POSTAL Book Package 2021

CIVIL ENGINEERING

Railway, Airport, Dock, Harbour & Tunnel Engineering

Conventional Practice Sets

Contents

MADE EASY Publications

1 CHAPTER

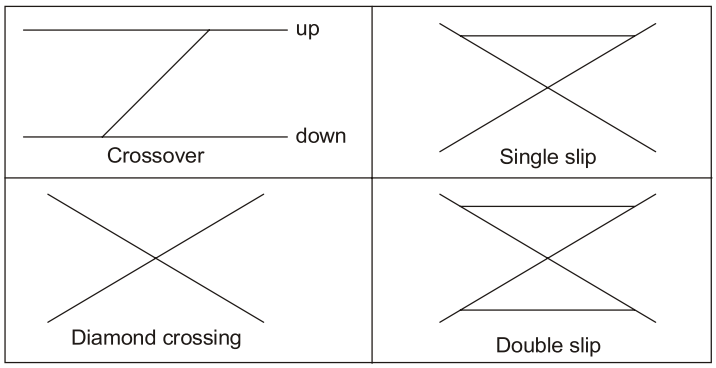
Railway Track

Q.1 Differentiate between single slip and double slip in rails. If the tread diameter on both the rail is the same then show that the slip is about 0.029 m per degree of central angle of Broad Gauge (BG).

Solution:

Double slip and single slip: A **double slip** is a narrow angled diagonal flat crossing of two lines combined with four pairs of points in such a way as to allow vehicle to change from one straight track to other or go straight. In double slip train can move from either track to other one.

In single slip, arrangement of points are such that it provide for only one switching possibility train moving on one track can move to other track or go straight but train at other track can go only straight.



Date given: BG track $G = 1.676$

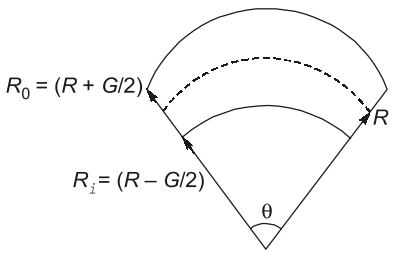
Say radius of track is R, $\theta = 1°$

Linear travel by inner wheel = wR_i

Linear travel by outer wheel = wR_0

$$\text{Slip} = wR_i - wR_o$$

$$= \boxed{wR_0 - wR_i = w\left(R + \frac{G}{2}\right) - w\left(R - \frac{G}{2}\right)}$$



$$= \boxed{wG}$$

$$= \left(\frac{2\pi}{360} \times \theta\right) \times G = \frac{2\pi}{360°} \times 1° \times 1.676$$

$$= 0.029 \text{ m}$$

Q.2 What is meant by 'creep' in railway track? What are the cause of creep? How is creep measured? What are the remedial measures for correction of creep?

OR

Discuss the causes and effects of creep in a rail track; also discuss its management.

Solution:

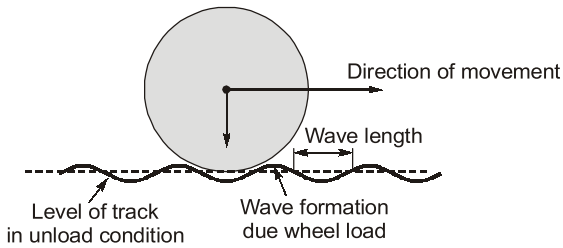
Creep: Creep is defined as longitudinal movement of the rail with respect to sleepers due to movement of traffic over a period of time. Its value varies from almost nothing to about 16 cm.

Effects of creep in a rail track:

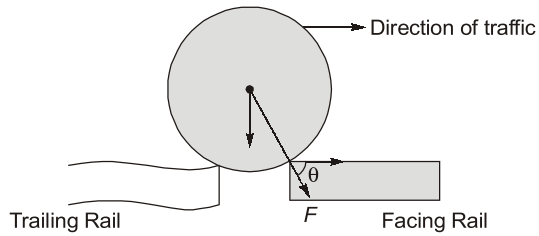
(a) Creep may leads to buckling of track in lateral directions.
(b) Square geometry arrangement of sleepers get disturbed and leads to distorted gauge and alignment.
(c) Rail joints are opened out and bolt holes get elongated leads to premature fracture of fish plate and bolts.
(d) Point and crossing get disturbed.
(e) The joints get continuously jammed, and maintenance and replacement become difficult.

Reason of creep:

(a) Wave motion theory: Due to wheel load a wave in rail is created in direction of traffic, resulting in creep.



(b) Percussion theory: Due to horizontal component of (load + kinetic) force *F*, at expansion joint, creep is observed.



(c) Dragging Theory: Due to fraction force between wheel & rail a drag force generate opposite to movement of train, resulting in creep.

(d) Due to braking & acceleration (skidding + slipping).

Following are some of avoidable causes of creep:

(a) Rails are not property fastened with sleepers.
(b) Loose packing of ballast around sleepers.
(c) Improper expansion gaps.
(d) Too light rail for heavy traffic
(e) Sharp gradients and sharp curves.
(f) Uneven spacing of sleepers etc.

Preventive and remedial measures of creep:

(a) Rails should be firmly held to sleepers.
(b) Bearing load of fastenings should always be slightly more than the ballast resistance.
(c) Ballast should be properly packed specially around sleepers and shoulders.
(d) Use of creep anchors at adequate internal.
(e) When creep became excessive (> 150 mm) causing maintenance problems. The same should be adjusted by pulling back manually or mechanically during pulling back operation survey of expansion joint, gaps and rail to rail joint with sleepers should be carried out properly.

Measurement of creep:

(a) Creep posts are erected every kilometer on either side of the track and position of joints is marked on one of the posts.

(b) Then measurement of creep is taken at an internal of about 3 month.

(c) Creep in excess of 150 mm should not be allowed on a straight and levelled track.

(d) In approaches of points and crossing. There should be no creep allowed.

Q.3 Why is it necessary to provide adequate drainage facility for a railway track? Suggest remedial measures to solve the following problems, due to poor drainage of railway track, giving suitable sketches.

(i) Wet earth clogging the ballast

(ii) Ballast sinking into the wet earth.

Solution:

Adequate drainage is necessary in railway track for following reasons:

1. To maintain bearing capacity of formation soil.
2. To prevent settlement of track embankment.
3. Excessive water reduces track stability and results in ballast pockets and unstable formation.
4. If surface and subsurface water not properly drained out it results in soft spots, unstable banks, cutting, bank slips and land slides.
5. In rainy season, due to water logging, wet earth clogging of ballast may happen which further reduce its ability to drain.

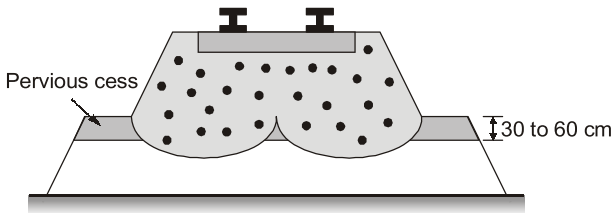
(i) The following remedial measures can be a adopted to solve the problem of wet earth clogging of ballast:

(a) to unclogg the ballast, clearing of shoulder ballast is often sufficient. In this process shoulder ballast is removed to a certain depth, then it is cleaned and repacked again. It can be done manually or by the mechanized way.

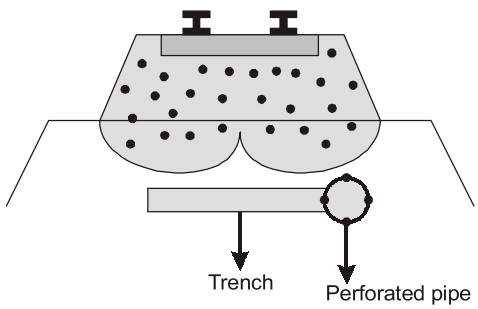
(b) If ballast is old than it has to be removed and replaced by new ballast. It can be done by simple dumping the new ballast and raising the track, then old ballast can be removed by under cut.

(ii) Following remedial measures can be adopted to prevent ballast sinking in wet earth:

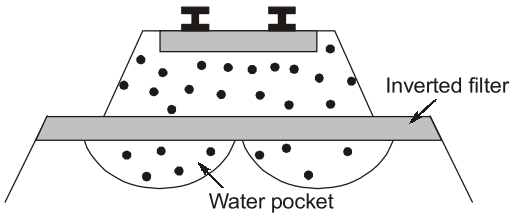
(a) **Use of pervious cess:** It is provided to remove water pocket in formation.



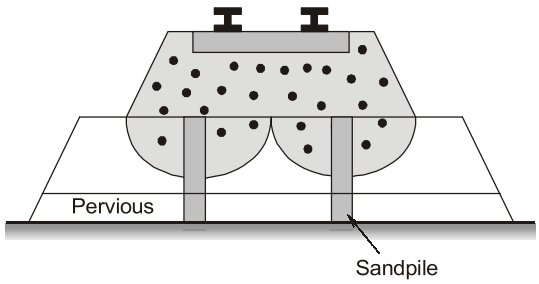
(b) **Perforated pipe and trench drains:** Water is collected and drained out by combination of perforated pipe and trench drains.



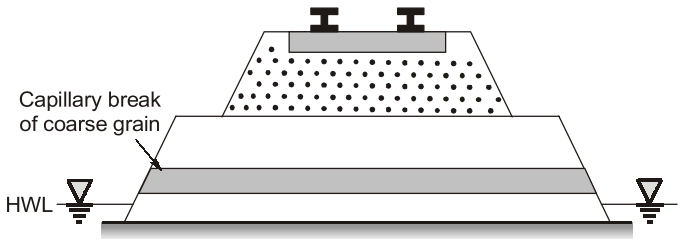
(c) **Use of inverted filter blanket:** After draining out of water pocket a 20 cm to 30 cm inverted filter blanked is provided over formation for drainage.



(d) **Use of sand piles:** If pervious soil exists below cohesive soil, this method is used for water drainage.



(e) **Use of capillary break:** If water pocket is created due to capillary water, a coarse grain layer is provided to cut it off.



Q4 **Explain what is meant by the capacity of a railway track and suggest different measures to increase the track capacity.**

OR

Explain what is meant by capacity of railway track. Discuss the various measures to increase the capacity of track.

Solution:

Capacity of railway track: Maximum number of trains that can be run on any given length of the track during a calender day of 24 hours. The **Scott's formula** is normally used for assessment of line capacity of a given section.

Line capacity, $$C = \frac{24 \times 60}{T_{rb} + T_o} \times \eta$$

Where, T_{rb} = The highest time in minutes taken by the slowest train to pass over the ruling block section.

T_0 = The average time required for signalling and block operations.

η = Efficiency factor.