Transportation Engineering – II Notes:

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UNIT-I:

*Introduction of Railway:-

*Rails:-

↳ Rails are defind as a railway track, which is formed by providing the rolled steel section in two parallel lines over sleepers.

*function of Rails:-

↳ The surface provided by the rails is hard, smooth and even. The friction between them and wheel of the train is low.

↳ Rails transmit the wheel loads to the sleepers, ballast and the developmest between the safe limits.

↳ Rails have to carry.

1. Vertical forces and lateral force of the trains.
2. Breaking force
3. Thermal stresses.

↳ Rails constructed with high carbon steel. Subjected to minimum wear and tear due to worst atmospheric conditions.

*Various Components of permanent way are:-

A permanent way should serve the following:

- ↳ Both rails should be at the same level.
- ↳ Curves should be properly designed:
- ↳ proper superelevation should be provided.
- ↳ Track should be elastic to reduce hardship of impact between rails and the moving wheels.
- ↳ Joints should be properly provided designed.
- ↳ Components (rail, sleeper, ballast, fixture, and fastenings) should be properly designed
- ↳ Even, uniform and correct gauge should be provided.
- ↳ should be strong enough to resist lateral forces.

* Types of Rails :-

One Indian Railways rails are of the following three types:

↳ 1). Double headed.
2) Bull. headed.
3) flat footed.

1) Double headed. :-

↳ The Double headed purpose of having head and foot of the same section was to use the 'foot' as head. When the head got turn out. However, the section was Abandoned as could not serve the purpose for which it was initially introduced.

ii) Bull Headed Rails :-

↳ In this rails the metal in the foot is sufficient to bear the stresses caused by moving wheels

Advantages of Bull headed Rails:

↳ Easier for Manufacture.

↳ Long Life

↳ Maintain Better Alignment.

↳ These rails can be removed and replaced easily.

Dis Advantages:

↳ Reduced strength.

↳ Costly fitting.

↳ Costly Maintenance

iii) Flat Footed rails :-

↳ These rails are commonly used in India.

Advantages:

↳ Strong enough and do not require any chair.

↳ Less fitting and hence Economical maintenance.

Dis Advantages:

↳ fastenings get loose.

↳ Difficult to maintain points and crossing.

↳ Easier for removal and replacement which mean the track renewal is difficult.

↳ Under heavy loads rails sink into wooden sleeper.

(3)

Cross-section of permanent way:

↳ permanent way consists of ballast, rails, fixture and the formation.

↳ A railway track contains a pair of rails which are fixed to sleepers resting on the ballast.

↳ The ballast is placed over a formation as shown in fig. The rails positioned with the help of sleeper and fasteners.

↳ During the running of train the rails act as girder and transfer the entire load to the ballast to distribute the load from the rail to the formation.

The components of permanent way are as follows,

i) Rails, ii) sleeper, iii) Ballast, iv) formation,

function of sleepers:

↳ Holding gauge in proper gauge and level. 25
↳ Act as elastic medium,
↳ Support the rails firmly and evenly.
↳ Distribute the load transmitted from the rolling stock over large area of ballast.

Types of sleepers:

↳ 1) Timber, 2) steel 3) Cast iron, 4) Concrete R.C.C & prestressed.

* Timber or wooden sleepers: -

↳ This type timber or wooden sleeper used to the following advantages.

a) Normally timber sleeper of life may be taken as 12yr
b) Specially suitable for higher load and high speed.
c) Low initial cost
d) Few & simple fastening.
e) Easy to handle
f) Suitable for all type of ballast
g) Can be used with every type of rail.
h) Less damage during accident
i) Easy renewal of track

*Component (or) function of ballast :-

1) It transfers the load from the sleeper to the formation
2) It drains the water from the sleeper and keep them dry.
3) It forms as elastic bed by providing riding by comfort to the passengers.
4) It has to the resist various displacement of tracks.
5) It prevents the growth of vegetation on sleeper and formation inside the track.
6) It protect the surface of formation.

*Materials :-

i) Sand ii) Moorum, iii) Kankar. iv) Broken ballast. v) Broken stone vi) Gravel. vii) Blast furnace slag. viii) selected earth composed of indurated clay and decomposed rock. ix) Ashes or Cinder.

*Sand: Advantages :-

↳ Good drainage property if it is free from vegitation & earth.
↳ It provides a track free from noise.
↳ Cheap.

*Disadvantages :-

↳ Getting in to moving parts of the vehicles of the train resulting friction
↳ Creates difficulties in the upkeep and maintenance

ii) Moorum:

↳ Moorum under the impact of heavy load.

↳ It gets crushed to powder

↳ Due to this it is used to the in unimportant and side lines.

iii) Kankar:

↳ It is used to the meter gage and Narrow gauge.

↳ Track with very light traffic because Kankar is soft and it can be powdered easily.

iv) Broken Ballast: stones:

↳ Broken ballast stones satisfy all the requirement of the ballast.

↳ It is hard, Angular non porous and does not get desintegrated into flakes when broken.

↳ It is suitable for trap, quartz & granite.

iv) Broken Ballast:-

↳ Excellent drainage property.

↳ Does not permit growth of vegitation.

↳ It is cheap material as it is obtained from over burnt bricks unsuitable for masonry work.

*Creep of Rails:-

↳ The term 'Creep' in rails denotes longitudinal movement of rails in the track.

↳ principal causes of creep are explained as below:

a) percussion Theory:

↳ According to this theory, impact of wheels at the end of trailing rail at each fish plate joint results in the depression of the trailing rail with resulting creep in the forward direction.

b) Wave Theory:

↳ The train wheels cause depression under them setting forming lefts or crests immediately at the rear and in front.

↳ This action pushes the rail forward resulting creep in the direction of motion

c) Due to the unequal expansion, due to the expansion and contraction of rails.

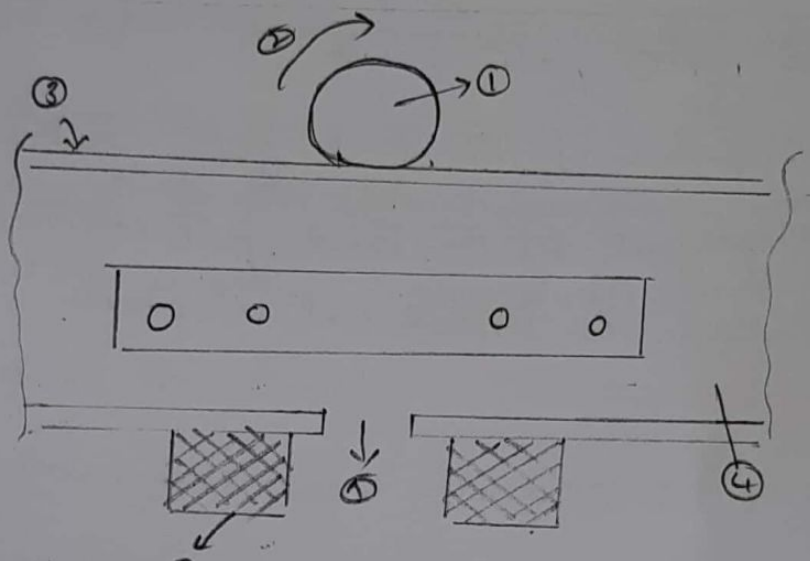
d) Due to de-acceleration or stopping of train, the breaking action tends to push the rail forward resulting creep in the forward direction.

e) Creep is greater than the curved direction portion. than in the straight portion

⑥

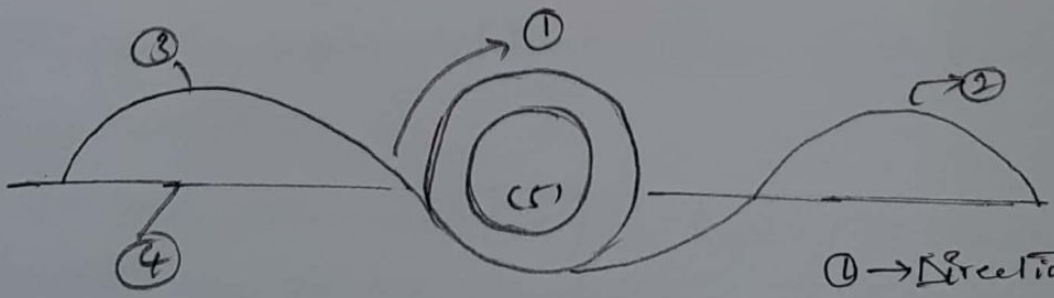
5) Creep is more than the track with the steep gradient.

9) In single line track creep results in the direction of traffic



1) Wheel
2) Direction of moment
3) Trailing rail.
4) Facing rail
5) Joint
6) Sleeper

* Percussion theory of creep



* Wake theory of creep

① → Direction of movement
② → Lift in front of wheel
③ → Lift at rear of wheel
④ → Normal surface of rail
⑤ → Wheel.

Sleeper density:

↳ Sleeper density is the measure of number of sleeper per rail length.

↳ It depends upon the following factors.

i) Method of providing rail joints: Three or four extra sleepers are required in case of staggered joints which have to be provided along the curves as compared to sleepers required in case of square joints.

ii) Speed of the train.

iii) Maximum axle load which the track is expected to carry.

iv) Lateral thrust of the locomotive.

↳ On account of the restriction in respect of parking space, the number of sleeper per rail can not be increased indefinitely.

↳ The parking space of India varies from 30.5 cm to 25.5 cm except at joints.

↳ In India sleeperdensity is kept as 1f sleeper per rail length due to increase in speed of fast moving trains this number of 1f per the sleeper density on main routes is being increased.

UNIT-II:

Geometric Design of Railway Track.

* Gradients :-

↳ The term Gradient indicates the rate or rise or fall of the track.

↳ for Example if there is a fall of 0.50m in every 100m. its gradients is expressed as 1 in 200 or 0.5%.

↳ In case the track has a grade of 1m in every 100m. its gradients will be expressed as 1 in 100 or 1%.

In order to connect different stations located at higher or lower altitude track has to be laid to some gradient depending upon the terrain and difference of elevation between the two stations.

Gradients in railways are classified as below:

i) Maximum permissible gradients or ruling gradients.
ii) pusher gradients
iii) Momentum gradients.
iv) station yard gradients.

Rulling Gradient:

↳ It is the maximum gradient to which a track may be laid in a particular section. The factor which govern this gradient are:

i) Load on the track and available power of the locomotive, the value of which is W. $\sin\theta = W \tan\theta = W \times$ Gradient.

↳ It will thus be seen that additional power required to pull the train along upward gradient is governed by by the gradient itself.

* In India the ruling gradient provided

↳ In plains 1 in 150 – 1 in 200

↳ In Hilly terrain 1 in 100 to 1 in 150

Along the curves additional power is required to pull the train.

It therefore follows that along curves some compensation has to be provided in ruling gradient failing which the speed of the train will have to be reduced.

· To avoid lowering of speed in a train a reduction is carried out in the gradient of the track.

↳ Some times. Even in areas in the plains every falling gradient is followed by rising gradient.

These type of gradients which utilise the momentum gradient by a falling track for negotiating following stretch of rising track is known as momentum gradient.

* Station Yard Gradient :-

↳ Along station yards gradients as rule are avoided

i) Extra power is required to pull the train on gradient

ii) In case of very strong wind bogies standing on gradient may initiate movement of the bogie and may result in accident.

Taking in to consideration the above factors gradients are completely avoided on platform and maximum limit of 1 in 400 is specified in station yard complex Railways have specified provision of a gradient of 1 in 1000

↳ Such a reduction of gradient is termed as a grade compensation. following compensation is provided on Indian railway

On Curves on B.G Track. 0.04%.

On Curves on M.G. Track 0.03%.

On Curves on N.G Track 0.02%.

Pusher gradient:

In the case of mountain railway it becomes some time Economical to provide ruling gradient. in the requiring very heavy cutting over a large strip of land In order to keep such cutting to the minimum one extra engine is provided to push the train along the terrain there type of situation, where extra Engine is required to the train, the gradient provided is known as pusher gradient.

Momentum gradient:

A falling gradient in hill Track is usually followed by a rising gradient.

The falling gradient in a hilly Track provide momentum to the train

The momentum along the falling portion is utilised for the following rising gradient.

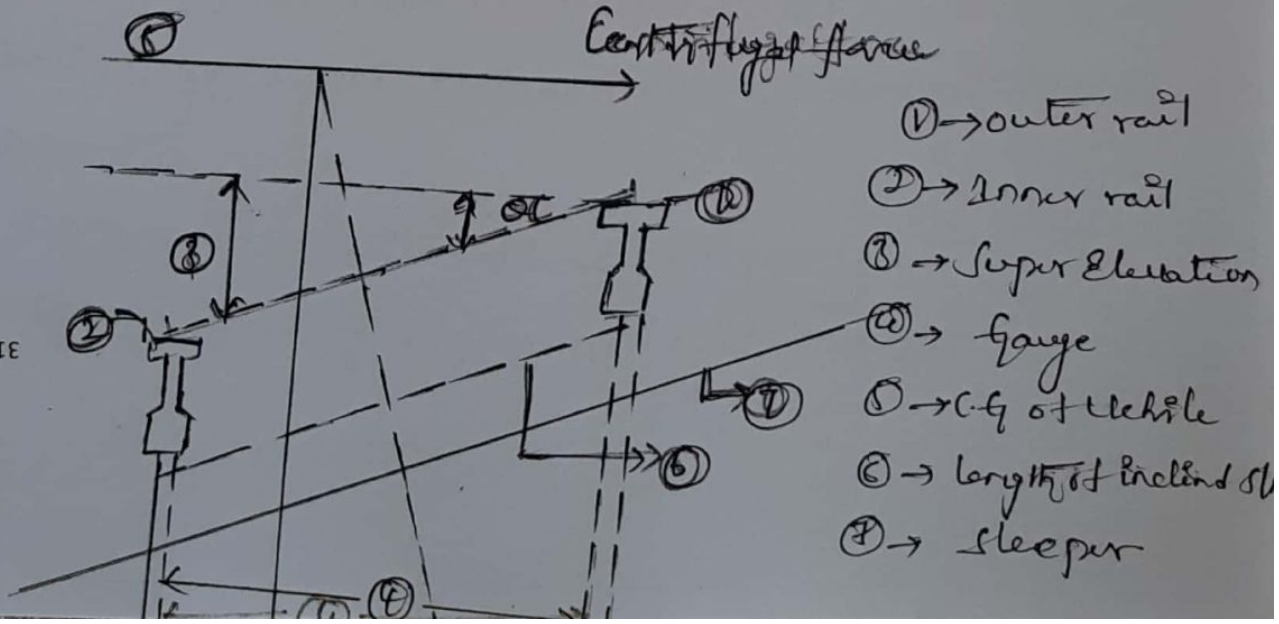
* Supercleuation :-

↳ In a horizontal curve the raised cleuation of the outer rail above the inner rail at horizontal curve In the case of railway track is known as Superelevation

↳ In place of supercleuation the term. 'CANT' or BANKING' is some times used.

This term should however be used to denote the angle of transverse slope provided to the sleepers by packing more ballast under outer edge

↳ The centripetal force F is introduced to counteract the tendancy of centrifugal force acting horizontally through C-G of moving vehicle to the pull vehicle out of the track and resulting increase in the wheel load on the outer rail.



Cant (or) Equilibrium Cant

↳ A cant which balance the Equilibrium speed of vehicle with the effect of centrifugal force is known as Equilibrium cant.

↳ It is denoted by the letter. 'e'

$$e = \frac{GV^2}{gR}$$

$e \rightarrow$ Equilibrium cant.

$G \rightarrow$ Gauge

$V \rightarrow$ Velocity

$g \rightarrow$ Acceleration due to gravity.

$R \rightarrow$ Radius of the curve

*Degree of curves:

Horizontal and Vertical Curves:

↳ The purpose of providing Curves on railway track is to connect important points as well as to avoid obstructions. However, if at reconnaissance stage suitable precaution are taken the Number of the curves on the track can be considerably reduced if not eliminated.

It may be noted that with proper planning of 491 Km straight line across Nullarbor plain in Australia has been built During reconnaissance survey therefore the survey party should as far as possible avoid introducing curves

the main reasons being:

↳ Due to increase in Traction force along the curve, there is more wear and tear of track components resulting in the increase in maintenance cost.

↳ Working of the train is affected which restricts speed, limits length of the train and prevents heaviest type of locomotive.

↳ Danger of derailment and collision.

↳ Smooth running of trains is not possible

On following places curves should be avoided

a) Deep cutting
b) Bridge and Tunnels and their approaches
c) On steep gradient
d) Level crossing.
e) Station and yards.

*Reasons for Introducing Curves:-

a) To provide gradual change in direction
b) To provide gradual change in gradient.
c) To provide easy Turning of Train.

*Types of curves:

Curves on railways are of two types
i) Horizontal, ii) Vertical

*Horizontal Curves:-

Ihes further divided into:

a) Simple b) Compound
c) Reverse d) Deviation

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a) Simple curves:

↳ It is a circular curve consisting of single curve of uniform radius

↳ The curve may be located blw two tangents length or blw two transition curves.

Salient feature of simple

i) The curve may be laid within two tangent lengths or two transition curves

ii) The curves is designated by the degree of the curve

Degree of a curve is the angle subtended at it centre by an arc of (100') 30m

$$\text{Radius of 1° curve} = \frac{30 \times 360}{2\pi} = \frac{1718}{D} = 1718\text{m}.$$

D = Degree of the curve

R = Radius of the curve in metres.

$$\text{Radius of 0° curves} = \frac{1718}{D}$$

The radius of 4° curve will be 1718/4 = 429.5m.

Simple curve is provided at every change in alignment of the track in plains as well as in hilly regions.

b) Compound Curves:

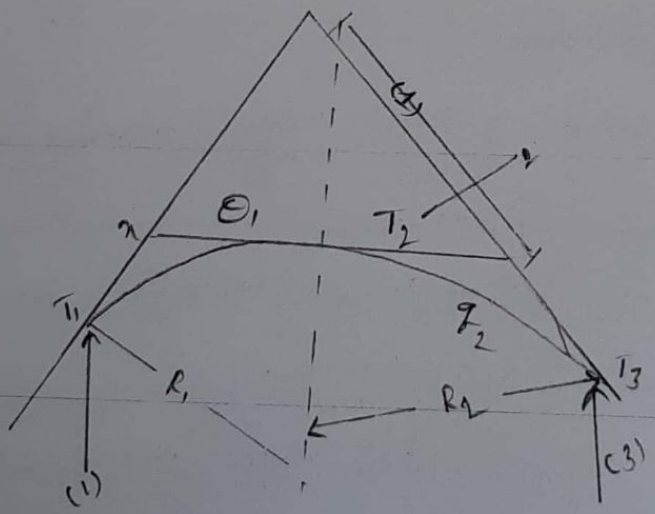
↳ It is a circular curve constituted by a series of two or more simple curve of different radii, running in the same general direction.

Simple curve T_1T_2 and T_2T_3 have a common tangent at T_2 their centres lie on the same side of the curve.

This type of curve is resorted to under

i) To avoid heavy filling or cutting

ii) To avoid cutting through hard rock.

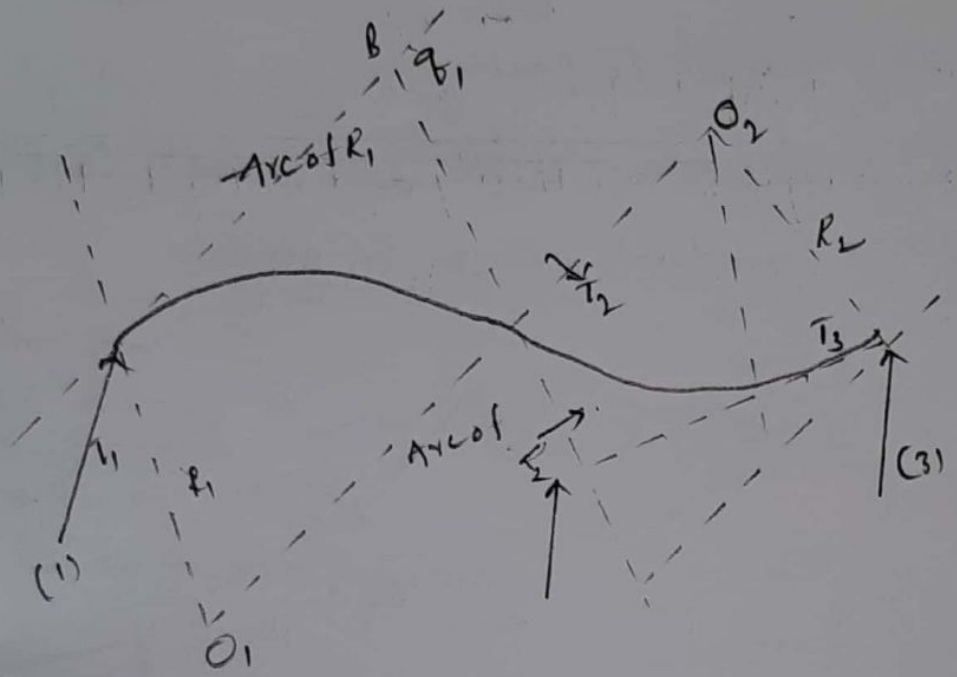


1) Tangent at T_1
2) Tangent at T_2
3) Arc of T_2

→ Compound Curve

c) Reverse Curve :-

These type of curve is used in cross-over in station yards and in alignment of railway track



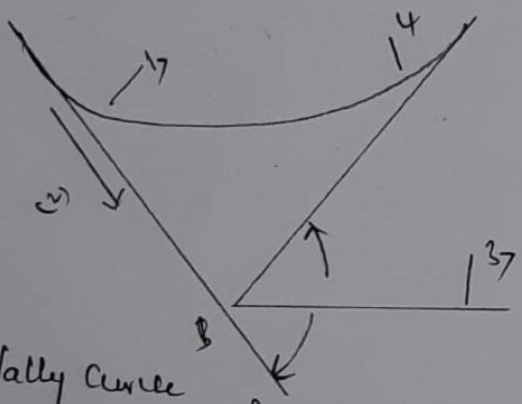
d) Deviation Curve :

↳ This purpose of this curve is to deviate the track the straight position to a changed or deviated position to avoid accident prone areas or for repairs to the worn out

Vertical Curves:

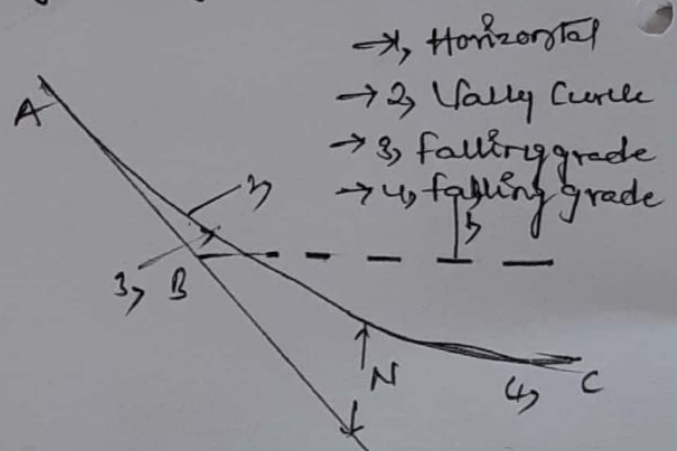
↳ Vertical curves are provided a change of gradient in the alignment of a track for the following.

i) providing comfort to passengers.
ii) providing adequate visibility and safety to traffic.
iii) providing gradual change in grade



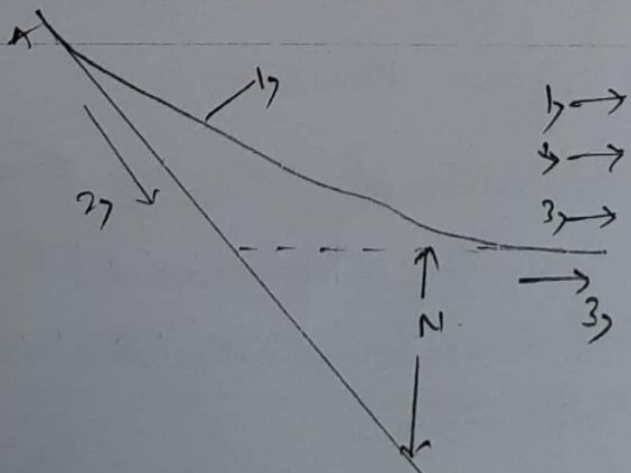
1) Valley curve
2) falling grade
3) Horizontal
4) Rising grade

i) falling gradient intersect another rising gradient



1) Horizontal
2) Valley curve
3) falling grade
4) falling grade

ii) falling gradient intersects another falling grade



1) → Valley curve
2) → falling grade
3) → Horizontal path

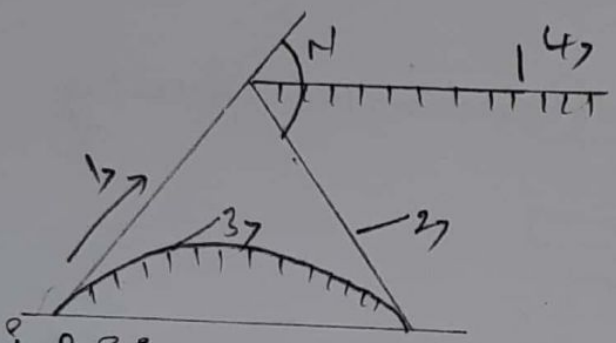
iii) falling gradient meeting a horizontal path.

Vertical curves are divided into the following two types.

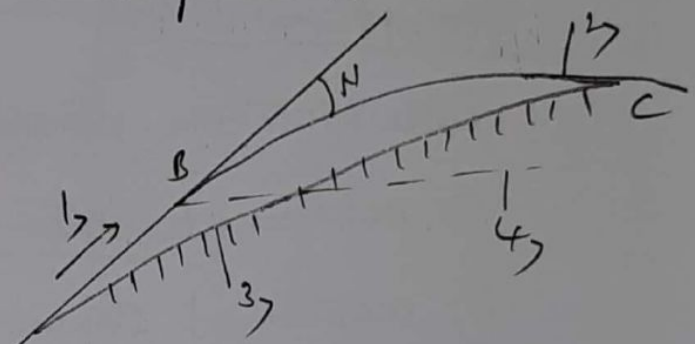
a) Valley curves:
b) Summit curves:

a) Valley Curves:-

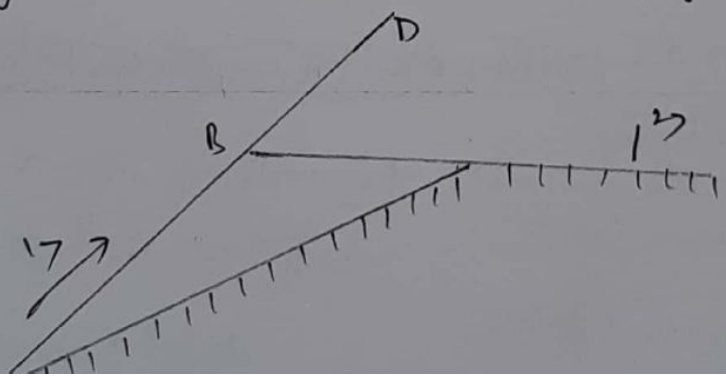
These curves have their convexity downwards



i) Raising gradient intersecting falling grade



ii) Raising gradient intersecting another rising grade



ii)

Rail Joints: -

↳ A rail joint provided for connecting one rail to another rail in the correct position is known as rail joint.

↳ While joining the rails, a certain gap is provided for expansion and contraction of rails.

Types of rail joints:

Rails joints are classified based on the following

a) position of joints.

b) position of sleepers.

a) Based on the position of joints: -

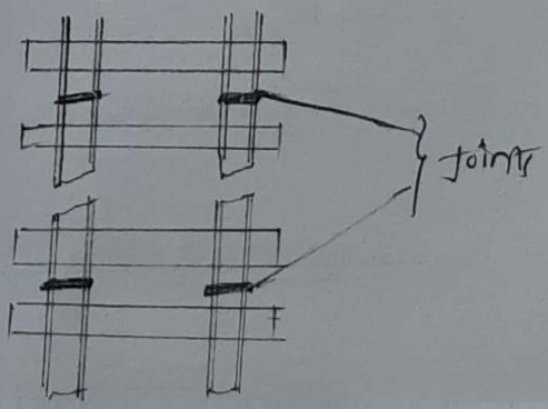
Based on the position of joints, the rail joints are classified into two types:

i) Square joints

ii) Staggered joints.

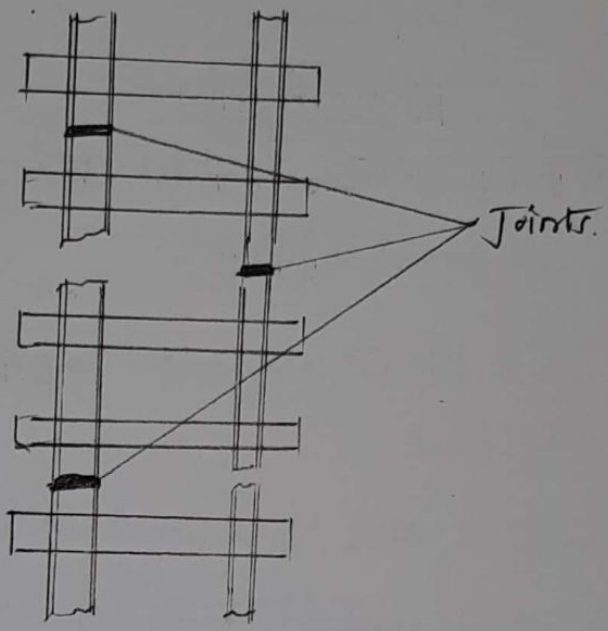
i) Square joints: -

↳ In this type of joints, the joints (in two parallel rails) are positioned in such away that they are opposite to each other as shown in fig:



ii) Staggered joints:

↳ In this type of joints, the joints are positioned such that the one joint in a rail, at the centre of two joints in a parallel rail.



b) Based on the position of sleeper:

↳ Based on the position of sleeper the rail joints are classified into 3 types:

i) Suspended joints.

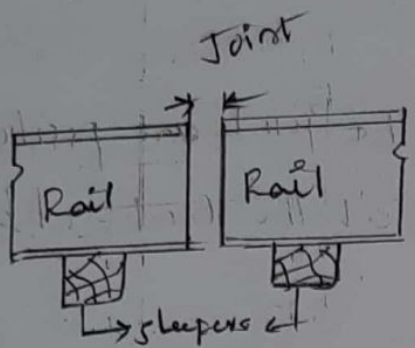
ii) Supported joints

iii) Bridge joints.

i) Suspended joints:-

↳ A joint positioned in btw two consecutive sleepers is known as suspended joint.

↳ the rails placed on top of the sleepers. carries an axle load and distribute it equally on both the sleeper.

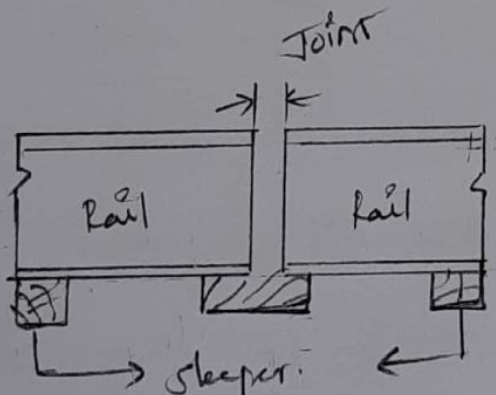


i) Square joints.

ii) Supported joints:

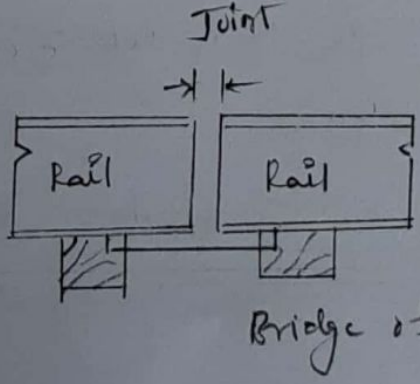
↳ A joint below which the sleeper is placed is known as supported joint.

↳ These joints are not capable of supporting heavy axle load



iii) Bridge joints: -

↳ These type of joint is same as the suspended joint. In this joint an additional bridge is provided below the rail and is laid over the sleepers.



*Classification of station yards:-

*Yards are of the following types:

1) passenger yards:
2) Goods yards:
3) Marshalling yards:
4) Locomotive yards:

*passenger yards:-

↳ Railway platform is an example of passenger yard.
↳ It provides facilities for the safty and convesience of passengers.
↳ These type facilities like waiting room, cloak room, parking space charging batteries, enquiry office, medicals, etc.

* Goods yards:-

↳ Goods yards in a place where loading and loading of deli-very goods are done.
↳ All the goods trains move from here
↳ It is provided in all the stations. Except flag station

3. Marshalling yards:-

↳ Marshalling yard is required to separate goods wagons received from various centres in the order of stations to which they are to be sent.

↳ World's most advanced marshalling yard is Toronto yard in "Canadian National Railway"

↳ It sort out about 500 wagons daily. It contains about 250km length of railway track

* The following factors should be considered in the design of marshalling yards.

a) Shunting operation should not affect time table of normal trains.

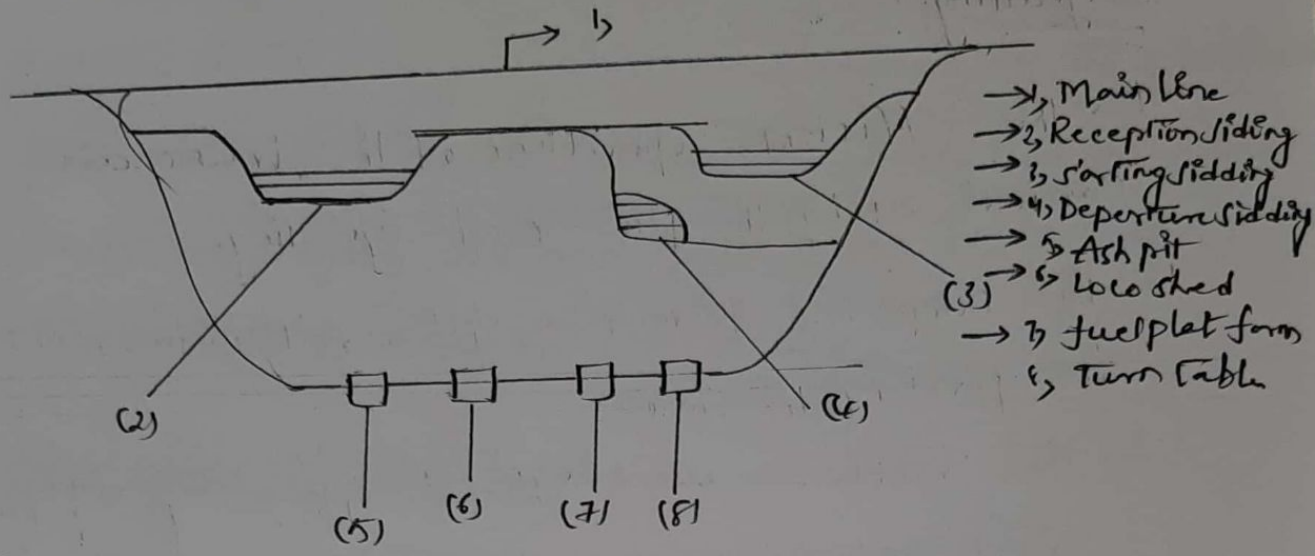
b) Efficiency of yard depends upon the number of wagons sorted out.

c) Probable future expansion is to be considered

d) Marshalling yard should be kept parallel to running line

e) Yards should be so designed that wagons move in one direction only.

f) Transhipment platform with repacking facility should be provided



Marshalling yards are following types:

a) Flat yard: Suitable for areas where limited space is available Grater power is consumed

b) Gravitational yards: Track of yard are laid at suitable gradient. shunting operations are carried out by gravity. assisted by engine power

c) Hump yard: Wagons are pushed up to summit by Engine and allowed to gravitate down the slope.

*Locomotive yard :-

↳ All servicing activities like cleaning, oiling, filling water. and small repair etc.

*Signalling :-

↳ The efficient operations of the trains are carried out by the process of signalling.

↳ It comprises of devices, system and various means for operating the trains.

↳ The tracks are used highly for providing safety to the staff, passengers and rolling stock.

Objectives of signalling:

↳ The different objectives of signalling are,

a) The safe and efficient facilities should be provided for shunting operation

b) When multiple trains appear at each other part the safety should be ensured between the trains.

c) At converting the junctions the trains should be protected and at diverging junction, directional indication should be provided.

d) proper facilities should be provided for systematic trains should be properly guided.

* Interlocking :-

↳ The interlocking technique obtained by the electrical and mechanical device should be such that the signal must be properly set and held before it is taken to OFF position is known as interlocking.

Necessities of Interlocking :-

↳ The operations of signalling. The lowering of signal should be carried for a defined route and inadvance the route is correctly set.

↳ The working of signals is safe and proper by the help of interlocking device

Methods of interlocking:

↳ a, key system. b, Route relay system c, tapper and lock system:

UNIT-3:

Airport Engineering:

Airport site Selection:

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

↳ However if such factor as required for the section of the largest facility are considered, the development of the airport by stages will made easier and economical.

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

1. Regional plan 2) Airport use 3) proximity to other airport 4) Ground accessibility 5) topography. 6) obstructions, 7) visibility 8) wind 9) Noise nuisance 10) Grading drainage and soil characteristics. 11) feature development. 12) Availability of utilities from town 13) Economic considerations.

1) Regional plan:

↳ The site selected should fit well into regional plan. Here by forming it an integral part of the national net-work of airport.

2) Airport use:

↳ The selection of site depends upon the use of an airport. i.e. whether for civilian or for military operation.

↳ During the civilian emergency airports are taken over by the defence

↳ The airport site selected should be such that it provide natural protection to the area from air raids.

Airport classification:

The airports have been classified by various agencies.

↳ 1) International Civil Aviation Organisation (ICAO).

↳ 2) Federal Aviation Agency (FAA).

* International Civil Aviation Organisation (ICAO).

↳ The ICAO classifies the airport in two ways.

1) 1st Method:

↳ The classification is based on the basic runway length of the airport.

↳ It is also describes various other geometric standards of the airport.

↳ The classification has been done by using code letters.

↳ A to E in which the 'A' type of the airport has the largest runway length

↳ 'E' type has the shortest length.

↳ 2nd Method:

↳ Here it classification is based on the Equivalent Single wheel, Load (ESWL) and the tire pressure of the air craft. which will use the airport.

↳ the classification has been done by using the numerical numbers. viz '1 to 7'

i) Maximum efficiency: 1.0 per cent for A, B, C & Grade
2.0 % for D & E types.

ii) Maximum transverse grade: 1.5 % for A, B, C & D
2 % for D & E types.

iii) Rate of change of longitudinal grade: for 30m (100 ft) length of vertical curve
0.1 % for A & B.
0.2 % for C
0.4 % for D & E types.

Runway Geometric Design :-

- ICAO gives various geometric standards for the Airport design.
- Most of its number nations provide international air. services
- In order to have uniformity in the landing facilities at the airport located in different countries
- It is desirable to follow the common design standards as recommended by ICAO
- The following items are considered in the geometric design of runway:
  - Runway length
  - Runway width
  - width & length of safty area
  - Transverse gradient.
  - Longitudinal & effective gradient.
  - Rate of change of Longitudinal gradient.
  - Sight distance.

* Runway Length:

↳ It is determined from the performance characteristics of the aircraft using the airport by considering following factors and standard conditions.

a) performance characteristics of aircraft using airport.
b) Normal Landing & normal takeoff of the aircraft.
c) Average maximum airport temperature (at 15°c)
d) Runway gradient.
e) Engine failure.

* Runway width:

↳ ICAO recommends that the width of the pavement varying from 18m to 45m for different types of airport.

↳ Runway width on major airport keeps the outermost machine of large jet aircraft on paved runway surface to protect aircraft engines from the loose material of shoulders causing damage to machine 45m. (150ft). is sufficient for large airport as recommended by ICAO.

3. Width and length of Safty Area:

↳ shoulders are useful during on emergency landing or take-off.

↳ the width of the safty area for non-instrumental runway should be 150m for A, B & C types and for instrumental for D, E type, it should be 300m & 75m resp.

↳ the length of the safty area must be equal to the length of runway 120m above.

4) Transverse Gradients:-

↳ Transverse gradient is used for quick drainage of surface water.

↳ As per ICAO recommendation Transverse gradient should be not > 1.5% for A, B, C & 2% for D & E types & portion of shoulder from the central runway should not exceed 2.5% and remaining portion should not be grater than 5%.

Runway length :-

↳ Runway length is computed from the performance characteristics of aircraft using the airport by considering following standard conditions.

1. performance of characteristic of aircraft using airport.
2. Normal landing and Normal take-off of the air craft.
3. Average maximum airport temparature at 15°c
4. Runway Gradient
5. Elevation of the airport site at the sea-level.
6. No wind blowing on runway.

The 3 following cases are usually considered for Jet engine aircraft.

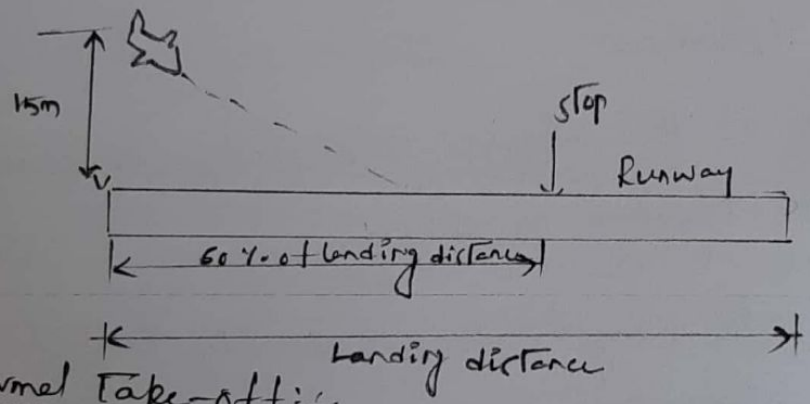
i) Normal Landing
ii) Normal take-off
iii) Engine failure.

i) Normal Landing:-

↳ The position of Engine aircraft, normal landing case and engine failure case are considered.

↳ In this case, aircraft should be stopped with in 60% of landing distance.

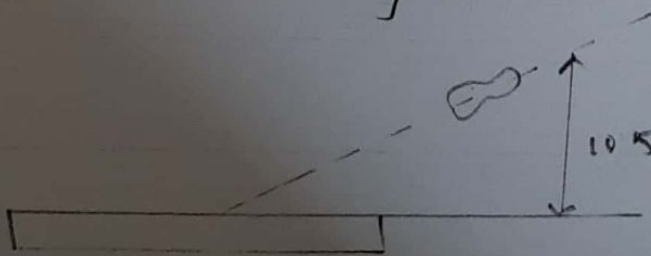
↳ This landing distance is provided with full strength of pavement.



ii) Normal Take-off:-

↳ In this case clear way is required beyond the runway and it is alignment with the centre line of runway.

↳ The width of clear way kept free from obstructions. and is not less than 150m and it should not exceed 1.25% of inclination from the runway end.



Factors Controlling Taxiway Layout :-

1. Methods of design. 2. Steering Angle 3. Three Node Concept. 4. Runway Incursions. 5. Intersection Angle 6. operational Requirement. 7. Coordination.

↳ Methods of design :-

↳ 1) The Generally the taxiway are designed for "cockpit over centreline"

↳ A sufficient width of pavement is allowed for wander based on "taxiway edge safety margin"

↳ Steering Angle :-

↳ 1) The general accepted value to prevent excessive tyre scrubbing is 50 degrees.

↳ Taxiway should be designed such that the nose gear steering angle is less than this value

* Three Node concept:

↳ A maximum of three choices of travel should be provided for taxiway intersection to maintain pilot situational awareness.

Runway Incursions:

↳ Generally, the runway incursions should be reduced in design through proper airport geometry.

Wind rose Diagram:

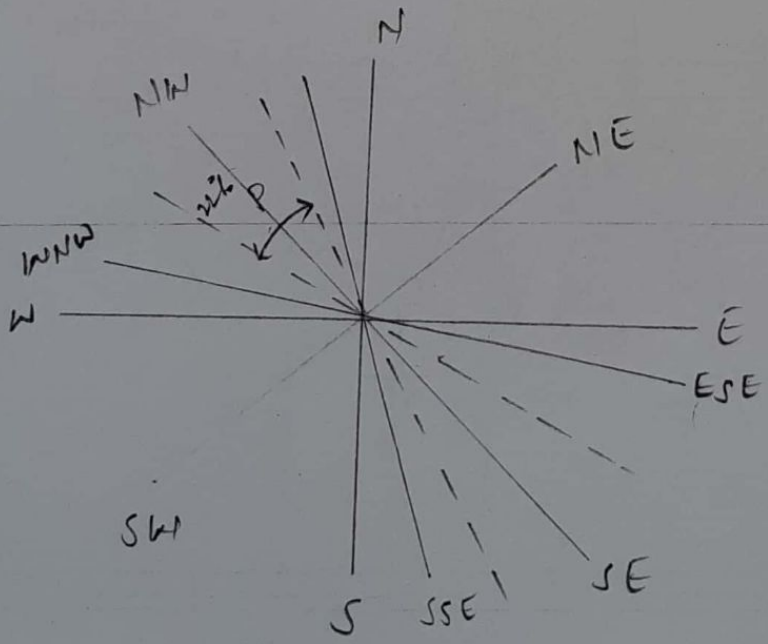
↳ In this diagram in which the information about wind represents graphically.

↳ wind information includes the direction duration and intensity of wind

User:

↳ 1. wind rose diagram is used to analyse the wind data

↳ 2. To obtain the most suitable runway direction.



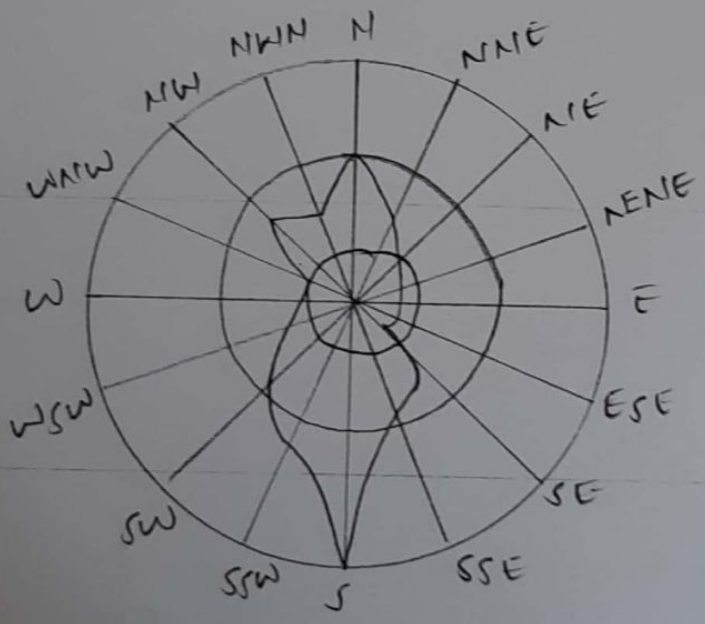
* Type 1 Wind rose diagram:

↳ The radial lines represents the direction of wind

↳ The circle represents the duration of wind in the fig.

↳ The longest line on the wind rose diagram indicates the best direction of runway.

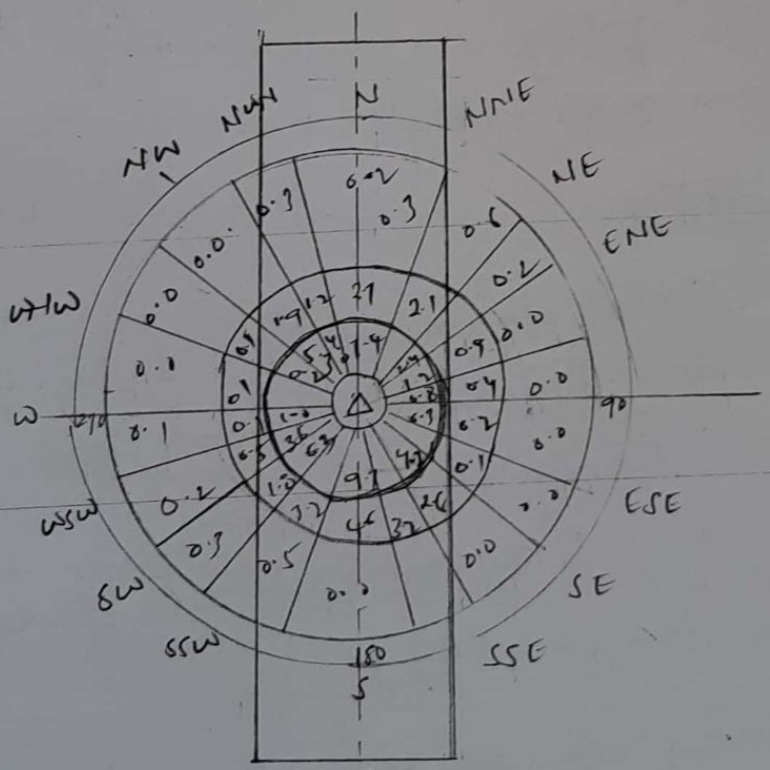
↳ Hence the best orientation is along NS direction.



* Type II: Wind rose diagram:

↳ The each circle represents the intensity of wind to some scale.

↳ The values written in each component represent the time percentage in year during which the wind having a intensity. blows from the particular directions.



Runway Lighting System:

↳ The runway lighting system in runway is basically provided to enable the pilot in judging the position of aircraft over the runway.

↳ Then it lighting system helps to pilot to determine the proper alignment, height, distance and lateral displacement of aircraft on the runway

*↳ There are two methods for providing the lighting system.

*(a). Flood Lighting

(b): Narrow-gauge lighting.

* Flood Lighting:

↳ In this method of runway lighting the complete area of runway is illuminated by flood lights which are provided at the edge of the runway.

↳ This method of lighting is not use currently due to reason of block-hole effect.

↳ The block-hole effect is observed while the aircraft crosses the threshold and is just near the runway.

b) Narrow Gauge Lighting:

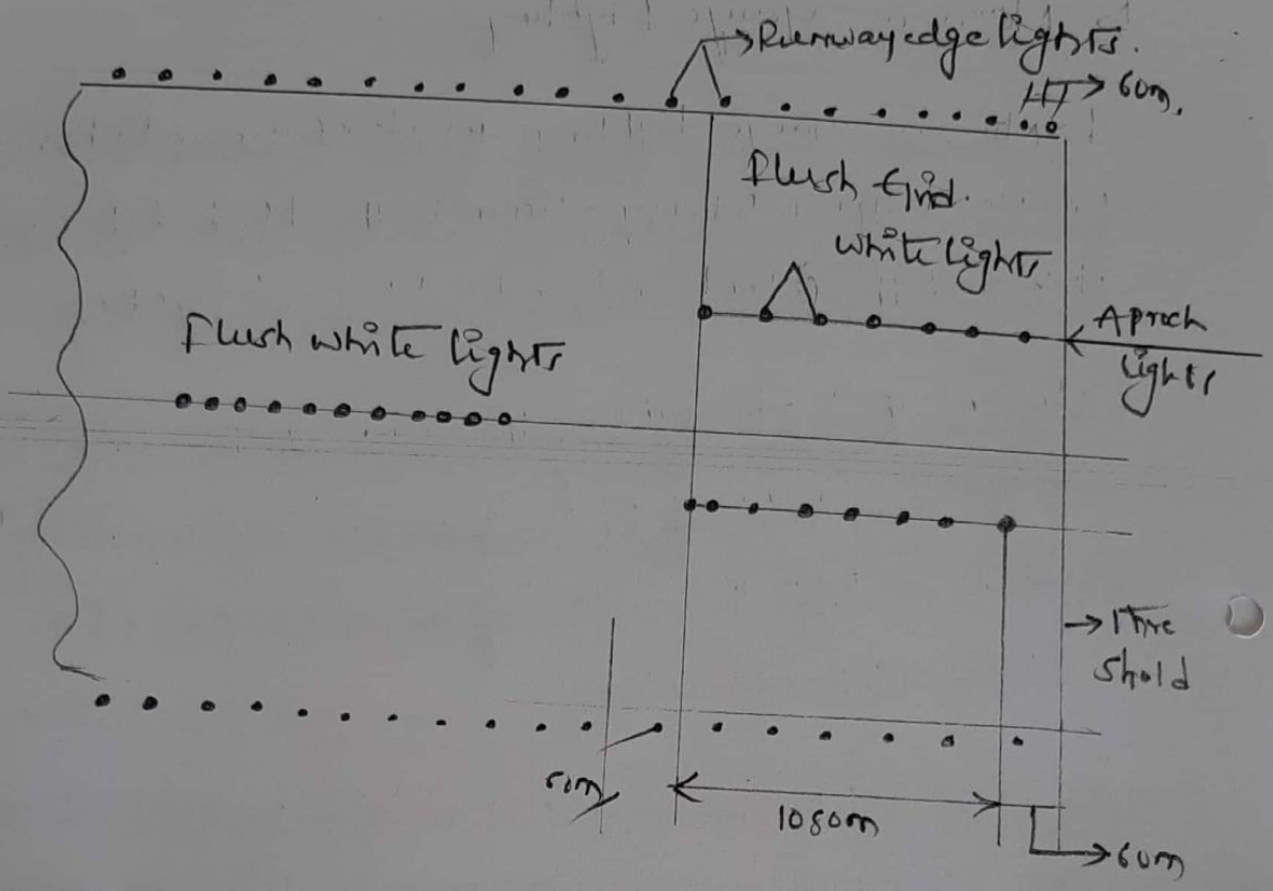
↳ Narrow Gauge lighting involves a more better and precise design of totally eliminate the block-hole effect. observed the (block-hole effect) flood lighting.

↳ This method of lighting the runway, the central area of the area runway is illuminated. by providing two group of high intensity. lights on two side of the centre line of runway.

↳ These lights are placed at a uniform distance 1m along the centre line and extends to distance of 1040m from the threshold line.

↳ After the distance of 1040m, the lighting is provided in the form of flush lights running along the centre line of the runway.

↳ These lights are provided till the other end of the runway and are spaced at very close intervals.



÷ UNIT-IV ÷

PORT and Harbour Engineering: ÷

Port: ÷

↳ Jawaharlal Nehru port located in mumbai Harbour is one of the eleven major port in India in the year of 1989.

↳ it is the first growing port with dedicated facilities for handling containers and dry bulk.

↳ port linked with the National network of railway and highway of India.

Requirement of port:

↳ A port should be possess simple links with the railways to make transportation of commodities to and from the port easily and rapidly.

↳ Dimension of the passage should be have suitable depth and width inorder to promote navigation.

↳ the Anchor facility must be perfect when the ship reach the harbour of berth during loading and unloading of cargo. fuel and supplies etc.

↳ The port should own provision to store the commodities during the transportation.

↳ The port should include the arrangement to undergo servicing works of ship whenever it is required.

Requirements of Harbour :-

↳ The depth of the ship channels either natural or artificial, should be adequate so that the vessels can draft smoothly.

1) Natural Harbour :-

↳ The harbour provide natural protection in the form of Creeks and basins.

↳ In other words it is in bt protected from waves and storms.

↳ These Harbour more useful to commercial vessels additional construction take place to enable them to receive larger vessels and provide better facilities.

↳ Port of Kandla and Mumbai are example natural harbour.

Artificial Harbour:

↳ It is protected by walls of breakwaters or by dredging.

↳ Artificial good stead is obtained by the construction of breakwater.

↳ These offer facilities like protection to ships, vessels, if climate becomes worse

↳ The protection can be obtained, if the area of the water that is near to shore by the artificial walls in all weather conditions.

↳ Where such natural facilities are not available countries having a seaboard, had to create or construct such structures making use of engineering skills and method and such harbour are called artificial Harbour (or) man made harbour

Ex: Madras is an Artificial harbour.

* Different type of ports:

↳ 1) Sea port
2) River port
3) Fishing port
4) Warm water port
5) Dry port
6) Inland port

* Sea port:

↳ Where type of sea port used to handle ocean-going is called as sea port.

* River port:

↳ The river traffic includes shallow draft vessels and barges are controlled by river port.

* Fishing port:

↳ To land and distribute fish, a fishing port is highly suitable.

* Dry port:

The place where containers or commercial bulk cargo is to placed ... is called as dry port.

Warm water port :-

↳ The place where there is no-freeze of water in water is called warm water port.

Inland port :

↳ The direct access of port on river, lake or canal, To ocean or sea is called as Inland port.

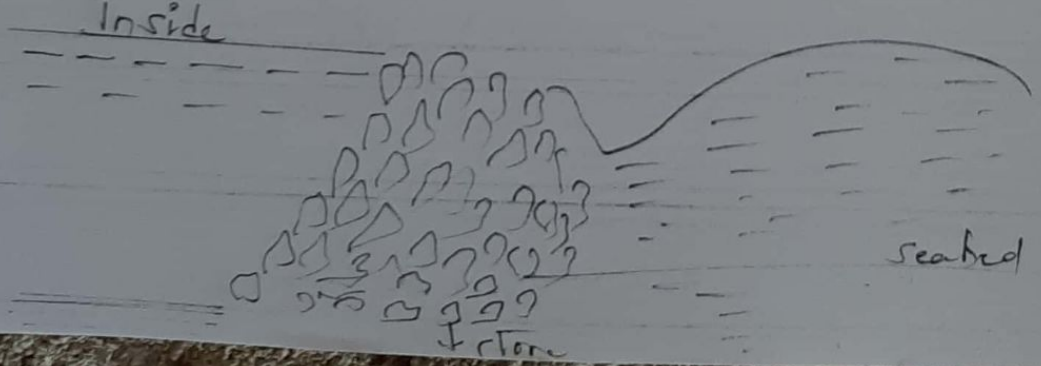
Break waters:

Types of Break waters:

1) Stone dike
2) Stone dike with armoured face
3) Concrete block
   i) Type-I
   ii) Type-II
4) Concrete caisson
5) Over flow type
6) Combined type
7) Caisson with holes.
8) Air water jet type
9) Submarine type

Stone dike:-

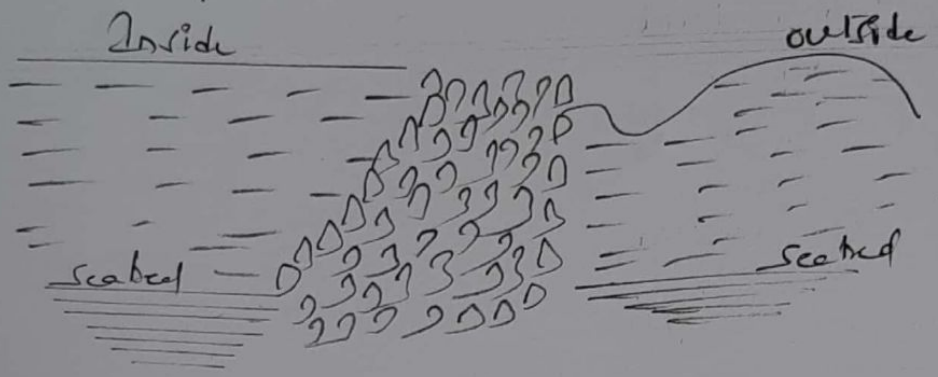
→ The most simplest and economical type of breakwater structure is a stone dike. Its layout is shown in the fig.



Stone dike with Armour stone :-

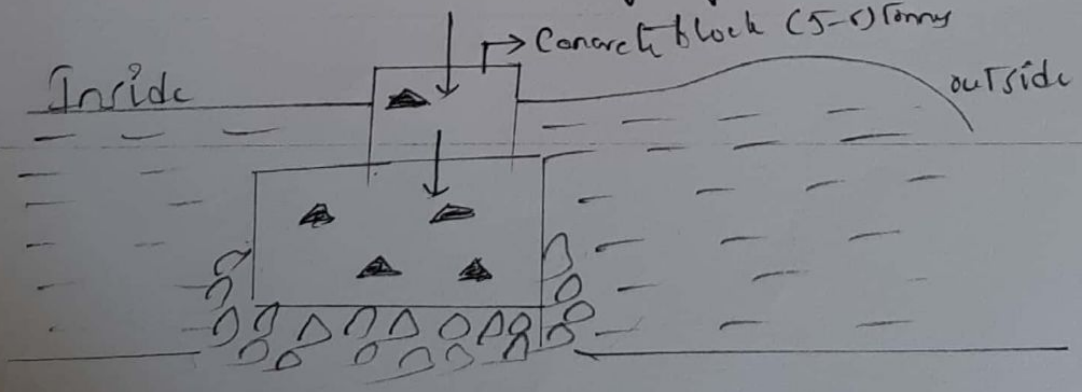
↳ It is reinforced structure which is covered with armour stone of about two to three stone.

↳ The layout of stone dike structure.



Concrete block - I :

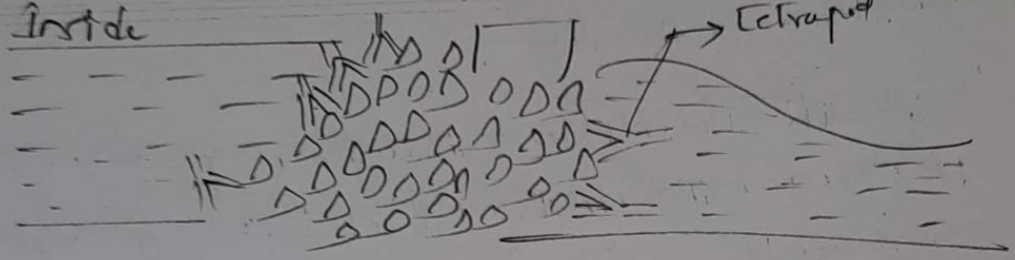
↳ These type of break water is much stronger than the stone dike structure as it involves the use of concrete blocks weighing :



Concrete block-II:

↳ The break water concrete block structure (type-II) is an alternative for type-I concrete block.

↳ These type of structure is provided with Tetrapods.



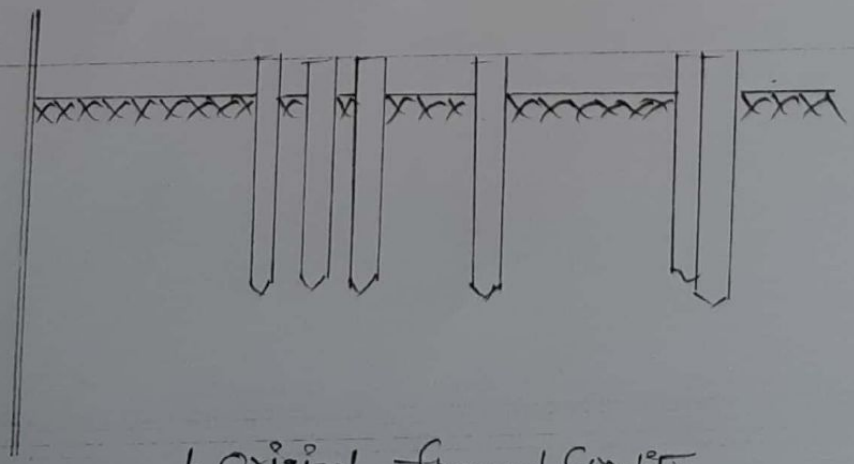
* Dry docks: -

↳ The construction of docks can be done by they are situated on a part of a shore that is between highest and lowest levels which can be reached by the sea on a particular harbour that is dewatered at the site.

↳ The site is enclosed through a wall of sheet piling when the construction of timber graving dock is carried out.

↳ Before the excavation is done a portion of ground piling is driven inside the ground.

↳ The four stages in dry docks construction on a ledge rock that is covered by soil below the water.



↳ Original Ground Condition.

Navigational aids:

↳ The Navigational aids are the structures are fixed or floating type:

↳ These type of structure are provided with beacon lights - sound warning device and radar reflectors

↳ These structure are standardized. The lands close to the shore are used to build signals

↳ One of the major source for floating stations is light vessel.

↳ Approach channels can be demarcated by standard floating beacons.

↳ The Navigational aids are classified based upon the range of visibility and the service that provide render and they are four types:

↳ 1) Coast Approach light station.
↳ 2) Obstruction light station
↳ 3) Approach channel lighting
↳ 4) Harbour light signal,

UNIT-5.

Intelligent Transport System:-

ITS: Introduction:

↳ IT is a Transport System which use modern information and information technologies in vechicle to increase the Transportation networks.

↳ It promotes the vehicle safty.

↳ Capacity of existing structure needed for the operation of Transport network is improved.

↳ It reduce congestion problem.

↳ Low speed, increased accidents rates, increased fuel consumption and increased pollution.

↳ Impossible to build enough new roads or to meet the demand.

↳ The goal of ITS is to improve the Transportation System. To make it more efficient and safer by use of information communication and control technology.

Benefits of ITS:

↳ For the several aspects, the ITS provides the parking information and guidance system.

↳ The driver can choose his path and can park at right place without wasting of time.

↳ By providing passengers information, people can plan to travel different place more easily without causing only inconvenience to driver.

↳ By using various ITS technique such as red light violation detection system,

↳ The most accurate monitoring can be achieved with lesser employment of man power as well as ensuring safety of the road users.

Automatic Vehicle Location (AVL).

↳ Automatic Vehicle location (AVL) evaluate and safeguards the real time assessment of vehicle by tracking it position against schedule.

↳ It tracks the information regarding VehicleID. the Servicenumber. the line, the location of an event.

↳ Automatic Vehicle location can be carried in two ways.

- ↳ Location-at-time
- ↳ Time-at-location.

↳ AVL system provided important input data for analysing dwell and running time regulary service headway reliability indicators.

Automatic Vehicle Identification

↳ In this Automatic Vehicle identification is basicly discussed three system.

↳ 1) Read-only
↳ 2) Read-write
↳ 3) Smart-card.

1) Read only:

↳ In these Vehicle device Transponder Transmits the data due to roadside division and all the data records are stored by the tolling administration.

2) Read-write:

↳ In these Vehicle device transponder broad cast information to roadside division and stories it. this record of information transaction is maintained by the smooth tolling administration and the user

3) Smart-card:

↳ Smart card unites the above system with the user services like transportation parking payment it provides mayday function advanced security option.

Applications of Intelligent transport system:-

↳ It provide the information about weather conditions, speeds and route to be followed by the drivers on the roads

↳ The traffic flow is monitored or controlled by ITS based on the information provided by the advanced Travellers information system.

↳ It detects the crashes (or) collisions of the vehicle and give the information about the incidents to the emergency services. It allows electronic collection of toll.

↳ By the use of electronic devices and computers vehicle are guided, the information regarding routes Schedules is provided to the vehicle.

↳ It reduces the congestion and delay problems by controlling the traffic flow and adjusting the signals.

* APTS Technologies:-

↳ The Advanced public Transportation System has been categorized into six types.

↳ Fleet management system.
↳ Traveller information system.
↳ Electronic payment system.
↳ Transportation demand management
↳ The transit intelligent vehicle initiative

* fleet management system:

↳ In this system is to check and control the effectiveness of fleet in various aspects such as to fulfill customer demands, details mishap or accidents response management and service restoration.
↳ They increase the efficiency of transit system.

* Traveller information system:

↳ In this system mainly used to provide the users with the data required to plan and schedule their journey.

↳ The users should be able to access vehicle information such as arrival time required available

↳ At any time and any place using this information.

↳ a traveler can take timely decision to choose the route mode to transport etc.

↳ The make the journey more comfortable.