UNIT III AIRPORT PLANNING

2 MARK QUESTIONS AND ANSWERS

1.Define wind Coverage (AUC NOV/DEC 2010) ,(AUC NOV/DEC 2011)

The percentage of time in a Year During Which the cross-wind components remains within the limits is called the wind coverage .For busy Airport the wind coverage may be increased to as much as 98 to 1007

2.What are the Factors Affecting airport operating capacity (AUC NOV/DEC 2010)

The number of aircraft movement Which an airport Can process within a Specified period of time , with an average delay in to the departing aircraft within the acceptable range

3.Distinguish Between Runway and taxiway (AUC NOV/DEC 2012)

Runway is a long Rectangular Strip, which is Constructed with Adequate Strength for landing and takeoff of Aircraft at an Airport

A Strip of Pavement connecting the apron to the Hanger as well as Runway ends to the Apron is called Taxiway

4.Listout the four Standard Factor Conditions involved for the Design of Runways (AUC NOV/DEC 2009)

Runway Geometric design comprises of the following Elements as per ICAO recommendations. That are

1. length of the runway
2. Width of the Runway
3. Longitudinal Slope or Gradient
4. Transverse Slope of cross Gradient
5. Sight distance
6. Runway Surface
7. Runway Strips
8. Runway- end safety areas
9. clearway
10. Stop ways

5.Define Cross Wind component and Wind coverage (AUC NOV/DEC 2009)

If the direction of wind with a Velocity of V is making a certain angle θ with the centre line of the runway , Its components perpendicular to the enter line of the Runway will be V and θ . This normal components of the wind is called the Cross-wind Components

The percentage of time in a Year During Which the cross-wind components remains within the limits is called the wind coverage .For busy Airport the wind coverage may be increased to as much as 98 to 1007

6. How much Correction Should be made in the Runway Length for Gradient

(AUC MAY/JUNE 2011)

1. Correction for elevation
2. Correction for Temperature
3. Correction for elevation and temperature
4. Correction for Gradient

7.What is an Exit Taxi way **(AUC NOV/DEC 2011)**

Exit taxiway are the Taxiways Which are Provided ti minimize the Runway occupancy time by the landing Aircraft

8. Write any Three Components of an Airport **(AUC MAY/JUNE 2011)**

1. Types of Airport

(a) Based on Function
(b) Based on Usage
(c) Based on Utilities
(d) Based on type of Aircraft

2. Landside Part of an Airport

(a) Terminal Area
(b) Terminal Building
(c) Service for the Air passenger
(d) Government Agencies
(e) Security Arrangement

3. Airside part of an Airport

(a) Runway
(b) Taxiway
(c) Apron
(d) Holding pad or Bay
(e) Navigational Aid
(f) Hanger
(g) Landing Indicators

9. What are the Objectives of the master plane According to FAA

(AUC MAY/JUNE 2011)

- Determines the Development of physical facilities including land use
- Give short and long term policy guidance
- Assist in getting the financial aid
- Coordinates the monitoring procedure, data management
- Determining the funding Sources and constrains during the physical planning
- Determines the community attitude

10.What are the data Required before the site Selection for new airport

(AUC MAY/JUNE 2012)

- The class of the Airport , viz., national, the Size and the Shape , Runway and Taxiway Requirements
- The peak-hourly volume of air traffic to be Handled now and in Future
- The various types of operational Control to be Used
- To provide facility now based on the airport and Anticipated additional facility

13.Wing rose Diagram

Using a Diagram is plotted called wind rose Diagram. There are two Types that re Given Below

Type 1 : Showing direction and Duration of Wind

Type 2 : Showing Direction, Duration and Intensify of Wind.

14.List the Various imaginary Surfaces around the Airport

1. Approach Surface
2. Horizontal Surface
3. Conical Surface
4. Take-off climb Surface
5. Transitional Surface.

16 MARK QUESTIONS AND ANSWERS

1.The length of the runway under the Standard condition is 1620 m. The airport site has an Elevation of 270m. And the reference temperature of the airport is 32.90^{0}C . It is decoded to construct the runway with can effective Gradient of 0.20 %. Determine the Corrected length of the Runway (AUC NOV/DEC 2010)

Step 1 : Correction for Elevation

Correction = 7*1620*270/100*300
= 102.06 m
Corrected Runway Length = 1620+102.06
=1722.06 m

Step 2: Correction for Temperature

Standard Atmospheric temperature at the Elevation = 15^{0}C -0.0065*270
=13.25^{0}C

Rise of the temperature = 32.90^{0}C - 13.25^{0}C
=19.65^{0}C
Correction = 1722.06*19.65/100
= 338.38m
Correction Length = 1722.06+338.38
=2060.44 m

Step 3. Combined Correction

Combined Correction for the Elevation and temperature =2060.44-1620*100/1620
=27.18%

As per ICAO this combined correction Should not Exceed 35 %

Hence the correction is ok

Step 4. Correction for Gradient

Applying Correction for the Effective Gradient at the rate of 20% for Each 1 % effective Gradient

Correction = 20*2060.44*0.20 /100

=82.41m

Corrected Length = 2060.44 + 88.41

=2142.85 m

above value may be rounded to the nearest 10 m, then the corrected length

Correction Length = 2140 m

2.What are the basic pattern of Runway Configuration ? Discuss Each pattern in all the Details. (AUC NOV/DEC 2010)

The capacity of an Airport is based on the number of runways and their configuration. the pattern of runway is mainly Governed by the Volume of Air traffic to be Handled

Basic Patterns of Runway are

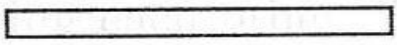
1. **Single Runway**
2. **Parallel Runway**
3. **Intersecting Runway**
4. **Non-Intersecting Runway**

1.Single Runway Pattern

The capacity of the runway patterns. It is Usually Adopted When the wind direction is on the Direction for the most of the time in a year and the air traffic is not Very High

Under the Visual Flight rules, A single Runway can Handle about 45 to 60 operations or movement per hour. Under the Instrument Flight rules Capacity of Single Runway is reduced to about 20 to 40 operations per hour

In a single pattern runway only one operation., i.e landing of take off can be done at a time.



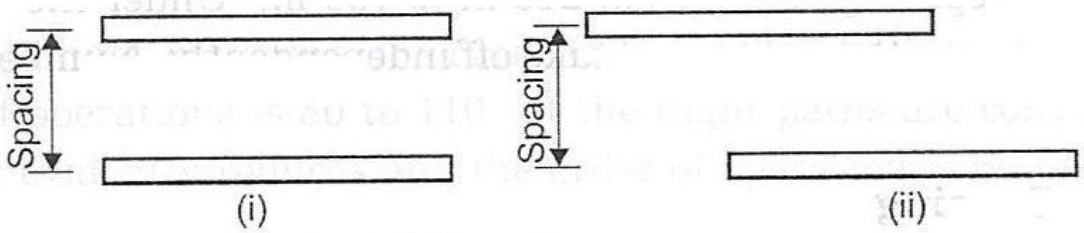
(a) Single runway

2. parallel Runways

Capacity of parallel runway pattern is based on the lateral Spacing Between the Two Runways, Number of Runways , the weather conditions and the navigational aids provided at the airport

The Spacing Between the two parallel Runway Varies significantly

1. Close Spacing
2. Intermediate Spacing
3. Far Spacing



(b) Parallel runways

1. Close Spacing

For this case the Spacing Varies from 210 m to 750 m. Under the IFR Condition Each runway can operate with landing and Takeoff Independently. The number of operations os From 50-60

2. Intermediate Spacing

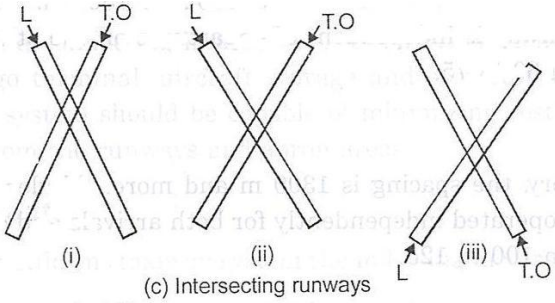
For this category, the Spacing is 750-1300 m and more. Under the IFR conditions, the arrival on one runway can be operated independently for the both arrival and departure on the other runway

3. Far Spacing

For this category, the spacing is 1300 m and more. Under the IFR Conditions the Two runway can be operated independently for the both arrival and departure. Number of operation is from 100-120m

3. Intersect Runway

This pattern of Runway is Provided When the wind in a particular Direction does not Provide the Required Coverage. Use of the Both Runway at a time Depends upon the Cross-wind Component of each Runway



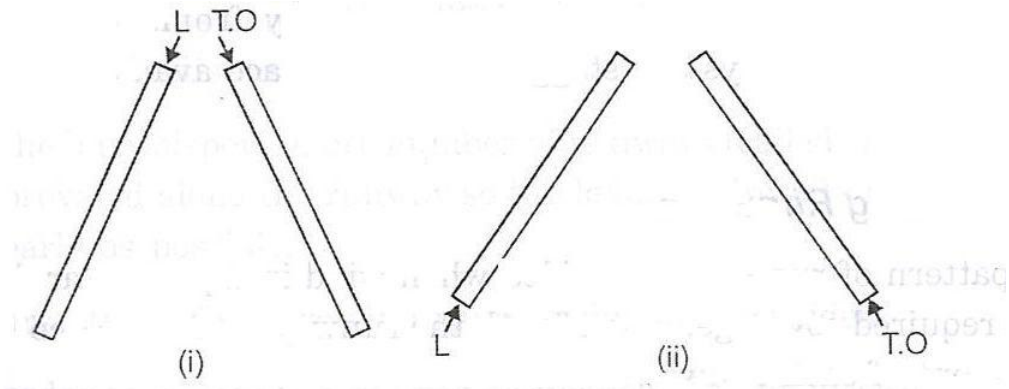
(c) Intersecting runways

Favorable wind Conditions are Prevailing the capacity of the Each runway depends upon the direction of landing and takeoff, the lateral at the glide paths of the aircraft and the point of intersecting of the runways

Under the IFR conditions the operations vary from 40-70 and under the VFR conditions the operations vary From yhe 50-175. For Example, for an Intersection at the middle the IFR Operations are From 45-60 Whereas under the VFR operations are from 60-100

4. non-Intersect Runway

Non – intersecting Runways are called as Divergent or open- V Runways Diverges in Direction without the intersection Each other. This capacity of this Pattern Again on the Wind Condition



(d) Non-intersecting runways

When the Flight of the Paths are Divergent the capacity of the Highest and the order of operations is 80-110.

3.Discuss in detail the factors affecting the choice of the Selection of Site for an Airport (AUC MAY/JUNE 2010)

1. **Land use and Land Values**
2. **Topography of the Area**
3. **Geological Factors**
4. **Grading and Drainage**
5. **Ground accessibility**
6. **Proximate to other Airports**
7. **Obstruction**
8. **Atmospheric Factor**
9. **Availability of Utilities**
10. **Aircraft Noise**

1.Land use and Land Values

Depending on the size of the Airport and the Anticipated Expansion the Land Area Required Should be assessed

As a general Guide Develop without investing heavy funds on purchase on lands. Early acquisition of Cheaper lands is always advisable

2. Topography of the Area

Topography is an important factor to be Considered as involves terrain Slope, Natural features like trees, Streams, Further for a better maintenance grading of the topography and the Drainage are the Very important

3.Geological Factors

The soil and Rock type Available at the area to be selected Should be Known. As heavy weight of aircraft is coming on a smaller area the soil and rocky Ground Should have High bring values as soil Improvement techniques are costly, soils of less bearing value may be avoided.

4. Grading and Drainage

In order to facilitate easy take off and landing , Grading and Drainage play an Vital role in the Construction and the maintenance of an airport and in turn the Site Selection. The Ground Profile Should be in a position to drain the water during floods and rains

5.Ground accessibility

Basically it is Essentially to have fast and Efficient access facilities for passengers and freight. The passengers are very much Concerned with the time taken From the Home to Airport and vice-versa

If the site is commuted by public transport it forms the Best location

6.Proximate to other Airports

Every airport has to Use certain air Space For landing and Take-off of Aircrafts. This Varies with the Type of Aircraft and the number of Aircraft used in the airport

For Example airports Using small general aviation Aircraft the Spacing of airport may be the order of 4 km whereas for jetting operated Aircrafts it could be as high as about 150km

7. Obstruction

Aircraft While landing or taking off lose or Again altitude Very Slowly as compared to the forward Speed At high altitude

In order to accommodate this long, Clearance areas are provided on either side of runway. Such an Identified Approach area Should be Free From any Obstruction

8. Atmospheric Factor

Inadequate Visibilities affects the traffic capacity of an airport. IF there is an Future Development Industries in a site to be Selected, it has to be Avoided.

It is advantageous to locate the site in the windward direction of the city Such that only a minimum Smoke the city is Brown over the Site

9. Availability of Utilities

It is a general advantageous to utilize the General utilities Such as main power line, water Supplies , Sewage disposal. Telephone Services, fuel,

Availability and use of these facilities may reduce the total cost the Project

10. Aircraft Noise

Construction materials like Stone can be Clearly Obtained if Stone Quarry is Located near the Site area. Further availability and use of these water will largely economies the cost

4.The length of the runway under the Standard condition is 1600 m. The airport site has an Elevation of 320m. And the reference temperature of the airport is 33.60 ^{0}C . It is decoded to construct the runway with can effective Gradient of 0.25 %. Determine the Corrected length of the Runway (AUC NOV/DEC 2010)

Step 1 : Correction for Elevation

Correction = 7*1600*320/100*300
= 119.46 m
Corrected Runway Length = 1600+119.46
=1719.47 m

Step 2: Correction for Temperature

Standard Atmospheric temperature at the Elevation = 15 ^{0}C -0.0065*320
=12.92 ^{0}C

Rise of the temperature = 33.60 ^{0}C – 12.92 ^{0}C
=20.68 ^{0}C
Correction = 1719.47*20.68/100
= 355.58m
Correction Length = 1719.47+355.58
=2075.05m

Step 3. Combined Correction

Combined Correction for the Elevation and temperature =2075.05-1600*100/1600
=29.69%

As per ICAO this combined correction Should not Exceed 35 %

Hence the correction is ok

Step 4. Correction for Gradient

Applying Correction for the Effective Gradient at the rate of 20% for Each 1 % effective Gradient

Correction = 20*2075.05*0.25 /100

=103.75m

Corrected Length = 2075.05 + 103.75
=2175.80 m

To above value may be rounded to the nearest 10 m, then the

Correction Length = 2170 m

6. Explain in Detail About Airport Zoning (AUC NOV/DEC 2010)

Zoning Laws

Zoning laws Should be primarily Control the following

1.To regulate the Construction of height of the Structure as per the permissible limit norms depending upon the type of airport and the Aircrafts Which are intended to use the Airport

2. To prevent the manufacturing of certain items which may result the Smoke nuisance, odour, Etc

3. To announce for compensation to the affected party if the Zoning Ordinance is likely to be Provocateur

1. Approach Zone

During the time of landing, an Aircraft Choose a particular path is called as the glide path. The glide path of an aircraft varies from a steep of the flat Slope

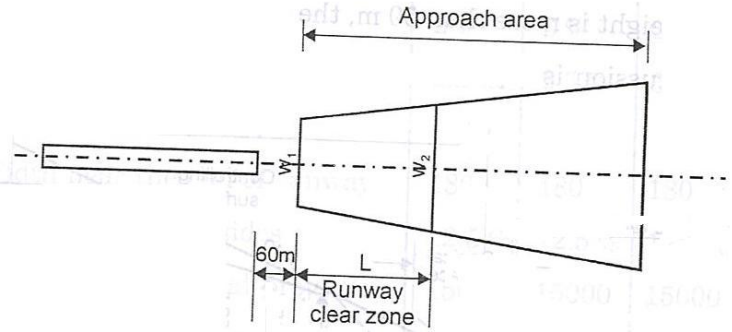
A wide clearance area has to be identified Which is Known as Approach Zone. These Zone are Required on either Side of the Runway along the Direction of the landing and take off of Airport

T he plan of an Airport Approach Zone and Approach Surface is one and the Same. But the approach Zone is an imaginary Whereas the approach area is the Actual Ground area

1.1 Clear Zone

Clear Zone is the inner most part of the Approach area Which is the most Critical area. The detail of the clear Zone Instrumental and Non-instrumental Runway

It is Generally recommended to procure adequate land for Effective Implementation of Zoning laws.



It is Enough to clear all the Obstructions. Minor Obstruction Such as fences, ditches, ect may be allowed

1.2 Highway and Runway Clearance

Highway Runway Clearance are not Considered as objectionable in the Clear Zone. As a matter of the fact Even vehicle movements are allowed but they Have to comply with the Clearance Standards Laid down in the Zoning Laws

The essential Clearance needed are reflected as follows

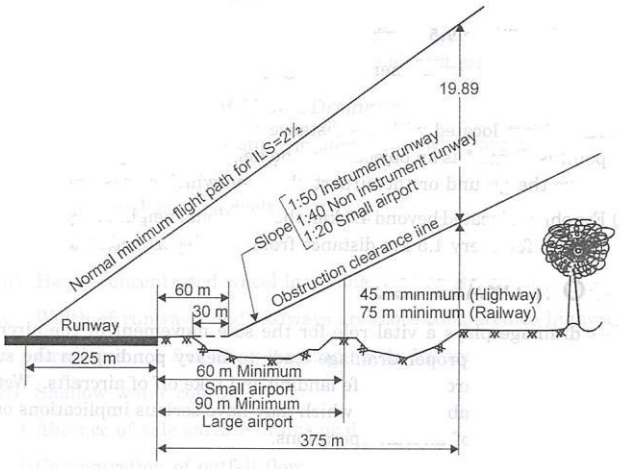


Figure 9.4 Clearances over highway and railway

2. Turning Zone

The turning zone is the area in an airport other than the Approach area. It is intended for turning operations of an aircraft in terms of emergencies like some troubles in airways

In such cases, the pilot takes the turn and comes in line with the runway before the landing

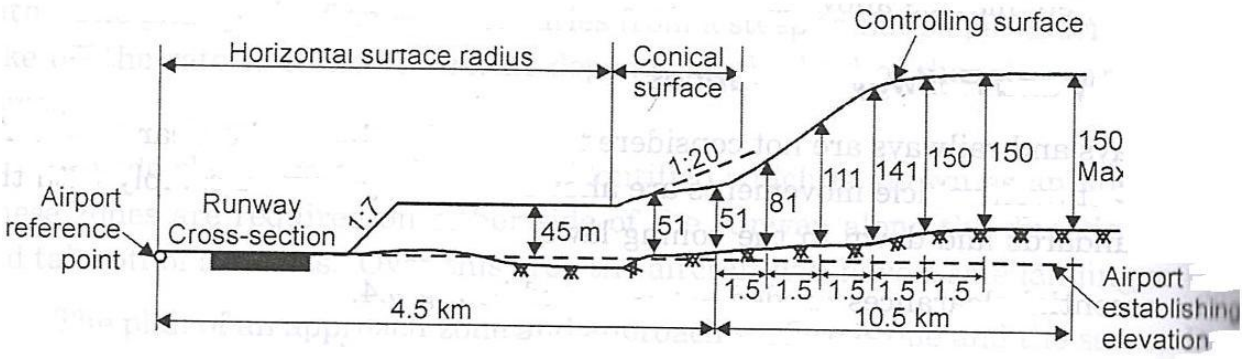
In a situation like this the Aircraft operate at low height in the turning Zone and So the Turning Zone Should be free from the Obstructions

Turning Zone Profile of a runway with the Instrument Landing Facilities is Shown Given Below

For an Airport With the Airport landing System the following points to be Considered

1.Any object located within a Distance of 4.5 km From the airport references point is treated as an Obstruction, If the Height of the Object is more than 51 m above the Ground of the Airport Elevation Whichever is more.

2. For object located Beyond 4.5 km. the additional height of the Object is considered is more 30 m for Every 1.5 km distances from the Airport Reference Point



7 . What is meant BY Airport Zoning. Discuss all in Detail

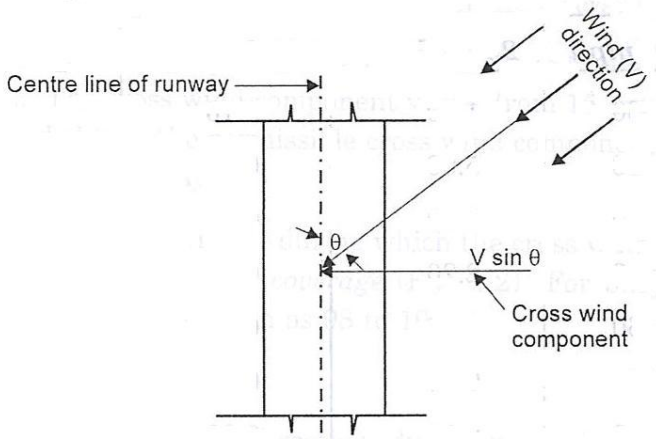
The wind data Comprising of Direction, duration and intensity are graphically represented by a diagram called Wind rose. In order to Obtain an average wind data Should be collected at the proposed location for at least for 5 to 10 years

Type 1 : Showing direction and Duration of Wind

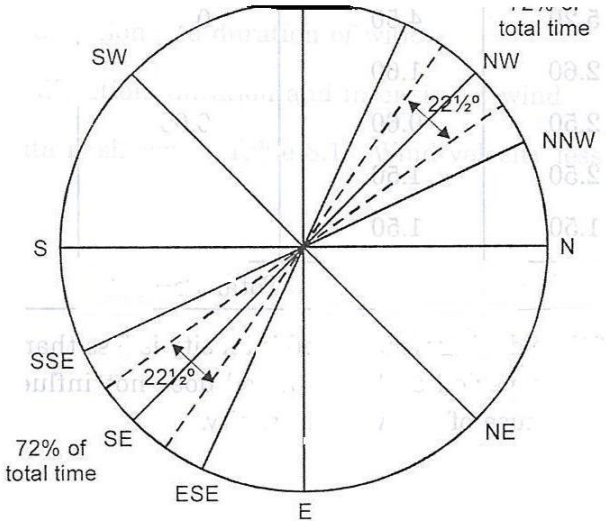
Type 2 : Showing Direction, Duration and Intensify of Wind

A typical wind data is Shown in the Given Table. Wind velocity less than the 6.4 kmph is considered as calm

The duration of the wind for anyone direct ion covers the angle of 22.5 degrees as Shown Given below



It is assumed that wind may below From any direction within the 22.5 Sectors. Based on the wind data Given in the wind rose Diagram Can be plotted



Wind rose Diagram can be plotted in the Following two ways

Type 1 : Showing direction and Duration of Wind

Type 2 : Showing Direction, Duration and Intensify of Wind

Type 1 : Showing direction and Duration of Wind

A typical Wind rose Diagram for the Wind Data Given in the following Diagram

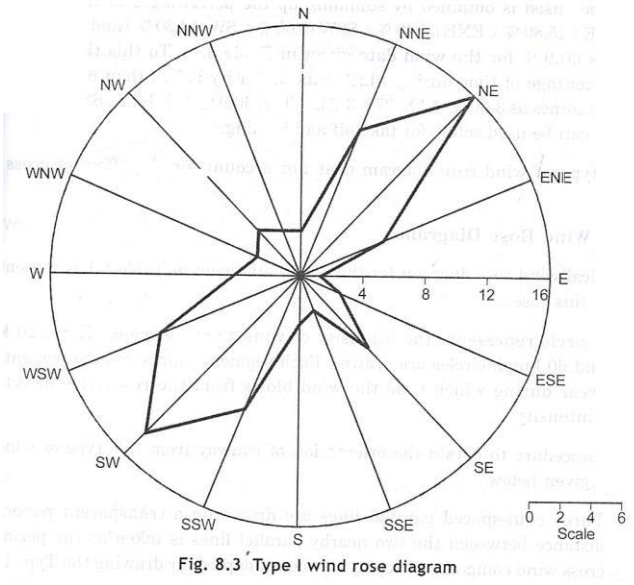


Fig. 8.3 Type I wind rose diagram

The wind rose Diagram is plotted taking a Suitable Scale for the percentage total wind duration. Keeping this Scale the percentage total wind direction in Each Direction is plotted.

For Example 2.7 % is plotted Along the north direction for the use Scale of 1cm =20% Similarly other than values are plotted along the respective direction. All plotted points are than then joint by Straight lines as Shown in Figure

The best Direction of the Runway is generally Taken as the longest line on the wind rose Diagram. For the Example Given the best direction of runway is along the NE-SW Direction

Derivation of wind direction up to 22.5+11.25 From the direction of landing and Take off is permissible. The percentage of time in the year during which the runway can Safely be used is Obtained but summing up the percentage of time Along NNE, NE, ENE, SSW, SW, WSW.

This type of wind rose diagram does not account for the effect of Cross wind component

Type 2 : Showing Direction, Duration and Intensify of Wind

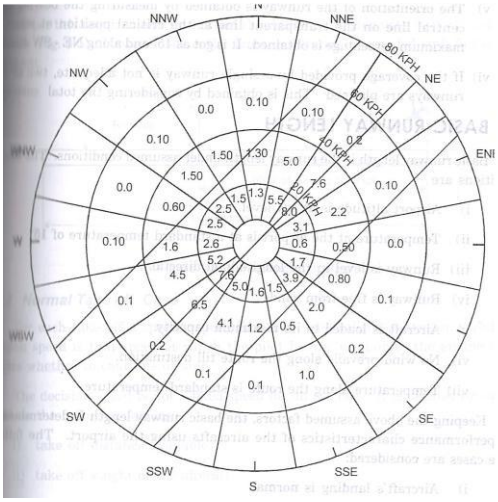
A typical wind rose diagram for the wind Data in table is represented in the following figure

Each circle represents the intensity of wind to some Scale. Here the 20, kmph, 40 kmph and 60 kmph Circles are Drawn. Each Segments represents of time in year during the wind Blows from the respective direction of particular intensity.

The procedure to Obtain the orientation of runway from this type of wind rose Diagram is Given below

1.The transparent paper Strip is placed Over the wind rose Diagram such that the critical line passes through the center line of the diagram

2. In this position , the tracing paper is rotated Such that the Sum of the following values indicating the duration of wind, within the two outer parallel lines is the maximum



3.The orientation of the runway is Obtained by measuring the bearing of the central on the transparent line at the Critical position at Which the Maximum percentage is Obtained

4.If the coverage provided by a Single runway is not Adequate, two or more Runways are planned. This is obtained by Considering the total Coverage