Airport planning and operation

IV B. Tech (JNTUH R-15)

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UNIT-I

INTRODUCTION

Private airports and public use airports.

- Airport planning is a systematic process used to establish guidelines for the efficient development of airports that is consistent with local, state & national goals. Key object of airport planning is to assure the effective use of airport resources in order to satisfy aviation demand in a financially feasible manner.

- National system planning.

- State airport system planning

- Metropolitan airport system planning

- Airport Master planning

PUBLIC & PRIVATE USE AIRPORT

- When we think of public airports, it is usually commercial service we think. However, Oregon's system of more than 100 public use airports includes a half dozen commercial service airports.

- All public categories for purpose of oregano aviation plan.

- Private air charter services, one advantage to use a private airport is the privacy factor. Travelling

- Details are kept confidentially including the destination, members of travelling parity & Potential return dates.

COMMERCIAL SERVICE AIRPORTS:

- There are publicly owned airports that have at least 2,500 passenger
- Boarding's each calendar year & receive schedule passenger service.
- Significant function is accommodate scheduled major/or national or regional/commercial air carrier service. And Is designated criteria is scheduled commercial service

GENERAL AVIATION AIRPORTS:

- Their significant function is accommodating corporate aviation activity, including business jets, helicopters and other general aviation activities.

- Their designated criteria is 30,000 or more annual operations, of which a minimum of 500 are business related aircraft. Business use heliports.

REGIONAL AIRPORTS:

- Accommodate a wide range of general aviation users for large service areas in outlying parts of Oregon. Many also accommodate seasonal regional fire response activities with large a/c.

- Designation criteria

- Generally less than 30,000 operations. Geographically significant location with multiple communities in the service area.

HUB CLASSIFICATION:

- Hub and spoke operations are typically achieved by consolidating originating and transfer passenger flows, which imply the existence of two dimensions of “hubbing” traffic generation & connectivity.

- **Hubs are classified as**:

1. Large Hubs
2. Medium Hubs
3. Small Hubs

LARGE HUBS

- **LARGE HUBS**:

  Large hubs are those airports that account for at least 1 percent of the total annual passenger enplanements in the United States. In 2002, there were 31 large hub airports in the NPIAS. These 31 large hub airports accounted for 70 percent of all passenger enplanements in the United States

SMALL HUBS

- Small hub airports are those that process between 0.05 percent and 0.25 percent of revenue passenger boardings annually, whether or not in scheduled service. The table below lists the airports in the United States that have been designated as small hubs.

- Small hubs are defined as those airports accommodating greater than 0.05 percent but less than 0.25 percent of annual U.S. enplanements. Seventy-four NPIAS airports were categorized as small hubs.

MEDIUM HUBS

- Medium hub airports are those that process between 0.25 percent and one percent of revenue passenger boarding's annually, whether or not in scheduled service. The table below lists the airports in the United States that have been designated as medium hubs. The table is sorted by 3-character Airport Code.

- Medium hubs are those airports that account for at least 0.25 percent but less than 1 percent of the total annual passenger enplanements. In 2002, there were 37 airports classified as medium hubs.

NON-HUBS

- Non-hubs are those airports that enplane at least 10,000 annual enplanements but less than 0.05 percent of the annual total U.S. enplanements. In 2002, 280 primary commercial service airports fell into the non-hub category.

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)

AIRPORT-AIRSIDE

- Chief—airside operations The chief—airside operations is responsible for all airfield operations. In this capacity, principal duties include:

1. Enforcing operating and security rules, regulations, and procedures concerning landing, taxiing, parking, servicing loading and unloading of aircraft, operation of vehicular traffic on the airfield, airline activities, and emergency situations.

2. Inspecting conditions of airfield lighting, runways, taxiways, and ramp areas.

3. Correcting hazardous conditions.

Coordinating airfield activities with maintenance and security Personnel.

1. Assisting in all airfield emergency calls and disasters by notifying control tower to close runways, directing maintenance personnel, directing security officers in crowd control, and overseeing other safety considerations and activities necessary to resume normal airport operations.

2. Investigating and reporting on complaints and disrupted airport operations, including unscheduled plane arrivals, aircraft accidents, rule and procedure violations, airline activities, and other operations of the airport.

3. Assigning gate and parking spaces to all aircraft.

4. Coordinating special arrangements for arrivals and departures of important persons. 39 Airports and airport systems: Organization and administration

5. Completing all report forms pertaining to operations activities on assigned shifts.

6. Assisting in directing noise level studies with other departmental personnel.

AIRPORT-LANDSIDE

1. The chief landside operations is responsible for all landside operations. In this capacity, principal duties include:
2. Enforcing operating and security rules, regulations, and procedures concerning buildings, access roads, and parking facilities.

1. Coordinating terminal building and other facility activities with maintenance and security personnel.
2. Coordinating all parking facility activities with tenants and transit companies.
3. Preparing personal injury and property damage reports and general incident reports.
4. Completing all report forms pertaining to operations activities on assigned shifts.

TYPES OF AIRPORTS

There are three types of Airports

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

INTERNATIONAL AIRPORTS

1. An international airport has direct service to many other airports.
2. Handle scheduled commercial airlines both for **passengers and cargo.**
3. Many international airports also serve as "HUBS", or places where non-direct flights may land and passengers switch planes.
4. Typically equipped with customs and immigration facilities to handle
   international flights to and from other countries.
5. Such airports are usually larger, and often feature longer runways and facilities to accommodate the large aircraft. (FBO, MRO etc..)

DOMESTIC AIRPORTS

1. A domestic airport is an airport which handles only domestic flights or flights within the same country.

2. Domestic airports don't have customs and immigration facilities and are therefore incapable of handling flights to or from a foreign airport.

3. These airports normally have short runways which are sufficient to handle short/medium haul aircraft.

REGIONAL AIRPORTS

1. A regional airport is an airport serving traffic within a relatively small or lightly populated geographical area.

2. A regional airport usually does not have customs and immigration facilities to process traffic between countries.

3. Aircraft using these airports tend to be small business jets or private aircraft (general aviation)

UNIT – II

AIRPORT PLANNING

AIRPORT SYSTEM PLANNING

- The passenger and cargo terminals have been described as interface points between the air and ground modes, the movement of passengers, baggage, and cargo through the terminals and the turnaround of the aircraft on the apron are achieved with the help of those involved in the ground handling activities at the airport (IATA 2012). These activities are carried out by some mix of the airport authority, the airlines, and special handling agencies depending on the size of the airport and the operational philosophy adopted by the airport operating authority. For convenience of discussion, ground handling procedures can be classified as either terminal or airside operations.

Passenger Handling

- Passenger handling in the terminal is almost universally entirely an airline function or the function of a handling agent operating on behalf of the airline. In most countries of the world, certainly at the major air transport hubs, the airlines are in mutual competition. Especially in the terminal area, the airlines wish to project a corporate image, and passenger contact is almost entirely with the airline, with the obvious exceptions of the governmental controls of health, customs, and immigration

TYPES OF AIRPORT PLANNING STUDIES

2. **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 and facilities, parking lots, ground access infrastructure, and support facilities such as fuel farms, power plants, and non-aeronautical land uses such as office parks, hotels, restaurants, or rental car locations.
3. **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.
4. **Economic planning**, which considers the future of economic activity, such as trade and commerce, and the activity of industries that exist on airport and off-airport property and are either a direct or indirect result of airport operations.

TYPES OF AIRPORT PLANNING STUDIES

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

6. **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

7. **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. In this connection, the following three studies are made to assist the project authorities in planning the airports.

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

IMPORTANT COMPONENTS OF AN AIRPORT

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

Fig. 1 examples of runways

TERMINAL BUILDINGS

1. Also known as airport terminal, these buildings are the spaces where passengers board or alight from flights. These buildings house all the necessary facilities for 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.

2. Ticket counters, luggage check-in or transfer, security checks and customs are the basics of all airport terminals. Large airports can have more than one terminal that are connected to one another through link ways such as walkways, sky-bridges. Smaller airports usually have only one terminal that houses all the required facilities.

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.`

•Although the use of the apron is covered by regulations, such as lighting on vehicles, it is typically more accessible to users than the the runway or taxi way. However, the apron is not usually open to the general public and a license may be required to gain access.

TAXIWAY

They mostly have hard surface such as asphalt or concrete, although smaller airports sometimes use gravel or grass.

TAXIWAY

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**.**

Hangar

AIR TRAFFIC CONTROL TOWER

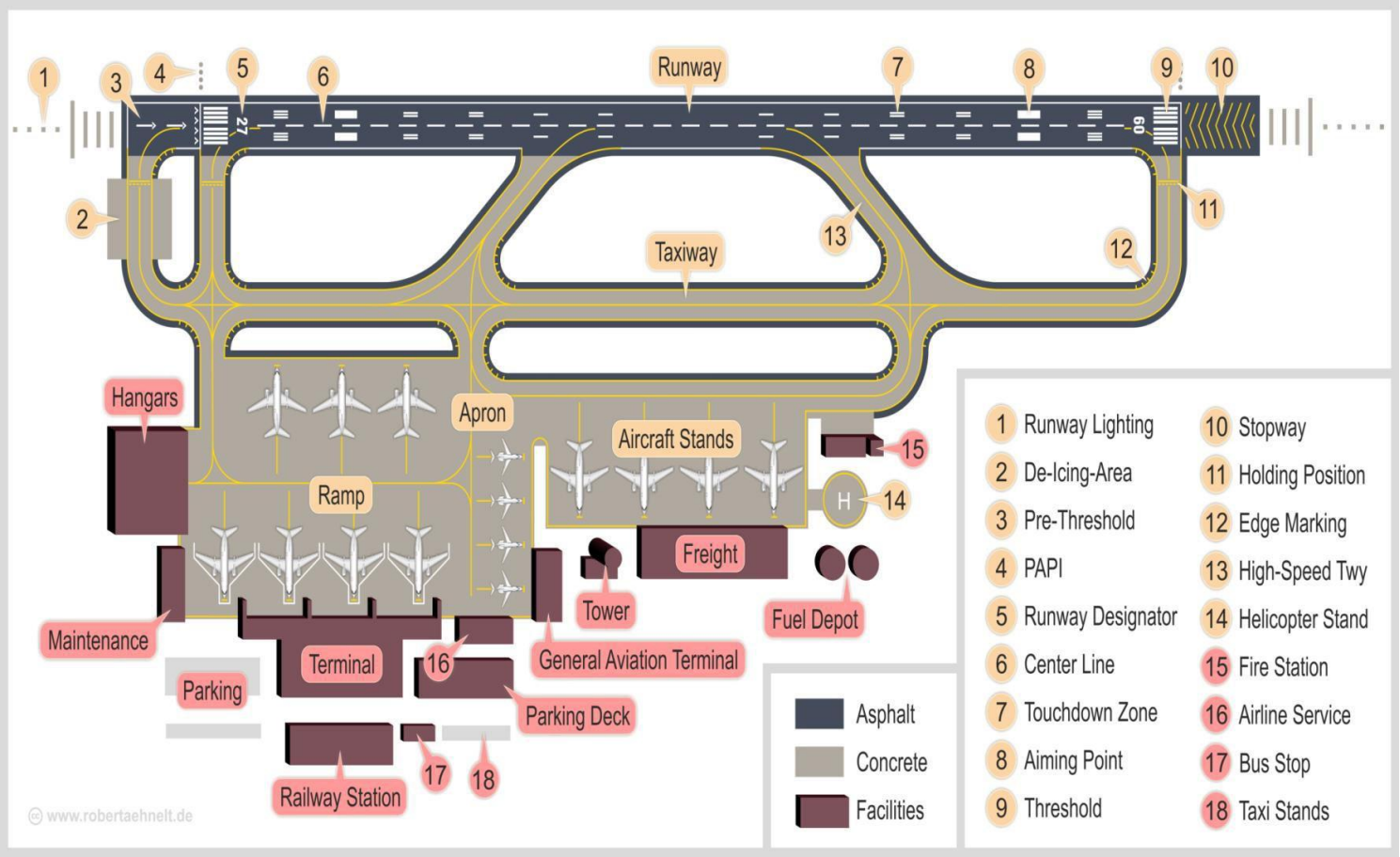
A tower at an airfield from which air traffic is controlled by radio and observed physically and by radar.

PARKING

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

parking

TYPICAL LAYOUT OF AN AIRPORT



Layout of an aiport

UNIT – III

GROUND HANDLING AND BAGGAGE HANDLING

Passenger handling

- Passenger handling in the terminal is almost universally entirely an airline function or the function of a handling agent operating on behalf of the airline.
- In most countries of the world, certainly at the major air transport hubs, the airlines are in mutual competition.
- Especially in the terminal area, the airlines wish to project a corporate image, and passenger contact is almost entirely with the airline, with the obvious exceptions of the governmental controls of health, customs, and immigration. Airline influence is perhaps seen at its

Ramp handling

- During the period that an aircraft is on the ground, either in transit or on turnaround, the apron is a center of considerable activity (IATA 2004).

- Some overall supervision of activities is required (ICAO 2010) to ensure that there is sufficient coordination of operations to avoid unnecessary ramp delays. This is normally carried out by a ramp coordinator or dispatcher who monitors departure control.

Runway Configurations

- Many runway configurations are existing.

Most of them are combinations of the following basic configurations:

1. Single runway
2. Parallel Runways

   Two parallel runways

   Two parallel runways with staggered thresholds

   Four parallel runways
3. Open-V Runways
4. Intersecting runways

Aircraft Ramp Servicing

- Most arriving or departing aircraft require some ramp services, a number of which are the responsibility of the airline station engineer. When extensive servicing is re

Ramp

Ramp layout

1. During the design phase of a commercial air transport aircraft, considerable thought is given to the matter of ramp ground handling.
2. Modern aircraft are very large, complicated, and expensive. Therefore, the apron
3. servicing operation is also complicated and consequently time-consuming

Departure control

1. The financial effects of aircraft delay fall almost entirely on the airline. The impact of delays in terms of added cost and lost revenue can be very high.

2. Consequently, the functions of departure control, which monitors the conduct of ground handling operations on the ramp (not to be confused with ATC departure), are almost always kept under the control of the airline or its agent.

PARALLEL RUNWAYS

There are 4 types of parallel runways

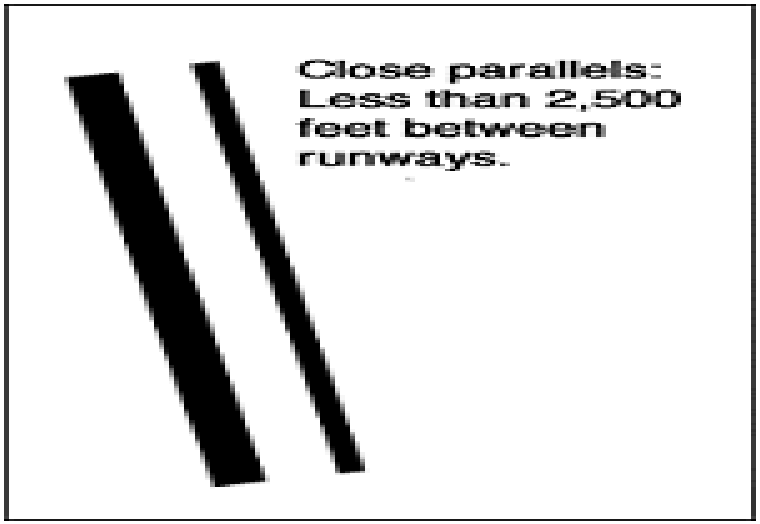


Fig. 2 close parallels

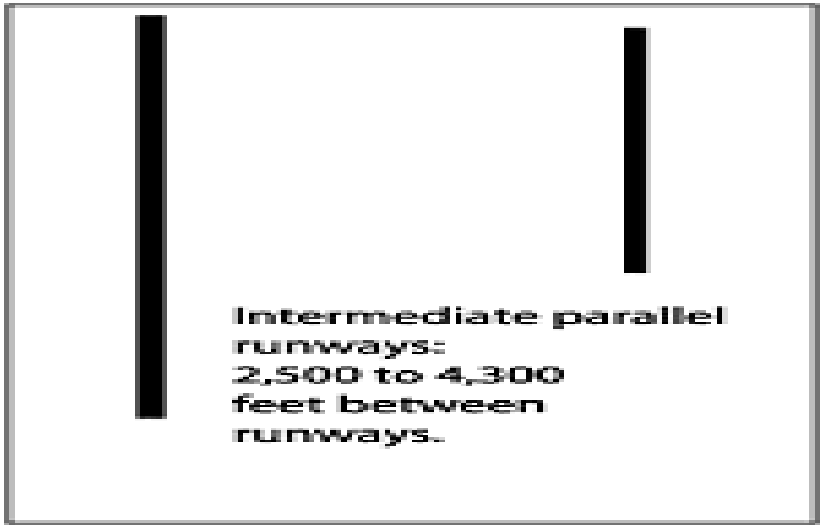


Fig.3 intermediate paralles

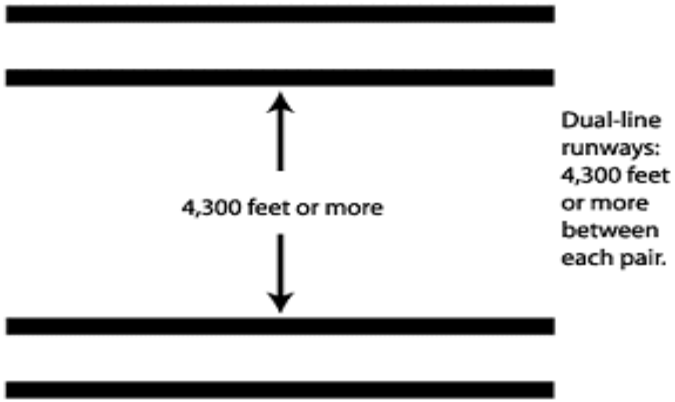


Fig. 4 Dual-line runway

Fig. 5 Far parallel runway

Division of ground handling responsibilities

1. There is no hard-and-fast rule that can be applied to the division of responsibility for ground handling functions at airports. The responsibility varies not only from country to country but also among airports in the same country.

2. Prior to airline deregulation, handling activities were carried out mainly by airlines (acting on their own behalf or for another airline) or the airport authority.

UNIT-IV

PASSENGER TERMINAL OPERATIONS

Types of systems

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

THE PASSENGER TERMINAL SYSTEM

1. 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.

2. Passenger terminals provide the first and last impressions for visitors to the airport.

3. The terminals are the ‘front door’ to the Airport and serve as the public interface between the landside and airside elements.

4. 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 componens 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

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

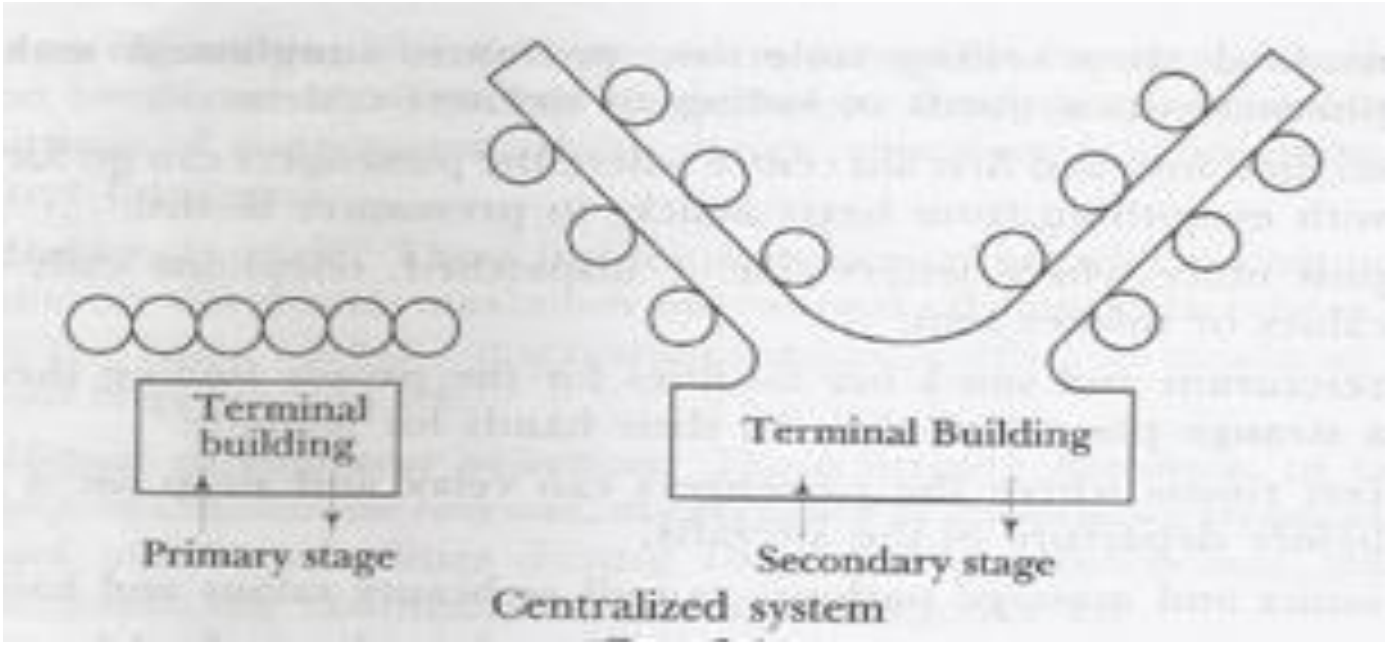
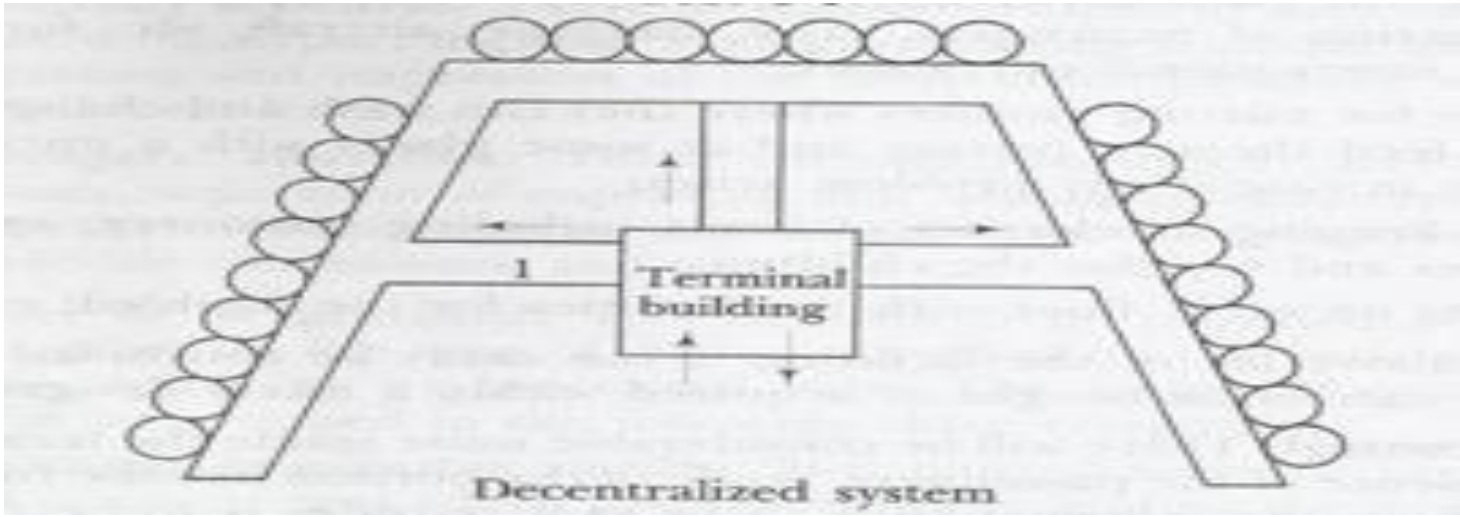


Fig. 1 Centralized system

DECENTRALIZED SYSTEM

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

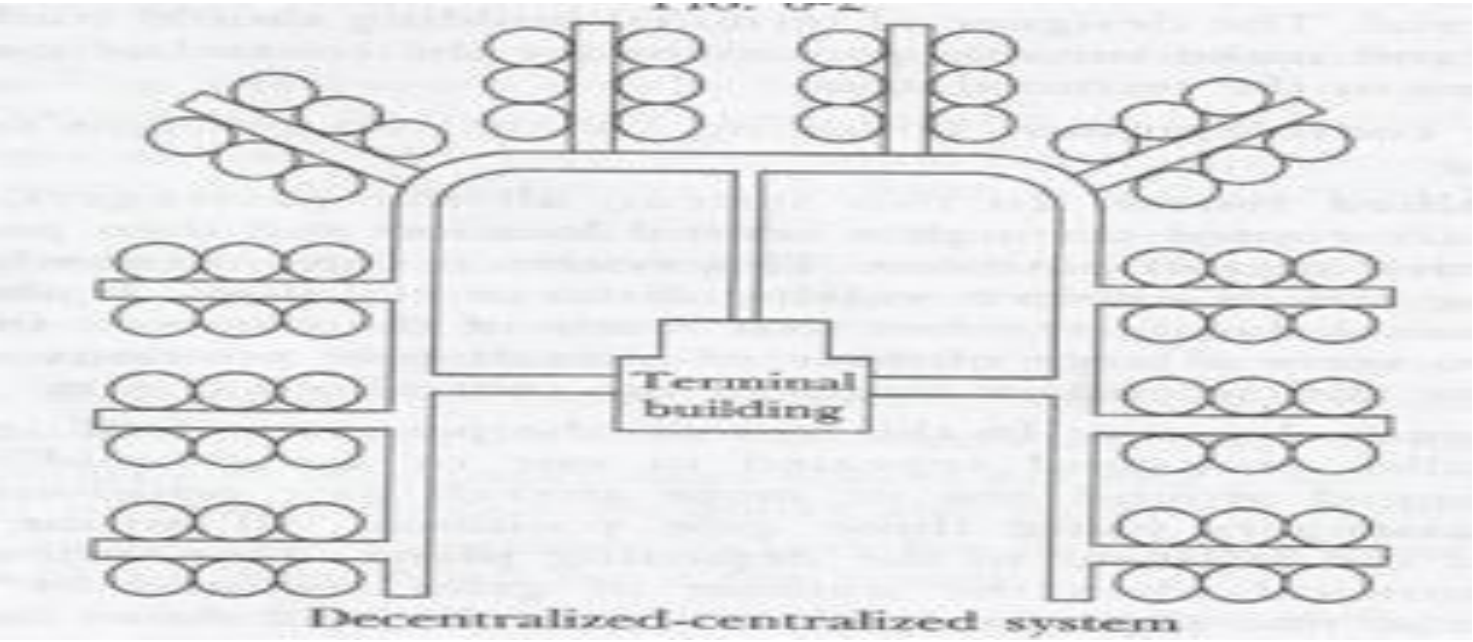


Decentralized system

DE-CENTRALISED SYSTEM

It is a combination of the above two systems

2. In this system, each individual airliner operation is centralized.
3. This kind of system more suitable at major airports where the volume of air traffic is too high.



Decentralized system terminal building

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.

THE APRON-GATE SYSTEM

- **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

FUNCTIONS OF THE PASSENGER TERMINAL

- Analysis of the operation of an airport passenger terminal leads to the conclusion that three principal transportation functions are carried out within the terminal area (Ashford et al. 2011):

- **The processing of passengers and baggage**. This includes ticketing, check-in and baggage drop, baggage retrieval, governmental checks, and security arrangements.

- **Provision for the requirement of a change of movement type.** Facilities are necessarily designed to accept departing passengers, who have random arrival patterns from various modes of transportation and from various points within the airport's catchment area at varying times, and aggregate them into planeloads. On the aircraft arrivals side, the process is reversed. This function necessitates a holding function, which is much more significant than for all other transport modes.

- **Facilitating a change of mode**. This basic function of the terminal requires the adequate design and smooth operation of terminal facilities of two mode types. On the airside, the aircraft must be accommodated, and the interface must be operated in a manner that relates to the requirements of the air vehicle

TERMINAL FUNCTION

- Transportation planners use the term *high-activity centers* to describe facilities such as airport terminals that have a high throughput of users.
- In the peak hour, the largest passenger airports process well in excess of 10,000 passengers.
- With the increased security measures since 2001, departing international passengers are likely to spend IV2 to *2* Hours in the terminal facility, and arriving international passengers spend at least 30 minutes

PHILOPHIES OF TERMINAL MANAGEMENT

- Although the basic operational procedures of airports as they relate to safety are generally similar throughout the world, the manner in which those procedures are operated and the organization used to effect them can differ quite radically.

- Perhaps nowhere in the airport do the operational philosophies differ as much as in the terminal area. The two extreme positions may be designated as:
- Airport-dominant
- Airline-dominant

DIRECT PASENGER SERVICES

- Terminal operations that are provided for the convenience of air travelers and are not directly related to the operations of the airlines are normally designated as direct passenger services.

- It is convenient to further divide this category into commercial and noncommercial services.

- There is no hard-and-fast division between these two subcategories, but noncommercial activities are usually seen as being entirely necessary services that are provided either free of charge or at some nominal cost

Flight Dispatch

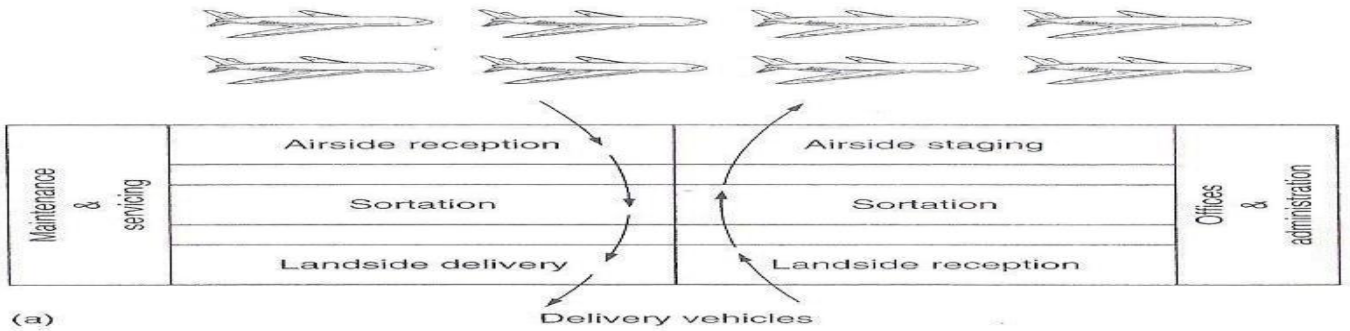
- A major preoccupation for airline management in relation to airport terminal operations is the achievement of on-time departures. Many of the activities associated with this, such as the refueling and cleaningof aircraft, together with the loading of food supplies, are carried out on the ramp and are familiar to most airport staff. There is, however, a less familiar procedure that covers all the necessary technical planning without which a flight could not depart. The main activities associated with this procedure of flight dispatch are:

- Flight planning
- Aircraft weight and balance
- Flight-crew briefing
- Flight watch

CARGO LAYOUT BY INTEGRATED CARRIES

- Operation of the IC's air cargo terminals is quite different from that of conventional terminals, and it is difficult to draw comparisons between the two operations even at the same airport.

- The terminals of the ICs have very high daily peaks and are characterized by lack of the required storage space because very little cargo dwells in the terminal for any significant time



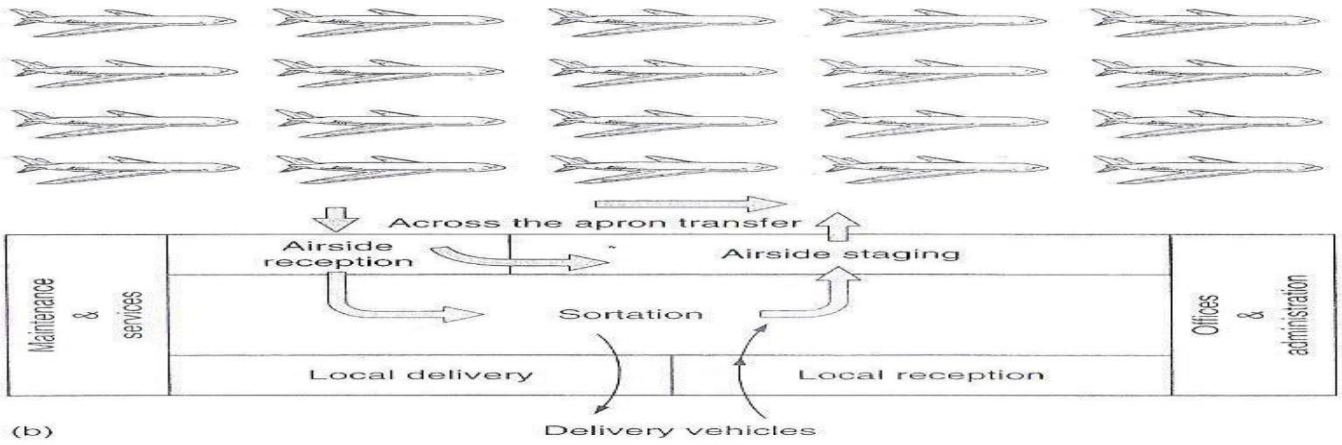


FIGURE 10.14 (a) Schematic of flows in a spoke terminal of an integrated carrier. (b) Schematic of flows in a hub terminal of an integrated carrier.

schematic of flows in a spoke terminal

EXAMPLES OF MODERN CARGO TERMINAL DESIGN AND OPERATION

- Lufthansa redesigned its Frankfurt air cargo terminal in 1995 to handle a capacity of approximately 1 million tons per year.
- Frankfurt has a very high proportion of transfer freight, some of which requires reconsolidation within the cargo terminal itself.
- The handling system within the terminal saves both labor and space by the employment of extensive mechanization.

PATTERNS OF FLOW THROUGH CARGO TERMINAL

- The cargo terminal, like the passenger facility, experiences significant temporal variations in throughput.
- Unlike the passenger terminal, freight facilities often demonstrate very large differences between inbound and outbound flows on an annual basis.
- Cargo flow variations occur across the year, across the days of the week, and within the working day.
- The pattern of variation differs quite noticeably among airports and even may vary remarkably among airlines at the same airport.

PASSENGER INFORMATION SYSTEMS

- Passengers move through airport terminals under their own power.
- They are not physically transported in a passive manner, as is freight, although in larger terminals mechanical means are used to aid in movement through the facility.
- This, of course, does not refer to people with restricted mobility, who need special ramps and other necessities, which are beyond the scope of this book.
- Equally important, a large number of passengers reach airports in their own personal vehicles.
- There is therefore a need to ensure that the passenger has sufficient information both in the access phase of the journey and in passing through the terminal.

NON-PASSENGER-RELATED AIRPORT AUTHORITY FUNCTIONS

- It is often convenient at smaller airports to locate within the terminal building for ease of intercommunication all the airport authority's non-passenger-related functions. These include

1. Management
2. Purchasing
3. Finance
4. Engineering
5. Legal
6. Personnel
7. Public relations
8. Aeronautical services
9. Aviation public services (e.g., noise monitoring)
10. Plant and structure maintenance

GOVERNMENTAL REQUIREMENTS

- Most airports handling passenger movements of any reasonable scale will be required to provide office and other working space in the vicinity of the passenger terminal for the civil aviation authority and the ATC authority, if this is constituted separately.

- At major airports where international passengers are handled, it is also possible that up to four governmental controls must be accommodated:

1. Customs
2. Immigration
3. Health
4. Agricultural produce

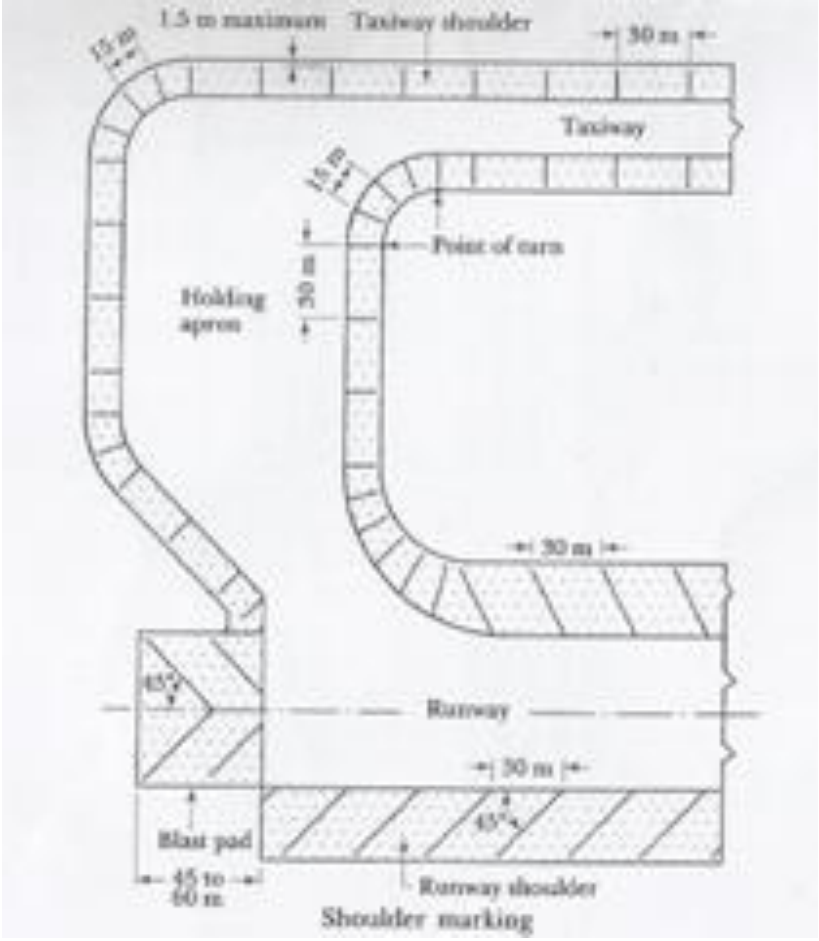
UNIT-V

AIRPORT TECHNICAL SERVICES AND AIRPORT ACCESS

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

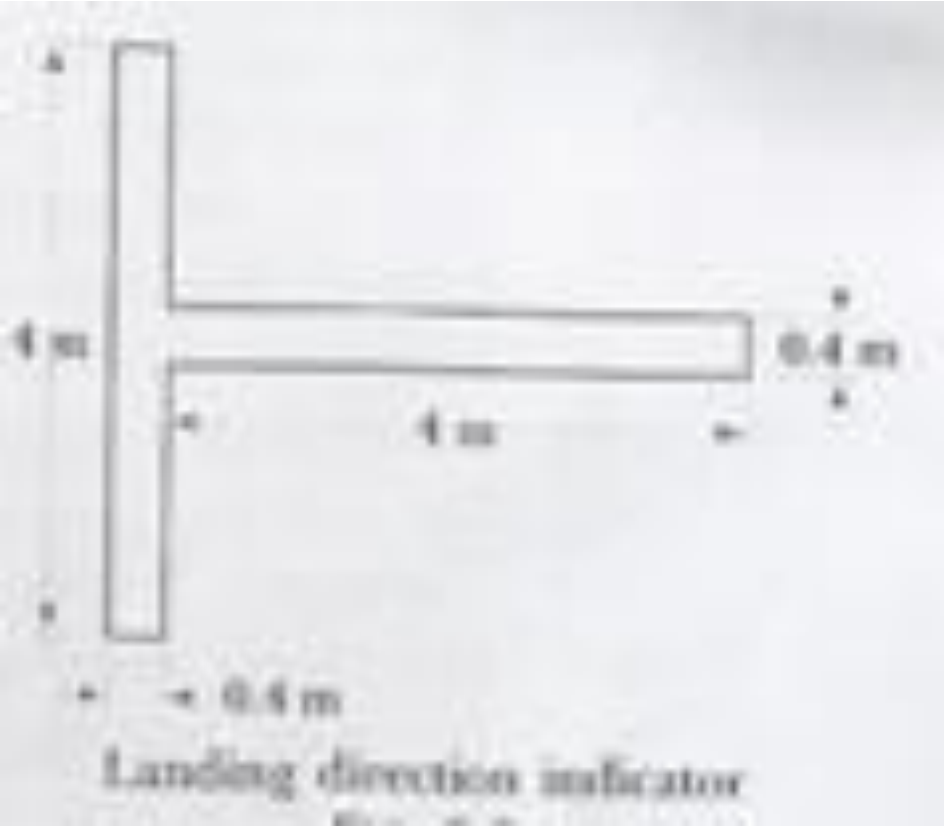


Shoulder marking

Landing Direction Indicator

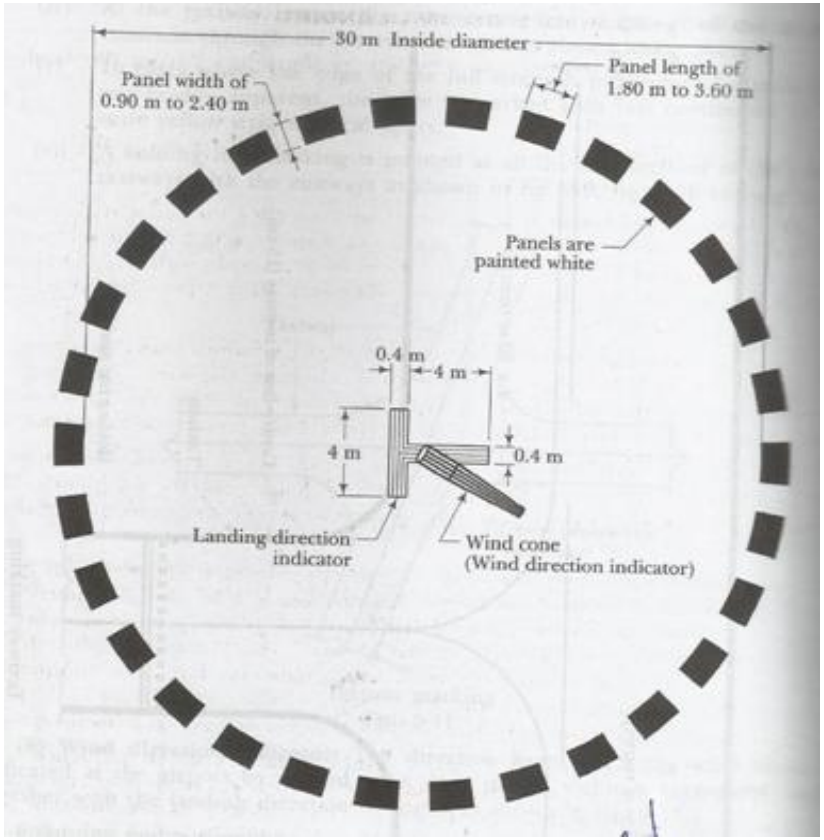
- To indicate the landing direction, an arrow or a tee is placed at the centre of a segmented circle.
- It indicates to the pilot the direction of the active runway of the airport.
- It is painted by orange or white color for being spotted with during day time and is lighted during night time.
- It is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

Landing Direction Indicator



Landing direction indicator

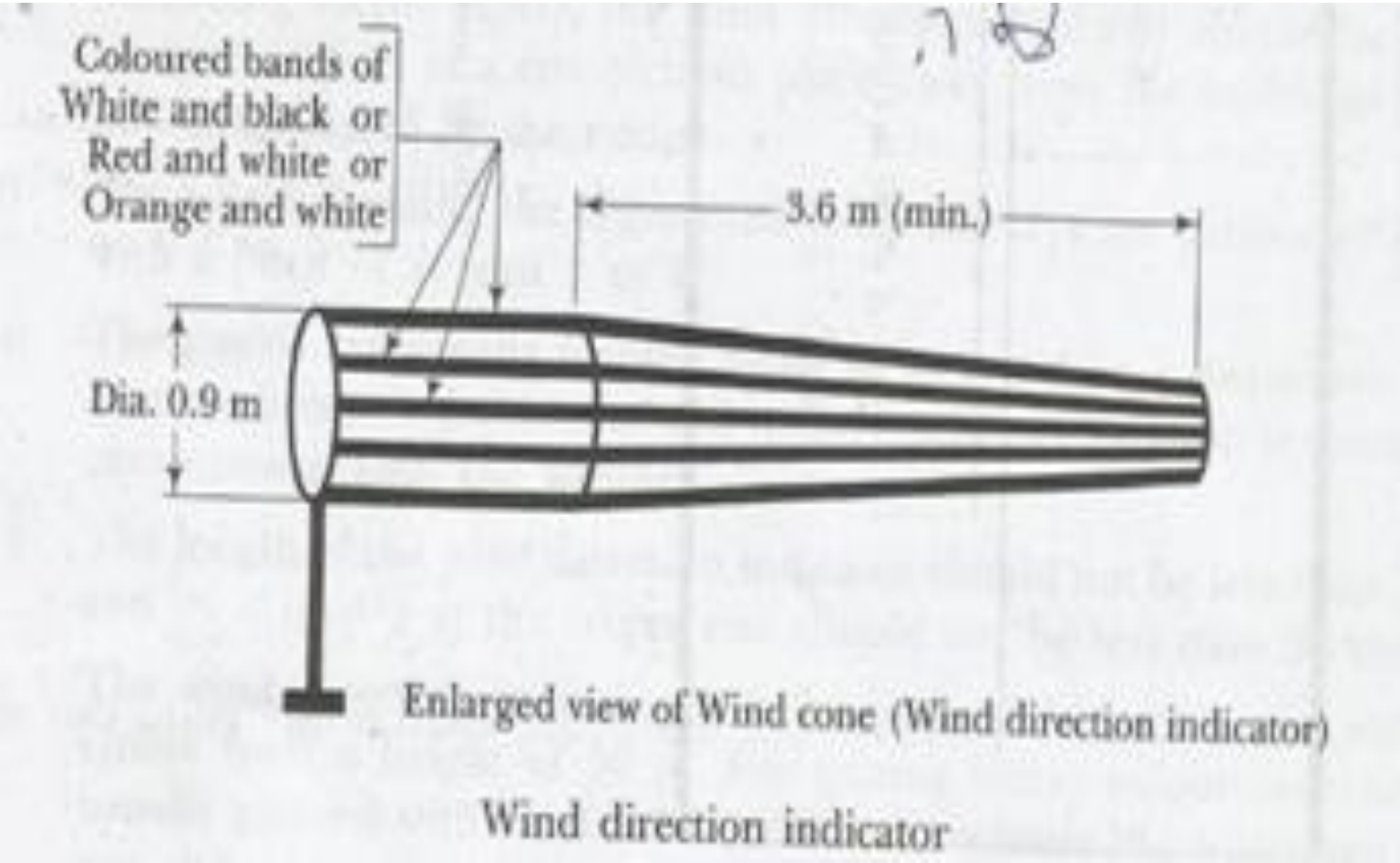
Landing Direction Indicator along with Wind Direction Indicator



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



Enlarged view of Wind cone (Wind direction indicator)

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

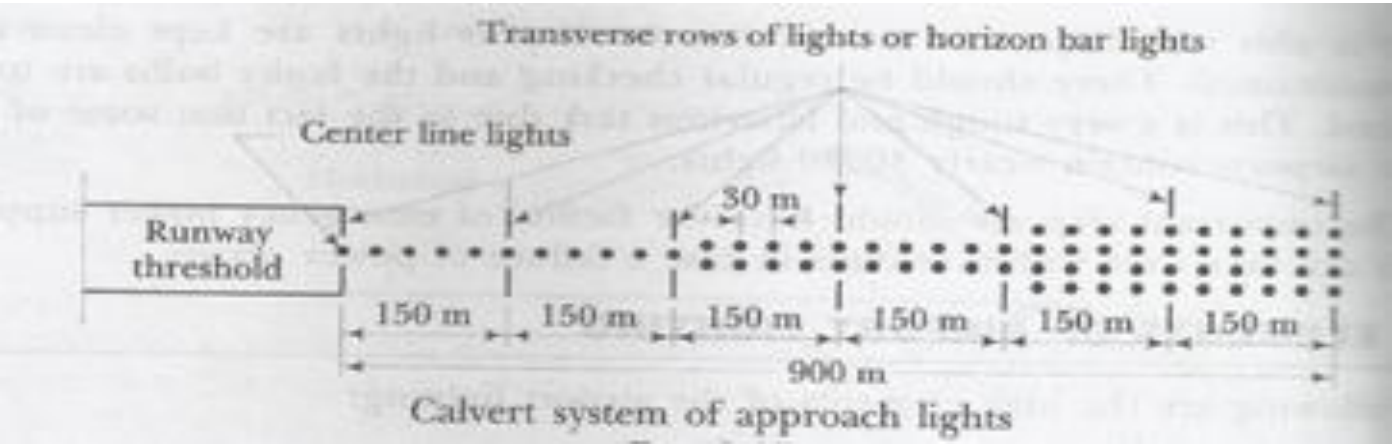
- Before the runway actually begins, there is a sequence of high-intensity lighting arrangement for a length of 900 m.
- These lights then give way to touch down zone lights from the threshold lighting.

- 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.



Calvert system of approach lights

ICAO System of Runway Approach Lighting

1. Number of transverse crossbars:

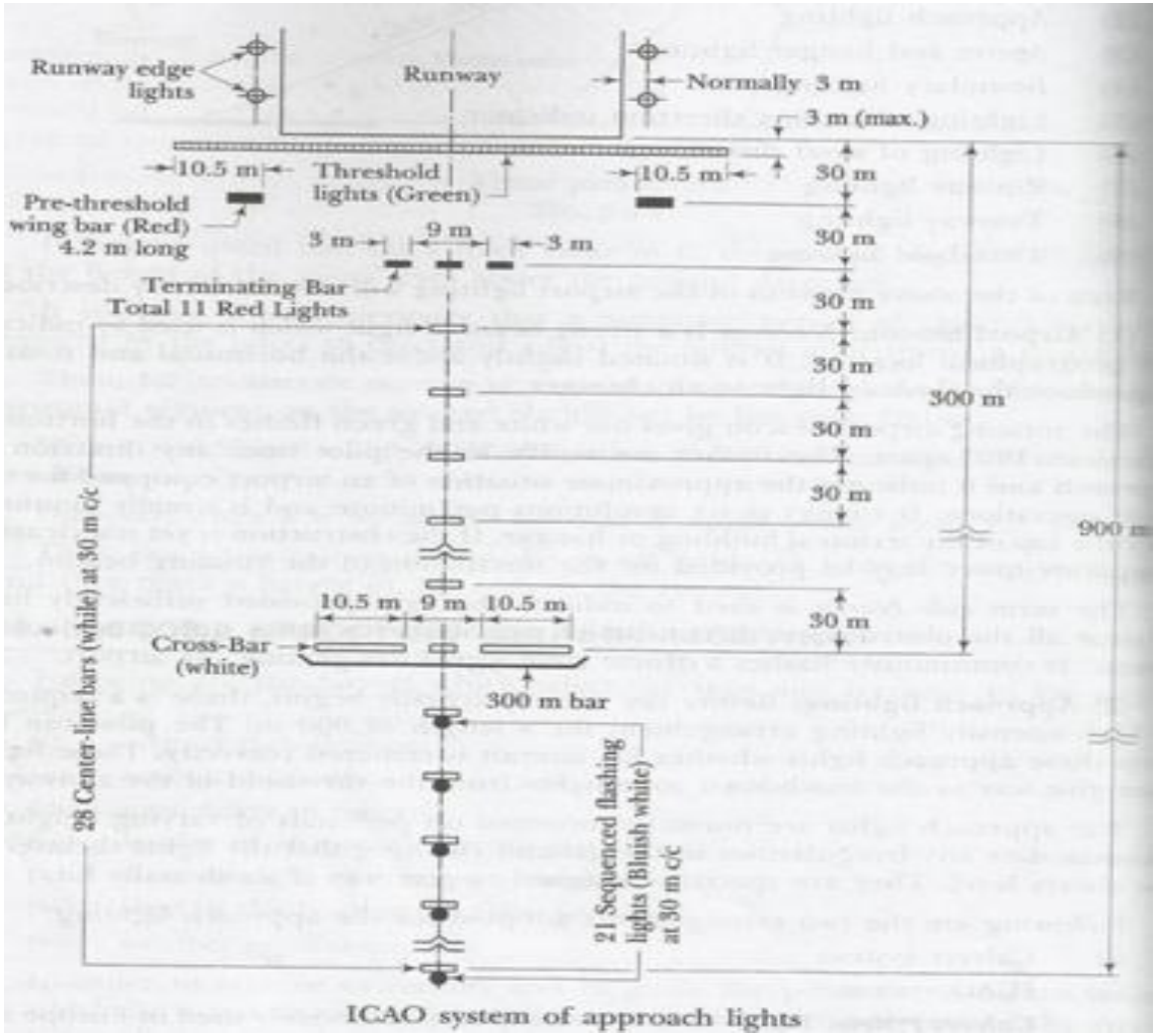
In ICAO system, there is only one crossbar 300 m from the threshold.

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.

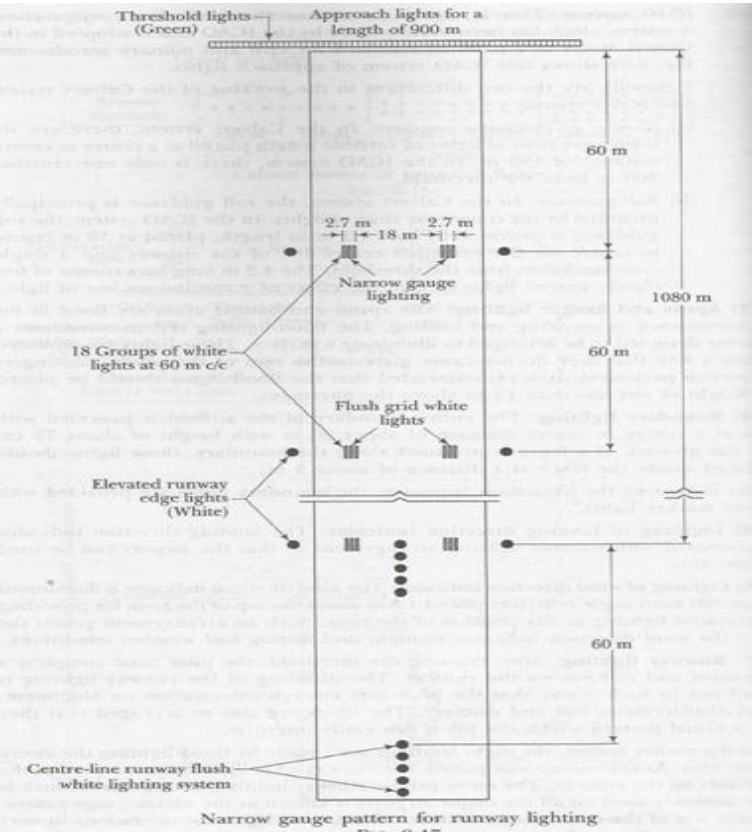
Black Hole Effect

- 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

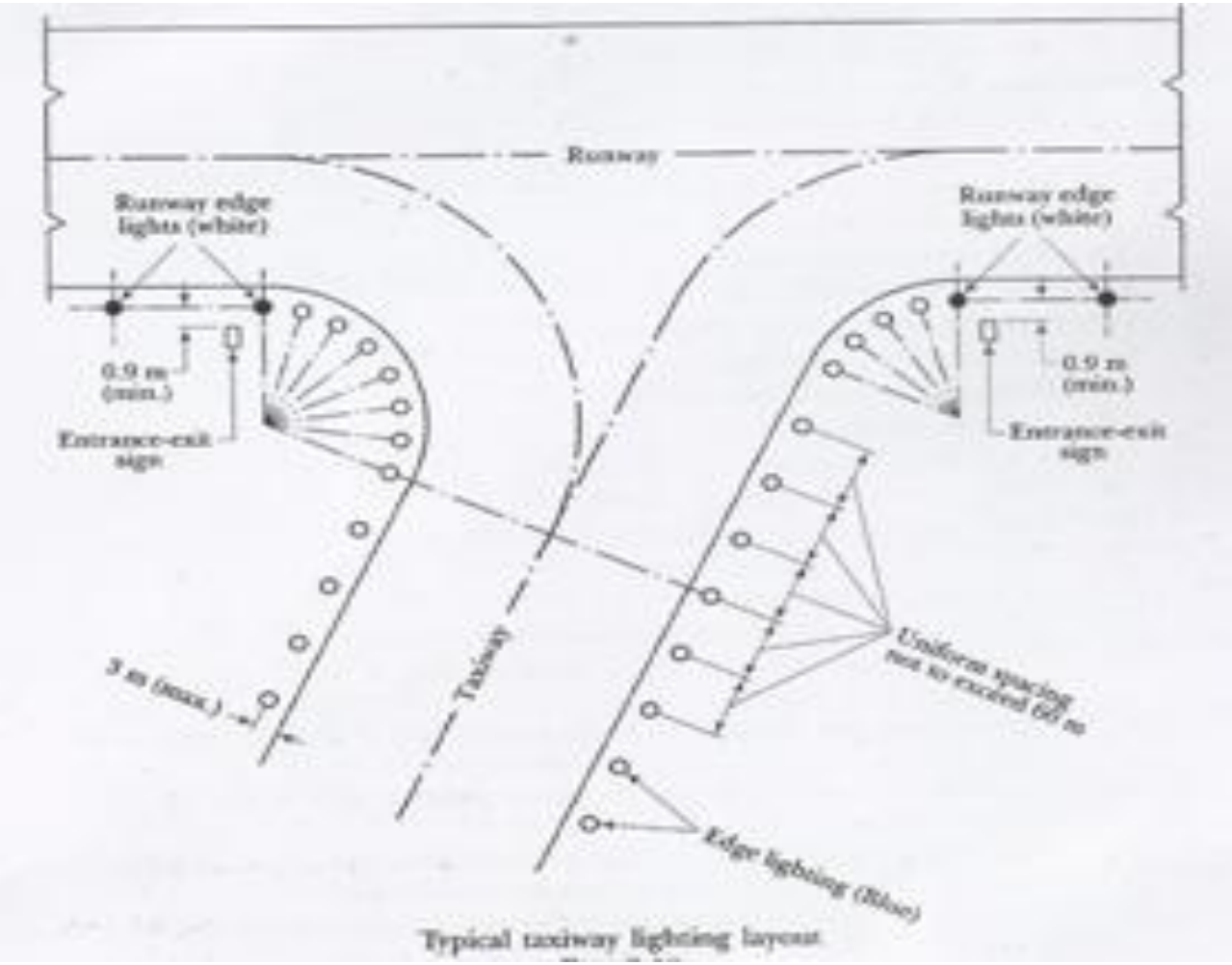


Narrow gauge pattern for runway lighting

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

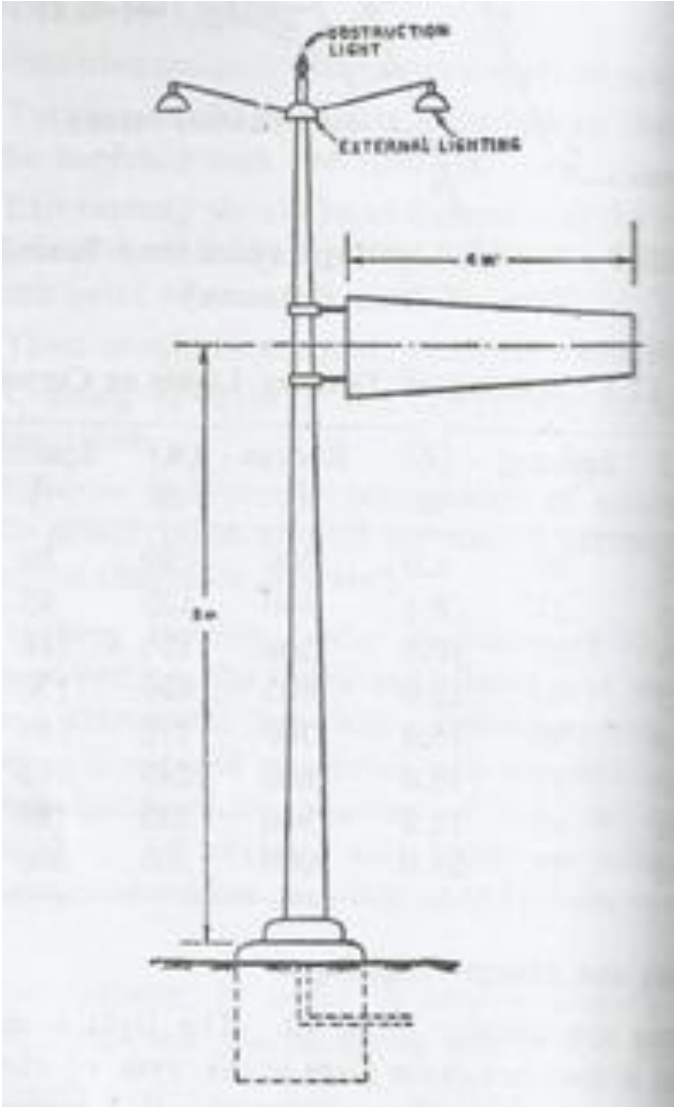
- Apron and Hangars are provided with flood lighting system in order to facilitate servicing loading and unloading.
- The light source is so mounted that it does not cause glare in the eyes of the pilots, the service personnel or the passengers.
- It is recommended that flood lights should be mounted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

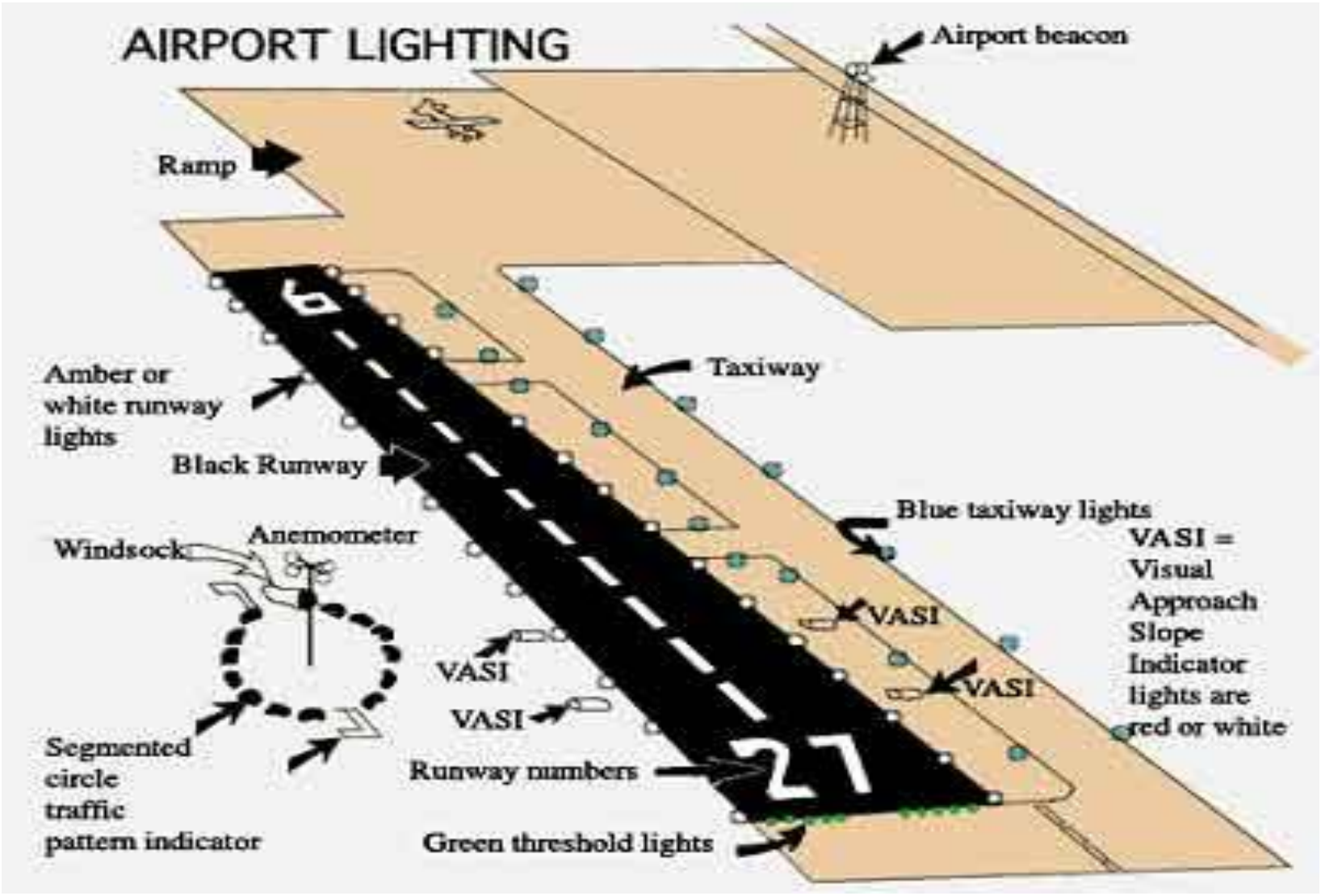
Lighting of Landing Direction Indicator

- 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
VASI = Visual Approach Slope Indicator lights are red or white
Windsock
Anemometer
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 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

THANK YOU