IV/IV B. Tech (Regular) DEGREE EXAMINATION

March, 2017 **Civil Engineering**

Eighth Semester **Transportation Engineering-II**

Time: Three Hours **Maximum:** 60 Marks

Answer Question No.1 compulsorily. (1X12=12 Marks)

Answer ONE question from each unit (4X12=48 Marks)

1. Answer all questions (1X12=12 Marks)
   a) Define vehicular characteristics?
   b) Write down the average of speed of vehicles on national highways?
   c) What is meant by possible capacity?
   d) What is driver reaction time required for road accidents?
   e) Draw a sketch which is suitable road marking for no overtaking?
   f) What is the design capacity of rotary intersection at rural areas?
   g) Draw a neat sketch of suspended rail joint?
   h) Write down component part of crossing?
   i) Illustrate the type of marshalling yards?
   j) Describe the reason of topography study in airport site selection?
   k) What is the minimum spacing between the airports for piston engine aircraft under IFR condition?
   l) Define harbor?

UNIT-I

2. a) What are the different road user characteristics which affect the road design? Briefly Explain? 6M
   b) Explain the term traffic volume. What are the objects of carrying out traffic volume studies? 6M

(OR)

3. a) Write a short note on 30^{th} highest hourly traffic volume? 4M
   b) How the spot speed studies conducted? Explain the procedure to analyze the average speed of a vehicle? 8M

UNIT-II

4. a) What are different causes of traffic accidents? Discuss briefly? 6M
   b) Explain various types of traffic signals & their function? 6M

(OR)

5. a) Explain briefly the various design factors that are to be considered in rotary intersection design? 6M
   b) Illustrate with neat sketch recommended types of markings in road design? 6M

UNIT-III

6. a) Compare railways transportation with road transportation & mention characteristics of railways transportation? 6M
   b) Draw a typical cross section of a permanent way. Discuss in brief the basic function of various components of a railway track? 6M

(**OR)**

7. a) Discuss different types of rail joints with the help of neat sketch and give their merits and limitations? 6M
   b) Explain the different types of signals used in the station yards? 6M

UNIT-IV

8. a) Explain the various factors to be considered for airport site selection 8M
   b) Write a short note on clear zone? 4M

(OR)

9. a) Explain various types of break waters? 8M
   b) Write a short essay on wharves? 4M

CE-421

SCHEME OF EVALUATION

IV/IV B.Tech (Regular) DEGREE EXAMINATION
March, 2017
(Eighth Semester)
CIVIL ENGINEERING
(TRANSPORTATION ENGINEERING-II)

Answer Question No.1 compulsorily
Answer ONE question from each unit.

1. a) Define vehicular characteristics? **(**12x1=12 **Marks)**

Sol:

It is quite important to sudy the various vehicular characteristics which affect the design of the road facilities and the traffic performance there-on.

Static characteristics of vehicles are vehicle Dimensions, total weight, height of drivers seat and maximum turning angle etc.

Dynamic characteristics of vehicles are speed, Acceleration/deceleration and braking characteristics.

1M

b) Write down the average of speed of vehicles on national highways?

Sol: For Cars Avg. Speed is: 60-80kmph
For Two wheelers Avg. Speed is: 40-50kmph
For Trucks Avg. Speed is: 40-50kmph
For Buses Avg. Speed is: 50kmph

1M

c) What is meant by possible capacity?

Sol:

It is maximum number of vehicles that can pass a given point on a lane or roadway during one hour under prevailing roadway and traffic conditions.

1M

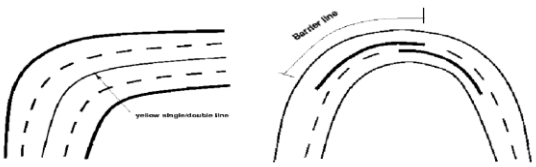
d) What is driver reaction time required for road accidents?

Sol: Reaction times vary greatly with situation and from person to person between about 0.7 to 3 seconds (sec or s) or more. Some accident reconstruction specialists use 1.5 seconds. A controlled study in 2000 found average driver reaction brake time to be 2.5 seconds.

1M

e) Draw a sketch which is suitable road marking for no overtaking?

Sol:



1M

f) What is the design capacity of rotary intersection at rural areas?

Sol: A total volume of about 3000 PCU per hour can be considered as the upper limiting case and a volume of 500 PCU per hour is the lower limit.

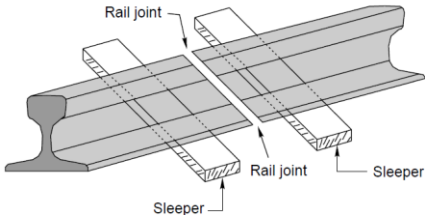
The capacity of rotary is determined by the capacity of each weaving section. Transportation road research lab (TRL) proposed the following empirical formula to find the capacity of the weaving section.

$$Q_w = \frac{280w[1 + \frac{e}{w}][1 - \frac{p}{3}]}{1 + \frac{w}{l}}$$

1M

g) Draw a neat sketch of suspended rail joint?

Sol: Suspended joint: In this type of joint, the ends of the rails are suspended between two sleepers and some portion of the rail is cantilevered at the joint.



1M

h) Write down component part of crossing?

Sol: i) A crossing or Vee Piece ii) point and splice rails iii) Wing rails iv) Check rails v) Chairs at crossing, at toe and at heel vi) Blocks at throat, at nose, at heel and distance block

1M

i) Illustrate the type of marshalling yards?

Sol: i) Flat yards ii) Gravitational yards iii) Hump yards

1M

j) Describe the reason of topography study in airport site selection?

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

Reasons are:

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

1M

k) What is the minimum spacing between the airports for piston engine aircraft under IFR condition?

Sol: 25.6 km

1M

l) Define harbor?

Sol: Harbour can be defined as a sheltered area of the sea in which vessels could be launched, built or taken for repair; or could seek refuge in time of storm; or provide facilities for loading and unloading of cargo and passengers.

1M

UNIT – I

2. a) What are the different road user characteristics which affect the road design? Briefly Explain? 6M

Sol:

Road Users Characteristics:

The human element is involved in all actions of road users either as Pedestrian, Cyclist, motorists or vehicle driver.

Physical, mental or emotional characteristics of human beings affect their operational ability and safety of driving.

Factors affecting road user characteristics

Physical: vision, Hearing, strength and general reaction to stimuli

- Vision – Acute, Peripheral and Tunnel, Glare vision, glare recovery

3M

Acute vision is in 3^0 cone, Up to 10^0 is fairly good (but in general 20^0 in horizontal)

In the vertical plane the clear vision is only 2/3rds of that in the horizontal plane.

Eye movement is required to see in peripheral vision (160^0 and 110^0 in horizontal and vertical plane)

As the speed increases the peripheral vision decreases.

This depends on physical and mental characteristics

- Glare – dark to light and light to dark
- Depth judgement for judging distance and speed of vehicles or objects
- Hearing – more important to pedestrians and cyclists
- Strength – for parking and steering heavy vehicles
- General reaction – PIEV theory
- Fatigue, illness and alcohol/drugs increase reaction time, reduce alertness and affect judgment

Mental: knowledge, skill, intelligence, literacy and experience

- Knowledge of vehicles, traffic, driving knowledge, psychology of road users, road rules
- Skill, intelligence, literacy will help of timely actions
- Experience helps react spontaneously to situations

Psychological: Emotional, fear, anger, impatience, superstition etc

- Emotional, fear, anger, impatience, superstition(false notion) etc

Impatience leads to dangerous actions, dis-regard to traffic rules, and not having right attitude

- Non traffic events, mental worries.

Environmental: Traffic stream characteristics, facilities to the traffic, atmospheric conditions and the locality.

3M

- The traffic stream consists of mixed traffic or heavy vehicles where as the facilities to overtake for faster vehicles may be limited.
- The other environmental factors of importance are the weather visibility and other atmospheric conditions.

b) Explain the term traffic volume. What are the objects of carrying out traffic volume studies? **6M**

Sol: Traffic volume is a measure to quantify the traffic flow. Traffic volume or traffic flow is expressed as the number of vehicles that pass across a given transverse line of the road during unit time. It is generally expressed as number of vehicles per hour or per day, per traffic lane. **2M**

Objectives & Uses

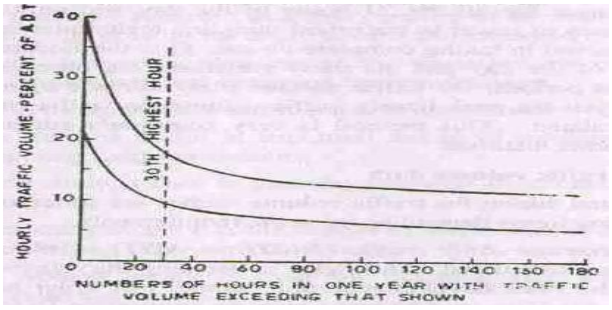
- True measure of relative importance of road
- Used in planning operation and control
- Analysis of traffic patterns **2M**
- Classified traffic volume useful in structural design
- Volume distribution for one way streets and other regulation
- Turning movements of traffic for intersection designs
- Pedestrian Volume for foot paths side walks, pedestrian signals etc **2M**

. (OR)

3. a) Write a short note on 30th highest hourly traffic volume? **4M**

Sol: Thirtieth highest hourly traffic volume is the hourly volume that will be reached only thirty times or exceeded only 29 times in a year and all other hourly volumes of the year will be less than this value. The highway facilities designed with capacity for 30^{th} highest hourly traffic volume in the assumed year is found to be satisfactory from the consideration of facility as well as the cost. This is because the cost will be much high lesser when compared to the peak hourly volume and there will be congestion only during 29 hours in the year and this is considered reasonable. **2M**

Thus the 30^{th} highest hourly volume is generally taken as the Design hourly volume for the purpose of design of the roadway facility. **2M**



b) How the spot speed studies conducted? Explain the procedure to analyze the average speed of a vehicle? **8M**

Sol:

Methods of conducting spot speed Studies are divided into two main categories Manual and Automatic. **1M**

Manual Methods:

1.Pavement markings:

In this method, markings of pavement are placed across the road at each end of trap. Observer start and stops the watch as vehicle passes lines. In this method, minimum two observers required to collect the data, of which one is stand at the starting point to start and stop the stop watch and other one is stand at end point to give indication to

stop the watch when vehicle passes the end line. Advantages of this method are that after the initial installation no set-up time is required, markings are easily renewed, and disadvantage of this is that substantial error can be introduced, and magnitude of error may change for substitute studies and this method is only applicable for low traffic conditions.

1M

2.Enoscope or Mirror box:

Enoscope consists of a simple open housing containing a mirror mounted on a tripod at the side of the road in such a way that an observer's line of sight turned through 90^0. The observer stands at one end of section and on the other end enoscope is placed and measure the time taken by the vehicle to cross the section (fig 1). Advantages of this method are that it simple and eliminate the errors due to parallax and considerable time is required to time each vehicle, which lengthen the study period and under heavy traffic condition it may be difficult to relate ostentatious to proper vehicle are the disadvantages of enoscope method.

2M

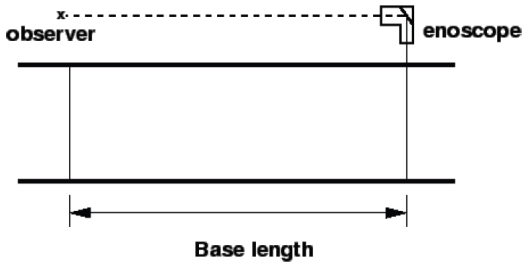


Fig. 1: Enoscope Method

Automatic Methods:

1.Road Detector (Pressure contact strips):

Pressure contact strips, either pneumatic or electric, can be used to avoid error due to parallax and due to manually starting and stopping the chronometer or stopwatch. This is the best method over short distance it gives quite relevant data and if it is connected through graphical recorder then it gives continuous data automatically.

1M

2.Doppler-Principle Meters (Radar):

This is recently developed method, it automatically records speed, employs a radar transmitter-receiver unit. The apparatus transmits high frequency electromagnetic waves in a narrow beam towards the moving vehicle, and reflected waves changed their length depending up on the vehicles speed and returned to the receiving unit, through calibration gives directly spot speed of the vehicle.

Procedure for finding Average Speed of a Vehicle

Frequency Distribution Table:

After the collection of data in the given conditions, arrange the spot speed values in order to their magnitudes. Then select an interval speed (e.g. 5 kmph) and make grouping of data which come under this range. Now, prepare the frequency distribution table.

1M

Frequency Distribution Curve:

For each speed group, the % frequency of observations within the group is plotted versus the middle (mid-mark) speed of the group(s). As shown in Fig 2. From this curve the modal speed and pace of traffic flow can be determine. Generally the shape

of the curve follows the normal distribution curve, this because the most of the vehicles move on road near by mean speed and very few deviate from mean speed.

Cumulative Frequency Distribution Curve:

For each speed group, the % cumulative frequency of observations is plotted versus the higher limit of the speed group (Fig 2). The cumulative frequency distribution curve, however, results in a very useful plot of speed versus the percent of vehicles traveling at or below the designated speed. For this reason, the upper limit of the speed group is used as the plotting point. In both the distribution curve, the plots are connected by a smooth curve that minimizes the total distance of points falling above the line and those falling below the line. A smooth curve is defined as one without. **2M**

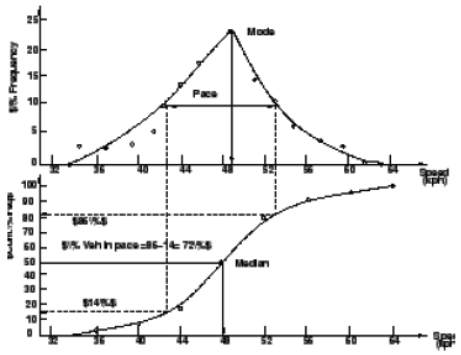


Fig. 2: Frequency and Cumulative Frequency Distribution curve

UNIT –II

4. a) What are different causes of traffic accidents? Discuss briefly? 6M

Sol: Road Accidents - Causes of Accidents

Driver: Rash driving, violation of rules, carelessness, fatigue, drunken driving

Pedestrians: violation of traffic rules, walking on road.

Passengers: alighting and boarding into moving buses. **2M**

Vehicle defects: Failure of brakes, steering system, lighting system, tyre burst and any other defects

Road condition: slippery or skidding road surface, pot holes, ruts etc

Road design: Defective geometric design like inadequate sight distance, width of shoulders, improper curve design and improper traffic control devices. **2M**

Weather: Unfavourable weather condition like mist, rain, snow, smoke or heavy rainfall will restrict normal visibility.

Animals: stay animals on road

Other causes: Incorrect signs or signals, gate of level crossing not closed when required, ribbon development, badly located advertisement boards etc. **2M**

b) Explain various types of traffic signals & their function? 6M

Sol:

Types of traffic signals:

The signals are classified into the following types:

(i) Traffic control signals

(a) Fixed-time signal

(b) Manually operated signal **1M**

(c) Traffic actuated (Automatic) Signal

(ii) Pedestrian signal

(iii) Special traffic signal

(i) **Traffic control signals** **1M**

a) Fixed –time signal or pre-timed signals are set to repeat regularly a cycle of red, amber and green lights.

b) Manually operated signals:
When traffic less, traffic police operates signal phases

c) Traffic actuated signals are those in which the timings of the phase and cycle are changed according to traffic demand.

In semi-actuated signals the normal green phase of an approach may be extended upto a certain period of time for allowing a few more vehicles approaching closely, to clear off the intersection with the help of detectors installed at the approaches. **2M**

In fully-actuated signals the detectors and a computer assigns the right of way for various traffic movements on the basis of demand and pre-determined programming. But these are very costly to be installed at all intersections.

ii) Pedestrian signal: These are meant to give the right of way to pedestrians to cross a road during the 'walk period' when the vehicular traffic shall be stopped by red or stop signal on the traffic signals of the road. **2M**

iii) **Special traffic signal:** Such as flashing beacons may be installed at certain locations in order to warn the traffic of certain situations.

(OR)

5. **a) Explain briefly the various design factors that are to be considered in rotary intersection design? 6M**

Sol: The various design factors for rotary intersection design are:

Design Speed:

Speeds shall be lesser while approaching but no need to come to stop for crossing.

40 Kmph for rural areas and 30 Kmph for urban areas as per IRC. **2M**

Shape of Central Island:

Depends on no. of approaches and layout of intersection - circular, elliptical, turbine tangent shapes.

When two equally important roads are crossing at roughly right angles, a circular shape is suitable.

Too elongated, tangent shapes lead to speeding up in particular direction.

Radius of rotary roadway:

Radii will be differing at different points depending on shape

Super-elevation can not be provided.

Only friction considered for design

$R = V^2/127f$

Radius of entry curve of 20 to 35 m and 15 to 25 m considered for entry speeds of 40 & 30 kmph.The min. radius of central island are 1.33 times the radius of entry curve.

Weaving angle and weaving distance:

Angle between path of entering vehicle and path of leaving vehicle, shall be small but not less than 15^0

Weaving length (merging, crossing and diverging) shall be 4 times width of weaving section.

45 to 90m for 40 kmph and 30 to 60 m for 30kmph.

Width of rotary roadway:

width of weaving section(W) depends on width of entry (e_1) and width of non-weaving sections(e_2). $W = [(e_1+e_2)/2]+3.5$

One lane wider than mean width of entry and non-weaving width

Entrance and Exit Curves:

For speed 40 kmph, is 20 to 35m and for 30 kmph, it is 15 to 25 m

Exit radius shall be > than entry curve.

Min two lanes to accommodate for mixed traffic at entrance and exit.

Extra widening to be provided at entrance and exit.

Width at entry > width at exit as exit curve is larger.

2M

Camber and super-elevation:

Shall be so designed to avoid flooding of rotary during rains

Sight Distance, Grade:

The min sight distance should be 45 and 30m for design speeds of 40 and 30 Kmph.

It is preferable to locate a rotary on level ground.

The slope not exceeding 1 in 50 with the horizontal.

Lighting:

Sufficient lighting to illuminate rotary

Traffic signs:

To guide traffic

Provision for Cyclists and Pedestrians:

If the no. of cyclists are < 50/hr, permitted to mix up with traffic.

If they are more a separate cycle track to be provided.

If pedestrians are more, separate footpath with guard rails should be provided around the rotary.

Provision of crossing facilities to pedestrians by subway or over bridge is possible, but it is costly.

2M

b) Illustrate with neat sketch recommended types of markings in road design? 6M

Sol:

Types of Road Markings

Road markings are basically of two types: Carriageway markings and Object markings.

Carriageway markings

As the name implies, these are the markings applied to the carriageway. Carriageway markings are of the following categories:

i) Center line

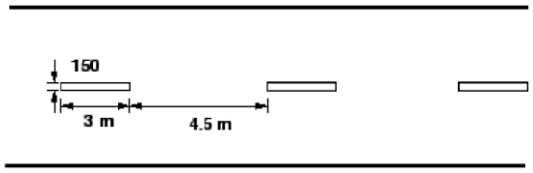
1M

ii) Traffic lane lines
iii) No-overtaking zone markings
iv) Pavement edge line (both sides)
v) Carriageway width reduction transition markings
vi) Obstruction approach markings
vii) Stop lines
viii) Pedestrian crossings
ix) Cyclist crossings
x) Route direction arrows etc.
xi) Word message
xii) Markings at approaches to intersections
xiii) Parking space limits
xiv) Bus stops

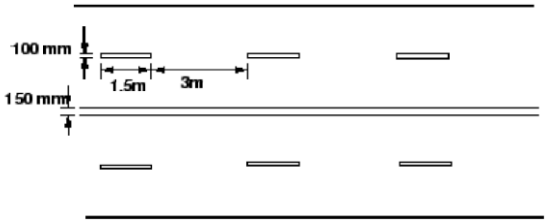
2M

<u>Object markings</u>

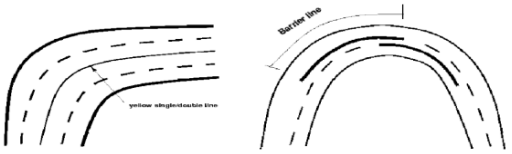
Object markings are of the following categories:
i) Objects within carriageway
ii) Kerb marking for visibility
iii) Kerb marking for parking restriction
iv) Objects adjacent to the carriageway
v) Median Marking



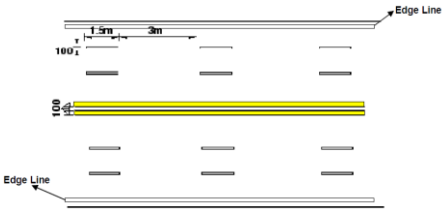
Centre line marking for a two lane road



Centre line marking for a four lane road

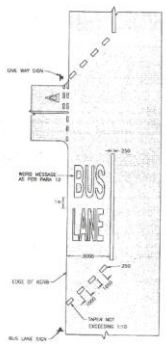


Barrier line marking at No Passing Zone

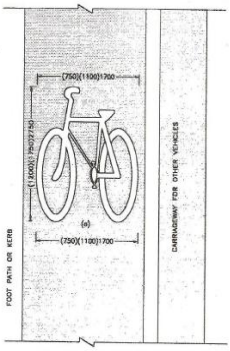


Edge line marking

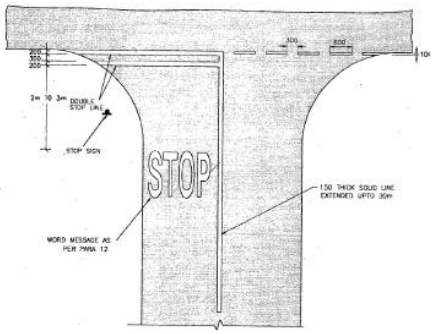
3M



Bus Lane Marking



Bicycle Lane Marking



Stop Line Marking

UNIT –III

6. a) Compare railways transportation with road transportation & mention characteristics of railways transportation? 6M

Sol:

S.No	Characteristics	Railway transport	Highway transport
1	Tractive resistance	1/5 of pneumatic type	5 to 6 times more than railway vehicles
2	Load handling	Railways can handle heavier loads at high speed	Can handle low loads
3	Right of entry	Rigid and well defined path, right of entry not free to all	Free and flexible, every body has right
4	Operational controls	Block system,singnalling and interlocking	No such control
5	Gradient	For carrying heavy loads at high speeds on railway , the gradient must minimum	Steeper gradient when compared with the railway
6	Construction and maintenance cost	Much higher than roads	less
7	Origin and destination	Starting and destination points are fixed	Receiving and delivering of the goods can be done at any point
8	Accident rate	Few Faccident	Very large
9	Right of way	Lesser	Greater

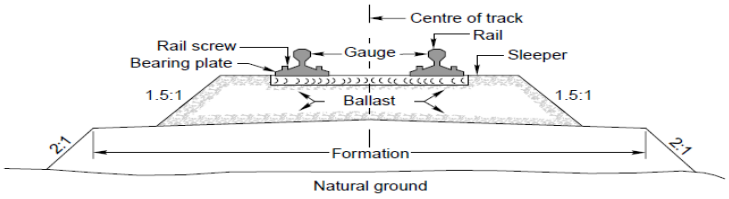
3M

3M

b) Draw a typical cross section of a permanent way. Discuss in brief the basic function of various components of a railway track? 6M

Sol:

The combination of rails, fitted on sleepers and resting on ballast and sub grade is called Railway track or Permanent way.



Cross Section of a Permanent Way

2M

Functions of Rails:

- Rails provide a hard, smooth and unchanging surface for passage of heavy moving loads with a min friction between the steel rails and wheels.
- Rails bear the stresses developed due to heavy vertical loads, lateral and braking forces and thermal stresses.
- Rails materials should give min. wear and tear.
- Rails transmit the loads to sleepers and consequently reduce pressure on ballast.

2M

Functions of Sleepers:

- Holding rails in their correct position
- Giving even support to the rails
- Transferring the load evenly from rails to a wider area on ballast
- Acting as a elastic medium

Functions of Ballast:

- It transform the load from sleeper to subgrade
- It holds the sleeper in correct position
- It imparts some degree of elasticity to the track
- It provides good drained foundation immediately below the sleepers

2M

(OR)

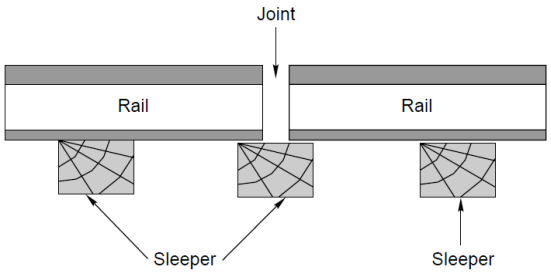
7. a) Discuss different types of rail joints with the help of neat sketch and give their merits and limitations? 6M

Sol:

Classification According to Position of Sleepers

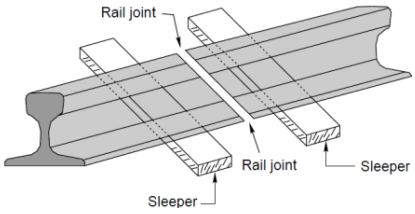
Three types of rail joints, come under this category.

Supported joint In this type of joint, the ends of the rails are supported directly on the sleeper. It was expected that supporting the joint would reduce the wear and tear of the rails, as there would be no cantilever action.



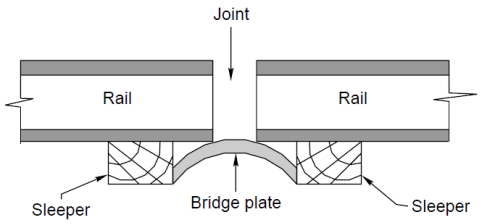
1M

Suspended joint In this type of joint, the ends of the rails are suspended between two sleepers and some portion of the rail is cantilevered at the joint.



2M

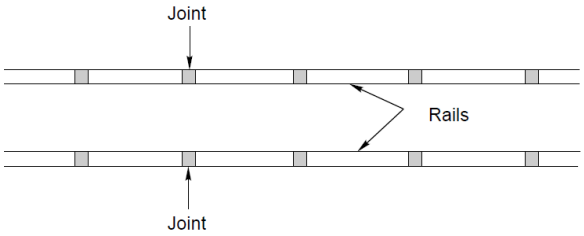
Bridge joints The bridge joint is similar to the suspended joint except that the two sleepers on either side of a bridge joint are connected by means of a metal flat or a corrugated plate known as a bridge plate. This type of joint is generally not used on Indian Railways.



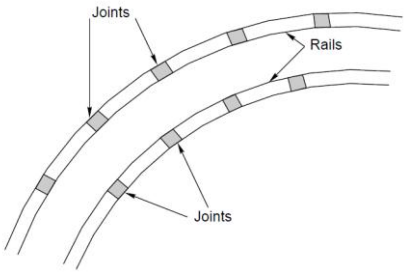
Classification Based on the Position of the Joint

Two types of rail joints fall in this category.

Square joint In this case, the joints in one rail are exactly opposite to the joints in the other rail. This type of joint is most common on Indian Railways.

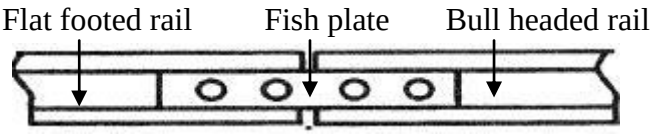


Staggered joint In this case, the joints in one rail are somewhat staggered and are not opposite the joints in the other rail. Staggered joints are normally preferred on curved tracks because they hinder the centrifugal force that pushes the track outward.



3M

Compromise Joint: When two rail sections are required to be joined together, it is done by means of fish plates which fit both the rails.



Compromise Joint

b) Explain the different types of signals used in the station yards? 6M

Sol:

Classification of signals

Signals can be classified based on following different characteristics

i) Operational characteristics

Based on form of communication of message in audible or visual form

- Detonating signals (also called Fog or Audible Signals)

  In cloudy or foggy weather when hand or fixed signals are not visible, audible signals like detonators are used which can attract attention of drivers by audible means Detonators contain explosive material and are fixed to the rails by means of clips.

  In the foggy weather, detonators are kept on the rails at least 400 to 500 m ahead of the signals to enable the driver to stop the train or to obey the signals

- Hand signals (Visual Indication signals)

  Hand signals are given either by flags fixed to a wooden handle or by bare arms when flags are not available during the day time

2M

During night time lamps are used in which movable glass-slides of green, red and yellow sheds are provided

Hand signals are generally used by guards, station masters, cabin man, gang man, key man or any other authorized man

- Fixed signals (Visual Indication signals)

These signals fixed firmly on the ground by the side of track (Sema-phore type)

ii) Functional characteristics

Based on communicating the information to driver to stop or to move cautiously or to carry shunting etc.

Based on their function, signals classified as

- Stop or semaphore type signals
- Warner signals
- Shunting or disc or ground signals
- Colored-light signals

2M

iii) Locational characteristics

These are based on reception and departure of trains

In view of the position where the signals are located, they can be divided into following categories:

- Reception signals
- outer signal and home signal
- Departure signal
- Starter and advance starter signal

iv) Special characteristics

Used for special purposes

Various special types of signals are:

- Repeater or co-acting signals
- Routing signals
- Calling on signals
- Point indicators
- Modified lower quadrant semaphore signal
- Miscellaneous signals

2M

UNIT-IV

8. a) Explain the various factors to be considered for airport site selection. 8M

Sol: Factors considered for selection of suitable site

Regional plan

Site selected should fit well into the regional plan and thereby forming it an integral part of the national network of airport

Airport use

Selection of site depends on use of airport i.e. whether for civilian or military operations

During emergency, civilian airports are taken over by the defense. Hence site should provide natural protection to the area from air raids

2M

Proximity to other airports

Site should be selected at a considerable distance from the existing airports so that the aircraft landing in one airport does not interfere with the movement of aircraft at other airport

Separation between airports depends upon the volume and type of aircraft, air traffic control etc.

Minimum spacing suggested under different conditions is:

Airports serving smaller aircrafts (under Visual Flights Rules (VFR) conditions) – 3.2 km

Airports serving bigger aircrafts (under VFR conditions) – 6.4 km

Airports operating piston engine aircrafts (under Instrument Flight Rules (IFR) conditions) – 25.6 km

Airports operating jet engine aircrafts (under IFR conditions) – 160 km

Ground accessibility

The air line passenger more concerned with his door-to-door time rather than the actual time in air travel, hence site should be readily accessible to users

The time required to reach an airport in a passenger car from business or residential centre, should normally not exceed 30 minutes

The best location is a site adjacent to the main highway, this provides quick access and minimizes the cost of an entrance road

Availability of public transportation facilities, e.g. bus, taxi etc. further qualifies the suitability of the site

2M

Topography

A raised ground e.g. a hill top, is usually considered to be an ideal site for an airport.

Reasons are:

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

Visibility

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

2M

Drainage and soil characteristics

- The cost of grading and drainage can be reduced by selecting a site with favorable soil characteristics
- Sites with high water tables, which may require costly sub-soil drainage should be avoided

- The most desirable type of soil for airport construction is the one which contains a reasonable amount of pervious material such as gravel, sand of decomposed granite combined with a suitable natural binder

Availability of utilities from town

- Airport has to be provided with facilities like water supply, sewer, telephone, electricity etc. availability of these utilities from town should be considered
- Economic considerations
- Amongst the various alternate sites, one which is economical should be preferred
- For this consider the cost estimates should include land cost, clearing and grading of land, drainage, lighting, construction of buildings, access roads and automobile parking areas

2M

b) Write a short note on clear zone? 4M

Sol:

- The inner portion of approach zone which is the most critical portion from obstruction point of view is known as clear zone
- The purchase of land in this zone is recommended for the effective implementation of zoning laws
- Not necessary to grade this area, but all obstructions removed. Fences, ditches and other minor obstacles are permitted

2M

Highway and runway clearances

- Roads and railways are not objectionable in clear zones provided they comply with the clearance standards and the vehicles within this zone are always in motion
- The essential clearances over a highway or a railway located any where in the approach area
- Objects exceeding their limiting height above the ground
- Within 4.5 km, object should be less than 30 m from ground
- Any object whose height exceeds 150 m or above considered as an obstruction

2M

(OR)

9. a) Explain various types of break waters? 8M

Sol:

There are three types of break water

a) Rubble Mound type

b) Composite type

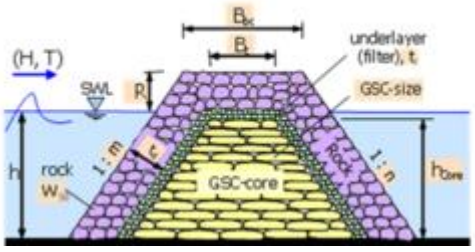
c) Vertical wall type

2M

i) Rubble Mound Type:

A rubble mound consists of a mass of stone, just as it is obtained from a quarry, tipped into the sea along a predetermined line till the mound emerges out of the water. The stone is deposited from barges or is carried to the work in wagons run out from the shore on staging ; frequently the two methods are combined. The larger masses of stone are often selected for placing in the more exposed parts of the work and on the

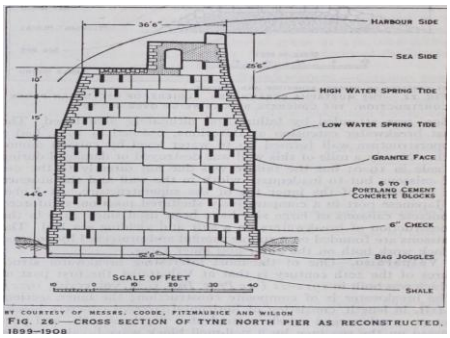
faces of the breakwater, and for this purpose the use of cranes may be necessary. The mound thus deposited is gradually consolidated under the action of the sea and the weight of material. and a tolerably stable form is by degrees attained by continued deposits of stone



ii) Composite Type:

composite breakwaters, the foundation level of the superstructure being placed at varying depths from near low water down to about 2 7f t. below low water in the case of the north pier. Towards the end of the century the north pier was severely damaged and breached as a result of the undermining of the foundation of the superstructure, brought about by the degradation of the rubble mound.

The reconstructed work is of the Dover type, the foundations, except near the inner end, being carried down to hard shale. All the exposed blocks are faced with granite and all blocks above low water are set in cement. A novel feature was introduced into the design with the object of preventing the sliding of one course of blocks over the course immediately below it ; a check 6in. high, extending practically from end to end of the work, being provided in each course of blocks below low water



BY COURTESY OF MESSRS. COODE, FITZMAURICE AND WILSON
FIG. 26.—CROSS SECTION OF TYNE NORTH PIER AS RECONSTRUCTED, 1899–1908

4M

iii) Vertical Wall Type:

vertical wall breakwaters are vertical structures built on rubble mound foundations. The vertical wall portion usually consists of caisson structures. "A caisson is a large, generally rectangular concrete box, usually not solid, but composed of walls and internal diaphragms to give it strength, and filled with sand or gravel to give it weight. It rests on the sea bottom, or on a layer or mound of stone, relying on its mass to resist wave action. A string of such caissons can make a continuous breakwater

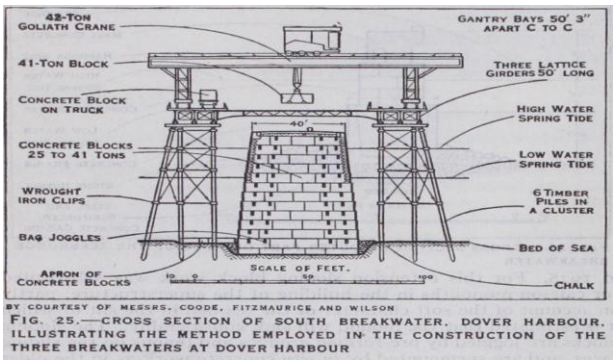
A "vertical breakwater" is generally a free standing caisson (or string of caissons) resting directly on the bottom, built on an improved foundation probably with a rubble mat flush with the natural ground. The most common type is the "low mound breakwater" where the vertical portion rests on a low

The basic design procedures are similar to rubble mound breakwaters, except that

- The wave forces must be explicitly calculated and

1M

- The stability of the vertical structure is of concern.



By courtesy of Messrs. Coode, Fitzmaurice and Wilson

FIG. 25.—CROSS SECTION OF SOUTH BREAKWATER, DOVER HARBOUR, ILLUSTRATING THE METHOD EMPLOYED IN THE CONSTRUCTION OF THE THREE BREAKWATERS AT DOVER HARBOUR

1M

b) Write a short essay on wharves? 4M

Sol:

Wharves: These are the platforms at which vessels take on and discharge passengers and cargo. In other words, they are docks that parallels the shore. They should be located in such a way as to give sufficient depth of water for the ship to float. They are built generally continuous with the shore but may not necessarily be so. They project out into or on to the water. Wharves built parallel with the shore are called quays. The walls are built to protect the quays are known as quay walls. They are built to retain and protect the embankment or filling. The Wharves design involves making provision for the berthing of the ship, handling and storage of cargo, and terminal facilities for rail and truck transportation. They are two types:

2M

1. Open Type Wharves: Open construction wharves can be either high level decks or relieving type platforms. High level decks have generally a solid deck slab. However, in a case of oil piers the slab may be of skeleton construction and omitted at the pipe way.
2. Solid Type Wharves: They are composed of earth or rock fill partly combined by some sort of bulkhead. Where water depth is less than 15m and bottom conditions are suitable for support of gravity type of structures, steel sheet pile cells are best suited.

2M

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