

## Transportat<sup>n</sup> Engineering

Q.1] Attempt any three  $\Rightarrow$  (3x8=24M)

Q.1-a] Write the merits & demerits of railway.

$\Rightarrow$  Merits of railway  $\Rightarrow$

- 1) Transportat<sup>n</sup> cost is low for common people.
- 2) Good for long journey.
- 3) Comfortable & safe journey due to railway seats.
- 4) It is time saving.
- 5) Power required for railway is comparatively less.
- 6) Railway play an important role in the Industrializat<sup>n</sup> of country.
- 7) Heavy goods & raw material can be transported easily.

Demerits of railway  $\Rightarrow$

- 1) Destinat<sup>n</sup> point & starting points are fixed & cannot be altered.
- 2) It can not provide door to door service.
- 3) There is restriction on the path of railway lines.
- 4) Noise pollut<sup>n</sup> increases due to railway.
- 5) special turning devices are required.

Q.1-b] Why cross-drainage work is necessary?

$\Rightarrow$  Necessity of cross-drainage work  $\Rightarrow$

- 1) To reduce excess moisture content CD work is necessary.
- 2) Due to poor drainage, waves & corrugations are formed & to reduce this CD work is necessary.
- 3) It helps to maintain the continuity in transportat<sup>n</sup>.
- 4) It provide the continuous access to the surrounding villages & towns even at the time of flood & heavy rain.
- 5) It maintain the gradient in undulating area in case of railway.
- 6) Due to moisture content strength of soil reduces & for maintaining the strength CD work is necessary.



Q1- c] Define gradient & write the purpose of providing gradient.

✓ \* Gradients ⇒

- The rate of rise or fall provided to the format<sup>n</sup> of a railway track along its alignment is known as gradient.

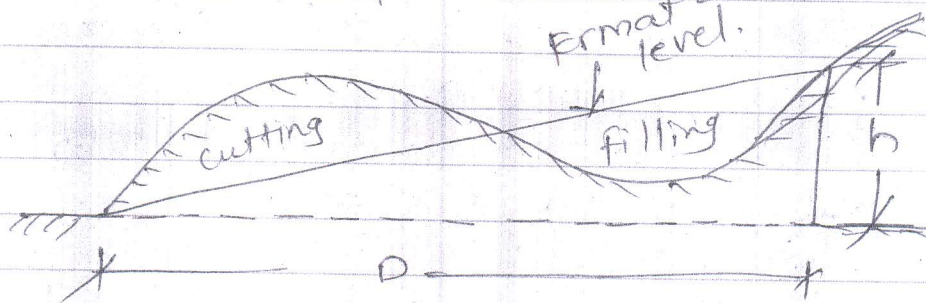
- It is the ratio of height & horizontal dist.

$$\text{Gradient} = \frac{\text{Vertical dist (h)}}{\text{Horizontal dist.}} = \frac{h}{p}$$

$$\text{or} = \frac{h}{p} \times 100$$

if it is 1 in 50, then 1 is vertical dist. & 50 is horizontal dist.

- It is also expressed in %.



- Rising gradient ⇒ When the track rises in the direct<sup>n</sup> of motion of train then the gradient is called as rising gradient.

- falling gradient ⇒ when the track is having downward slope in the direct<sup>n</sup> of motion of train, then the gradient is called as falling gradient.

Purpose of providing gradient ⇒

- 1) To reach the destin<sup>n</sup> state at diff. altitude.
- 2) To provide uniform rate of rise or fall.
- 3) To economise the earthwork / reduce earthwork.
- 4) To drain of the rain water easily.

Q.1-d] Why track maintenance is necessary?

\* Track maintenance is necessary because,

1) The strength of track structure reduces due to high speed of train, heavy loads & repetition of loads & due to this track alignment get disturbed.

2) The track structure get disturbed due to rain water, action of sun & wind etc & due to this the wear & tear take place.

3) The track components are subjected to many other effects due to heavy wheel load, curvature & speed of trains.

For reduce the above effects track maintenance is necessary.



Q. 2] Attempt any two. (4x2 = 08M)

a) Explain cant deficiency with their values.

\* Cant deficiency  $\Rightarrow$

- The difference bet<sup>n</sup> the equilibrium cant & actual cant provided is known as cant deficiency.

- equilibrium cant is necessary for max. permissible speed on curved track.

- The cant deficiency should be as low as possible

- If higher cant deficiency, then following disadvantages are occur,

1) Higher cant deficiency results in extra pressure & lateral thrust on outer rails.

2) Higher C.D. results in more side wear & creep of outer rail of track.

3) Higher C.D. results in more discomfort to passengers.

Values of cant deficiency.

Gauge	C.D.	
	Speed upto 100 km/h	Speed higher than 100 km/h
1) Broad gauge.	7.6 cm	10 cm
2) Metre gauge.	5.1 cm	not specified
3) Narrow gauge.	3.8 cm	—



Q.2-b) Write site selection criteria for railway station.

Site selection of railway station

- 1) The site should be close to the town or village.
- 2) The station site should have fairly level ground.
- 3) The station site should be situated on the straight portion of track.
- 4) The station site should have good approach roads connecting the nearby town.
- 5) The site should have good drainage facility.
- 6) The station site should provide amenities like drinkable water, electricity etc.
- 7) Sufficient land area for single track, double track, platform, station building & for future expansion, should be available.

Q.2-c) Define creep. What are the causes of creep?

Creep of Rail

The longitudinal movement of rails in a track is called as creep of rail.

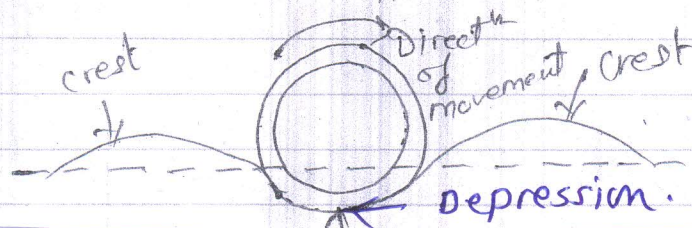
Causes of creep

i) Wave action or Wave theory

The creep is developed due to the wave action/motion of wheels on rails

Due to movements of the wheel load on the rails, the rail deflects/depressed below the wheel & creates crest near to the wheels.

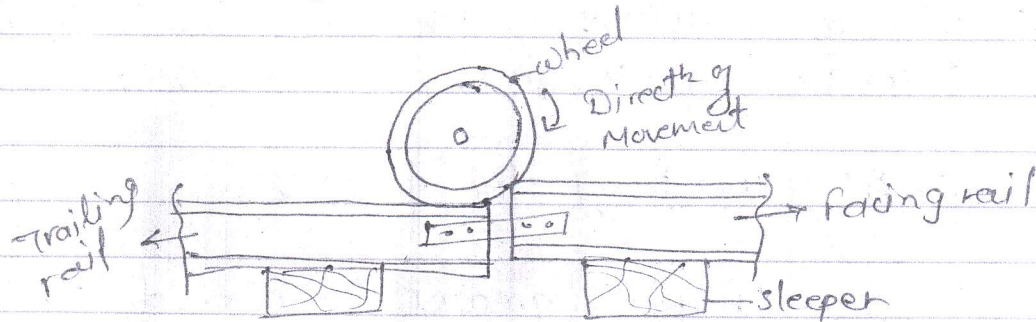
When wheels of rail strike these crests then creep is developed.





### Q.2. c) ii) Percussion theory

- According to this theory, the impact of rail wheel at the end of facing rail at each fish plate joint.



- When the wheel pair over such a rail joint the trailing rail depress down & the wheel give impact to the end of facing rail, which results creep in forward direction.

### iii) Starting of train

At the time of starting of train, the wheel push the rails backward & then creep is occurred.

### iv) Stopping of train

At the time of stopping of train, the wheel push the rails forward & then creep is occurred.

### v) changes in temp.

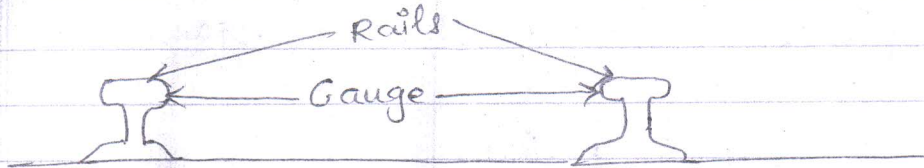
Due to changes in temp expansion or contraction of rails occurred & due to ~~expansi~~

Q. 3] Attempt any two ( $4 \times 2 = 8M$ )

a) What are the types of rail gauge & write any two factors affecting selection of rail gauge.

\* Rail gauge :-

Def<sup>n</sup> :- The gauge of a railway track is defined as the clear min. perpendicular Dist. bet<sup>w</sup> the inner faces of the 2 rails.



Types of gauge :-

Following are the 4 types of gauge.

1) Broad gauge :-

If the width of gauge is bet<sup>w</sup> 1676 mm to 1524 mm then it is called as Broad gauge.

2) Standard gauge :-

If the width of gauge is 1435 mm or 1461 mm then it is called as standard gauge.

3) metre gauge :-

If the width of gauge is 1067 mm or 1000 mm or 915 mm then it is called as metre gauge.

4) Narrow gauge :-

If the width of gauge is 762 mm or 610 mm then it is called as narrow gauge.



Q.13.1) Remaining Ans. -

Following are the factors affecting selection of rail gauge :-

1) Traffic condition :-

If the intensity of traffic on track is likely to be more than the gauge wider than, the standard gauge is suitable.

2) Cost of track :-

The cost of railway track is directly proportional to the width of its gauge.

If the fund available is not sufficient to construct a standard gauge then a meter gauge or narrow gauge is preferred.

3) Nature of country :-

In mountainous country, it is advisable to have a narrow gauge of the track since it is more flexible.



Q.3-b) Explain negative cant with neat sketch.  
 ✓ Negative Cant

The elevat<sup>n</sup> of outer rail below the inner rail of a turnout or branch track at the place where it meets the main track on curve is called negative cant or <sup>negative</sup> Super-elevat<sup>n</sup>.

- When a turnout is to be provided at curved portion of a main railway track, deflecting in the reverse direction, the outer rail of the turnout track, should be provided higher than its inner rail which requires the rail at point (A), higher than the rail at point (B).

- But <sup>the</sup> outer rail of main track is provided higher than its inner rail. (B is higher than A)

- so instead of point (A) of the outer rail on branch track being higher, it is kept lower than point (B) of the inner rail which reverse of the requirement.

- Thus, the S.E. is provided on the branch track is negative & such type of S.E. is called as negative cant or negative super-elevat<sup>n</sup>.

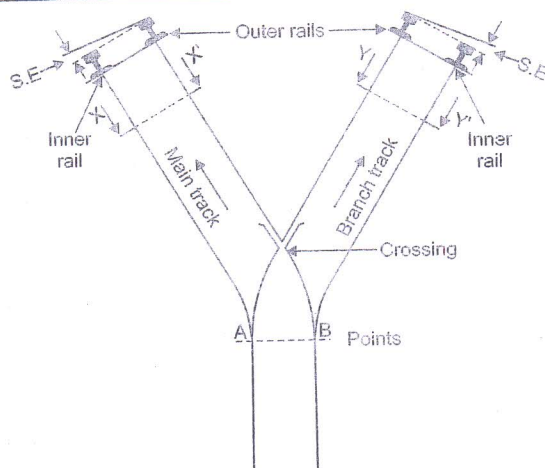


Fig. 2.49 : Negative Cant

Q. 3 - e) Explain coning of wheels in brief with neat sketch.

### \* Coning of Wheel ⇒

- The art of providing outward slope of 1 in 20 to the wheels is known as coning of wheels.

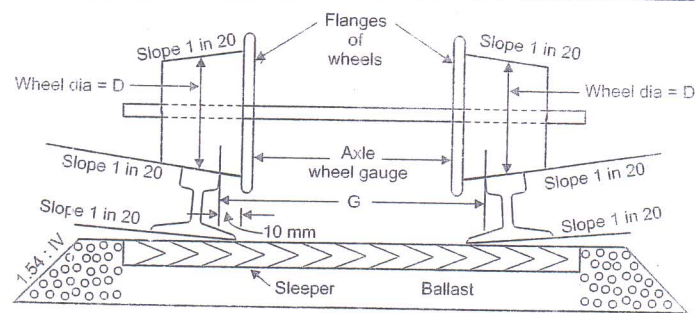


Fig. 2.43 : Coning of Wheels (on Level Track)

- The wheels are provided with flanges on inner side of rails.

- The function of providing wheel flanges on inner side is to prevent lateral slipping of wheels.

- The distance bet<sup>n</sup> inner faces of flanges is kept less than the gauge dist<sup>n</sup> to prevent rubbing act<sup>n</sup>.

- The outward slope of 1 in 20 is provided,  
1) To check the lateral movement, which cause damage to running or inner faces of rails  
2) To ~~reduce~~ inconvenience to passenger.

Advantages ⇒ 1) It decrease the dia. of wheel rim over the opposite rail of track.

2) It prevent lateral movement 3) It ensure smooth movement of train. 2) In convenience to passenger.