MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous)
(ISO/IEC-27001-2005 Certified)

WINTER-12 EXAMINATION

Subject Code: 12085 Model Answer Page No: 01/

Q.N.1.A) Attempt any six: **(12)**

a) Strength & stability is maintained of formation.

Sub grade & side slopes failure can be avoided. (2 x 1 = 2)

b) The whole combination of track (rail, sleepers, ballast, fixtures) & the formation between starting & end station permanent nature, for safe & quick movement of trains over it is known as permanent way. (02)

c) Maximum increase in water level due to obstruction in the path of flow of water is called as flux.
The vertical cutting of river bed is called as scour. (02)

d) The sectional area at the bridge site through which flows is called as waterway (02)

e)

- Timber bridge – textile & suspension
- Flying bridge -- warp & suspension cable
- Floating bridge—boat bridge, pontoon bridge & raft bridge. **(1/2x any four = 02)**

f)

- shortest route between two terminal stations
- Can carry railway lines roads public utilities etc across a stream or mountain
- can avoid costly land, property, monuments, minerals in alignment
- can provide free movement at traffic throughout the year (any two x 01 =02)

g)

- supply of fresh air inside tunnel
- removal of poisonous gases, dust, smoke from the tunnel
- reduction in temperature inside tunnel
- clear vision for driver (any two x 01 = 02)

h) A small portion of cross section of tunnel through which the whole length of tunnel is driven as pilot tunnel is known as drift. (02)

Q.1. B) Attempt any two:

a) i) Easy, cheap, fast transport of men, materials, & goods.

ii) Proper network of communication help in transport of agriculture & industrial production to market

iii) Accessibility to remote areas.

iv) Easy transport of military & during wars, floods, earthquakes.

v) Travel 7 tourism.

vi) National integration (1/2x 6 = 3)

b) Marking the position of centre line on ground for construction of permanent way is known as Alignment of rail. (01)

Factors affecting governing rail alignment—

i) It should be short & straight.

ii) It should be economical

iii) Availability of materials near site

iv) Costly & marshy land should be avoided

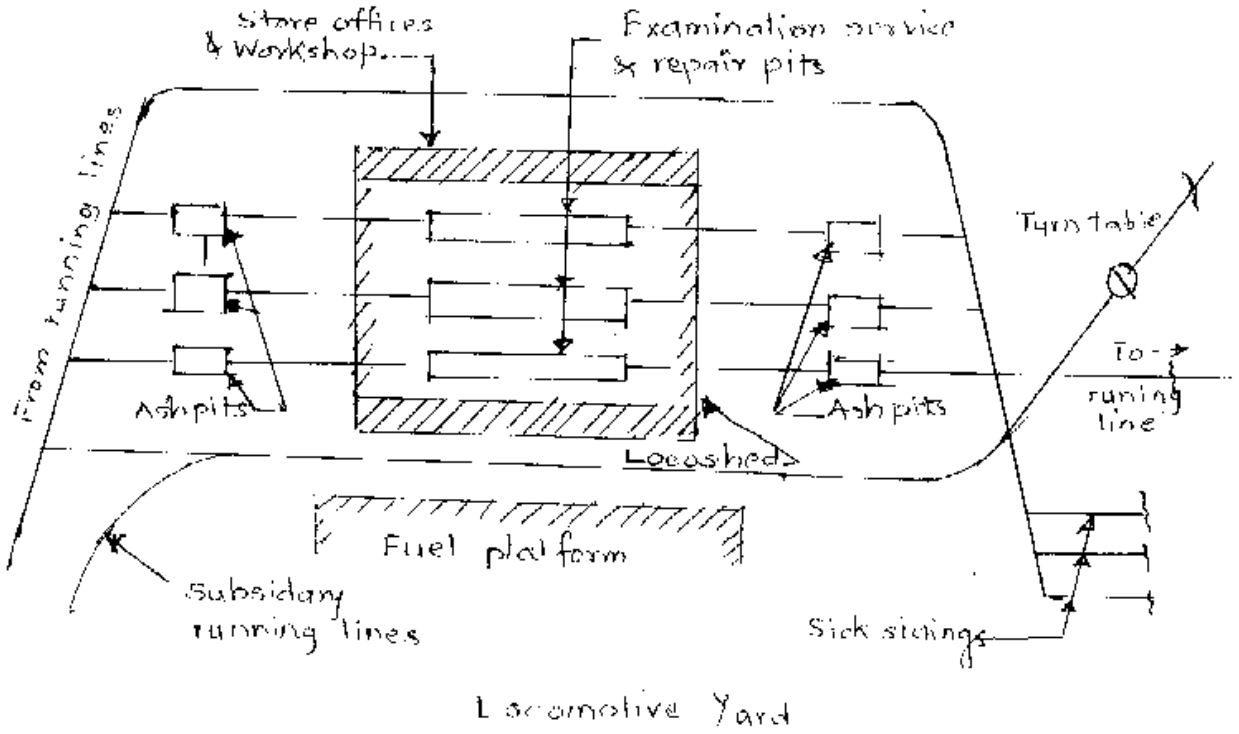
iv) Easy slope & curves

v) Topography

vi) traffic density

vii) availability of fund (1/2 x any six= 03)

c)



Q 1 B) (c) Sketch 2 mark
Label 2 mark

Q.N.2.Attempt any four: **(16)**

a) The clear horizontal distance between top of the inner faces of two rail on the railway track is called as rail gauge (01)

Sr.No.	.Type of Gauge	Gauge distance
1	Broad Gauge	1.676m
2	Mater gauge	1.000m
3	Narrow Gauge	0.762/0.610m

(3 x 1 =03)

b)

- Public requirement- i) Booking office for ticket ii)Passenger & goods platform iii) Name boards iv) Drinking water v) W/C & urinals vi) Enquiry office & announcements vii) Light, telephone, clock viii) Stalls
- Traffic requirement – i) staff room ii) retiring room
- Train requirement – i) Signals & movements controls ii) sufficient sidings iii)platforms in sufficient numbers iv) cleaning servicing facilities for wagons & boggies
- Development requirement—i) approach road ii) parking facilities iii) guide map iv) coolies. (any 8 x1/2 = 4)

c) Duties of Gang mate:

i) In charge of gang & responsible for safety & upkeep of section

ii) Arrangement for tools & equipments

iii) Check & examine points & crossings, gangs

iv) Maintain alignment & level of track

v) Repair broken parts of track in case of accidents

vi) Maintain complete record of work, report of key man

vii) Check the trespass of person & cattle

viii) Ensure safety of gang (any eight x ½ = 04)

d) **(any 4x1 = 4)**

Wooden sleepers	**Concrete sleepers**
Made up of wood	Made up of concrete
Less life	More life
More fittings required	Less fittings required
Difficult gauge adjustment	Easy gauge adjustment
Easy handling	Heavy equipment required for handling
Attack by white ants	No attack by any insects
Susceptible to fire	Less susceptible to fire
Initial cost is low	Initial cost is high

e)

Fish Plate	Baring Plate
Position: Used at rail joints	Between the flat footed rails and wooden sleepers on railway track.
Function: i) To maintain continuity of rails in track. ii) To allow expansion and contraction of rail due to temperature. iii) To maintain correct alignment of rail joints.	i)To prevent sinking of rails in the wooden sleepers. ii) To distribute load over sleepers uniformly. iii) To prevent shifting of rails. iv) To maintain the gauge very well when bearing plates are used.
Make: Made up of mild steel.	Made up of either steel or cast iron.
Types: i) Fish plate for joining flat footed rails. ii) Fish plates for bull headed rails.	i) Flat bearing ii) Canted bearing.

(4 x 1=04)

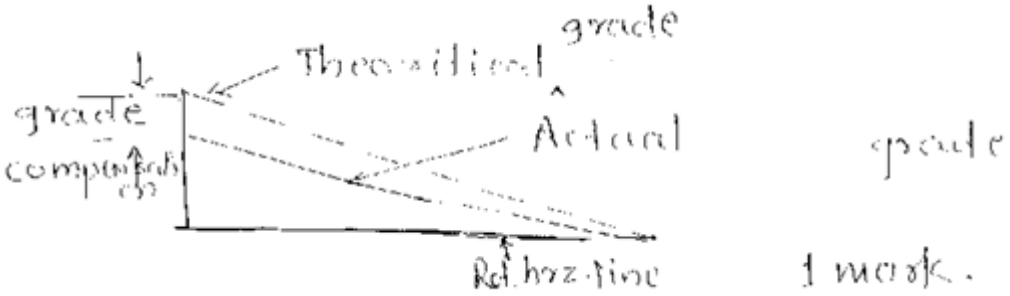
f) Grade Compensation on curves: The reduction in gradient on curved portion of railway track is called grade compensation on curve. (01)

On curved portion of railway track, extra power is required to pull the train due to more tractive resistance. To overcome this increase tractive resistance to a certain limit and to pull the trains with same speed, gradient on curves are reduced. This reduction in gradient is grade compensation on curves. The grade compensation is expressed in %. The values of grade compensation recommended by Indian Railway:

For B .G. Railway tracks: 0.04%.

For M .G. Railway tracks: 0.03%.

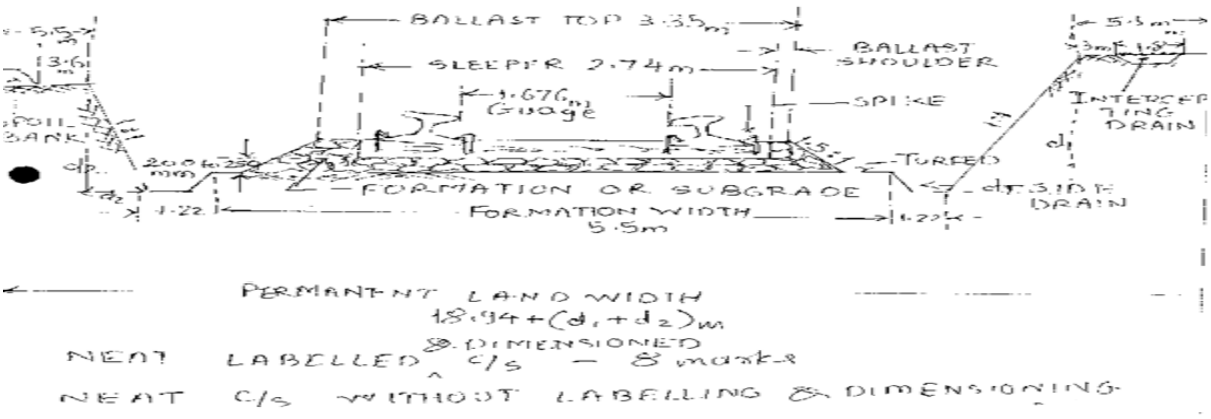
For N .G. Railway tracks: 0.02%. (02)



1 mark.

Q.3. Attempt any Two: **(16)**

a) C/s of B.G.Line in cutting:



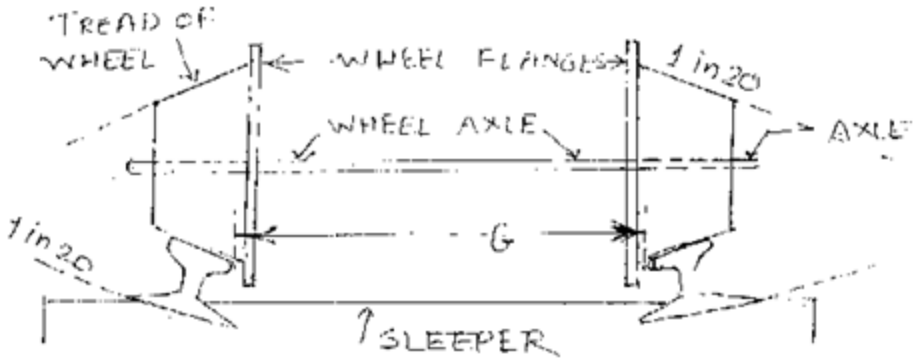
(8)

b) **Coning of wheels**- The art of providing an outward slope of 1 in 20 to the treads of wheels of rolling stock, is known as coning of wheels.

The Function of providing wheel flanges on inner side is to prevent lateral sleeping of the wheels over the rails in track. i.e. to check the lateral movement, which damages the running forces of rails& inconvenience to the passengers an outward slope of 1 in 20 is provided to treads of wheel,behavior of wheels on straight portion of track i) with provision of coning of wheels, if the axle moves towards one track rail

The diameter of wheel rim over that rail increases whereas it decreases over the opposite rail of the track. This prevent further lateral movement and the axle returns to its original position without causing excessive wear of the inner faces of track rail and inconvenient to passengers.(1)

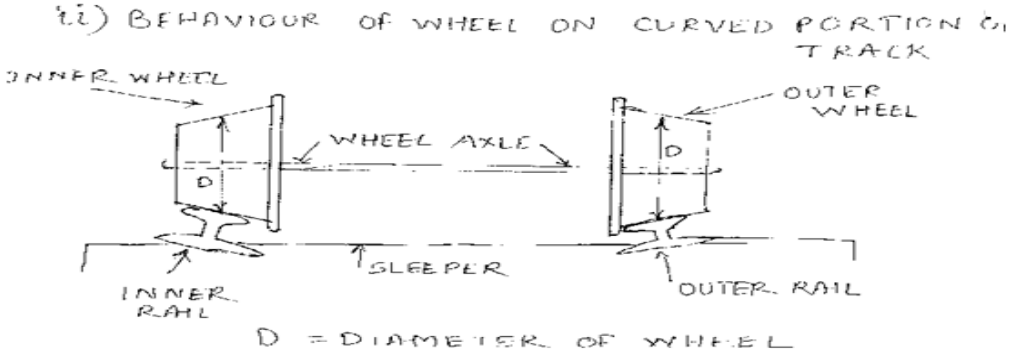
Q3 b) i) BEHAVIOUR OF WHEELS ON STRAIGHT PORTION OF TRACK.



(2)

ii) Behaviour of wheel on the curves:-

On the curves of outer wheel of a train have to travel a great /long distance as compared to the inner wheels. Under the effect of centrifugal force the axle moves outward or towards the outer rail due to coning of wheels diameter of the wheels on the outer rail increases while inner rail, it decreases. Thus the outer wheel covers greater distance than the inner wheel without slip. (1)



(2)

Necessity of tilting of rails: To make full contactbetween top surface rails, treads of wheels, I. To reduce wear of rails(inner face) II. To increase life of rails and sleepers III. Guage is maintained (2)

c) Definition of four parts of turn out.

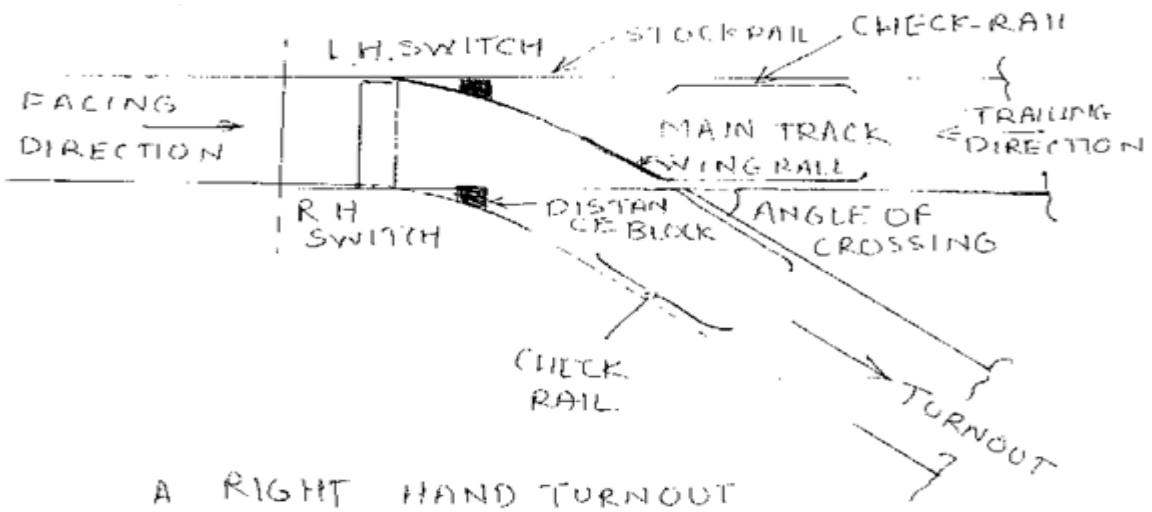
i) **Stock rail**: The fixed rail in a railway track against which tongue rail fits is known as stock

rail.

ii) **Wing rail**: The bent up lengths of rail used in front of nose of crossing which help in channelizing the train wheels in their proper route are wing rails.

iii) **Check rail**: The rail length which are provided on the opposite sides of the crossing to check the tendency of wheel to climb over the crossing is known as check rails.

iv) **Angle of crossing**: The angle between the running faces of ptrail and splice rail at a crossing is known as angle of cross. (4 x1 = 04)



A RIGHT HAND TURNOUT

(04)

Q.4. Attempt any four f the following: **(16)**

a) Factors affecting bridge site selection

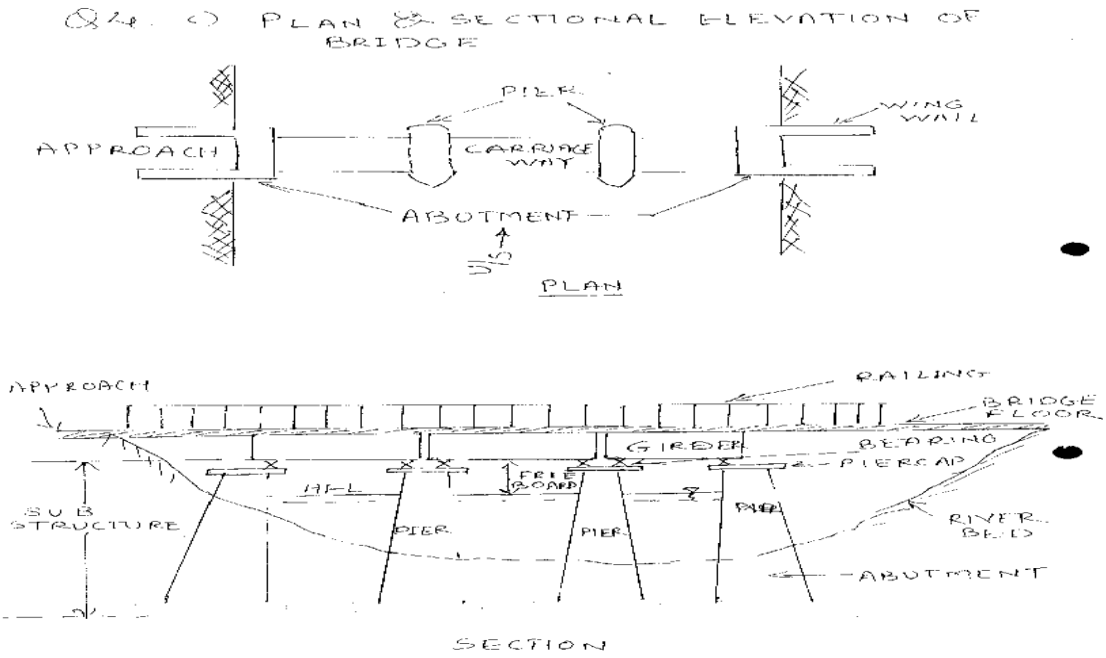
- A well defined & narrow channel
- A straight reach of stream at bridge site
- Good foundation bed at short depth
- Angle of crossing- The angle between stream & alignment of bridge should be right angle as far as possible
- Suitable high firm banks of the stream at bridge site
- Absence of scouring & silting- The stream should be steady at bridge site
- Minimum obstructions to waterway
- Sound & economical approaches
- Absence of costly river training works (Any8x1/2=04)

b) Classification of bridges according to

1. Alignment- i) Straight or right angle bridge ii) Skew bridge (02)

2. Position of HFL- i) Submersible ii) Non submersible (02)

c)

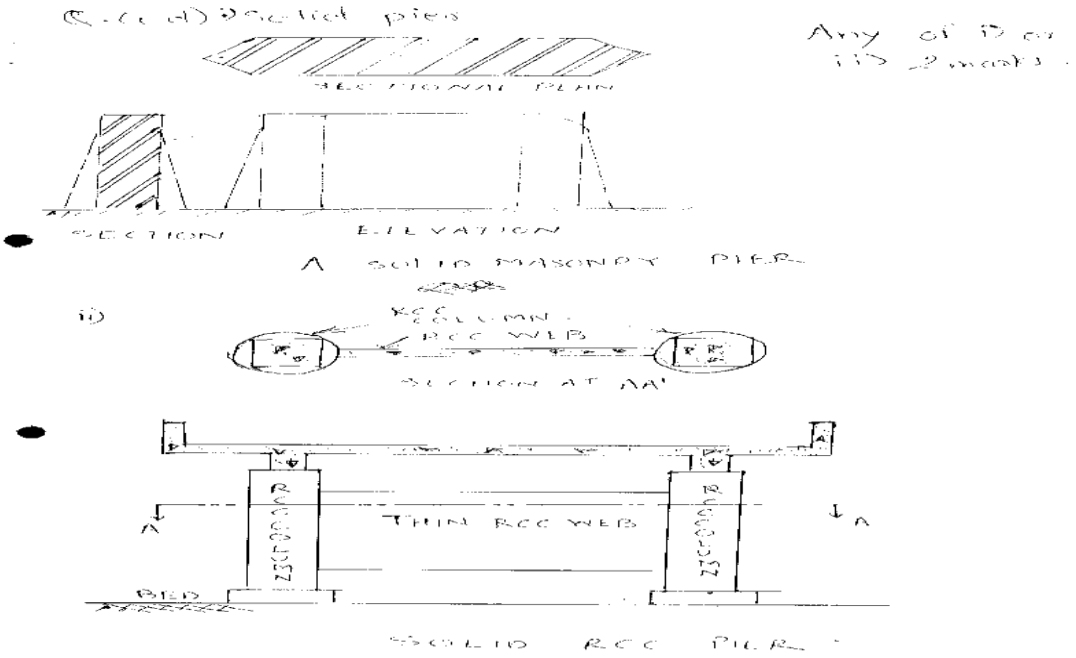


(04)

d) Solid pier- The pier which is solid in plan, elevation and sections are solid piers

Suitability- is suitable in water subjected to ice or debris & rapid running water.

Solid piers are i) Solid masonry pier ii) solid RCC piers (02)

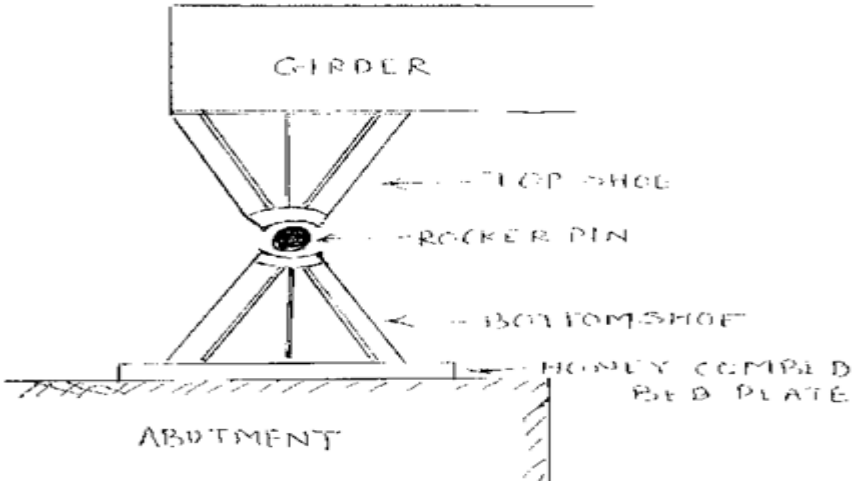


(02)

e) Functions of bearings in bridges:

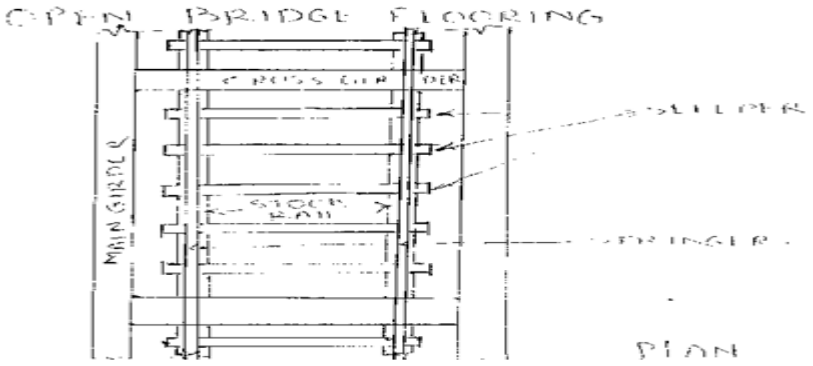
i) to distribute the load received through the ends of bridge girders over a large area of abutments or piers at their tops.

ii) to freely allow longitudinal movement , due to variation in temperature.
iii) to transfer horizontal forces due ti application of breaks
iv) to allow angular movement at support due to deflection of girder
iv) to allow for vertical movement at support due to sinking of any support (1/2x any four =02)



(02)

f) Open bridge floor are suitable only for railway bridges (01)



(02mark)

Explanation- The bridge floor does not cover the total space between the main girders is open floor. The main & guard rails are laid on the sleepers which are fixed over & across the longitudinally placed I section known as stringers. The stringers are fixed to plate girders or beams are known as cross girders or cross beams. (01)

Q.5. Attempt any four of the following: (16)

a) Data for design a bridge:

Following data should be collected for safe and economical design of a bridge:

- General data: maps, plans, topographical features, north direction.
- Alternative bridge sites and their cross sections.
- Hydraulic data of selected bridge site: High flood level, hydrographs for one year, design discharge, slopes of catchment.
- Geological data: Sub soil condition.
- Climatic data.
- Loading and other data. (04)

b) **Abutment**: The end supports of a bridge are known as abutment of bridge. (01)

Functions:

- To support the superstructure.
- To transmit the load of superstructure to foundations.
- To provide final formation level to bridge to bridge superstructure. (03)

c) Type of bridge:

i) **Culvert**: In highway work culvert have to be adopted to cross small streams, distributory.

ii) **Causeway**: Causeway may be adopted when depth of water in stream is very low and in hilly areas, where no. of small streams cross the road.

iii) **Movable bridge**: This type of bridges are constructed in navigational rivers where navigation is essential span up to 20 m.

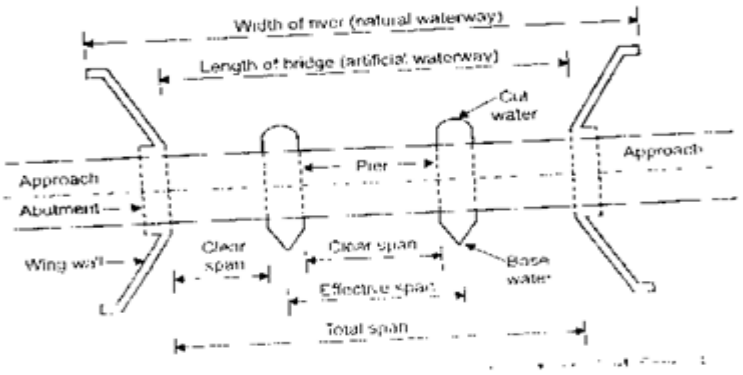
iv) Suspension bridge: Suspension bridges are adopted for very long span (1300 m) where the construction of other type of bridge is not economical. (4 x 1 =04)

d) **Routine maintenance of bridge:**

- To check proper functioning of weep holes.
- To check proper functioning of drainage devices.
- To check proper functioning of bearings and expansion joints.
- To repair the defective piers and abutments.
- Maintenance of water proofing coats.
- Maintenance of wearing coat of bridge floor.
- Maintenance of kerbs, railings.
- Careful examination of steel structures for corrosion and development of cracks.

(8 x ½ = 04)

e) Economical span of bridge: The span for which the total cost of bridge will be minimum is known as economical span of bridge. (02)

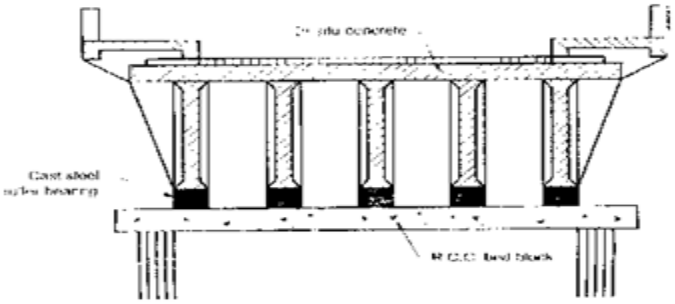


(02)

f) Prestressed Girder Bridge: The bridge having their superstructure consisting of prestressed concrete members in any structural form which support the bridge floor are known as prestressed girder bridge.

Prestressed Girder Bridge provides more smooth deck for high speed driving. Their maintenance cost is less. They have high load carrying capacity.

Prestressed Girder Bridge is specially suitable as '**urban highway bridge'.** **(02)**



Prestressed girder bridge

(02)

Q.6. Attempt an four of the following: **(16)**

a) Creep of rails: The creep of rails is the longitudinal movement of rails in a track. **(02)**

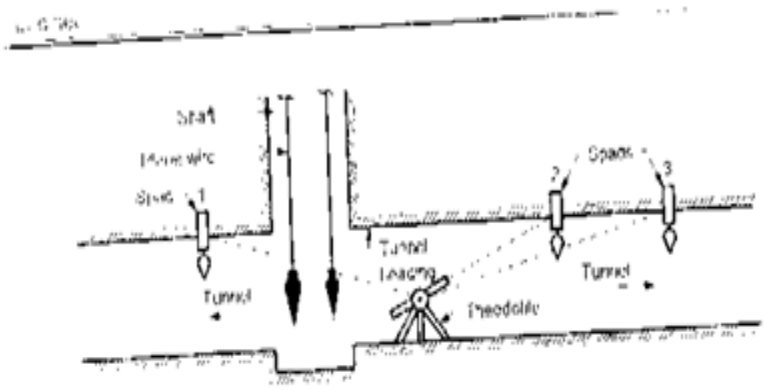
Prevention of creep: The following measures should be adopted if any creep is visible.

- Pulling back the rail to original position.
- Provision of anchors and anti—creepers should be done.
- One should increase number of sleepers per rail length.
- One should provide sufficient ballast and packing with care. **(4 x ½ = 02)**

b) Procedure of transferring of Centre Line inside the tunnel:

- For this, two small pillars are constructed on opposite edges of shaft along the centre line of tunnel.
- On the top of these pillars, the pints corresponding to the centre are correctly marked and wire then stretch between them.
- Two plumb bobs are suspended inside the shaft.
- By lowering both plumb bob to the bottom of shaft, two points are marked.
- The line joining the points represents the centre line of tunnel marked on the ground.

(02)



(ii) Transferring the alignment to inside of the Tunnel

(02)

c) Shield Method of tunneling:

- Tunneling in soft rock is done with the help of shield, used for the construction of circular tunnel.
- In this method, outer shell is constructed with steel plates by riveting or wielding them together.
- Cutting edge which cut the soft materials. Hydraulic ram moves forward leaving behind full size of tunnel.
- Tail is the last portion of shield. At this place, lining is done so that the roof of tunnel may not collapse. (4 x 1 = 04)

d) Heading and Bench Method:

- In this method, the driving of tunnel is done in two portions of its section. The top portion is known as heading and bottom portion is known as bench.
- Heading will be about 3 to 3.5m ahead of the bottom portion.
- The holes are drilled in to head and bench. Then these are loaded together with explosive and blasting.
- Firing of bench holes is done just before the heading holes are fired. After this, mucking is done manually. (4 x 1 = 04)

e) Precautions while construction of Tunnel:

- Proper use of labour and equipment, sequence of operation must be well planned previously.
- The use of outdated and unsuitable tool must be avoided.
- Loading and hauling of muck should be carried out efficiently.

- Pattern of blasting the material n different locations should be decided for maintaining the speed of driving and safety. (4 x 1 = 04)

f) Types of explosive used for Tunneling

- Disruptive explosive- straight dynamite
- Powder explosive- Blasting powder
- Liquid air (any twox1=2)

Precautions

- Pattern of blasting the material in different locations should be decided for maintaining speed of driving & safety
- After the blasting inside the tunnel ,the inside poisonous gases should be removed before allowing the workers to enter in the tunnel (2x1=2)