATC)

- **Air traffic control** (**ATC**) is a service provided by ground based controllers who direct the aircraft on the ground and through controlled airspace, and can provide advisory services to aircraft in non-controlled airspace

Functions of Air Traffic Control

1. To prevent collisions and therefore safeguard life and property.
2. To organize and expedite the flow of traffic
3. To provide information and other support to pilots
4. ATC may play security or defensive role or is operated by the military in some countries.
5. To prevent collisions, ATC enforces traffic separation rules, which ensure each aircraft maintains a minimum amount of empty space around it at all times.
6. Modern aircrafts have a collision avoidance systems, which provide additional safety by warning pilots when other aircrafts get too close.
7. ATC is the nerve centre of an airport.

Need of Air Traffic Control

- Air transportation must ensure safe, convenient and economic movement of aircraft from one airport to another airport. For this purpose, we need to control the air space.
- The aircraft flight from one airport to another airport is carried out in the following 4 phases.

1. The aircraft takes off from an airport
2. It maintains a proper altitude in air
3. It navigates from point to point safely
4. It lands at the desired airport

Air Traffic Control Centre Functions

- The functions of air traffic control centre are classified into the following categories.

1. Airport traffic control
2. Airway traffic control
3. Airway communication
4. Non-airway traffic control (General)

Airport Traffic Control

1. To guide the aircraft, desiring to land or take off.
2. To control the taxiing of arriving and departing aircraft between apron and runway.
3. It is taken care of by Airport Traffic Control Tower (ATCT)

Airway Traffic Control

- This regulates the movement of aircraft along the air route with adequate lateral and vertical separation to avoid collision, especially when visibility is poor.
- It is taken care of by Air Route Traffic Control Centre (ARTC)
- The entire geographical area of the country along the air routes is divided among 8 ARTC centers located at various places in India.
- The 8 ARTC centers are located in India at
  1. Mumbai 2. Chennai 3. Kolkata 4. Nagpur
  5. Allahabad 6. Delhi 7. Jodhpur 8. Ahmedabad
- These ATC centers will communicate with pilot and guide them, monitor them, control them whenever the flight is flying through air route under their geographical control.

Airway Communication

- Deals with conveying of airway and weather information to the pilot during the flight.
- This is normally done by ARTC through Flight Service Stations (FSS) located at various locations along the airways.

General or Non-Airway Traffic Control

1. Its a serious problem when personal flying is done by a large number of people.

2. In such cases, the movement of aircraft, not flying along the airway, must be regulated to prevent interference to main air traffic.

Air Traffic Control Network

- The network for controlling the air traffic can be divided in to three parts.

1. Control within terminal area

   - taken care of by Air Traffic Control Tower (ATCT)

2. Control over airways

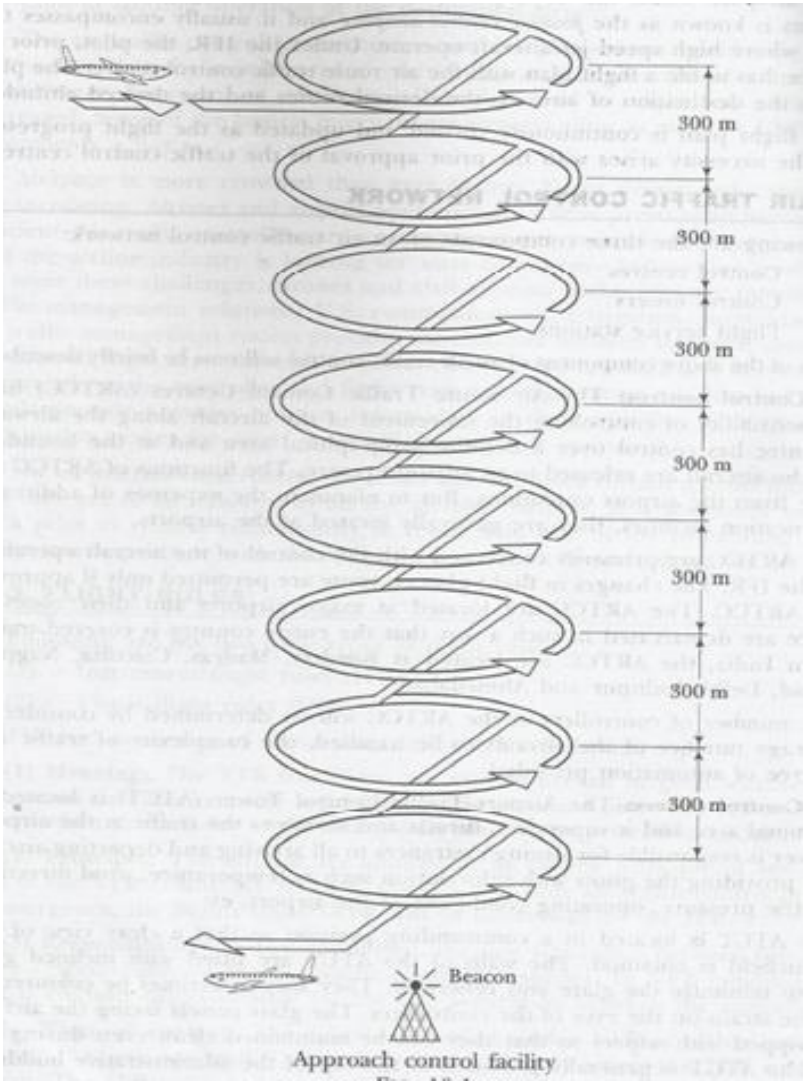
   - taken care of by Air Route Traffic Control Centre (ARTC)

3. Airway communication

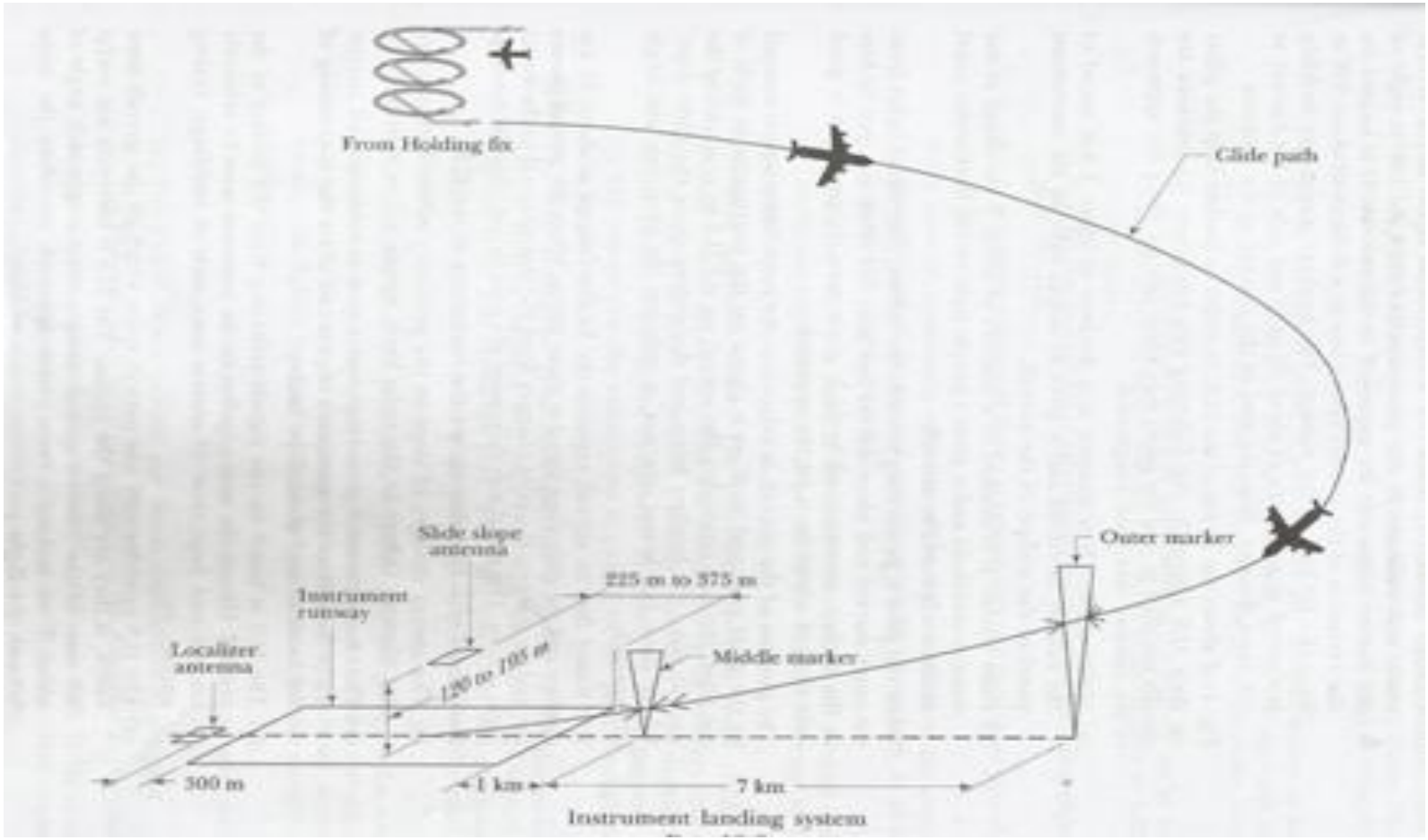
   - taken care of by Flight Service Station (FSS)

Holding Fix

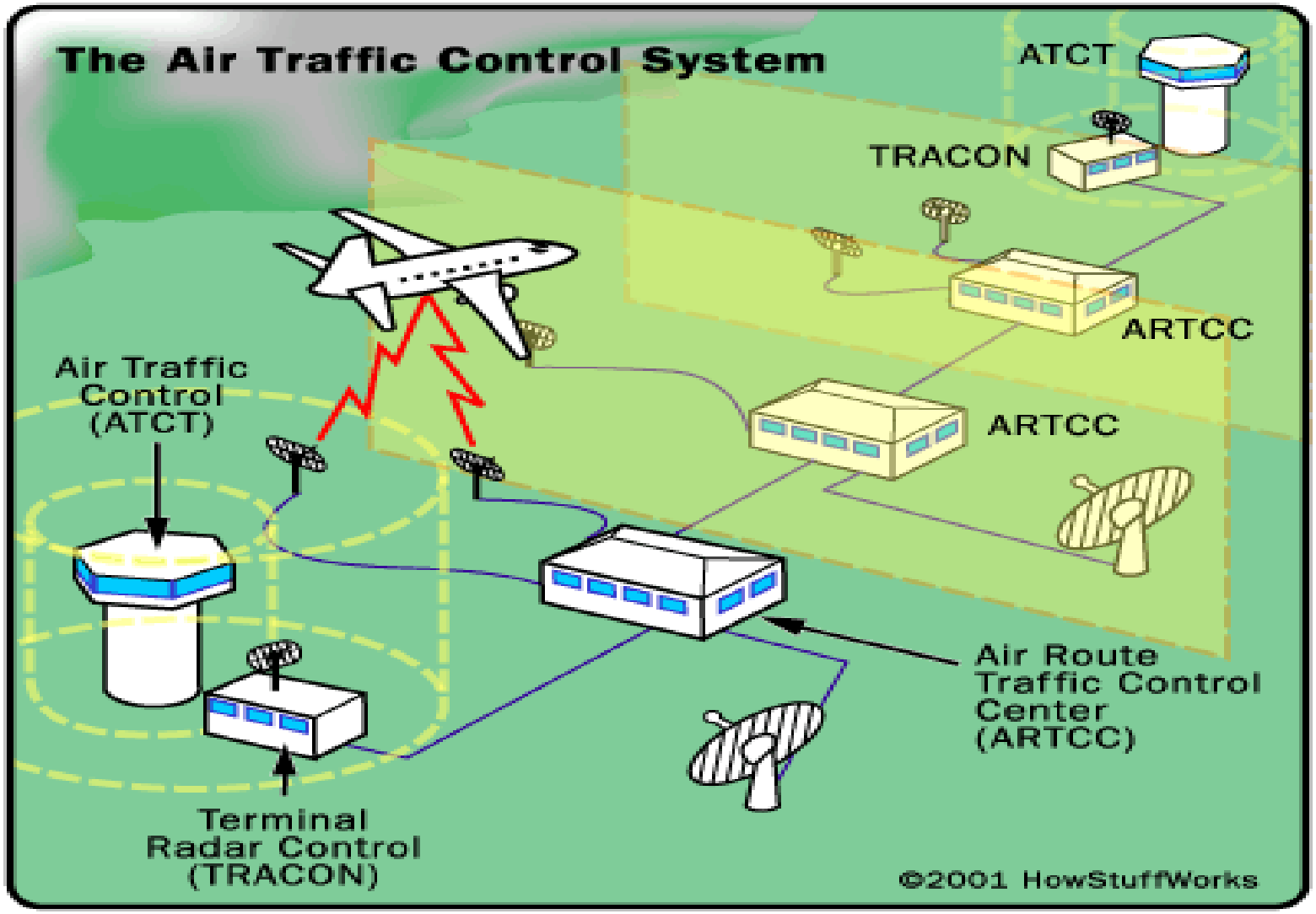
- If the traffic is heavy on the runway, then the aircrafts are detained at this place known as **"Holding Fix"** and they are required to keep moving with a vertical separation of 300 m. They are released one by one by the ARTC (or ATCT with approach control facilities).



Instrument Landing System



Air Traffic Control Facilities



Air Traffic Control Room

Flight Operation Rules
(or Air Traffic Control Rules)

- Aircrafts operate under two basic types of flight rules

1. Visual Flight Rules (VFR Conditions)
2. Instrument Flight Rules (IFR Conditions)

1. Visual Flight Rules (VFR Conditions)

- If VFR conditions prevail, the air traffic control during the route is practically not required, since pilots can maintain desired separation by visual aids.

2. Instrument Flight Rules (IFR conditions)

- The IFR conditions exist, when the visibility is lower than the limits prescribed for flight under visual flight rules. For example during nigh times and bad weather conditions (cloudy or foggy).
- Rigid traffic control has to be exercised by ATC under IFR conditions.

- The pilot, prior to his departure, prepares a flight plan which include

1. aircraft destination
2. air route to be followed
3. the desired altitude
4. estimated time for departure

- If the flight plan is approved, no change is allowed without prior approval of the Air traffic control centre

Air Traffic Control Aids

- The following air traffic control aids are always available to the pilot during the flight

1. Enroute aids or airway aids
2. Landing aids
3. Visual aids

Enroute Aids

The following aids are available to the pilot during his flight from one airport to another

1. Air Route Surveillance Radar (ARSR)
2. Air to ground communication
3. Airway Beacon
4. Direction Finder
   a) Automatic Detection Finder (ADF)
   b) Radio Detection Finder (RDF)
5. Distance Measuring Equipment (DME)
6. Low/Medium Frequency ratio range (LF/MF)
7. Marker Beacon
8. Tactical Air Navigation (TACAN)
9. Very high frequency Omni-directional Range (VOR)

Landing Aids

- The following aids are available to any aircraft while landing

1. Airport Surface Detection Equipment (ASDE)
2. Airport Surveillance Radar (ASR)
3. Instrument Landing System (ILS)
4. Precision Approach Radar (PAR) or Ground Approach Control (GAC)
5. Approach lights

Enroute Aids:
Air Route Surveillance Radar (ASR)

- The long range radars are installed along the airways to keep a watch on the aircraft.
- The controller gets a picture of each aircraft on the radar screen and he is able to decide the exact position of the aircraft.
- The effective range of radar is about 200 km.

Enroute Aids:
Air to Ground Communication

- The flight instructions and other relevant data will be conveyed to pilot from the ground along the length of the airway through FSS and ARTCC.

Enroute Aids:
Airway Beacon

- In the past, the airway beacons were placed at a distance of about 40 km along the airway from one airport to another airport to provide guidance to the pilot.
- They are not existing now. They exist only certain key locations like the hill peaks.

Enroute Aids:

Direction Finder

There are two types of direction finders.

a) Automatic Detection Finder (ADF)

Automatic Direction Finder (ADF) is the modern sophisticated equipment which keeps the antenna pointed towards the point of transmission and it requires no adjustment.

b) Radio Detection Finder (RDF)

The Radio Detection Finder (RDF) is to be rotated by the pilot to find out his direction with respect to the transmittier.

Enroute Aids:
Distance Measuring Equipment (DME)

- The equipment known as the Distance Measuring Equipment (DME) has been installed at nearly all the VOR stations.
- It indicates to the pilot the air distance between the aircraft and a particular VOR station.
- The pilot is able to gauge his exact position by knowing his bearing with respect to the airway.

Enroute Aids:

Low/Medium Frequency ratio range (LF/MF)

- It was invented during early1930s.
- The four course radio range sends out 4 radio beams along 4 directions.
- This facility may be located near an airport.
- If a pilot is able to pick up a steady tone, it indicates the correctness of the air route.
- If pilot is not on the correct route, he will hear a dot-dash or dash-dot signal and he can adjust his position accordingly.
- There will be difficulty of static interference.
- The reception of radio signal will be almost absent during thunder storm.

Enroute Aids:
Marker Beacon

The small radio transmitters known as the marker beacons are helpful to the pilot for determining his position on a given airway.

They send coded radio signals which the pilot is able to identify.

There is a cone of silence just above the tower of radio range station.

As the aircraft enters the cone, the signals fade out and remain blank until the aircraft is in the cone area.

Enroute Aids:

Tactical Air Navigation (TACAN)

- It measures the azimuth and distance.
- It is operated in the ultra-high frequency band.

Enroute Aids:

Very high frequency Omni-directional Range (VOR)

- The most common ground system from which the bearings can be known is the VOR.
- The VOR stations sends out signals in all directions with 1° interval. There will be 360 routes. 0° refers to Magnetic north
- Each signal can be considered of a course or route referred to as a radial that can be followed by an aircraft.
- The VOR receiver in the cockpit has a dial for tuning in the desired VOR frequency.
- The pilots can select the VOR radial or route they wish to follow to the VOR station.
- The VOR stations are usually located on a small square building standing on an obstructed hill top or in the open grounds.
- The very high frequencies are free from static interference.

Landing Aids:
Airport Surface Detection Equipment (ASDE)

- During poor visibility conditions, the controllers experience difficulty in regulating taxiing aircraft because they are unable to see them.
- The ASDE gives pictorial display of runways, taxiways and terminal area along with the position of the aircraft.

Landing Aids:
Airport Surveillance Radar (ASR)

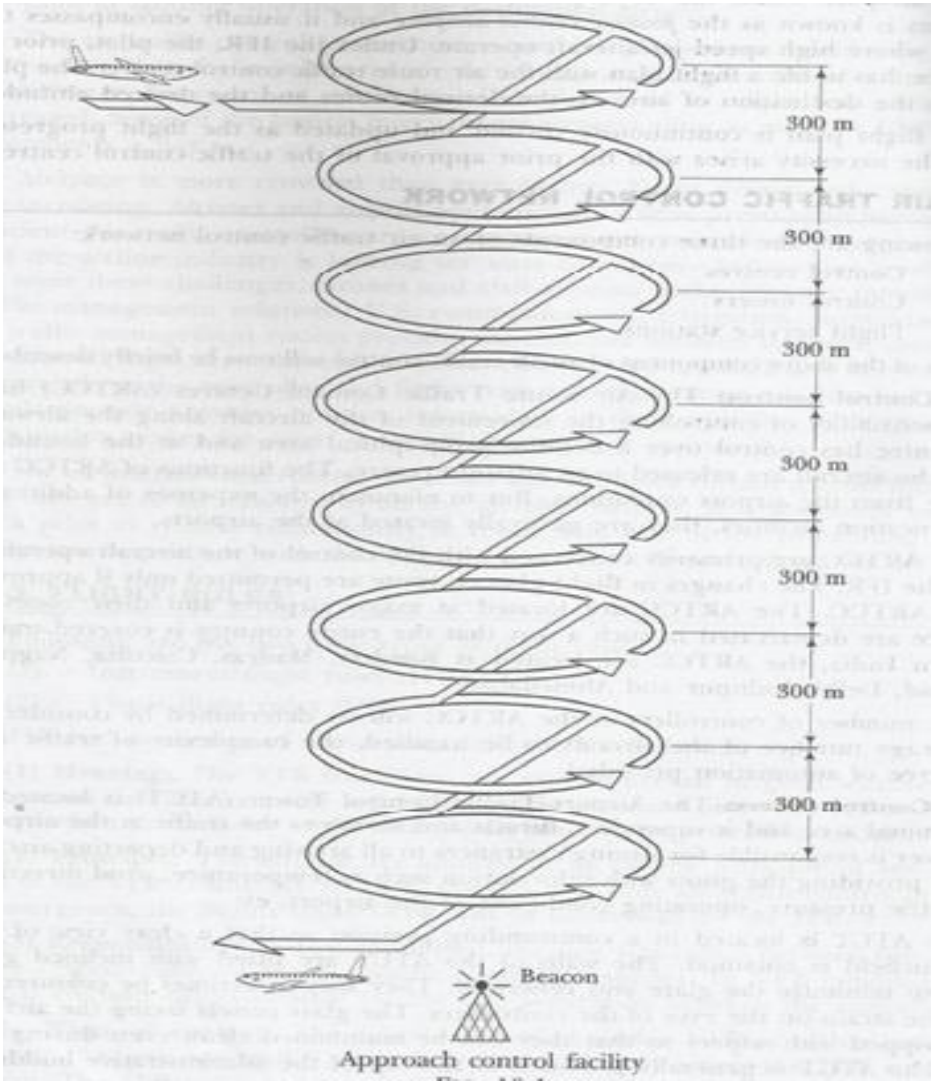
- Airport Surveillance Radar (ASR) is an instrument which provides to the control tower operator an overall picture of what is going on with in airspace surrounding the terminal.
- The ASR rotates through 360° and it has a range of 50 to 100 km.
- The information is received on a screen in the control tower.
- The relative horizontal positions of the aircraft are shown as blips.
- The blips of a moving aircraft leave a luminous trail or mark showing their direction and speed.

Landing Aids:
Instrument Landing System (ILS)

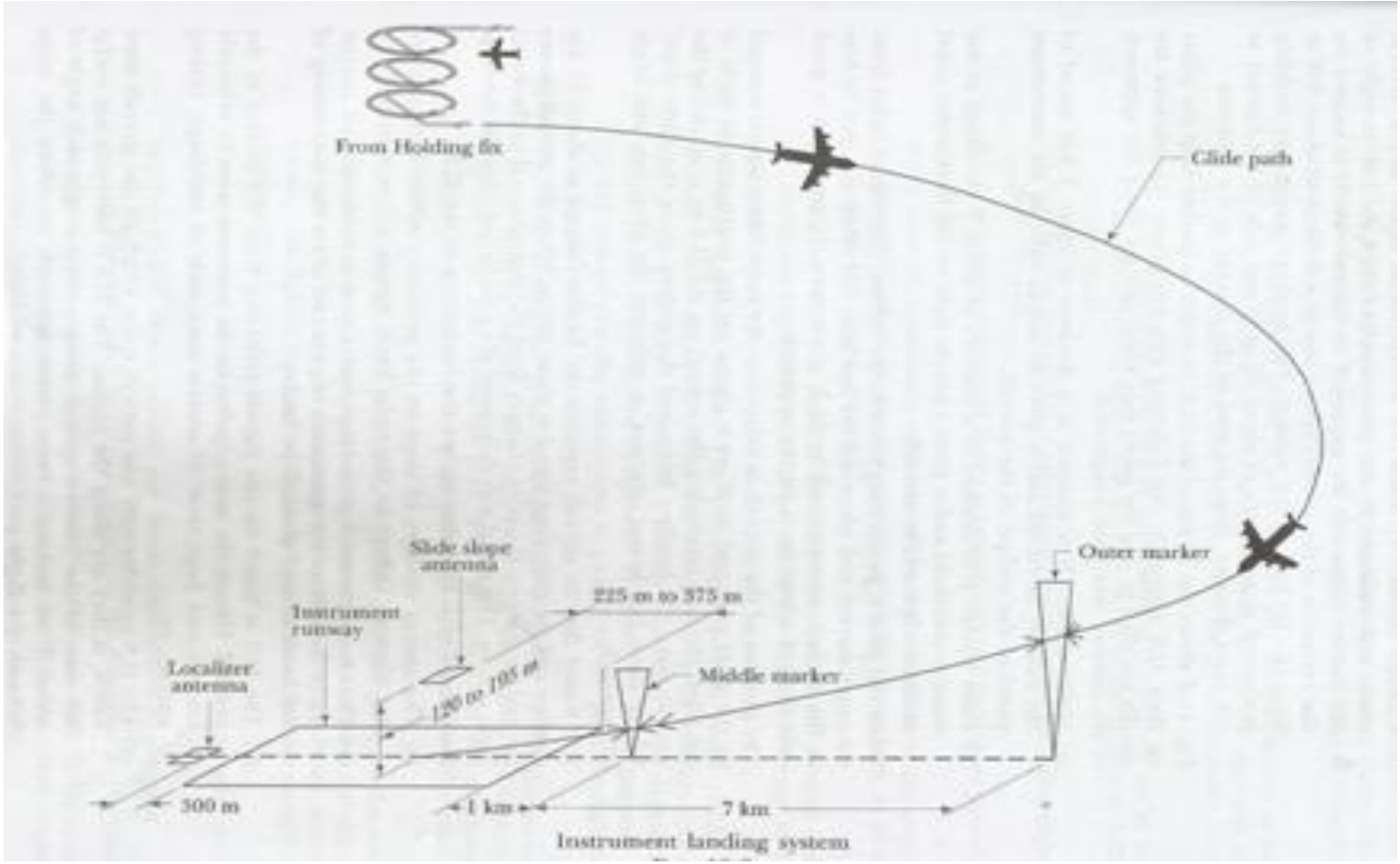
- It consists of telecommunication aids to the pilot to enable him to approach the runway and make a successful landing under conditions of poor visibility even when no ground reference data is visible.
- The ILS consists of the following two transmitted signals which combine to form an invisible path along which the aircraft can approach.

1. Guide Slope Antenna
2. Localiser Antenna

Holding Fix


300 m
300 m
300 m
300 m
300 m
300 m
300 m
Beacon
Approach control facility

Instrument Landing System



Landing Aids:

Precision Approach Radar (PAR)

- The Precision Approach Radar (PAR) or Ground Control Approach (GCA) serves as same purpose as an ILS except that the information is passed to the pilot through the hearing aid.
- It contains a mobile unit.

Landing Aids:

Approach lights

- The pilot has to change from the instrument to visual conditions as he approaches the most critical point of the runway threshold.
- The time available for the pilot is hardly a few seconds in which he has to make the transition and complete landing.
- To aid in making this transition with confidence, the lights are installed on the approach to the runway as well as on the runway themselves.
- These are known as Approach Lighting System (ALS)

GPS Air Traffic Control or **Next Generation Air Transportation System**

- It is originally designated to assist soldiers in military vehicles/planes
- The Next Generation Air Transportation System (NextGen) is a new National Airspace System due for implementation across the United States in stages between 2012 and 2025.
- NextGen proposes to transform America's air traffic control system from a ground-based system to a satellite-based system.
- GPS technology will be used to shorten routes, save time and fuel, reduce traffic delays, increase capacity, and permit controllers to monitor and manage aircraft with greater safety margins. Planes will be able to fly closer together, take more direct routes and avoid delays caused by airport "stacking" as planes wait for an open runway

Free Flight Air Traffic Control

- Free Flight is a new concept.
- True free flight eliminates the need for Air Traffic Control (ATC) operators by giving the responsibility to the pilot in control.
- This gives the pilot the ability to change trajectory in mid flight.
- With the aid of computer systems and/or ATC, pilots will be able to make more flight path decisions independently.

Airways

- An **airway** is a legally defined corridor that connects one specified location to another at a specified altitude, along which an aircraft that meets the requirements of the airway may be flown. Airways are defined with segments within a specific altitude block, corridor width, and between fixed geographic coordinates for satellite navigation systems, or between ground-based radio transmitter navigational aids (navaids) (such as VORs) or the intersection of specific radials of two navaids.
- There are two types of airways

1. Low Altitude routes or Victor routes
2. **High Altitude routes or Jet routes**

Low Altitude routes or Victor routes

- **Low Altitude routes** Serve primarily smaller piston engine, propeller driven airplanes on shorter routes and at lower altitudes. Airways start at 1,200 feet above ground level (AGL) and extend upward to an altitude of 17,500 feet mean sea level (MSL).

- Low Altitude airways are called "Victor" (V) airways, because they run primarily between VORs, and the phonetic alphabet term for "V" is Victor. Airways can be found on enroute low altitude charts and have names like V240 or V37.

High Altitude Routes or Jet Routes

- **High Altitude routes** actually called jet routes primarily serve airliners, jets, turboprops, and turbocharged piston aircraft operating over longer distances at altitudes of 18,000 feet MSL or higher. Jet routes start at 18,000 feet mean sea level (MSL) and extend upward to FL450 MSL. Jet routes can be found on enroute high altitude charts and have names like J42 or J121.

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Visual Aids

When approaching the airport, the pilots require the help of visual aids for carrying out landing operation.

There are two important types of Visual Aids. They are

1. Airport Markings
2. Airport Lighting

Airport Markings

The runways, taxiways and other allied components of the airport should be properly marked so that they can be easily interpreted by the pilot who is negotiating at a considerable height.

Types of Markings

There are 6 types of Airport Markings

1. Runway Marking
2. Taxiway Marking
3. Shoulder Marking
4. Apron Markings
5. Landing Direction Indicator
6. Wind Direction Indicator

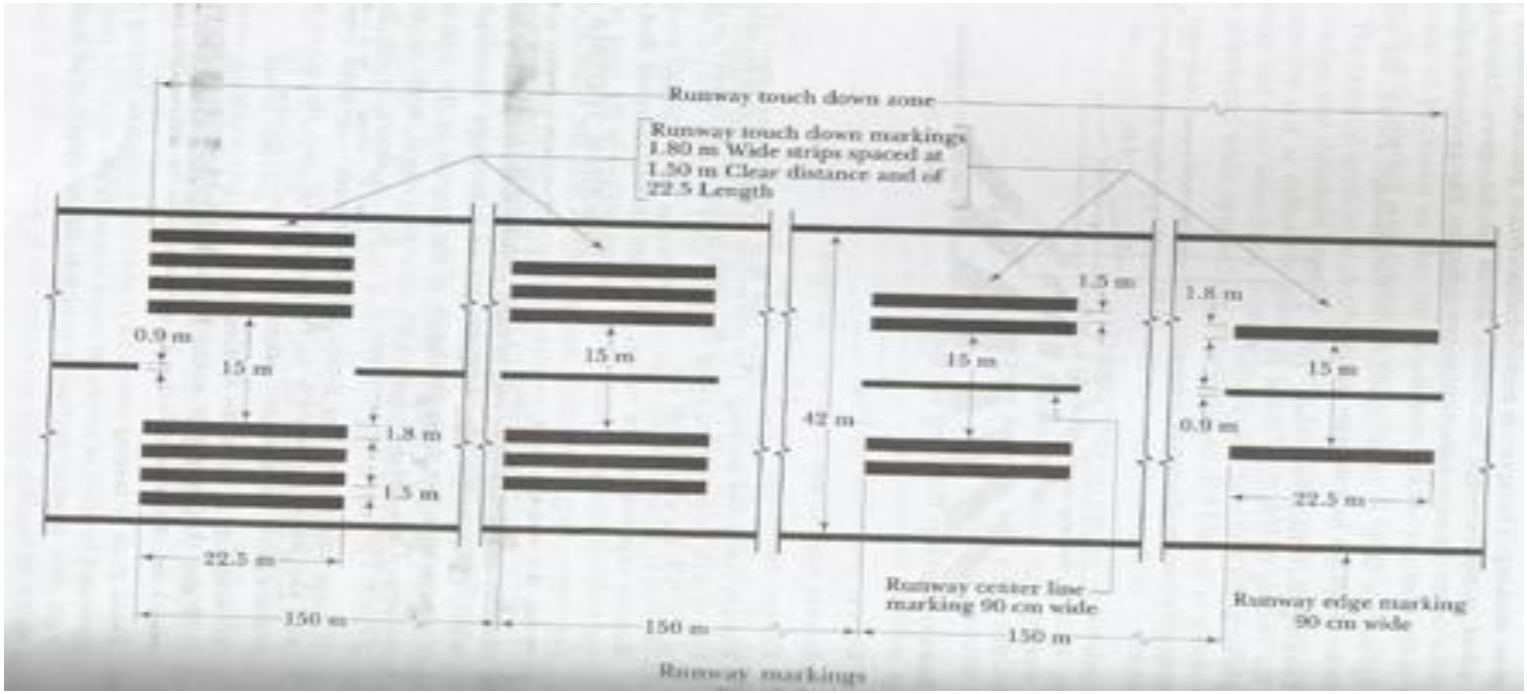
Runway Markings

- Following markings are made on the runways

1. Runway centre-line marking
2. Runway edge stripes
3. Touch down zone marking
4. Threshold marking
5. Displaced threshold marking
6. Runway numbering
7. Two or more parallel runways

Runway centre-line marking

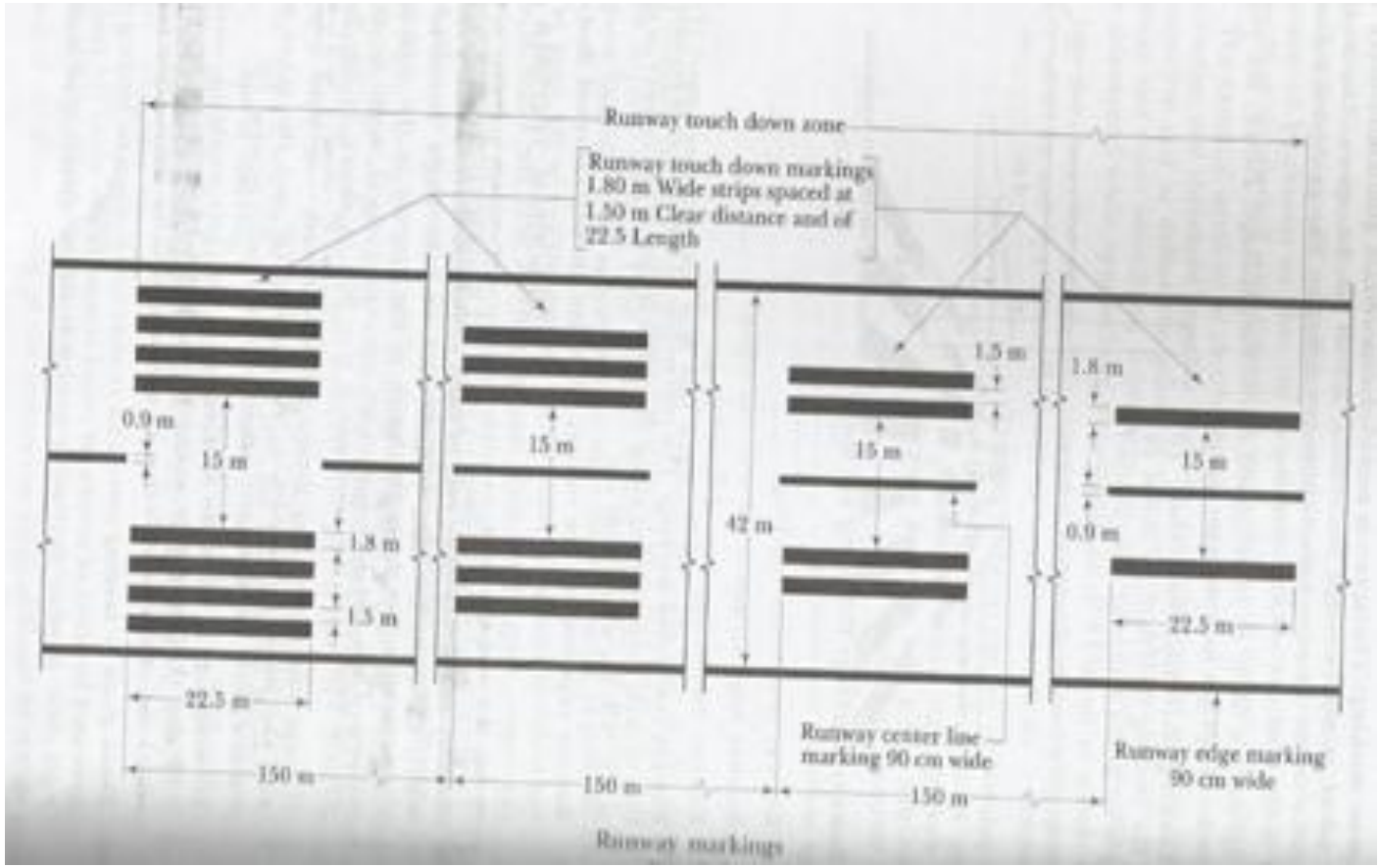
- It is represented by a broken line along the entire length as shown in figure.
- Its width is 90 cm.



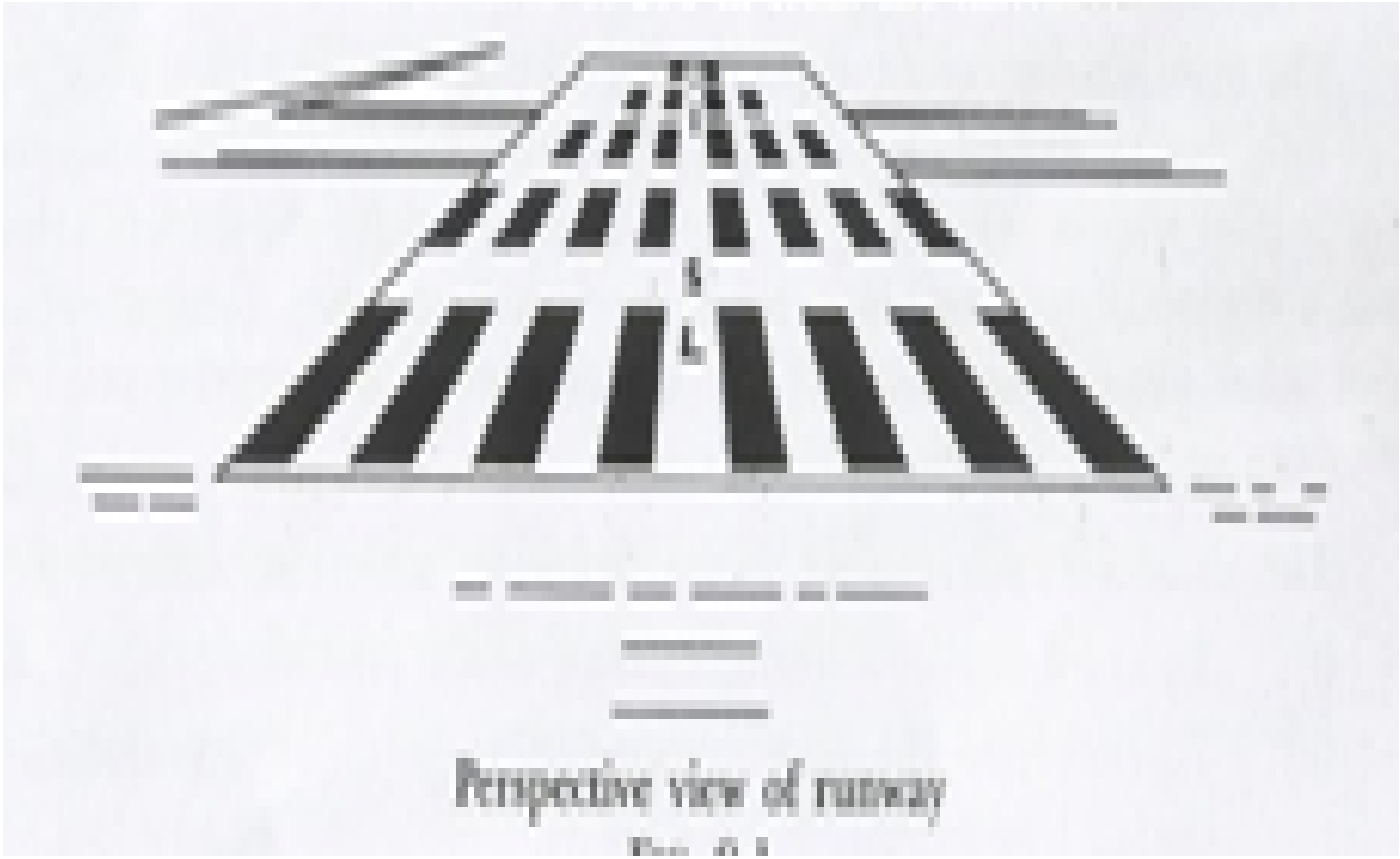
Runway edge stripes

- The runway edge stripes are normally marked.
- But when the runway width exceeds 45 m, the side stripes in the form of long continuous lines 90 cm wide may be marked near the edges as shown in figure.

Runway Markings



Perspective view of a Runway



Touch Down Zone Marking

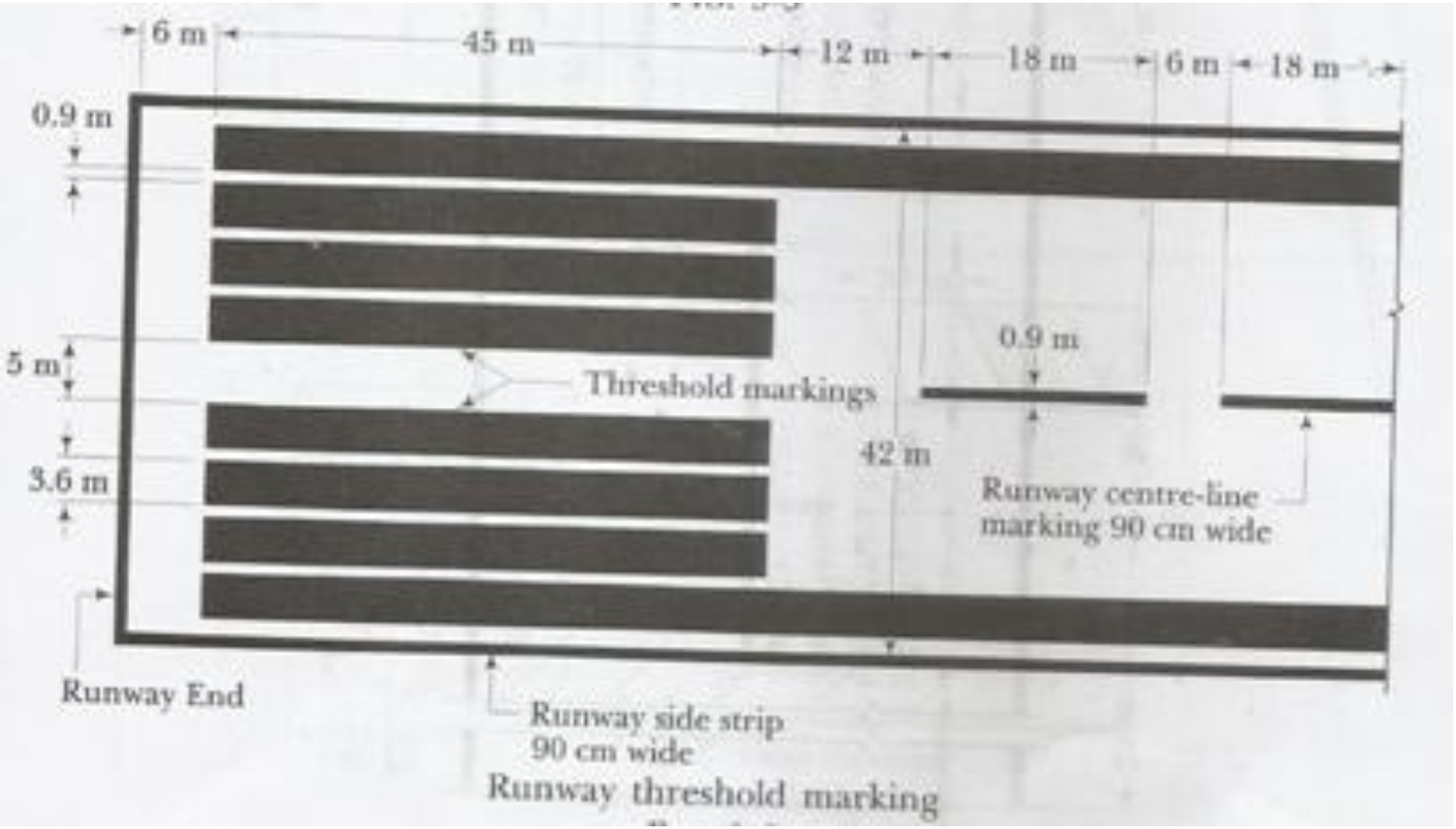
- The runway touch down zone or landing zone is indicated by a series of stripes arranged symmetrically about the centre-line with their number decreasing gradually in the direction of landing as shown in figure.

Threshold Marking

- The runway threshold is indicated by a series of parallel lines starting from a distance of 6 m from the runway end.

- The threshold markings are in the form of stripes 3.6 m wide spaced at 0.9 m clear and placed symmetrically on either side of the runway centre-line.

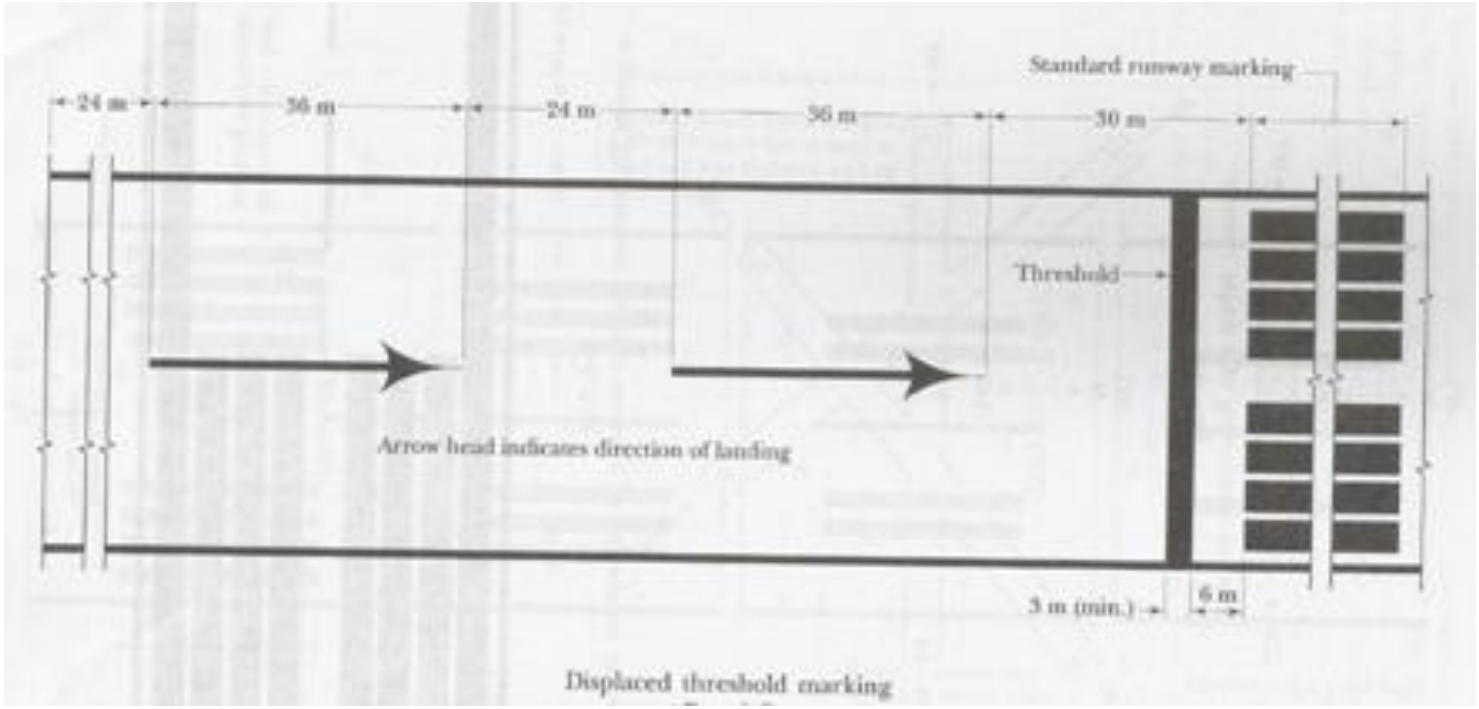
Runway Threshold Marking



Displaced Threshold Marking

- At some airports, it is desirable to displace the runway threshold on a permanent basis.
- A displaced threshold is one which has been moved a certain distance from the end of the runway.

Displaced Threshold Marking

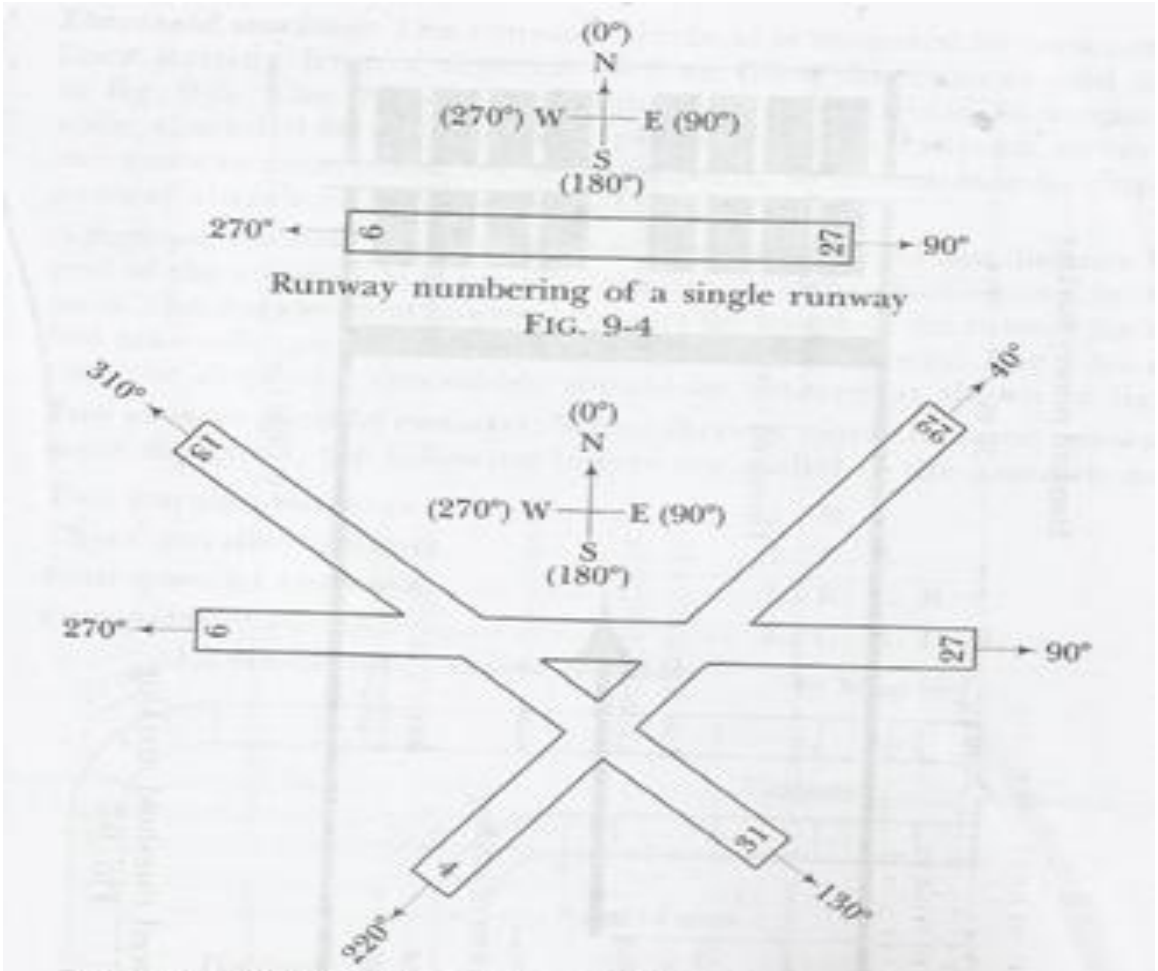


Runway numbering

- The end of each runway is marked with a number which indicates the magnetic azimuth (i.e. the angle measured in a clockwise direction from the north of the runway in the direction of landing).

- Thus the east end of an east-west runway would be marked 27 (for 270°) and the west end 9 (for 90°)

Runway Numbering



Runway numbering of a single runway

FIG. 9-4

Runway numbering of a system of three intersecting runways

Two or More Parallel Runways

- When there are more than one runway in the same direction, the following letters are added to the azimuth numbers.

  Two parallel runways - L, R

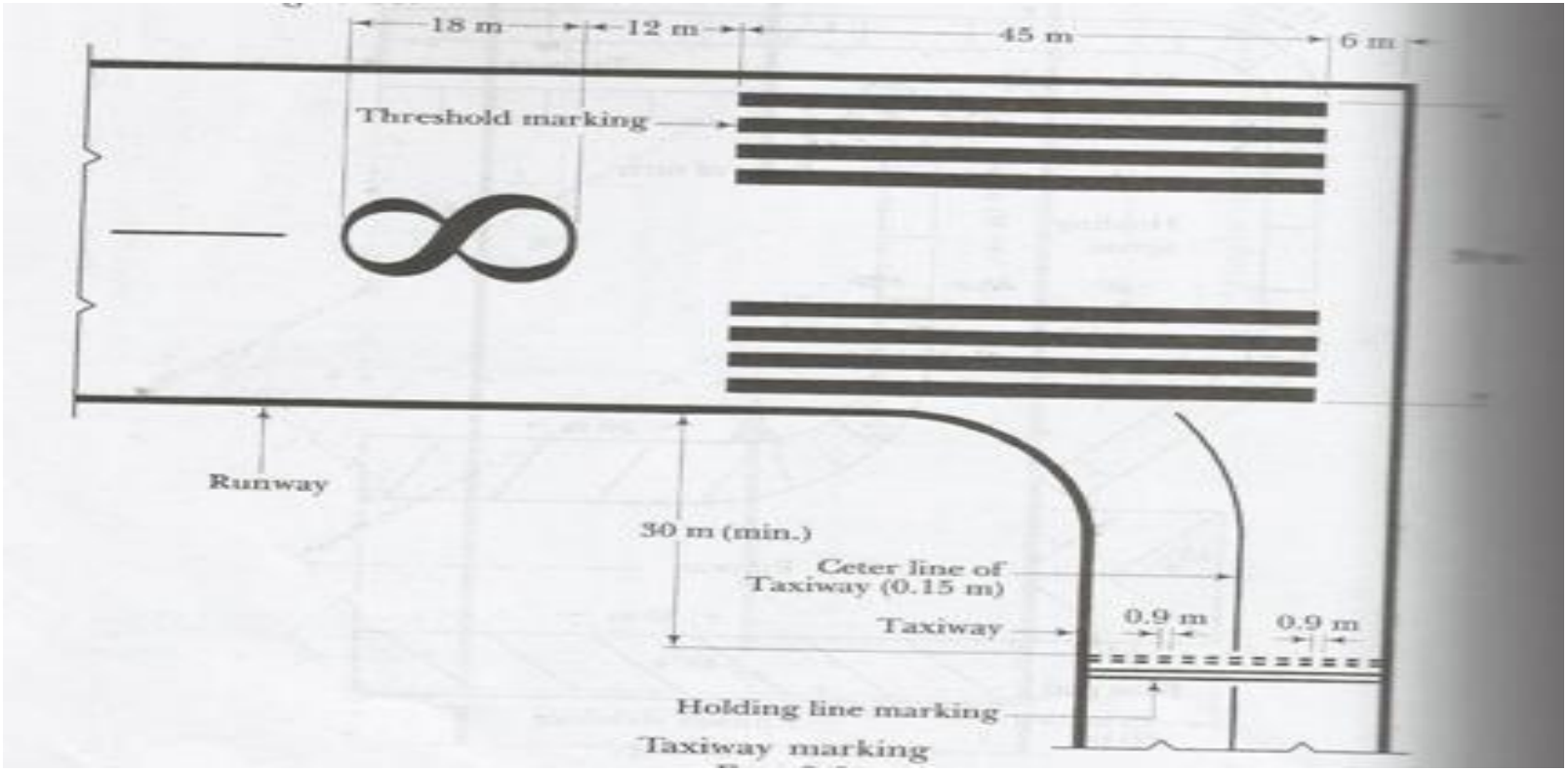
  Three parallel runways - L, C, R

Taxiway Marking

- A single continuous 15 cm yellow stripe is used to mark the centre line of the taxiway.
- At the intersections of the taxiways with the runway ends, the centre line of the taxiway is terminated at the edge of the runway.
- All other intersections of the taxiways with runways, the centre line of the taxiway is extended to the centre line of the runway.
- A holding line marking is painted at all the intersections of the paved taxiways with runways.
- At the taxiway intersection, the centre line markings of the taxiway continue through the intersection area.

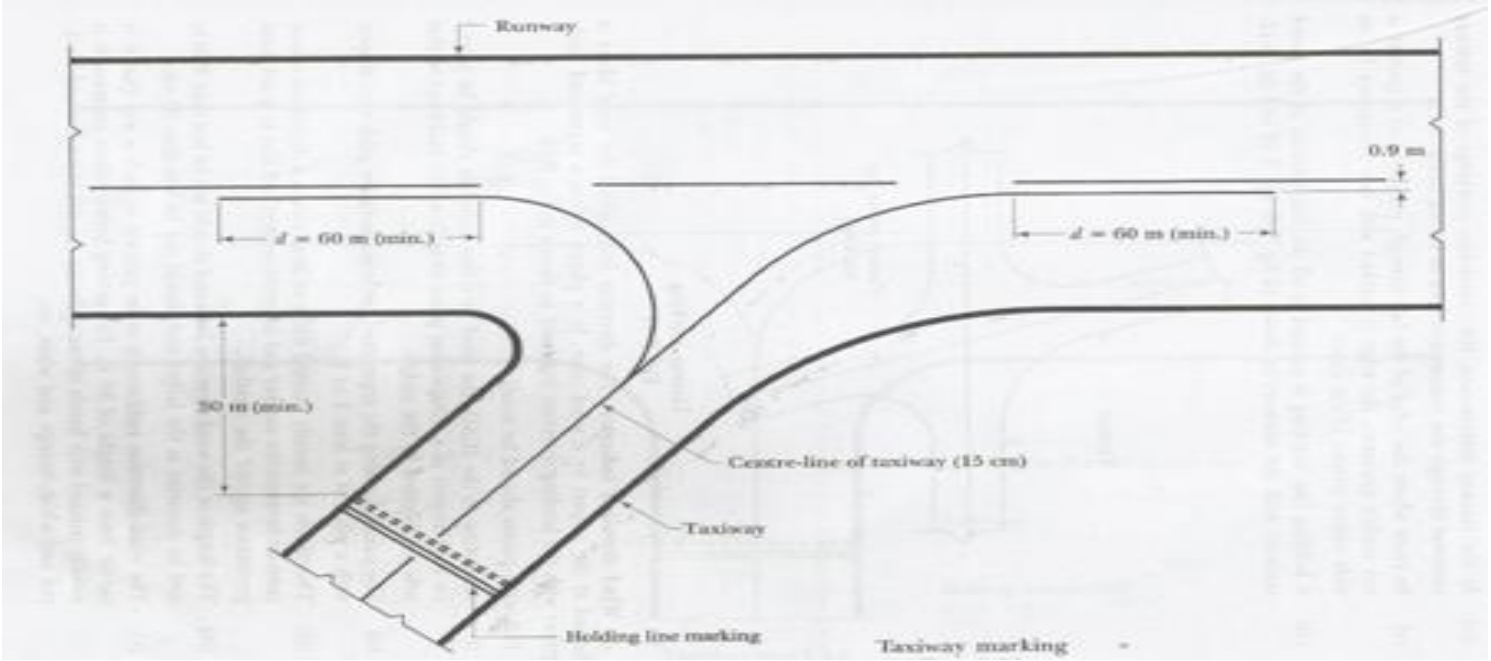
Taxiway Marking

- At the intersections of the taxiways with the runway ends, the centre line of the taxiway is terminated at the edge of the runway.



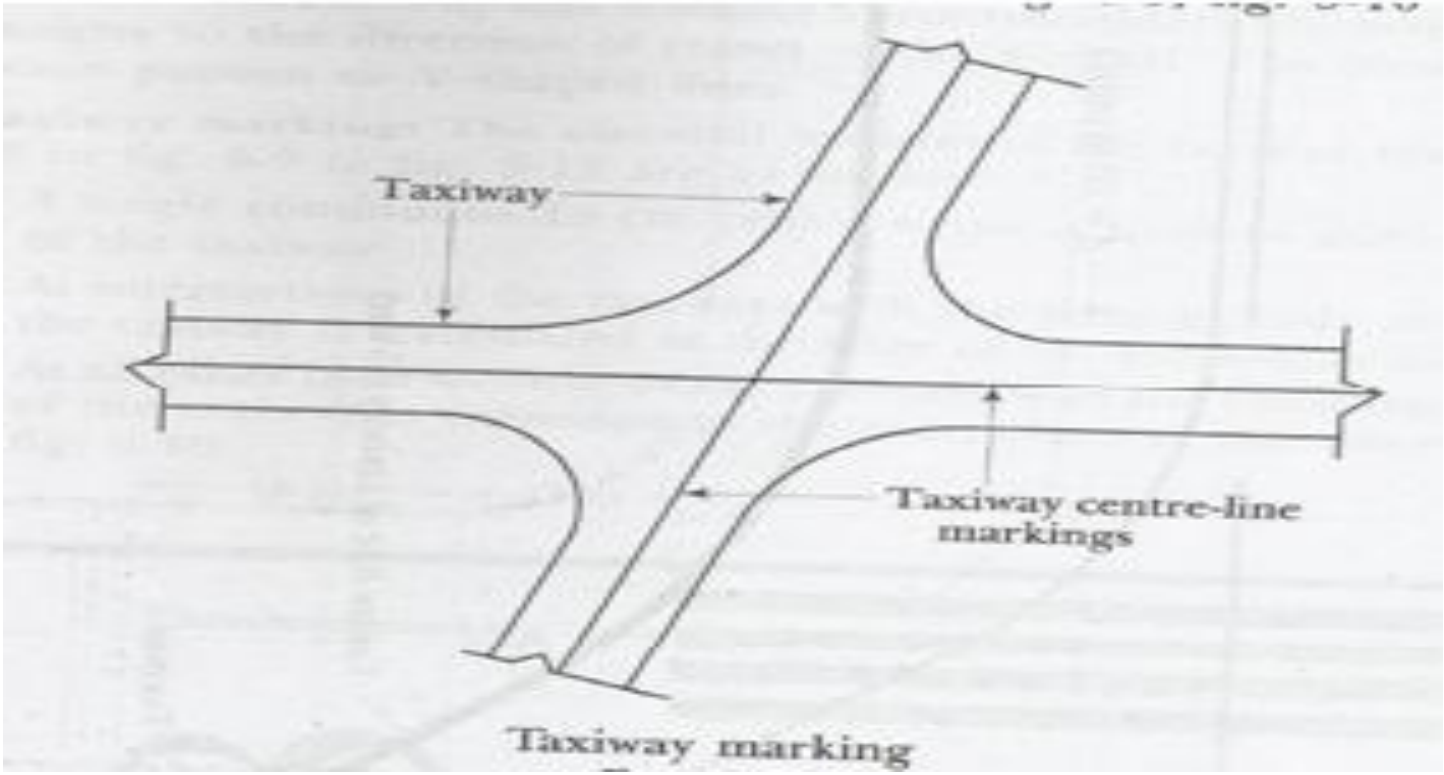
Taxiway Marking

- All other intersections of the taxiways with runways, the centre line of the taxiway is extended to the centre line of the runway.
- A holding line marking is painted at all the intersections of the paved taxiways with runways.



Taxiway Marking

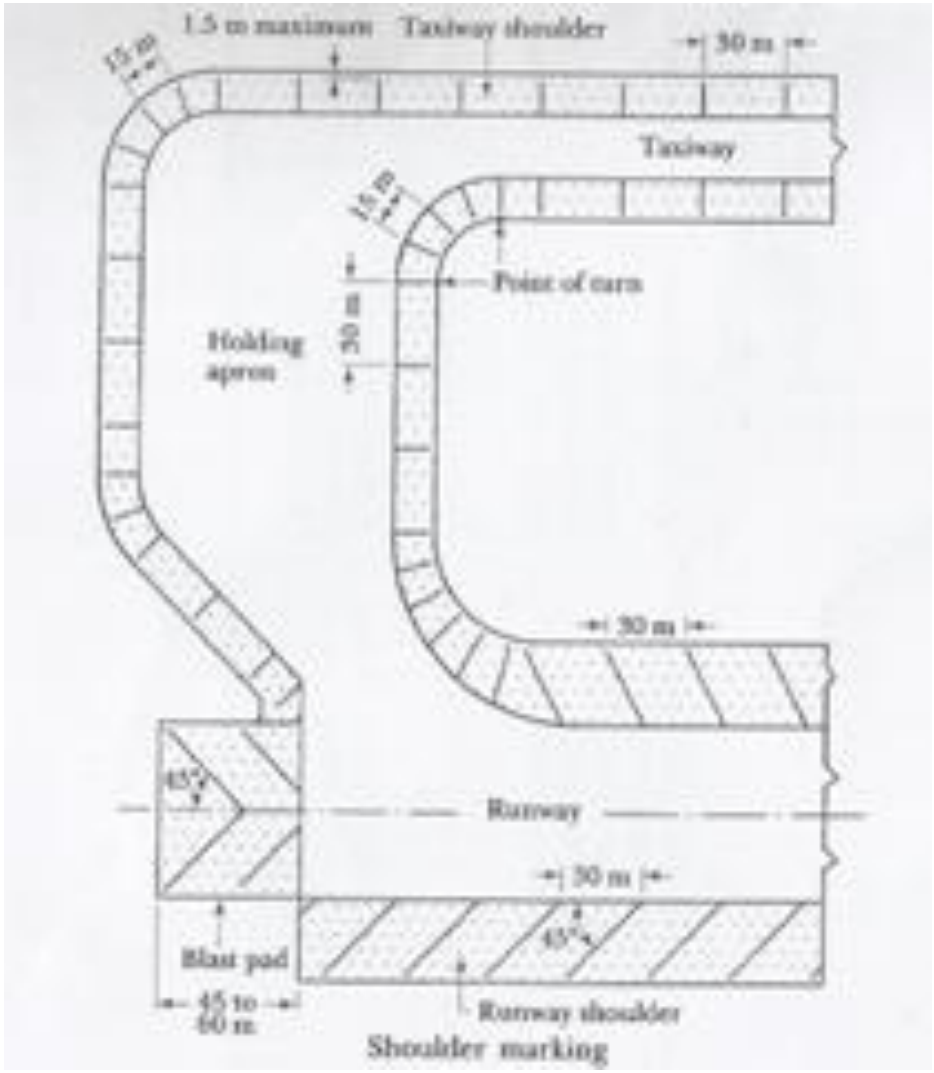
- At the taxiway intersection, the centre line markings of the taxiway continue through the intersection area.



Shoulder Marking

- The shoulders on the edges of a runway and taxiway are paved but they are not capable of withstanding loads
- A paved blast pad about 45 m to 60 m in length is provided adjacent to the runway end to prevent erosion of the soil.
- The paved area of the blast pad is not designed to support the aircraft loads , but it may have the appearance of being so designed.
- The paint used is yellow.
- Runway shoulders are marked with diagnol stripes each having a width of 90 cm.
- The taxiway and holding apron shoulders are marked with stripes at right angles to the direction of travel of aircraft.
- The blast pad is marked with V shaped or chevron pattern marks.

Shoulder Marking

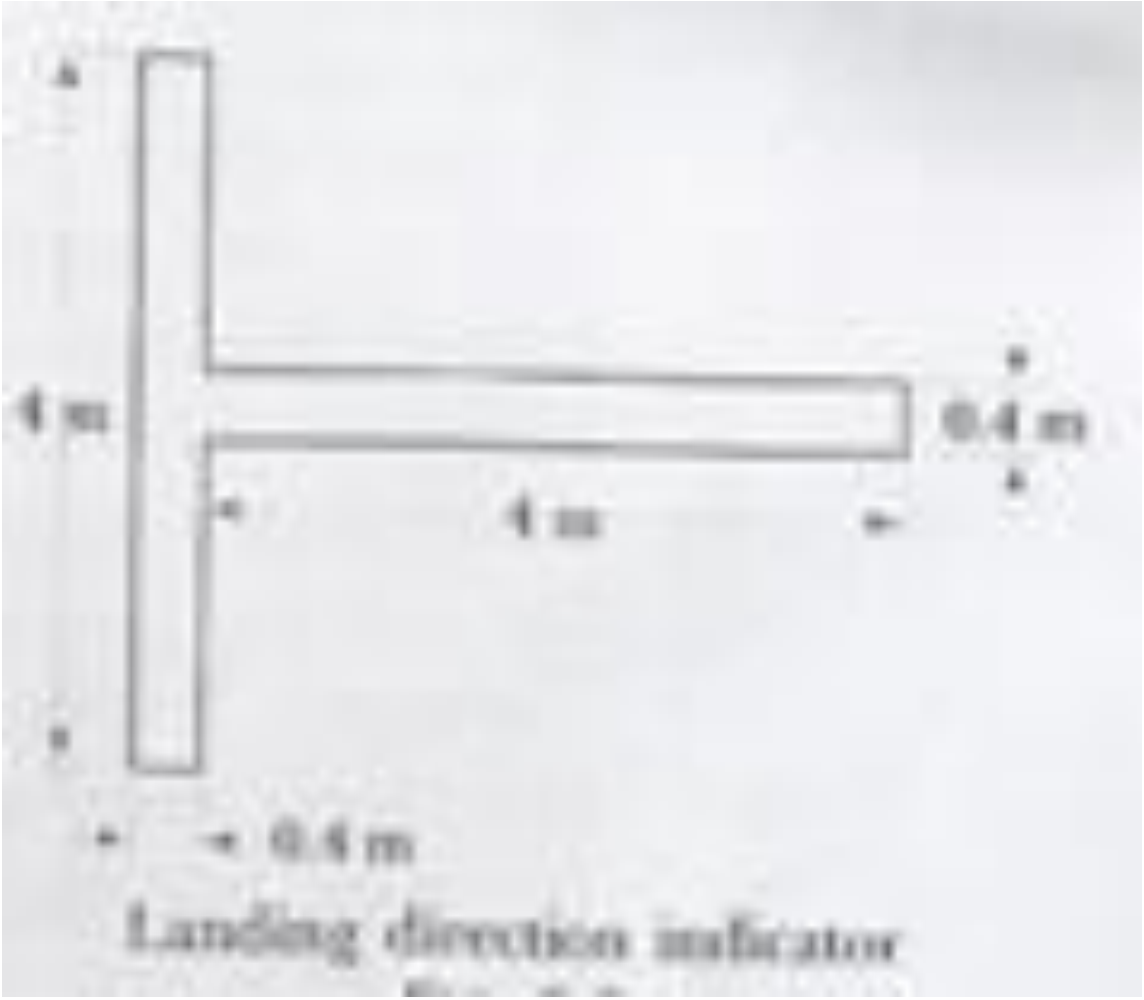


Shoulder marking

Landing Direction Indicator

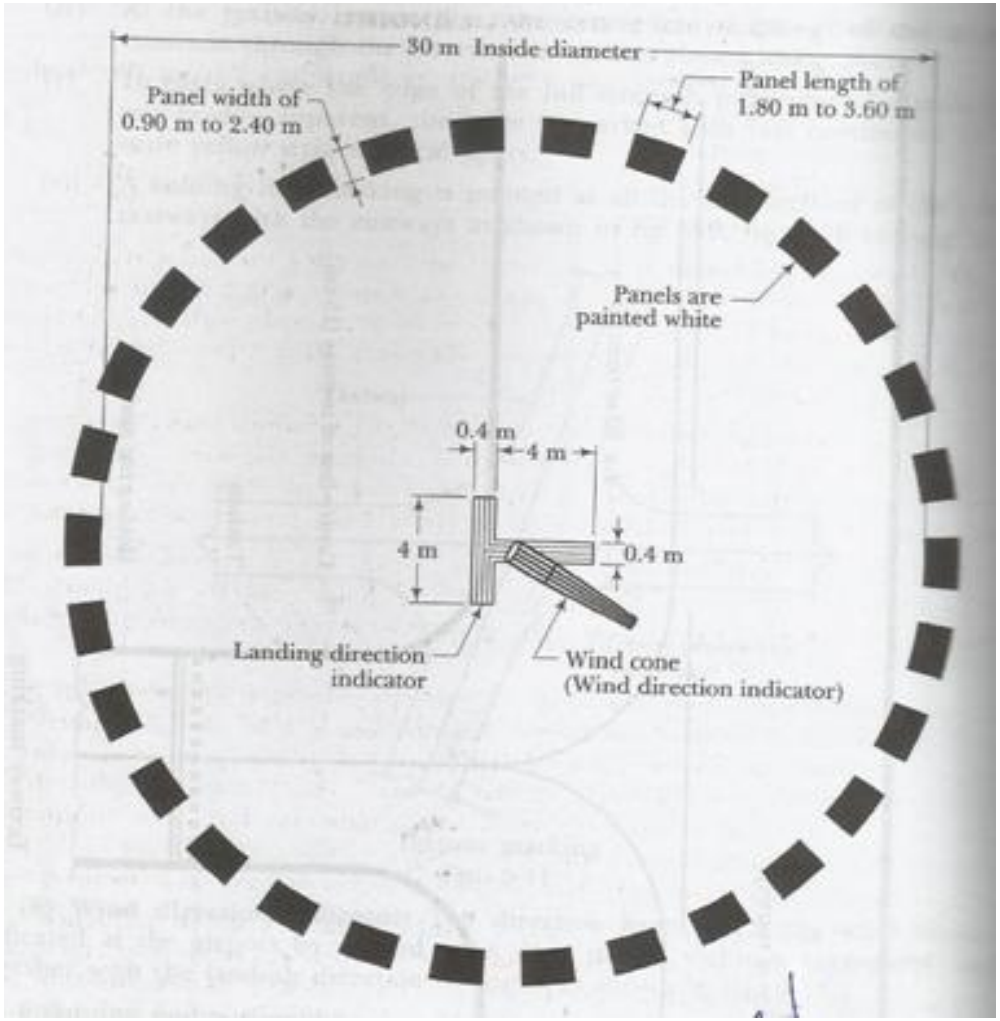
- To indicate the landing direction, an arrow or a tee is placed at the centre of a segmented circle.
- It indicates to the pilot the direction of the active runway of the airport.
- It is painted by orange or white color for being spotted with during day time and is lighted during night time.
- It is fixed at a distinct place.

Landing Direction Indicator



Landing direction indicator

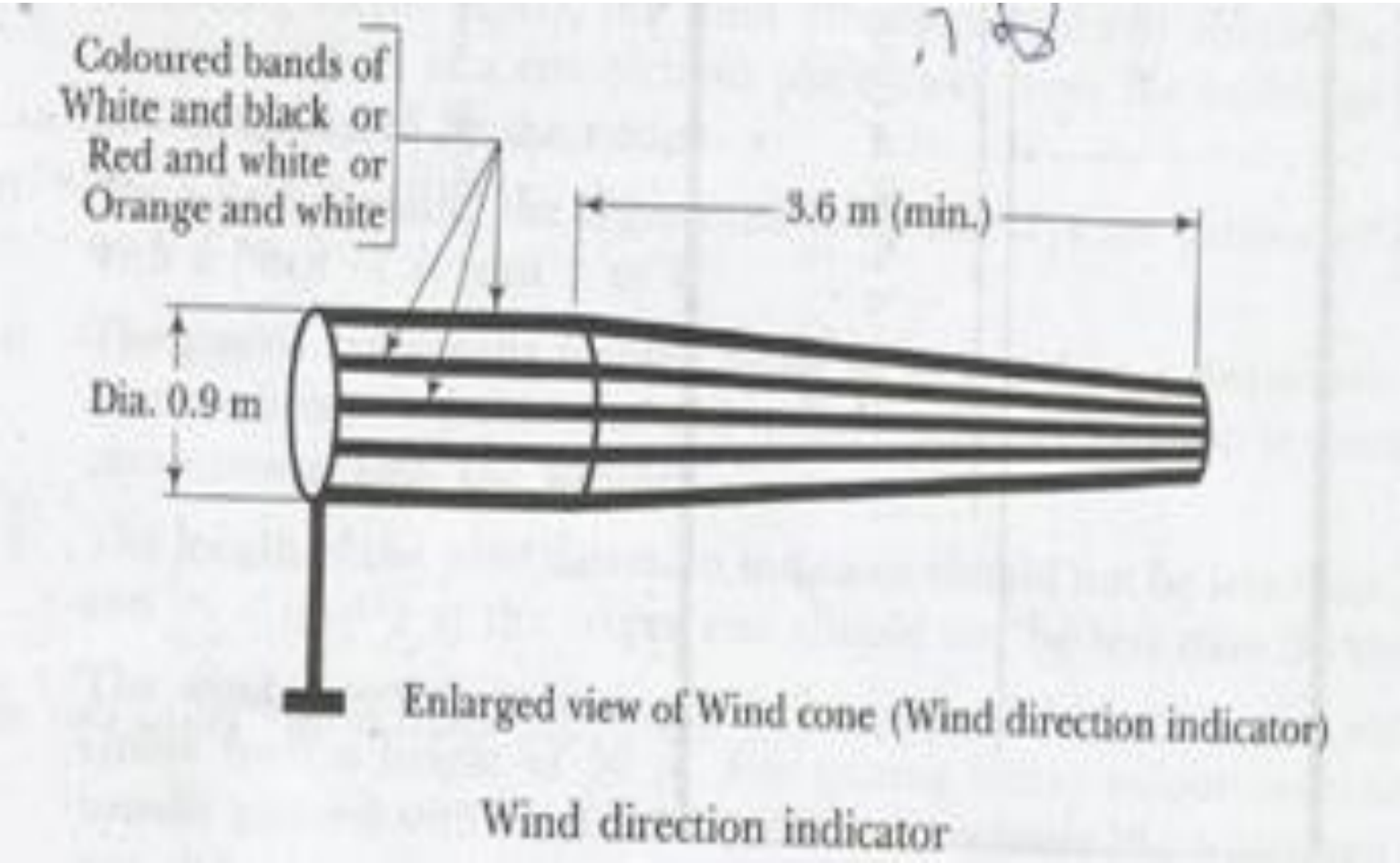
Landing Direction Indicator along with Wind Direction Indicator



Wind Direction Indicator

- The direction from which the wind blows is indicated at the airport by a wind cone.
- It is placed with in a segmented circle together with landing direction indicator.
- Wind cone length should not be less than 3.6m and its diameter should not be less than 90 cm.

Wind Direction Indicator



Airport Lighting

- It is essential to provide adequate lighting in the airport during night for clear visibility of centre lines, edges and thresholds of runways, taxiways, aprons and hangars etc.

- In order to achieve uniformity and to guide the pilots for using the airport for which he may not be familiar, the colors and general arrangement of the airport lights for all civil airports have been standardized.
- Some of the major airports may contain nearly 30000 lights.
- The bulbs should be checked regularly and the faulty bulbs are to be replaced immediately.

Factors Affecting Airport Lighting

The various factors affecting airport lighting are given below.

1. Airport Classification
2. Amount of Traffic
3. Availability of Power
4. Nature of aircraft using the airport
5. Type of Night Operations Planned
6. Type of Landing Surfaces Provided
7. Weather Conditions etc.

Airport Lighting

There are 9 elements of Airport Lighting.

1. Airport Beacon
2. Boundary Lighting
3. Approach Lighting
4. Threshold Lighting
5. Runway Lighting
6. Taxiway Lighting
7. Apron and Hangar Lighting
8. Lighting of Landing Direction Indicator
9. Lighting of Wind Direction Indicator

Airport Beacon

- A Beacon is a strong beam of light which is used to indicate any geographical location.
- The rotating airport beacon gives out white and green flashes in the horizontal direction 180^{o} apart.
- It rotates at 6 revolutions per minute and is usually mounted over the top of terminal building or hangar.

Boundary Lighting

- The entire boundary of the airfield is provided with lights at a centre to centre distance of about 90 m with a height of about 75 cm form the ground.
- When fence is provided, they can be placed at 3 m distance.
- To indicate hazardous approach, they are normally in red color.

Approach Lighting

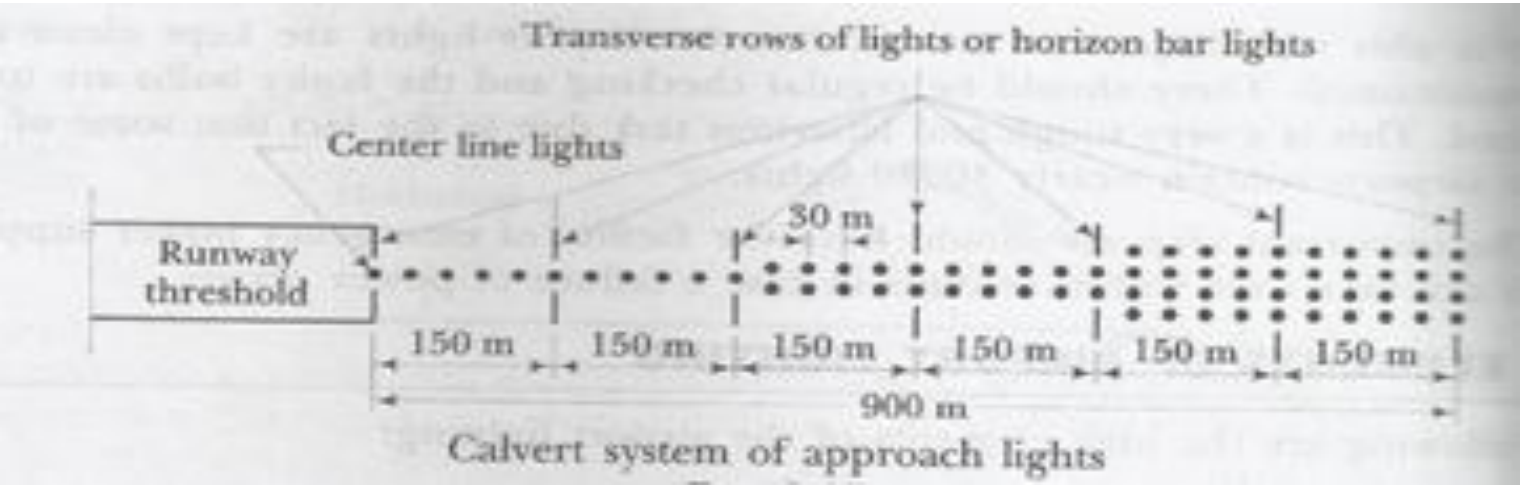
- Before the runway actually begins, there is a sequence of high-intensity lighting arrangement for a length of 900 m.
- These lights then give way to touch down zone lights from the threshold lighting.

- There are two types of arrangements for approach lighting

1. Culvert system - widely used in Europe
2. ICAO system - widely used in US

Culvert System of Runway Approach Lighting

- In culvert system, the approach lights are provided along the centre line for a length of 900 m from the threshold.
- The number of rows of lights will be decreasing in the direction of landing as shown in figure.
- **Number of transverse bars:** There are 6 transverse rows of lights of variable length placed at a centre to centre distance of 150 m.
- **Roll guidance:** The roll guidance is principally provided by the transverse rows of lights.



ICAO System of Runway Approach Lighting

1. Number of transverse crossbars:

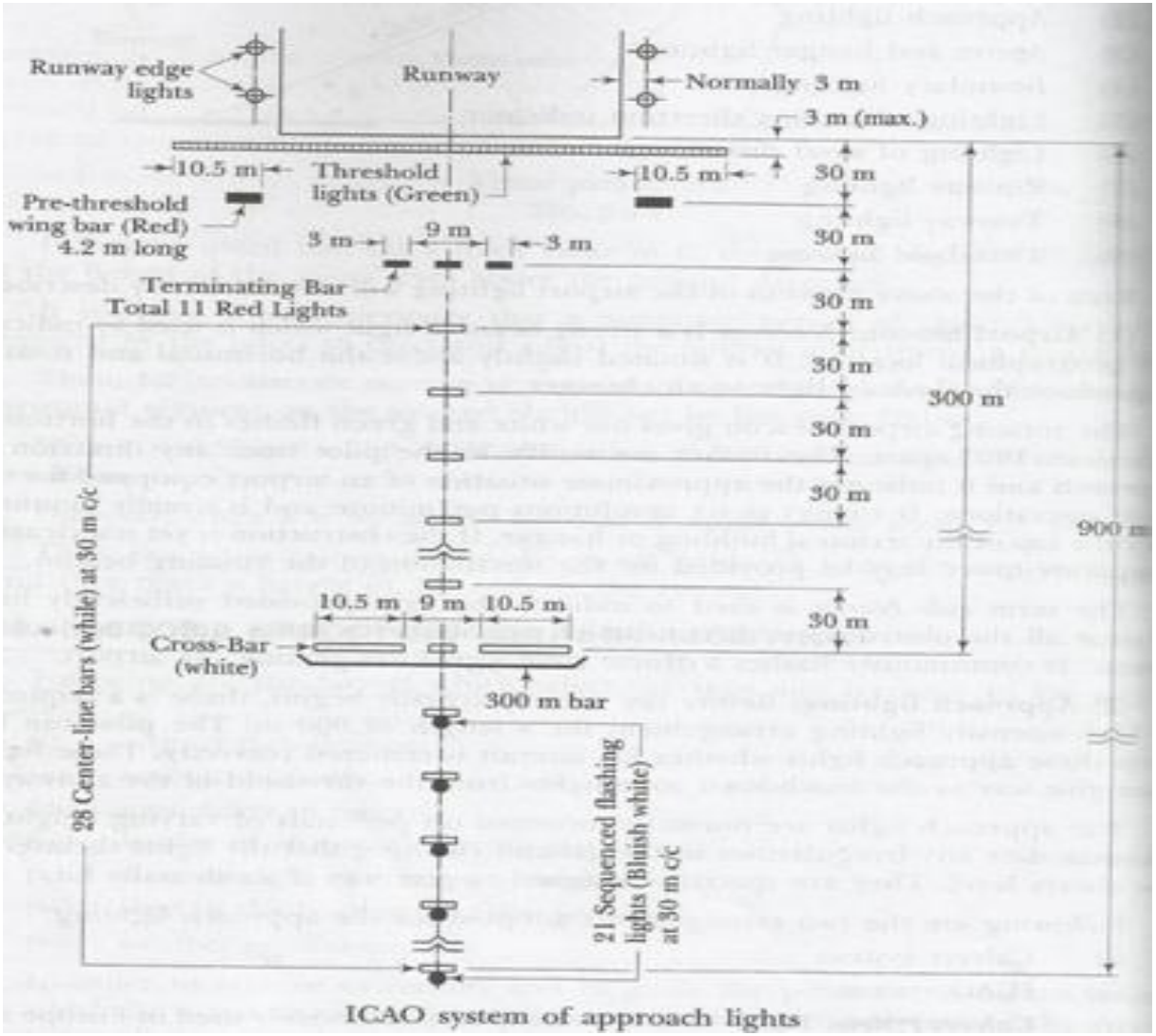
In ICAO system, there is only one crossbar 300 m from the threshold.

2. Roll Guidance:

In ICAO system, the roll guidance is provided by bars 4.2 m in length, placed at 30 m centre to centre on the extended centre-line of the runway and a single crossbar 300 m from the threshold.

The 4.2 m long bars consist of five closely spaced lights to give the effect of a continuous bar of light.

ICAO System of Runway Approach Lighting



ICAO system of approach lights

Threshold Lighting

- The identification of runway threshold is a major factor for the decision of the pilot to land or not to land.
- For this reason, the region near the threshold is given special lighting treatment.
- At large airports, the threshold is identified by a complete line of green lights extending across the entire width of the runway.
- The threshold lights in the direction of landing are green and in the opposite direction, they are red to indicate the end of runway.
- They must be of semi-flash type i.e. protruding not more than 12 cm above the surface.

Threshold lighting at Small Airports

- At small airports, the threshold is identified by 4 lights on each side of the threshold.
- They can be of elevated type i.e. protruding more than 12 cm above the surface

Runway Lighting

- After crossing the threshold, the pilot must complete a touch down and roll out on the runway.
- The planning of the runway lighting is carried out in such a way that the pilot gets enough information on alignment, lateral displacement, roll and distance.
- Earlier, night landings were made by flood-lighting the entire runway area.
- The more precise runway lighting arrangement which is now commonly used on all the major airports is known as the narrow gauge pattern.
- It makes use of the centre-line and touch down zone lights for operations in very poor visibility.

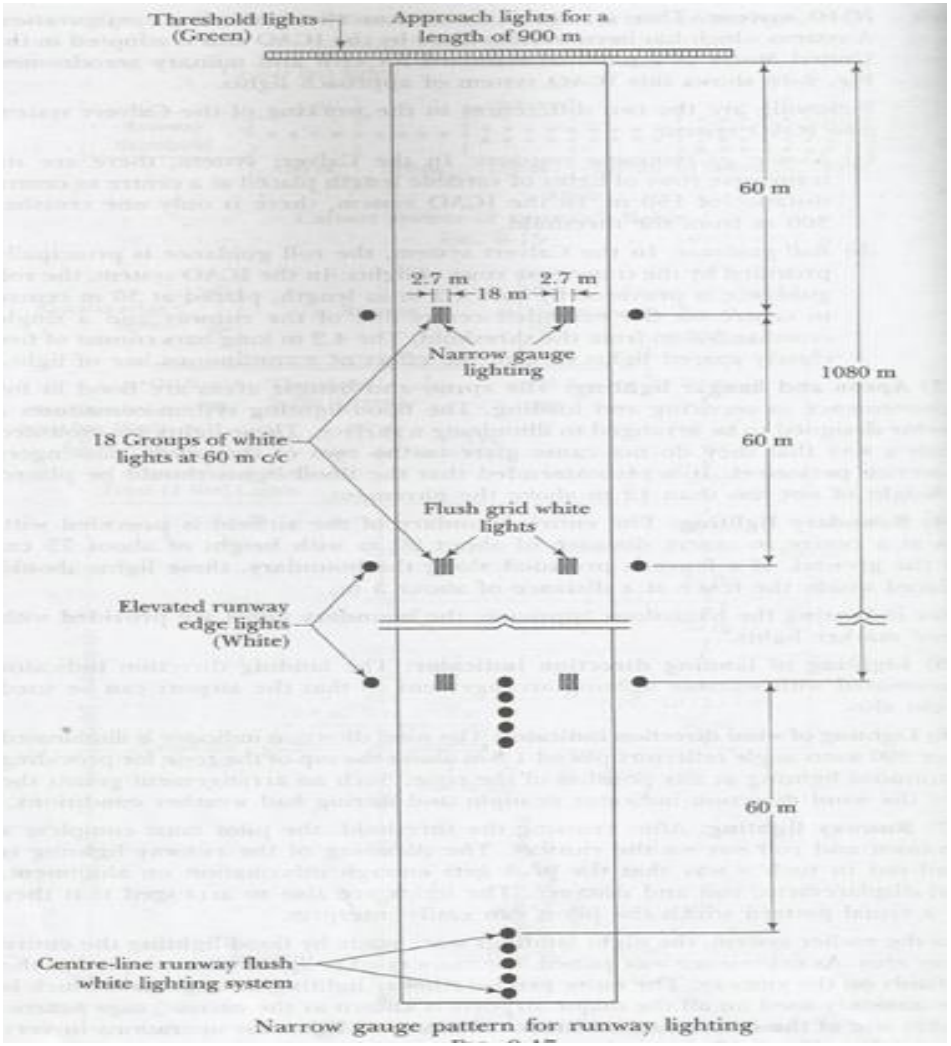
Black Hole Effect

- As the pilot crosses the threshold and continues to look along the centre-line, the principal source of guidance, namely, the edge lights have moved far to each side in their peripheral vision.
- As a result, the central area appears excessively black and the pilot is virtually flying blind except for the peripheral reference information.
- This is known as "black hole effect".

Narrow gauge pattern for runway lighting

- To eliminate the black hole effect by increasing the intensity of edge lights was proved ineffective.
- Therefore, the narrow gauge pattern of runway lighting is introduced in which the central portion gets illuminated and the black hole effect is partly illuminated.
- The narrow gauge pattern forms a channel of light 18 m width up to 1140 m from the threshold and beyond this distance, the closely spaced lights are placed along the centre-line of the runway extending up to the other end of the runway.
- All the lights provided on the runway are white in color and of flush type. (i.e. they do not protrude more than 1 cm above the surface of the pavement)
- The runway edge lights are of elevated type and they are white in color except for the last 600 m of an instrument runway facing the pilot which are of yellow color to indicate a caution zone.

Narrow gauge pattern for Runway Lighting

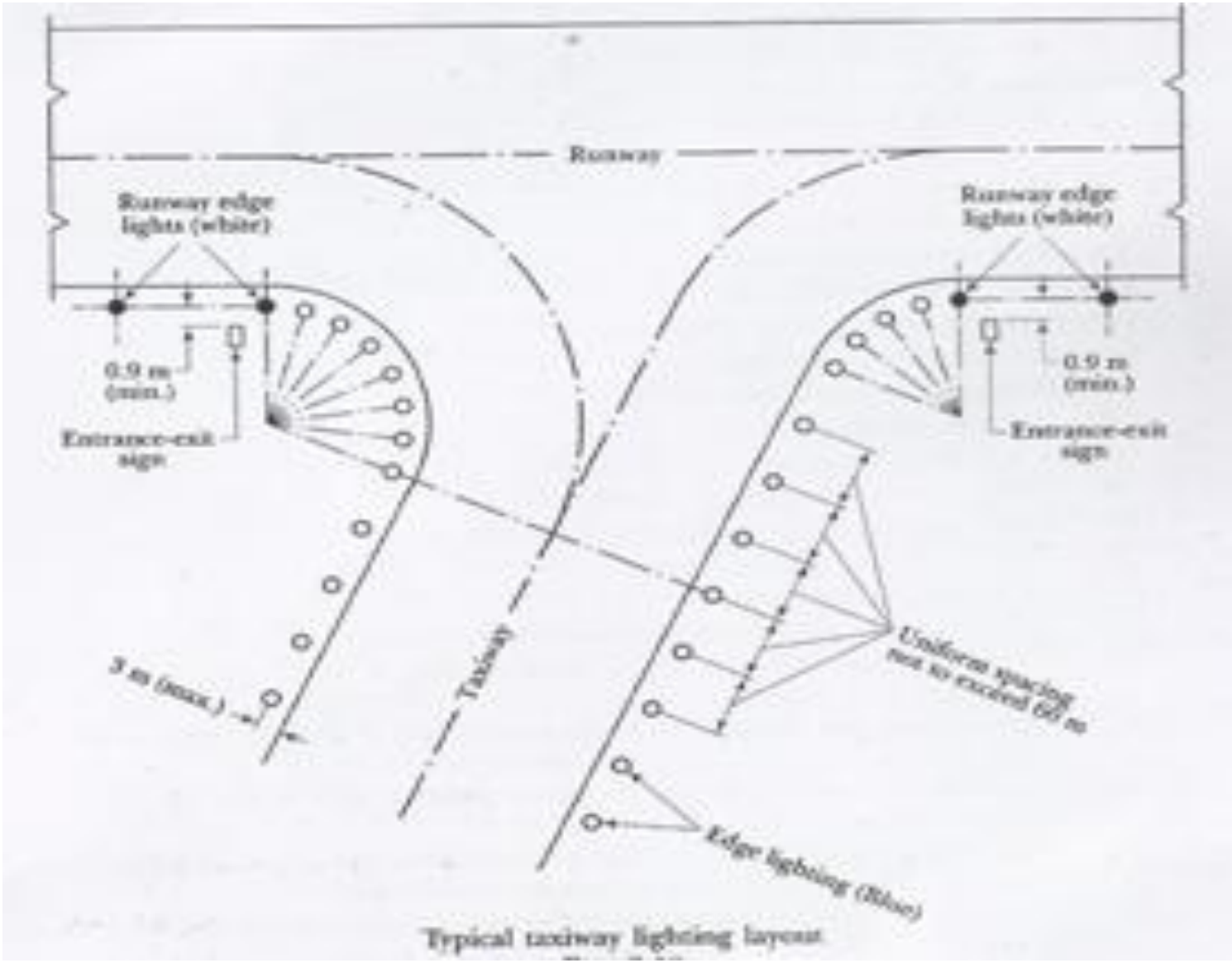


Narrow gauge pattern for runway lighting

Taxiway Lighting

1. For normal exits, the centre line lights are terminated at the edge of the runway.
2. At taxiway configurations, the lights continue across the intersections.
3. They are placed at a distance of 6 m to 7.5 m along the straight length and 3 m to 3.6 m along the curves.
4. The edge lights should not extend more than 75 cm above the pavement surface.
5. The exits from the runways should be so lighted that the pilots are able to locate the exits 360 m to 400 m ahead of the point of turn.
6. The taxiway edge lights are blue and the taxiway centre-line lights are green.

Taxiway Lighting



Typical taxiway lighting layout

Apron and Hangar Lighting

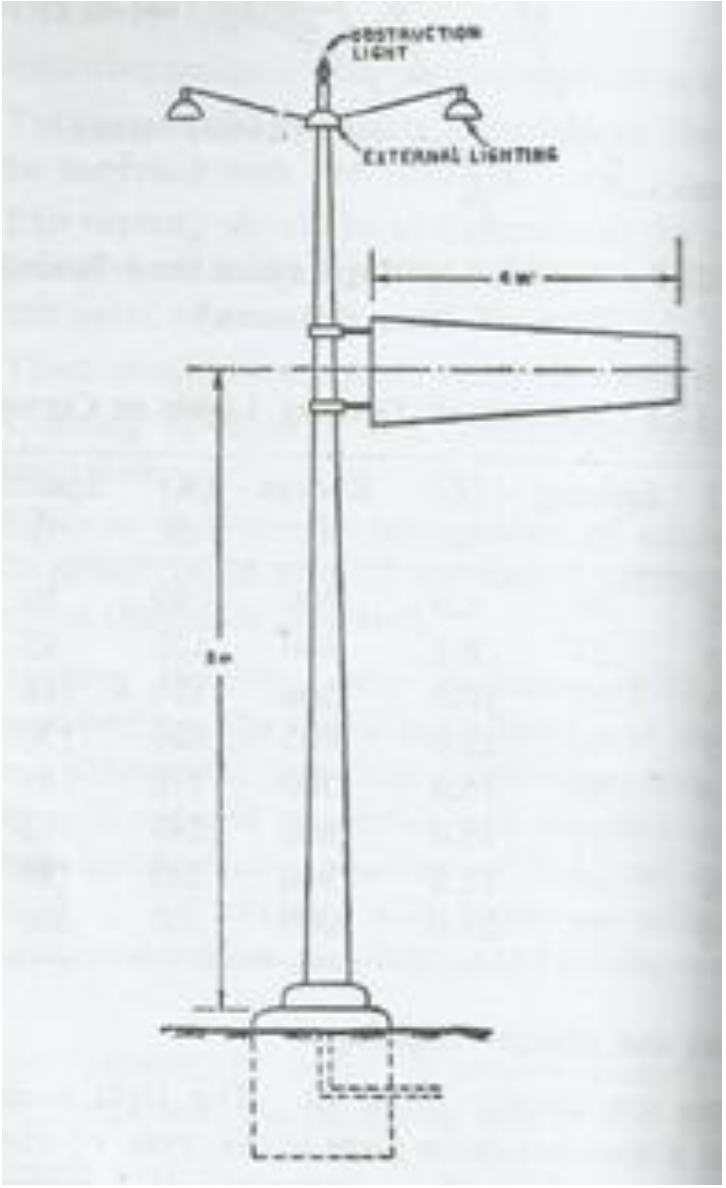
- Apron and Hangars are provided with flood lighting system in order to facilitate servicing loading and unloading.
- The light source is so mounted that it does not cause glare in the eyes of the pilots, the service personnel or the passengers.
- It is recommended that flood lights should be mounted at least 12 m (40 ft) above the pavement.

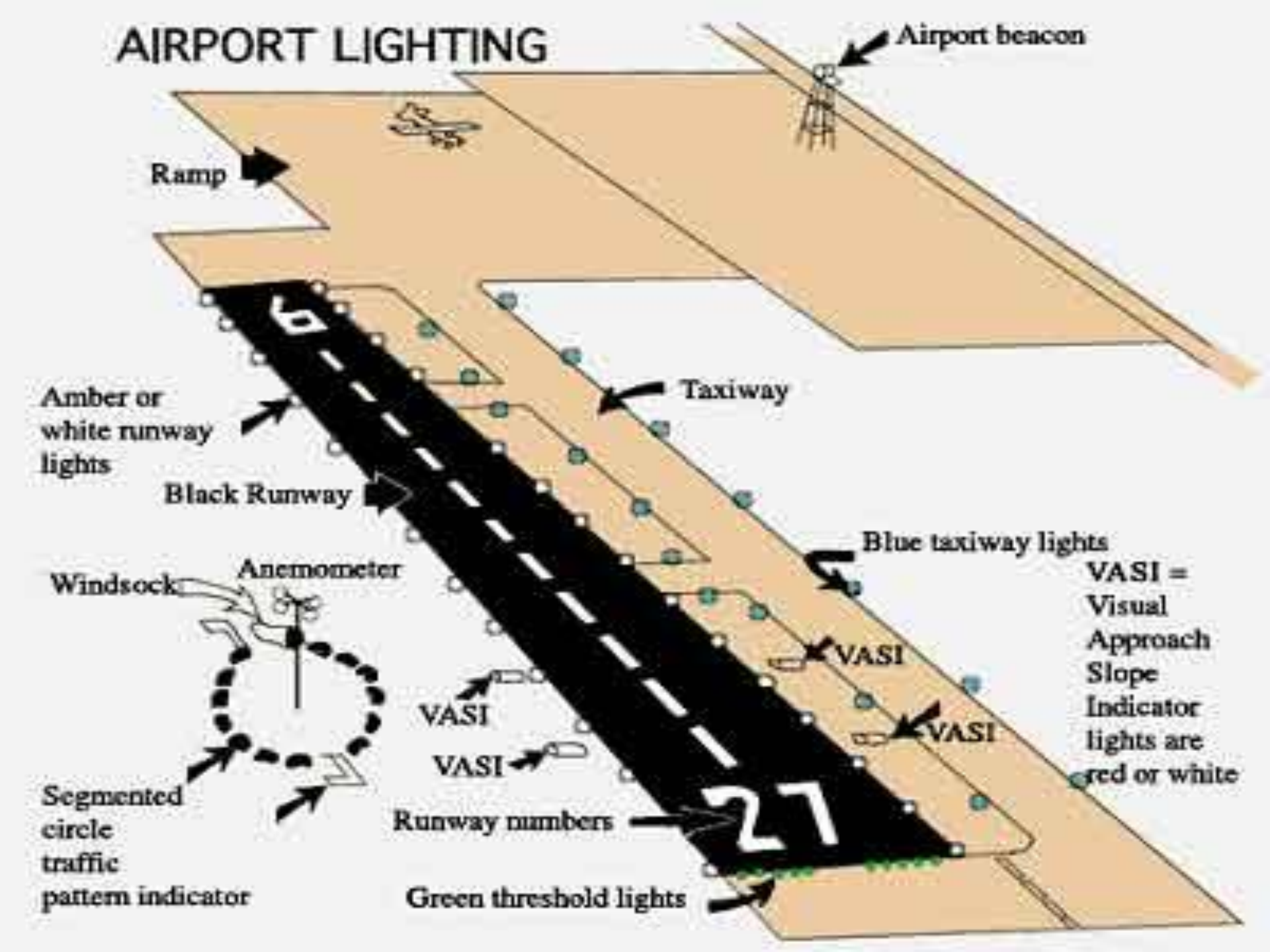
Lighting of Landing Direction Indicator

- The landing direction indicator usually a tee or arrow is illuminated with suitable lighting arrangement so that it is visible to the pilot during night also.

Lighting of Wind Direction Indicator

- The wind direction indicator is illuminated by 4 x 200 watts angle reflectors placed 1.8 m above the top of the cone for providing a continuous lighting at any position of the cone, so that it can be used during night or bad weather condition.




AIRPORT LIGHTING
Airport beacon
Ramp
Taxiway
Amber or white runway lights
Black Runway
Blue taxiway lights
Windsock
Anemometer
VASI = Visual Approach Slope Indicator lights are red or white
VASI
VASI
VASI
VASI
Segmented circle traffic pattern indicator
Runway numbers
Green threshold lights
27

Air Safety

- Every day, morethan1000 flights take to the sky and land without incident.
- But some times accidents may also occur as was happened in the case of previous years.
- International Air Transport Association has established a safety group (SG) and Operations Committee (OPC) in close cooperation with the member airlines and Strategic Partners in 2013.
- This group has formulated a Six Point Safety Strategy as a comprehensive approach to identify organizational, operational and emerging safety issues.
- The Strategy focuses in six key areas.

Air Safety & Regulation issues

- The IATA Safety group 6 point safety strategy includes:

1. Reduce Operational Risk

The area of reducing operational risks comprises safety issues related to:

1. Runway Safety (Debris on runway eg. Hail or dust)
2. Misleading information (misinformed printed doc)
3. Faulty instrument
4. Ice & Snow
5. Engine failure
6. Structural failure due to metal fatigue
7. Bird Strike
8. Volcanic ash
9. Pilot error
10. Resource Mismanagement

Air Safety

11. Improper communication
12. Electromagnetic Influence
13. Loss of Control In-flight
14. Controlled Flight Into Terrain
15. Collisions
16. Software programming problem
17. Virus Problem

Safety and Regulation Issues

2. Enhance Quality and Compliance

3. Advocate for Improved Aviation Infrastructure

- Phasing out NDB/VOR approaches and accelerating the implementation of **approaches with vertical guidance** (APV)
- Airport (runway & ramp infrastructure)
- Air Navigation harmonization and standardization

4. Support Consistent Implementation of Safety Management System

- implementing the Safety Management System (SMS)
- Safety performance monitoring
- Analysis and dissemination of information
- Safety promotion and facilitation

Safety and Regulation Issues

5. Support Effective Recruitment and Training

- Air Traffic Control (ATC)
- Next Generation of Aviation Professionals (N G A P)
- Ground Handling Agents (GHA)
- The IATA Training and Qualification Initiative (ITQI) should modernize and harmonize the training of existing and future generations of pilots and maintenance technicians.

Air Safety & Regulation Issues

6. Identify and Address Emerging Safety Issues

- Identifying and addressing safety issues related to:
- Restrictions on transportation of Lithium Batteries
- Safe Integration of Remotely Piloted Aircraft Systems (RPAS)
- GNSS signal interference – GNSS jamming and Space weather – Global Navigation Satellite System is particularly prone to unintended and malicious Radio Frequency Interference (RFI) due to the extremely low power level of the signal
- Laser attacks - Pointing a laser at an aircraft can be hazardous to pilots and has resulted in arrests.

Other Regulation Issues

1. Lease procedures of airports
2. Restriction on ownership and control of airport infrastructures
3. Building control
4. Environmental Management Regulations
5. Economic Regulations

Legislation

1. Airports Act - 1996
2. Airports Regulations – 1997
3. Building controls Regulations – 1997
4. Environmental Protection Act – 1997
5. Protection of airspace - 1997
6. Sydney airport demand management act – 1997
7. Sydney airport demand management Regulations – 1997
8. Environment Protection & Biodiversity Conservation Act - 1999

Assignment - 2 Questions

Answer any two questions from each unit.

Unit V:

1. Describe the factors to be considered for the selection of site of an airport.
2. What are different airport configurations that exist at airports.
3. What are the factors influencing airport size

Unit VI:

1. What do you understand by airport terminal area? What are the facilities provided in the terminal area?
2. Explain the Passenger Terminal System
3. Explain the Apron – gate System

Assignment - 2 Questions

Answer any two questions from each unit.

Unit VII:

1. Discuss the principle of operation of Instrumental Landing System.
2. Explain how the airspace of an air craft is controlled.
3. Explain the different types of airways.

Unit VIII:

1. Explain briefly the various en-route aids used to control air traffic on air routes
2. Explain the various landing aids
3. Write notes on Air safety and Regulation issues

Assignment - 1 Questions

Answer any two questions from each unit.

Unit I:

1. Explain the history of air transportation system.
2. Briefly explain the air transport and national economy.
3. Explain the functions of DGCA and AAI

Unit II:

1. Explain the airports and airways.
2. Explain the airlines and air passengers
3. Write about the air passengers and operating environment

Assignment - 1 Questions

Unit III:

1. What are types of airport planning studies.
2. Explain forecasting in aviation and airport planning

Unit IV:

1. Discuss the Runway configurations.
2. Discuss the Taxiway configurations

Objective Type Questions

1. Chevron type of markings are used for

a) Runway b) Threshold c) Blast Pad d) None

2. The purpose of airport beacon is

a) Guide pilots about the airport location b) wind indicator c) both a and b d) none

3. The terminal radar control play a role in guiding the pilots in

a) Landing b) take off c) both a and b d) none

4. The type of terminal in which the passengers are transported to and from the building to the parked airplane is called

a) Pier b) Transporter c) Satellite d) None

5. The type of parking in which the loading of passengers can be done both from front and rear gate is

a) Nose-in parking b) Parallel parking c) Nose-out parking d) Angled nose-in parking

Answers : 1) c 2) a 3) c 4) b 5) b

Objective Type Questions

6. STOL indicates

a) Short Take off and Landing b) area of landing c) area of take off d) none

7. The air service which passes or crosses the air space of territory of more than one country is known as

a) Airlines b) national air service c) airway d) International air service

8. High altitude routes are called

a) Victor routes b) jet routes c) both a and b d) none

9. Low altitude routes are called

a) Victor routes b) jet routes c) both a and b d) none

10. The flight rule under which the pilot has to prepare a flight plan and take the prior approval of ARTC before flying is called

a) VFR b) IFR c) both a and b d) none

Answers: 6) a 7) d 8) b 9) a 10) b

Objective Type Questions

1. The number of aircraft movements which an airport can process or handle in one hour is called _____
2. _____ is an area which indicates a defined area of the airport to accommodate aircrafts for loading and unloading of passengers and cargo.
3. A defined path on a land aerodrome which is used for the movement of the aircraft to and from aprons to runway is called _____
4. A defined path in an airport where landing and take off operations take place is called _____
5. An area in an airport where the aircrafts are stored, repaired or maintained is called _____

Answers : 1) airport capacity 2) Apron 3) taxiway 4) runway 5) hangar

Objective Type Questions

1. AAI stands for _____
2. ICAO stands for _____
3. FAA stands for _____
4. DGCA stands for _____
5. ATCT stands for _____
6. ARTC stands for _____
7. VFR stands for _____
8. IFR stands for _____
9. VOR stands for _____
10. ILS stands for _____

Answers : 1) Airports Authority of India 2) International Civil Aviation Organization 3) Federal Aviation Administration 4) Director General of Civil Aviation 5) Air Traffic Control Tower 6) Air Route Traffic Control Centre 7) Visual Flight Rules 8) Instrumental Flight Rules 9) Very High Frequency Omni-directional Range 10) Instrument Landing System

Objective Type Questions

11. TACAN stands for _____
12. TRACON stands for _____
13. DME stands for _____
14. ADF stands for _____
15. RDF stands for _____
16. PAR stands for_____
17. GCA stand for _____
18. ASR stands for _____
19. ARSR stands for _____
20. ASDE stands for _____

Answers: 11) Tactical Air Navigation 12) Terminal Radar Control 13) Distance Measuring Equipment 14) Automatic Direction Finder 15) Radio Direction Finder 16) Precision Approach Radar 17) Ground Control Approach 18) Airport Surveillance Radar 19) Air Route Surveillance Radar 20) Airport Service Detection Equipment

Objective Type Questions

21. FSS stands for _____
22. ALS stands for _____
23. APV stands for _____
24. GNSS stands for _____
25. RFI stands for _____
26. RPAS stands for _____
27. LOCI stands for _____
28. CFIT stands for _____
29. GHA stands for _____
30. NGAP stands for _____

Answers: 21) Flight Service Station 22) Approach Lighting System 23) Approaches with Vertical Guidance 24) Global Navigation Satellite System 25) Radio Frequency Interference 26) Remotely Piloted Aircraft Systems 27) Loss of Control in Flight 28) Controlled Flight into Terrain 29) Ground Handling Agents 30) Next Generation of Aviation Professionals

References

1. Airport Engineering by Rangwala, Charotar Publishing House.

2. Airport Planning and Design by Khanna, Arora and Jain, Nemchand and Brothers

Thank You

Have a Good Luck.

Have a Good Day.