India's No.1 Study Channel

Railway Engineering
By Sandeep Jyani Sir

26-06-2019

RRB JE CBT 2

Railway Engineering

Crash Course

LIVE

9 PM

Que 1. George Stephenson succeeded in running the first train of the world in

a) 1825

b) 1835

c) 1841

d) 1853

Que 1. George Stephenson succeeded in running the first train of the world in

a) 1825

b) 1835

c) 1841

d) 1853

Que 2. The first train in India was run in

a) 1825

b) 1835

c) 1841

d) 1853

Que 2. The first train in India was run in

a) 1825

b) 1835

c) 1841

d) <u>1853</u>

Que 3. The first train in India was run between

a) Delhi and Kolkata

b) Bombay and Thane

c) Delhi and Bombay

d) Bombay and Kolkata

Que 3. The first train in India was run between

a) Delhi and Kolkata

b) Bombay and Thane

c) Delhi and Bombay

d) Bombay and Kolkata

Que 4. The Indian Railway has been divided into

a) Six zones

b) Eight zones

c) Twelve zones

d) Sixteen zones

Que 4. The Indian Railway has been divided into

a) Six zones

b) Eight zones

c) Twelve zones

d) <u>Sixteen zones</u>

Syllabus

Railway Engineering

- Alignment and gauges
- Permanent way
- Railway track geometrics
- Branching of tracks
- Stations and yards
- Track maintenance

Railway Engineering

- Modern steam Engine was invented by George Stephenson of England in 1814
- First train of the world was successfully run on 27th September 1825 between Stockton and Darlington
- First train in India was run on 16th April 1853 between Mumbai and thane with four coaches and one steam locomotive for a distance of 34km.
- THE RAILWAY SYSTEM IN INDIA IS BIGGEST IN ASIA AND THE SECOND LARGEST IN THE WORLD UNDER SINGLE MANAGEMENT

Indian Railways

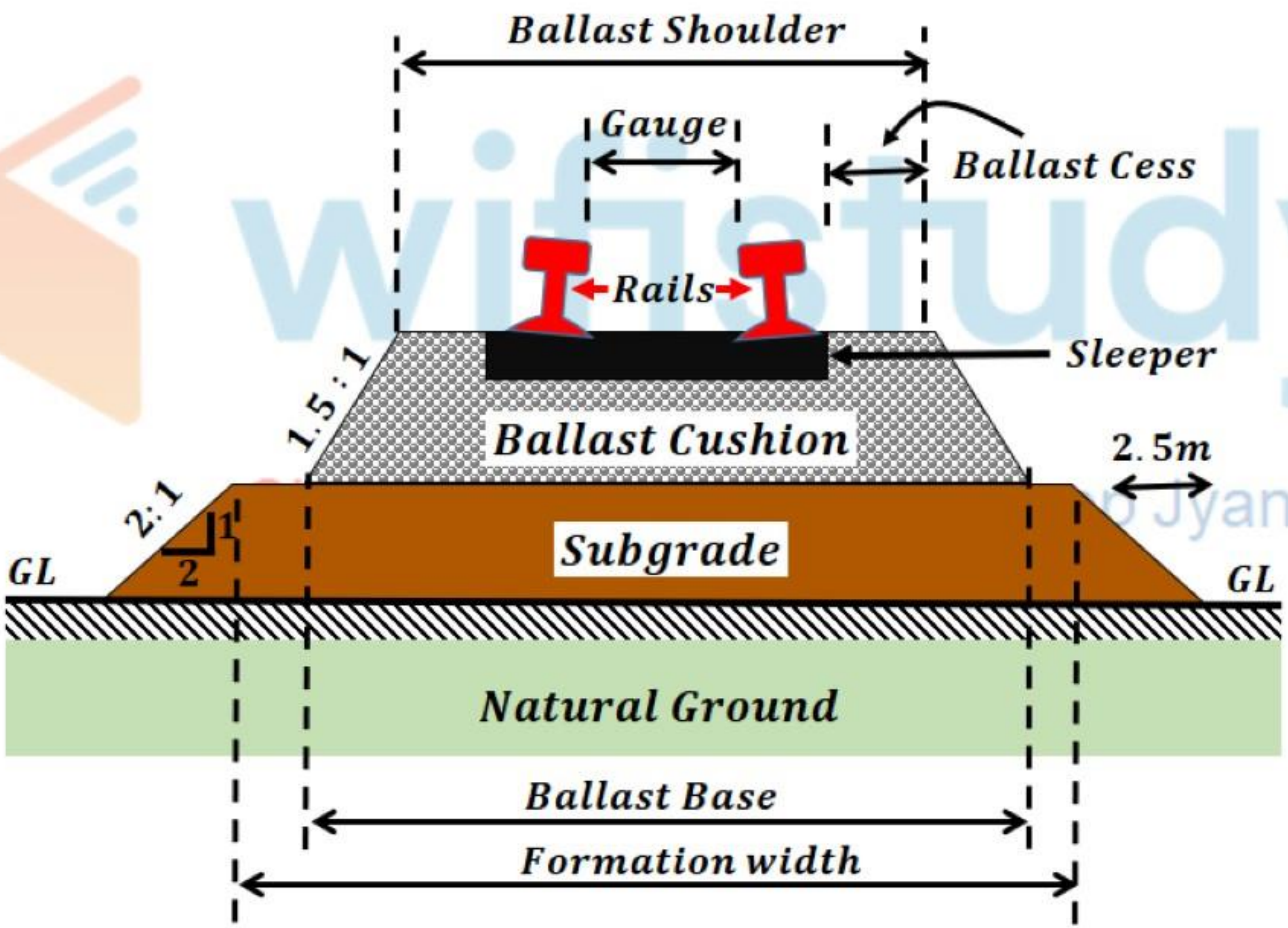
- Indian Railways runs around 11,000 trains everyday, of which 7,000 are passenger trains

7566 - locomotives	37,840 - Coaching vehicles	222,147 - Freight wagons	6853 - Stations
300 - Yards	2300 - Good sheds	700 - Repair shops	1.54 million - Work force

The Permanent Way

- The combination of rails fitted on sleepers and resting on ballast and subgrade is called Railway Track or Permanent Way.

The Permanent Way



Que 5. Gauge is the distance between

a) Centre to centre of rails

b) Running faces of rails

c) Outer faces of rails

d) none

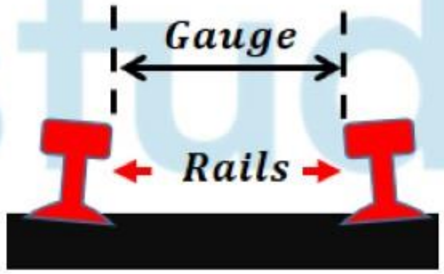
Que 5. Gauge is the distance between

a) Centre to centre of rails

b) Running faces of rails

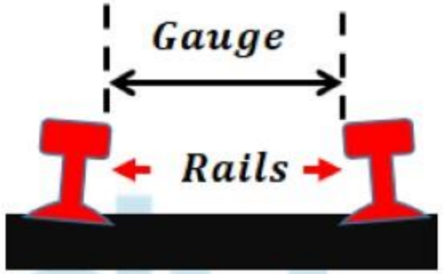
c) Outer faces of rails

d) none



Railway Gauge

- **Clear distance between inner faces of two rails near their tops is called a gauge**



1. **Broad Gauge (BG):**
   - 1.676 m wide
   - Adopted for main cities and routes of maximum intensity
   - Speed of locomotive is restricted to 96 kmph to 120kmph
2. **Metre Gauge**
   - 1m wide
   - Adopted for undeveloped areas
   - Speed of locomotive restricted to 80kmph
3. **Narrow Gauge**
   - 0.762m wide
   - Gauge is adopted for hilly areas and thinly populated areas
4. **Loading Gauge**
   - The gauge representing maximum width and height upto which a railway vehicle may be built
   - For broad Gauge it is fixed as 4.72m and for metre gauge 3.43m
5. **Feeder Track Gauge**
   - 0.61m
6. **Standard Gauge**
   - 1.435m

Indian Railways

- Indian Railways is a multi-gauge system covering the following:

Track Kilometers	Broad Gauge (1676 mm)	Meter Gauge (1000 mm)	Narrow Gauge (762/610 mm)	Total
	86,526	18,529	3,651	108,706
Route Kilometers	Electrified	Total		
	16,001	63,028		

Que 6. Rail is designated by its

a) Length

b) Weight

c) Cross section

d) Weight per unit length

Que 6. Rail is designated by its

a) Length

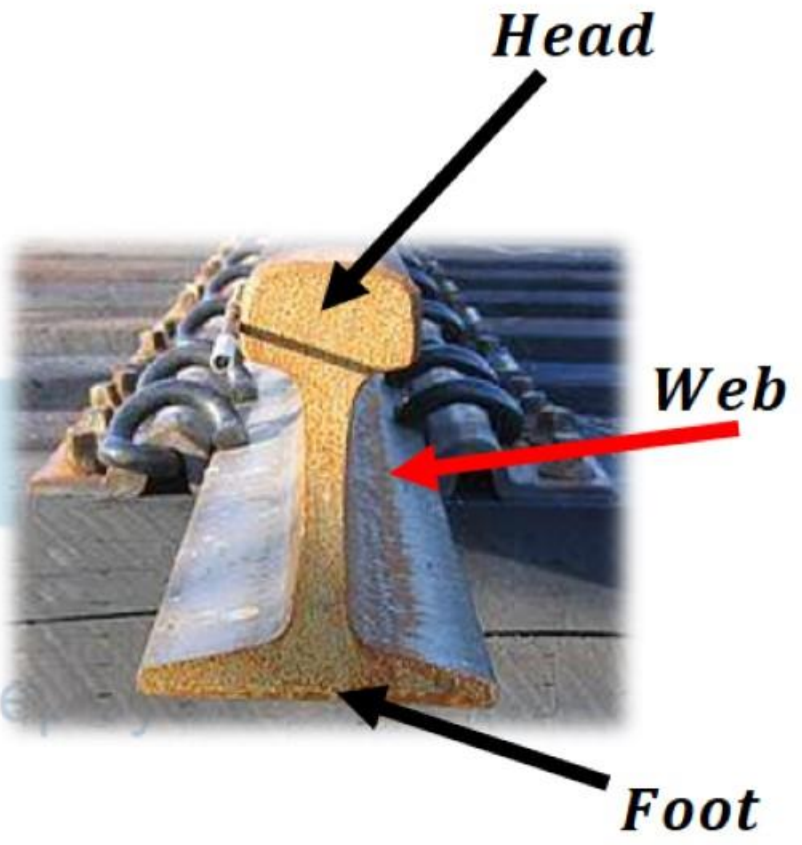
b) Weight

c) Cross section

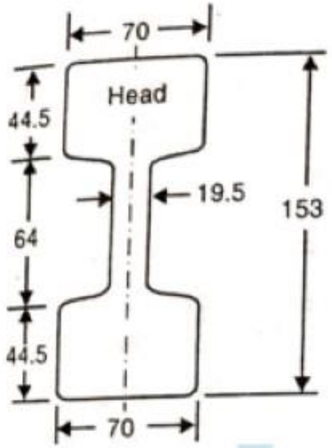
d) Weight per unit length

Rail Section

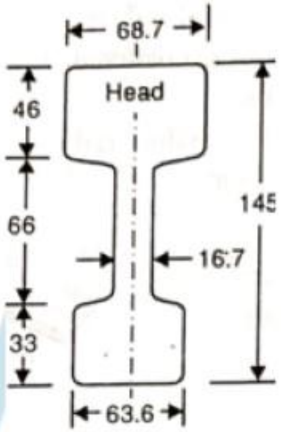
- Rails are continuous steel sections laid along two parallel lines over sleepers.
- They form a suitable track for train and should be strong enough to bear the stresses developed in the track due to wheel loads, lateral and other forces as well as variation due to temperature changes
- The rail section is designated by *mass per metre length*



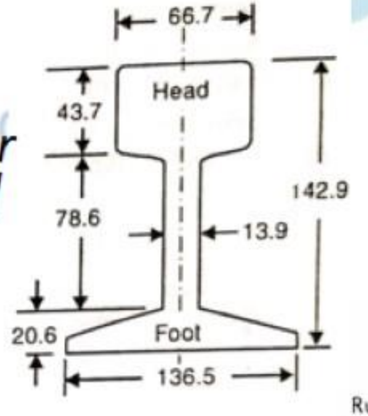
Rail Section

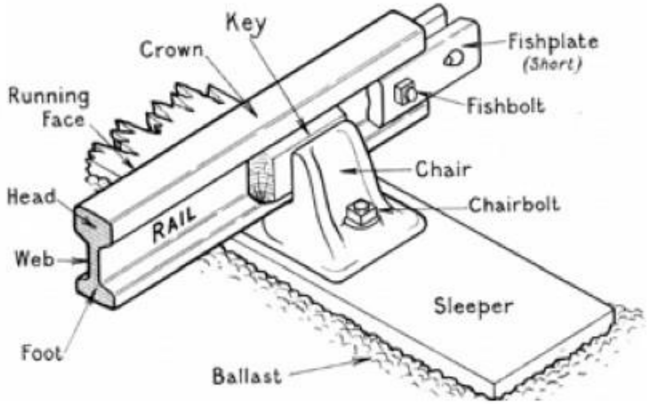


1. ***Double Headed Rail***
   - Both heads of rail section are kept equal
2. ***Bull Headed***
   - In this rail, top head is made heavier and lower head is provided with only required quantity of steel



3. ***Flat Footed***
   - Top head is made slightly less than that of bull headed rail and bottom is made flat footed
   - *Mostly used in Indian Railways because of better rigidity and stiffness to resist lateral and vertical forces*
   - It is simple to fix them with sleepers as neither chair nor key is required



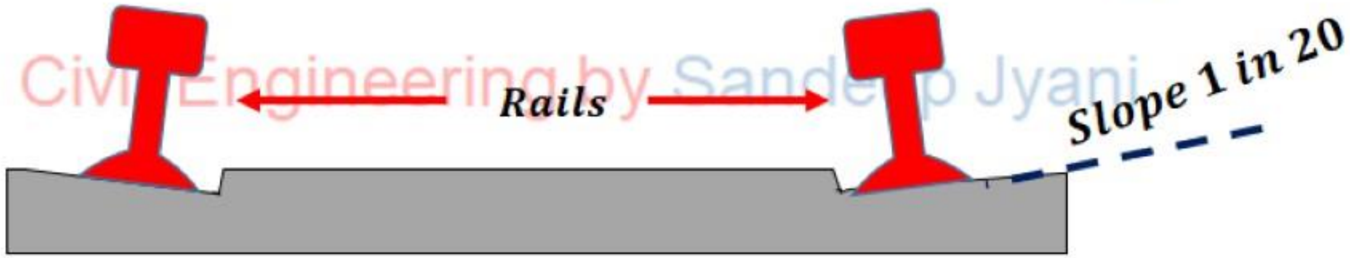


Length of Rail

- For **Broad gauge**, standard length of Rail is $12.8\ m$, and
- For **metre gauge**, standard length is $11.89\ m$

Tilting of Rails

- Placing of rail of the track at an inward slope of 1 in 20 is known as *Tilting of rails.*
- *Main purpose of it is to reduce wear on inside edges of the rail in a track*



Selection of Rail

- A rail is designated by weight per unit length
- Factors to be considered in deciding the weight of rail are
  1. Speed of train
  2. Gauge of the track
  3. Axle load and nature of traffic
  4. Type of Rails (DH/BH/FF)
  5. Spacing of sleepers (Sleeper density)
  6. Maximum permissible wear on top of rails (5% of wt of rail)

Selection of Rail

- A General rule adopted is to specify a certain constant value of the ratio between the weight of the rail and the locomotive axle load.
- In India the ratio is **1/510**.

$$\frac{Weight\ of\ the\ rail\ in\ tonnes}{Locomotive\ axle\ load\ in\ tonnes} = \frac{1}{510}$$

Que 7. For a locomotive axle load of 22.86 tonnes, the weight of rail required will be…?

a) 44.8 kg

b) 48.4 kg

c) 50 kg

d) 22.86 kg

Que 7. For a locomotive axle load of 22.86 tonnes, the weight of rail required will be...?

a) 44.8 kg

b) 48.4 kg

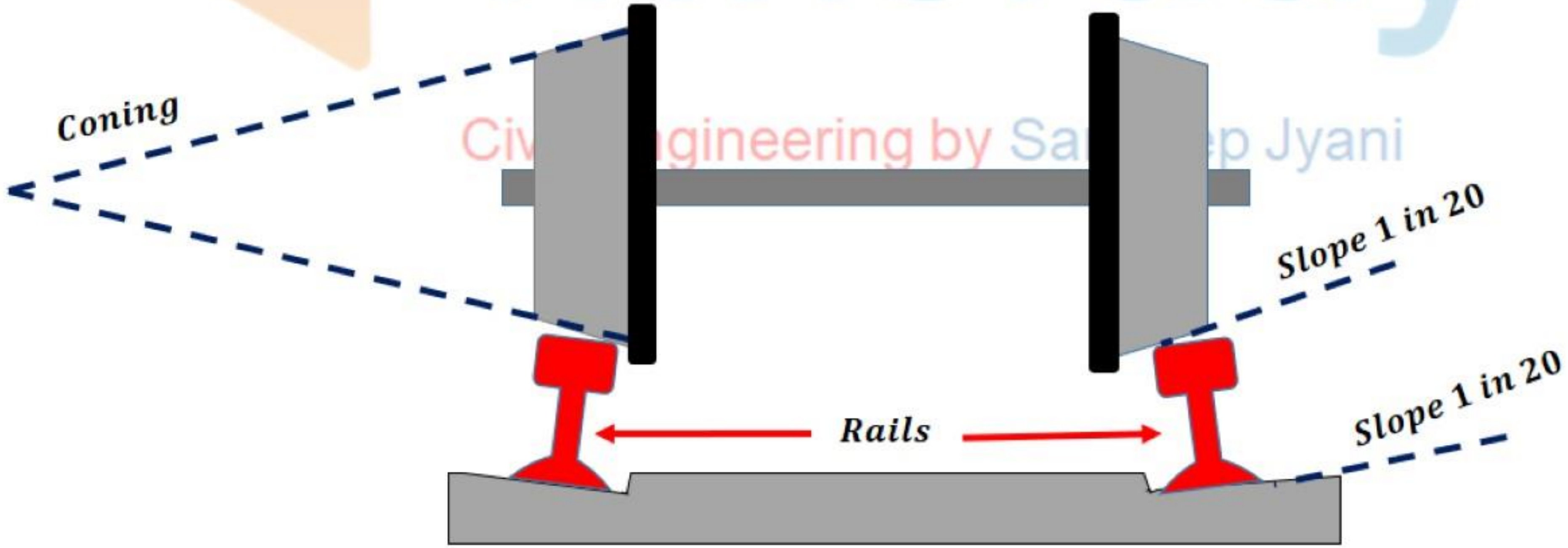
c) 50 kg

d) 22.86 kg

$$\frac{Weight\ of\ the\ rail\ in\ tonnes}{Locomotive\ axle\ load\ in\ tonnes} = \frac{1}{510}$$

Coning of Wheels

- Wheels of train are coned at an angle of $1\ in\ 20$ as well as the rails are also laid at angle of $1\ in\ 20$
- Its purpose is that the train wheel can move at the centre of rail.
- If due to any sideway effect, the wheels of the train will move sideway, then the diameter of sideway wheel will increase and other wheel will increase
- Hence length travelled by both wheels will be unequal which results in diverting back the wheel to its centre
- It also helps similarly when the train moves on any curve



Hogging and Buckling of Rails

- The loose packing under the rails and loose fish plates cause the rail ends to bent down and deflect. This is known as Hogging of rails
- When the rails get out of their original position due to insufficient expansion joint gap, the phenomenon is known as *Buckling of Rails*

Creep of Rail

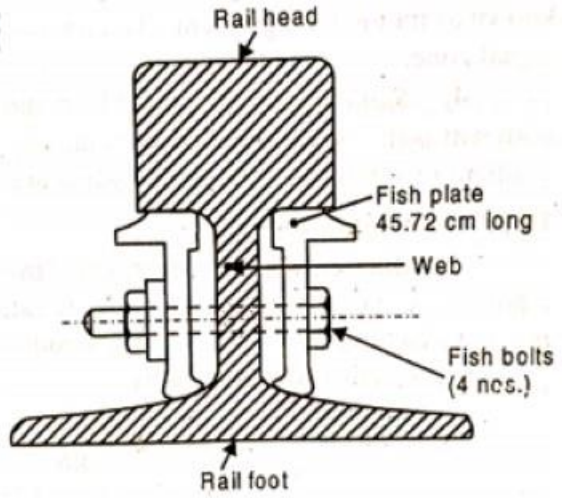
- Longitudinal Movement of Rail in a permanent track due to speedy rolling stock is known as Creep of Rail

Wear of Rail

- Flow of rail material due to heavy loads is called Wear of Rails.
- Permissible limit of rail wear is 5 percent by weight

Fish Plates

- Pair of plates of designed section, which are used in rail joints to maintain the continuity of rails and to provide expansion and contraction of rails due to temperature variation.
- These plates bear vertical and lateral stresses without distortion and resist wear.



Sleepers

- Members that are laid transverse to the rails to support the rails and to transfer the loads from rails to ballast are called *Sleepers.*
- *Main function of sleeper is to*
  1. To support rail firmly and evenly
  2. To keep two rails at correct gauge and level
  3. To distribute the load to ballast
  4. To act as an elastic medium
  5. To provide stability to permanent way

Types of Sleeper

1. **Wooden Sleepers**
   - Made of teak wood are used
   - Generally life of timber sleeper is taken as 12 years
2. **Steel Sleepers**
   - They cover about 30 percent of tracks on Indian railway
3. **Cast Iron sleepers**
   - They cover about 50 percent of the tracks on Indian Railways
   - They are liable to crack and break
   - They are classified as POT SLEEPERS or
4. **RCC Sleepers**
   - They are used due to their heavier mass which improves track modulus.
   - It has the capacity to maintain gauge properly and suitability for track circuiting.
   - It has long life and free from fire hazard.

wifistudy

Changing the way of learning...

Railway Engineering

Civil Engineering by Sandeep Jyani

SLEEPER DENSITY

- **It is defined as the number of sleepers used per rail length on the track.**
- **It is generally given as $(n + x)$, where n is the length of rail and x may vary from 2 to 7.**
- **In India, the sleeper density provided is 18 sleepers per rail length.**

Que 8. For a rigid track of broad gauge width, if sleeper density = (n+5), how many sleeper will be required for 1km length?

Solution: 12.8→ 18

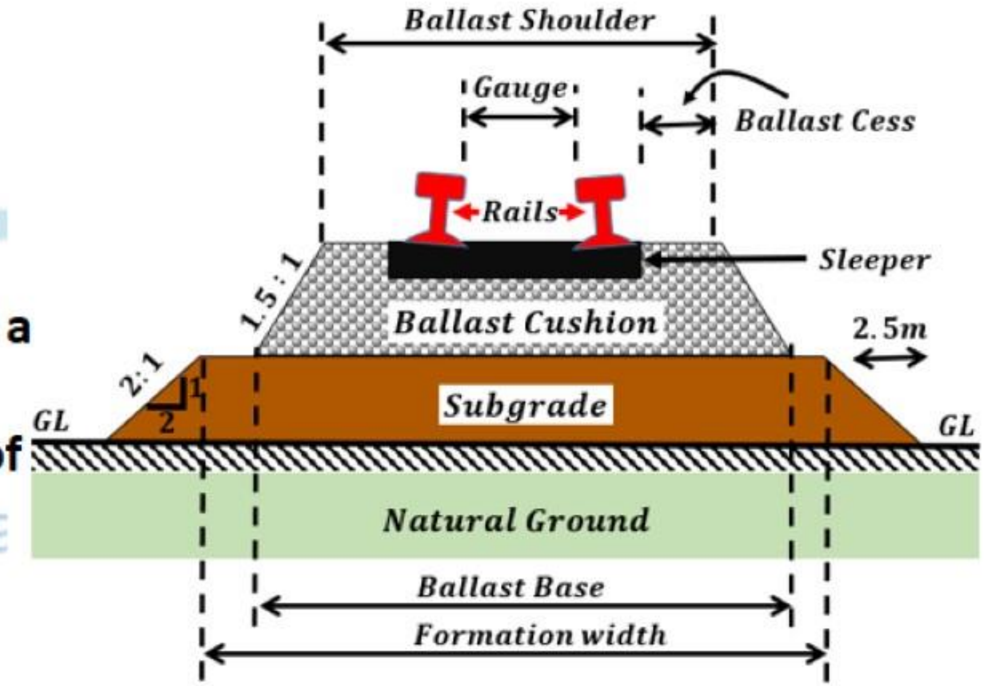
$$1000 \rightarrow \frac{18}{12.8} \times 1000 = 1406.25\ sleepers$$

Que 9. What is Plate Laying ?

Answer: The operation of laying out sleepers on the compacted formation is known as Plate Laying

BALLAST

- It is a layer of broken stones, gravel, morrum or any other gritty material, packed below and around the sleepers, so that the load from sleepers may be transmitted to the formation.
- Functions of ballast:
  1. Uniformly distributes the load from sleepers over a large area of formation.
  2. Holds the sleeper in position during the passage of moving trains.
  3. Provides elasticity and resilience to the track.
  4. Provides proper drainage to the track and keeps the sleepers in dry conditions.
  5. Prevents lateral, longitudinal and vertical movement of the track.
  6. Provides proper superelevation to the outer rail on curves.



MAIN CONSIDERATIONS FOR BALLAST

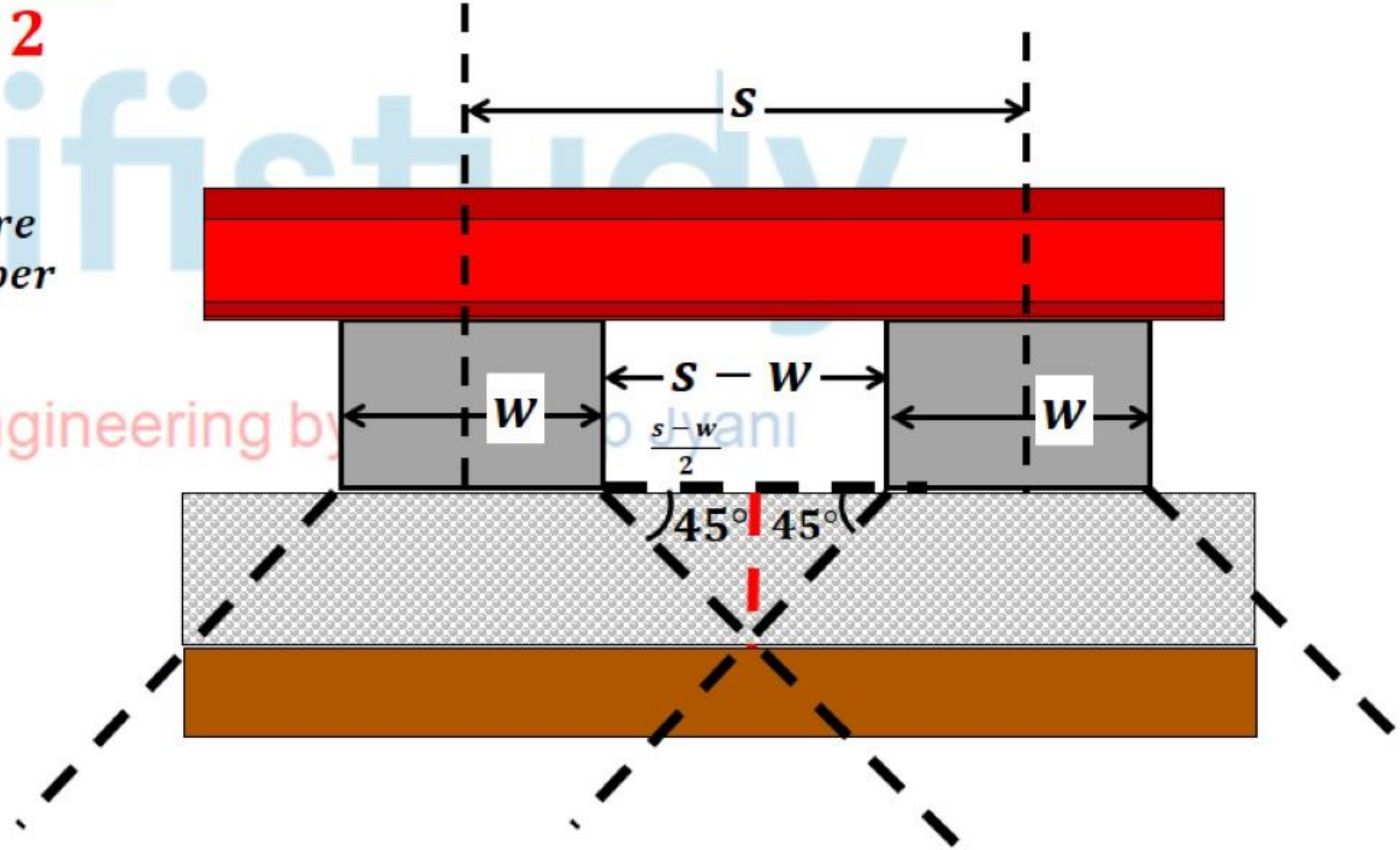
1. Size of ballast used on Indian railways for wooden sleepers is 50mm and for steel sleepers, it is 38mm.
2. Size of ballast used on Indian railways under points and crossings is 25mm.
3. The standard width of ballast for broad gauge track on Indian railway 3.35m and for metre gauge track, it is 2.3m.
4. The minimum depth of ballast for broad gauge track on Indian railways is 250mm and for metre gauge track, it is 200mm.

MINIMUM DEPTH OF BALLAST CUSHION(D_b)

$$D_b = \frac{s - w}{2}$$

s is the centre to centre spacing between sleeper

w is width of sleeper



Que. 10 The weight of the rails depends upon

a) gauge of the tracks
b) speed of trains
c) spacing of sleepers
d) nature of traffic
e) all the above.

Que. 10 The weight of the rails depends upon

a) gauge of the tracks
b) speed of trains
c) spacing of sleepers
d) nature of traffic
e) <u>all the above.</u>

Que.11 How does the depth of ballast cushion affect rail section?

a) Higher the depth bigger the rail section
b) Depth is less, bigger the rail section
c) Depth is less, smaller the rail section
d) Depth and Rail section same

Que.11 How does the depth of ballast cushion affect rail section?

a) Higher the depth bigger the rail section
b) Depth is less, bigger the rail section
c) Depth is less, smaller the rail section
d) Depth and Rail section same

Que. 12 Minimum depth of ballast prescribed of B.G. trunk lines of Indian Railways, is

a) 20 cm

b) 15 cm

c) 25 cm

d) 30 cm

Que. 12 Minimum depth of ballast prescribed of B.G. trunk lines of Indian Railways, is

a) 20 cm

b) 15 cm

c) 25 cm

d) 30 cm

Que.13 Boxing of ballast is done

a) under rails
b) at the rails
c) in between two rails
d) in between two sleepers.

Que.13 Boxing of ballast is done

a) under rails

b) <u>at the rails</u>

c) in between two rails

d) in between two sleepers.

Que.14 Best ballast contains stones varying in size from

a) 1.5 cm to 3 cm
b) 2.0 cm to 4 cm
c) 2.0 cm to 5 cm
d) 2.5 cm to 6 cm

Que.14 Best ballast contains stones varying in size from

a) 1.5 cm to 3 cm

b) 2.0 cm to 4 cm

c) <u>2.0 cm to 5 cm</u>

d) 2.5 cm to 6 cm

Que.15 Wooden sleepers used on the girders of bridges, are generally made of

a) sal
b) chir
c) teak
d) deodar

Que.15 Wooden sleepers used on the girders of bridges, are generally made of

a) sal
b) chir
c) <u>teak</u>
d) deodar

Que.16 Best wood for wooden sleepers is

a) sal
b) chir
c) teak
d) deodar

Que.16 Best wood for wooden sleepers is

a) sal
b) chir
c) <u>teak</u>
d) deodar

Que. 17 The standard length of rail for Broad Gauge and Meter Gauge are respectively

a) 12 m and 12 m
b) 12 m and 13 m
c) 13 m and 12 m
d) 13 m and 13 m

Que. 17 The standard length of rail for Broad Gauge and Meter Gauge are respectively

a) 12 m and 12 m

b) 12 m and 13 m

c) 13 m and 12 m

d) 13 m and 13 m

Que. 18 Largest dimension of a rail is its

a) height

b) foot width

c) head width

d) any of the above

Que. 18 Largest dimension of a rail is its

a) height
b) foot width
c) head width
d) any of the above

Que. 19 52 kg rails are mostly used in

a) **Broad Gauge**

b) **Meter Gauge**

c) **Narrow Gauge**

d) **both (a) and (b)**

Que. 19 52 kg rails are mostly used in

a) Broad Gauge

b) Meter Gauge

c) Narrow Gauge

d) both (a) and (b)

Que. 20 Head width of 52 kg rail section is

a) 61.9 mm

b) 66.7mm

c) 67mm

d) 72.33 mm

Que. 20 Head width of 52 kg rail section is

a) 61.9 mm

b) 66.7mm

c) <u>67mm</u>

d) 72.33 mm

Que. 21 The total gap on both sides between the inside edges of wheel flanges and gauge faces of the rail is kept as

a) 10mm

b) 13mm

c) 16mm

d) 19 mm

Que. 21 The total gap on both sides between the inside edges of wheel flanges and gauge faces of the rail is kept as

a) 10mm

b) 13mm

c) 16mm

d) 19 mm

Que. 22 Which of the following types of sleepers is preferred on joints ?

a) CST-9 sleeper

b) steel trough sleeper

c) wooden sleeper

d) concrete sleeper

Que. 22 Which of the following types of sleepers is preferred on joints ?

a) CST-9 sleeper
b) steel trough sleeper
c) wooden sleeper
d) concrete sleeper

Que. 23 Minimum depth of ballast cushion for a Broad Gauge wooden sleeper of size 275x25x13 cm with 75cm sleeper spacing is

a) 15 cm
b) 20 cm
c) 25 cm
d) 30cm

Que. 23 Minimum depth of ballast cushion for a Broad Gauge wooden sleeper of size 275x25x13 cm with 75cm sleeper spacing is

a) 15 cm
b) 20 cm
c) 25 cm
d) 30cm

$$D_b = \frac{s - w}{2}$$

s is the centre to centre spacing between sleeper

w is width of sleeper

Que. 24 Sleeper density in India is normally kept as

a) M + 2 to M + 7

b) M to M+2

c) M + 5 to M+10

d) M

Que. 24 Sleeper density in India is normally kept as

a) M + 2 to M + 7

b) M to M+2

c) M + 5 to M+10

d) M

Que. 25 Composite sleeper index is the index of

a) hardness and strength

b) strength and toughness

c) toughness and wear resistance

d) wear resistance and hardness

Que. 25 Composite sleeper index is the index of

a) hardness and strength

b) strength and toughness

c) toughness and wear resistance

d) wear resistance and hardness

Que. 26. The sleepers which satisfy the requirements of an ideal sleeper, are

a) cast iron sleepers
b) R.C.C. sleepers
c) steel sleepers
d) wooden sleepers

Que 26. The sleepers which satisfy the requirements of an ideal sleeper, are

a) cast iron sleepers
b) R.C.C. sleepers
c) steel sleepers
d) wooden sleepers

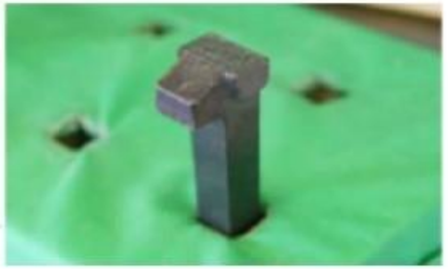
RAILWAY FASTENING AND FIXTURES

1. FISH PLATES

- The length of each fish plate is 45.72cm.
- The fish bolts are of 31.75mm diameter.

2. BEARING PLATES

- Used to fix flat footed rails on wooden sleepers.
- Main purpose is to distribute the pressure over wider area and to eliminate the adzing of wooden sleepers.
- Also prevents widening of gauge on curves.



3. SPIKES

- Commonly used spikes are dog spikes, round spikes and screw spikes.

Que. 27 Bearing plates are used to fix

a) flat footed rails to the wooden sleepers
b) double headed rails to the wooden sleepers
c) bull headed rails to the wooden sleepers
d) flat footed rails to the cast iron sleepers

Que.27 Bearing plates are used to fix

a) flat footed rails to the wooden sleepers
b) double headed rails to the wooden sleepers
c) bull headed rails to the wooden sleepers
d) flat footed rails to the cast iron sleepers

LWR (LONG WELDED RAIL)

- **A number of rails connected with the help of welding are called long welded rail.**
- **In this, the expansion joints are avoided and rail is welded to some kms and then an expansion joint is provided.**

$$\Delta l = l\alpha T$$

$$\frac{\Delta l}{l} = e(strain) = \frac{l\alpha T}{l}$$

$$\boxed{e = \alpha T}$$

LWR (LONG WELDED RAIL)

$$Stress = e.E_s$$

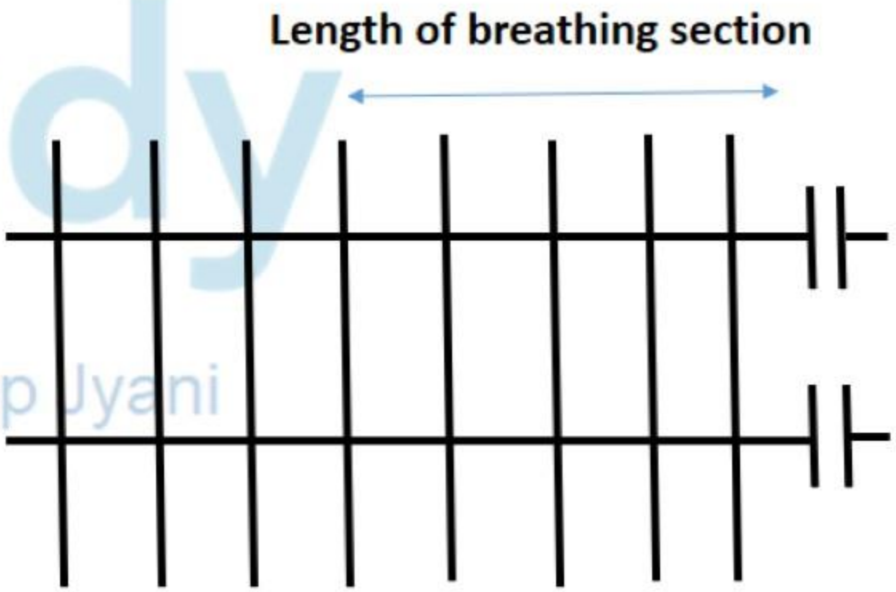
$$Force = stress \times area$$

$$Force = e.E_s \times A_s$$

Let force resisted by one sleeper = R

$$n = \frac{e.E_s \times A_s}{R}$$

$$n = \frac{\alpha T E_s A_s}{R}$$



$$Minimum\ length\ of\ LWR = 2 \times (n-1)s$$

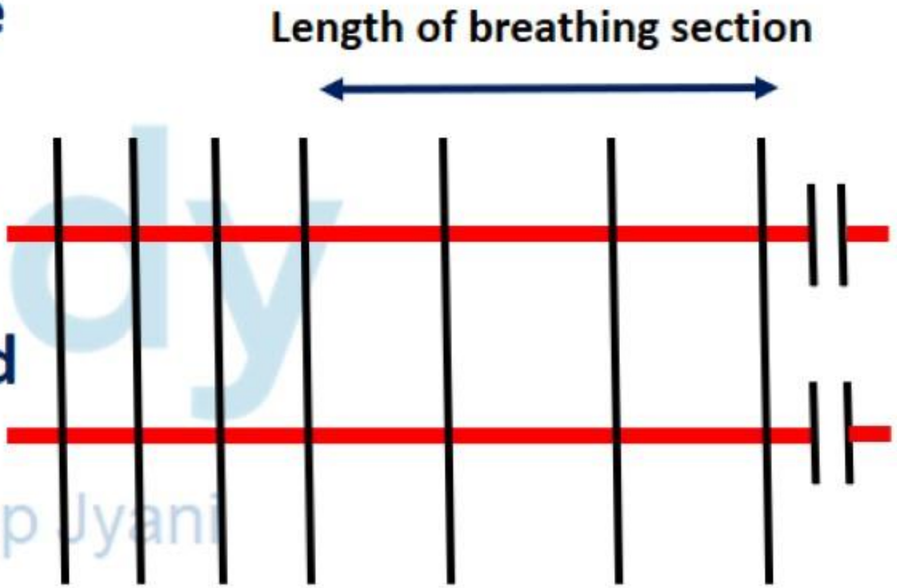
's' is the space between 2 sleepers

LENGTH OF BREATHING SECTION

Generally, at the end of long welded rails, there is a movement observed in the rail due to temperature variation.

This movement is observed because sufficient quantity of sleepers are not provided at the end and the section at which the movement is observed is called length of breathing section

If 's' is the space between 2 sleepers



$$\boldsymbol{length\ of\ breathing\ section = (n-1)s}$$

Que. 28 Determine minimum theoretical length of LWR beyond which the central portion of a long welded rail (52kg) would not be subjected to any longitudinal movement due to 30°C temperature increase.

Data given:

$1\ rail\ ;\ c/s\ area\ =\ 66.15cm^2\ ;\ E_s = 2.1 \times 10^6 kg/m^2;$

α=$11.5 \times 10^{-6}/$ °C ; $sleeper\ spacing\ =\ 60cm\ ;$

avg resisting force per sleeper= 300kg

Sol.

Force in rail = $\alpha T E_s A_s$

$=11.5 \times 10^{-6} \times 30 \times 2.1 \times 10^{6} \times 66.15$

=47925.67kg

No. of sleepers= $\frac{F}{R} = \frac{47925.67}{300}$ = 160

$$Minimum\ length\ of\ LWR = 2 \times (n-1)s$$

$$= 2 \times (160-1)60$$

=19080m

MAXIMUM SPEED IN RAILWAYS

The maximum speed will be the minimum of the following:

1. **Safe speed on curve (as per Martin Formula)**
2. **Maximum speed calculated on the basis of cant.**
3. **Maximum speed on the basis of transition curve.**
4. **Sanctioned speed as per railway board**

Safe speed on curve (as per Martin Formula):

$$for\ speed < 100kmph$$

- **If transition curve is present**

$$V_{max} = 4.35\sqrt{R - 67} \qquad broad\ and\ metre\ gauge$$

$$V_{max} = 3.6\sqrt{R - 6.1} \qquad narrow\ gauge$$

- **If transition curve is not present**

80%of above

$$V_{max} = 0.8 \times 4.35\sqrt{R - 67} \qquad broad\ and\ metre\ gauge$$

$$V_{max} = 0.8 \times 3.6\sqrt{R - 6.1} \qquad narrow\ gauge$$

$$for\ high\ speed > 100kmph$$

$$V_{max} = 4.58\sqrt{R} \qquad broad\ gauge$$

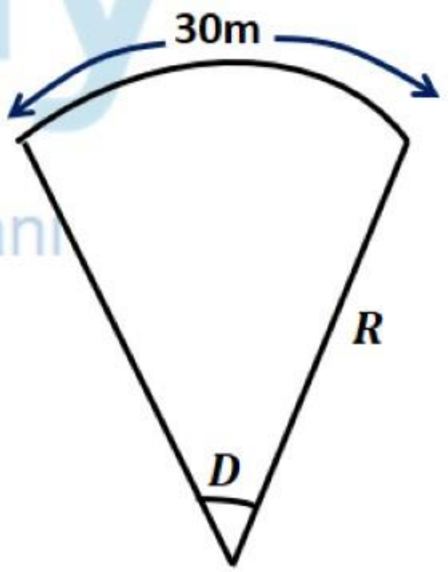
RELATION B/W DEGREE OF CURVE AND RADIUS OF CURVE

- **Generally, degree of curve is defined for per chain length.**
- **If we are using 30m chain, then degree and radius can be related by following:**

$$\frac{D^\circ}{30} = \frac{360^\circ}{2\pi R}$$

$$\Rightarrow R = \frac{360^\circ \times 30}{2\pi D^\circ}$$

$$\Rightarrow R = \frac{1718}{D^\circ} \approx \frac{1720}{D^\circ}$$



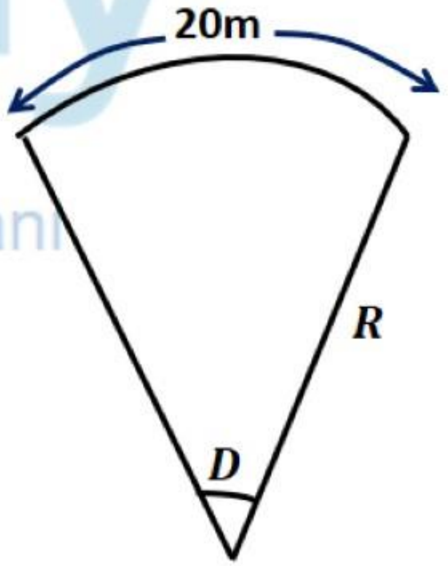
RELATION B/W DEGREE OF CURVE AND RADIUS OF CURVE

If we are using 20m chain, then degree and radius can be related by following:

$$\frac{D^\circ}{20} = \frac{360^\circ}{2\pi R}$$

$$R = \frac{360^\circ \times 20}{2\pi D^\circ}$$

$$R = \frac{1150}{D^\circ}$$



RELATION B/W DEGREE OF CURVE AND RADIUS OF CURVE

In India, curves on track are limited to the following maximum radii:

TYPE OF GAUGE	MAXIMUM DEGREE OF CURVATURE	MINIMUM RADIUS
B.G	10°	175m
M.G	16°	109m
N.G	40°	44m

RELATION B/W VERSINE OF CURVE AND RADIUS OF CURVE

Let R be the radius of circular curve, C be the length of chord and V be the Versine on the above chord length.

From property of circle,

$$AB \times (2AO - AB) = CB \times BD$$

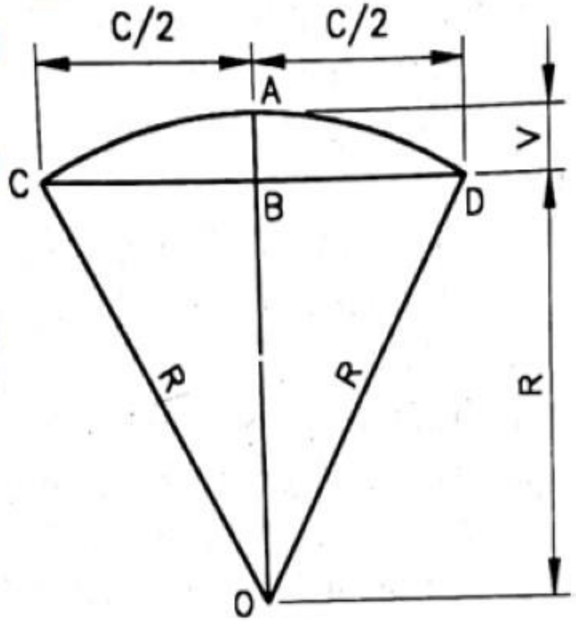
$$V \times (2R - V) = \frac{C}{2} \times \frac{C}{2}$$

$$(2RV - V^2) = \frac{C^2}{4}$$

As $V \ll R; V^2$ *can be neglected*

$$2RV = \frac{C^2}{4}$$

$$V = \frac{C^2}{8R}$$



GRADIENT

- **The rise and fall provided to the formation of rail track is known as gradient.**
- **Types of gradient:**
  1. **Ruling gradient**
  2. **Pusher gradient**
  3. **Momentum gradient**
  4. **Station yard gradient**

TYPES OF GRADIENT

- **RULING GRADIENT:**
  - The ruling gradient is the maximum gradient to which the track may be laid in a particular section.
  - It depends on the load of the train and additional power of the locomotive. The ruling gradients adopted:
  - In plains – 1 in 150 to 1 in 200
  - In Hilly tracks – 1 in 100 to 1 in 150

- **PUSHER GRADIENT**
  - Pusher gradient is the gradient where an extra engine is required to push the train.
  - These are steeper gradient than ruling gradient and are provided at certain places of mountains to avoid heavy cutting or to reduce the length of the track.

TYPES OF GRADIENT

- **MOMENTUM GRADIENT**
  - It is the falling gradient followed by a rising gradient and along which the train climbs easily due to momentum gained by them over the falling gradient.
  - In such gradients, no signals are provided to stop the train.

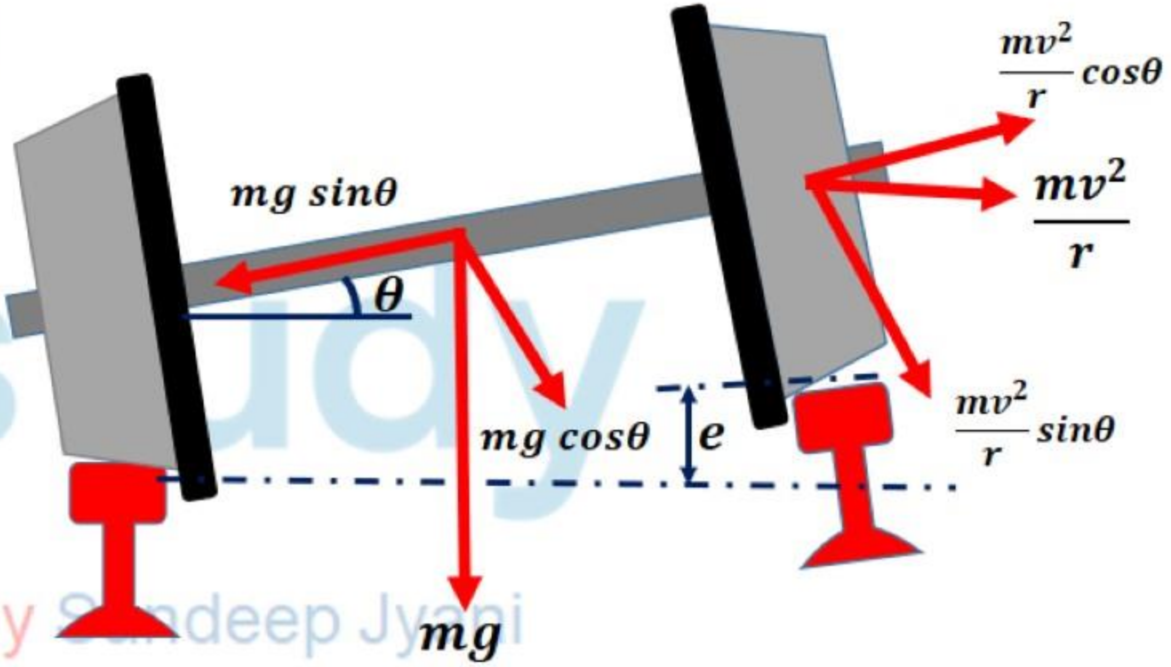
- **STATION YARD GRADIENT**
  - It is the minimum gradient provided in station yard for easy draining of rainwater.
  - In Indian Railway, the maximum limit of the gradient for station yards is fixed as 1 in 400 and minimum gradient recommended is 1 in 1000

GRADIENT

- **GRADE COMPENSATION OF CURVES:**
  - **Grade compensation on curves is the reduction in gradient, in order to avoid resistances beyond the allowable limits, on a curved portion of a track.**
  - **It is expressed as the percentage per degree of curve.**
  - **The grade compensation provided on**
    1. **B.G. curves – 0.04percent /degree or** $\frac{70}{R}$.
    2. **M.G. curves – 0.03percent /degree or** $\frac{52.5}{R}$.
    3. **N.G. curves – 0.02percent /degree or** $\frac{35}{R}$.

SUPERELEVATION/CANT

- It is the elevation provided to the outer rail w.r.t the inner rail at the circular curve to counteract the effect of centrifugal force.



$$mg\sin\theta = \frac{mv^2}{R}\cos\theta$$

R is radius in m

$$\tan\theta = \frac{v^2}{gR}$$

$$\frac{e}{G} = \frac{v^2}{gR}$$

e is cant in m

G is gauge distance in m

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

v is speed in m/sec

$$\boxed{e = \frac{GV^2}{127R}}$$

V is speed in kmph

GAUGE	PERMISSIBLE CANT FOR SPEED<120KMPH	PERMISSIBLE CANT FOR SPEED>120KMPH
B.G.	16.5cm	18.5cm
M.G	10.0cm	-
N.G	7.6cm	-

EQUILIBRIUM SPEED

- As on circular curve, different trains move with different velocities, so an equilibrium speed is defined on an average for which the cant is provided.
- Calculation of equilibrium speed:
  1. If designed speed is less than 50kmph

$$v_{eq} = minimum\ of \begin{cases} v_{max} \\ safe\ speed\ as\ per\ Martin's\ Formula \end{cases}$$

  2. If designed speed is more than 50kmph

$$v_{eq} = minimum\ of \begin{cases} \frac{3}{4}\ of\ v_{max} \\ safe\ speed\ as\ per\ Martin's\ Formula \end{cases}$$

  3. Speed on the basis of frequency

$$v_{eq} = \frac{v_1 n_1 + v_2 n_2 + v_3 n_3}{n_1 + n_2 + n_3}$$

v_1, v_2, v_3 – speed

n_1, n_2, n_3 – frequency

CANT DEFICIENCY

- Generally cant is provided for equilibrium speed which is called as ACTUAL CANT PROVIDED, but if a high speed train is moving on that curve, there is a deficiency of cant for its movement because it will require higher cant more than that of actual cant provided and thus there is a deficiency of cant termed as cant deficiency.

GAUGE	MAXIMUM CANT DEFICIENCY FOR SPEED UPTO 100KMPH	MAXIMUM CANT DEFICIENCY FOR SPEED>100KMPH
B.G	7.6cm	10cm
M.G	5.1cm	-
N.G	3.8cm	-

Que. 29 A 2 degree curve is provided for average speed of 80kmph. What is the cant deficiency for a train with speed of 120kmph. Assuming the track to be B.G.

Que. 29 A 2 degree curve is provided for average speed of 80kmph. What is the cant deficiency for a train with speed of 120kmph. Assuming the track to be B.G.

Sol. $R = \frac{1720}{2} = 860\text{m}$ $e_{actual} = \frac{GV^2}{127R}$

$$\Rightarrow e_{actual} = \frac{1.676(80)^2}{127 \times 860} = 0.0982m$$

$$e_{theoretical} = \frac{1.676(120)^2}{127 \times 860} = 0.2209m$$

$$e_{cant\ deficiency} = e_{theoretical} - e_{actual}$$

$$e_{cant\ deficiency} = 22.09 - 9.82 = 12.277cm$$

Que. 29 A 2 degree curve is provided for average speed of 80kmph. What is the cant deficiency for a train with speed of 120kmph. Assuming the track to be B.G.

GAUGE	MAXIMUM CANT DEFICIENCY FOR SPEED UPTO 100KMPH
B.G	7.6cm
M.G	5.1cm
N.G	3.8cm

Sol. $e_{cant\ deficiency} = 12.277cm > 7.6cm$

Hence, $e_{theoretical} = 9.82 + 7.6 = 17.42cm$

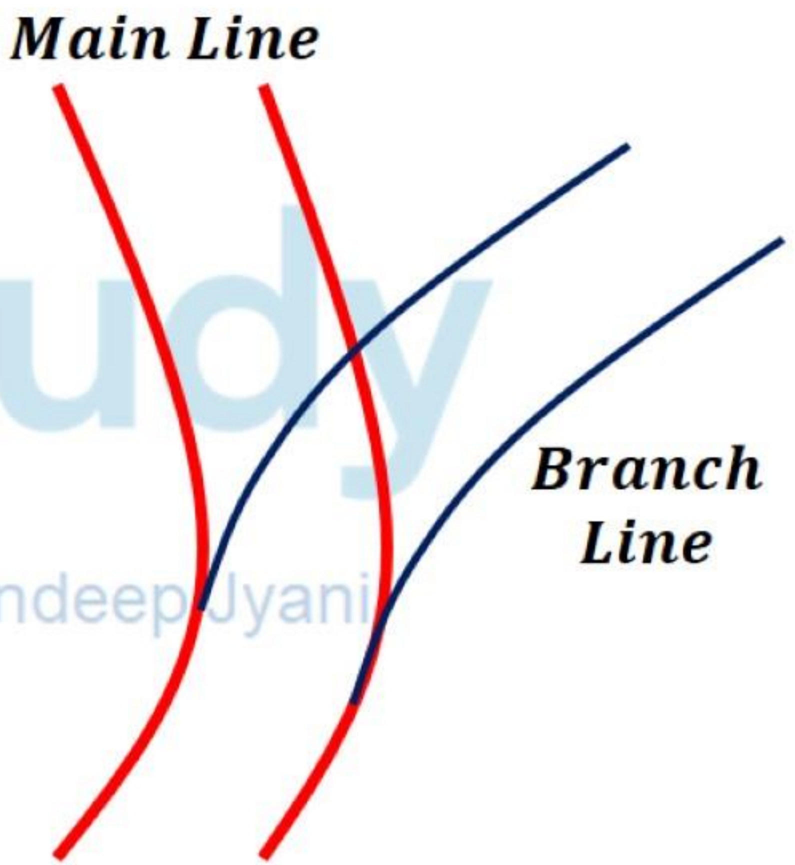
$$e_{actual} = \frac{GV^2}{127R}$$

$$0.174 = \frac{1.676V^2}{127 \times 860}$$

$V = 106.5kmph$ max $speed\ for$ max $cant\ deficiency$

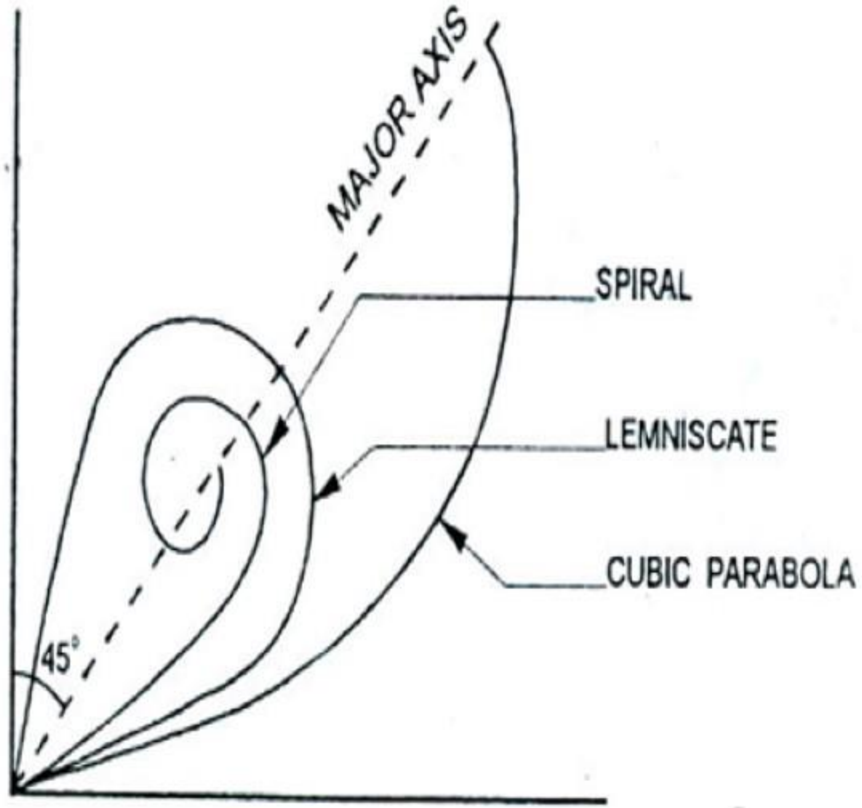
NEGATIVE CANT

- If positive cant is provided for the main line, then this value of cant will be negative for the branch line and this negative cant is called as Negative super elevation.



TRANSITION CURVE

- It is a curve used to connect a straight track to the circular track.
- It is used to gradually introduce centrifugal force.
- It is used for introduction of cant.
- The transition curve has radius equal to infinity at one end and radius 'R' at the other end.
- Types of transition curve
  - Spiral
  - Bernoulli's lemniscate
  - Cubic parabola
- In railways, generally ***cubic parabola*** are used



Safe speed on curve (as per Martin Formula):

$$for\ speed < 100kmph$$

- **If transition curve is present**

$$V_{max} = 4.35\sqrt{R - 67} \qquad broad\ and\ metre\ gauge$$

$$V_{max} = 3.6\sqrt{R - 6.1} \qquad narrow\ gauge$$

- **Length of Transition Curve**

$$L = 4.4\sqrt{R}$$

where R is the radius in metres

- **Minimum Length of Transition Curve**

$$L = \frac{SV}{198}$$

$$S = super\ elevation\ in\ mm$$
$$V = maximum\ premissible\ speed\ in\ kmph$$

Que 30. What must be done to wooden sleepers before use?

a) Seasoning

b) Washing

c) Painting

d) Hydrating

Que 30. What must be done to wooden sleepers before use?

a) Seasoning

b) Washing

c) Painting

d) Hydrating

EXTRA WIDENING IN CIRCULAR CURVE

- A vehicle normally assumes the central position on a straight track and the flanges of the wheels stay clear of the rails.
- On a curved track, the flange of the outside wheel of the leading axle continues to travel in a straight line till it rubs against the rail.
- Due to the coning of wheels, the outside wheel travels a longer distance compared to the inner wheel.
- This, however, becomes impossible for the vehicle as a whole since the rigidity of the wheel base causes the trailing axle to occupy a different position.
- In an effort to make up for the difference in the distance travelled by the outer wheel and the inner wheel, the inside wheels slip backward and *the outer wheels skid forward*.
- A close study of the running of vehicles on curves indicates that the wear of flanges eases the passage of the vehicle round curves, as it has the effect of increasing the gauge.
- The widening of the gauge on a curve has, in fact, the same effect and tends to decrease the wear and tear on both the wheel and the track.

EXTRA WIDENING IN CIRCULAR CURVE

$$E_w = \frac{13(B+L)^2}{R}$$

R is the radius of curve in metres

L is lap of flange in metres

B is width of wheel base.

$B = 6m\ for\ B.G.$

$B = 4.88m\ for\ M.G.$

$$L = 0.02\sqrt{(Dh + h^2)}$$

L is in metres
D(diameter) is in centimetres
h(flange depth from contact of wheel) is in centimetres

Que 31. For a B.G track, wheel base length is 6m. Diameter of wheel is 1.2m. Calculate the extra widening of curve required if the depth of flange below the rail surface is 3cm. Radius of the curve = 430m.

Que 32. For a B.G track, wheel base length is 6m. Diameter of wheel is 1.2m. Calculate the extra widening of curve required if the depth of flange below the rail surface is 3.1cm. Radius of the curve = 430m.

Sol. $L = 0.02\sqrt{(Dh + h^2)}$

$\Rightarrow L = 0.02\sqrt{(120 \times 3.1 + 3.1^2)}$

$\Rightarrow L = 0.39m$

$$E_w = \frac{13(B + L)^2}{R}$$

$\Rightarrow E_w = \frac{13(6+0.39)^2}{430}$

$\Rightarrow E_w = 1.23cm$

Que.33 At the time of construction of railway in India, after long controversy, the gauge adopted as a standard gauge was

a) 1.435 m
b) 1.524 m
c) 1.676 m
d) 1.843 m

Que.33 At the time of construction of railway in India, after long controversy, the gauge adopted as a standard gauge was

a) 1.435 m

b) 1.524 m

c) 1.676 m

d) 1.843 m

Que.34 The broad gauge is ………… wide.

a) 0.6096 m

b) 0.762 m

c) 1.00 m

d) 1.676 m

Que.34 The broad gauge is ………… wide.

a) 0.6096 m

b) 0.762 m

c) 1.00 m

d) 1.676 m

Que.35 For main cities and routes of maximum intensities, the type of gauge adopted is

a) broad gauge

b) metre gauge

c) narrow gauge

d) all of these

Que.35 For main cities and routes of maximum intensities, the type of gauge adopted is

a) broad gauge

b) metre gauge

c) narrow gauge

d) all of these

Que.36 For undeveloped areas, the type of gauge adopted is

a) broad gauge

b) metre gauge

c) narrow gauge

d) all of these

Que.36 For undeveloped areas, the type of gauge adopted is

a) broad gauge

b) metre gauge

c) narrow gauge

d) all of these

Que.37 For hilly areas and thinly populated areas, narrow gauge is adopted.

a) True

b) False

Que.37 For hilly areas and thinly populated areas, narrow gauge is adopted.

a) True

b) False

Que.38 Which of the following statement is correct?

a) At every change of gauge, the passengers have to change their train.

b) The timings of trains at gauge-change points should not coincide.

c) During war times, change in gauge is convenient to the army for quick movement.

d) If the intensity of traffic becomes more, it requires smaller gauge

Que.38 Which of the following statement is correct?

a) At every change of gauge, the passengers have to change their train.

b) The timings of trains at gauge-change points should not coincide.

c) During war times, change in gauge is convenient to the army for quick movement.

d) If the intensity of traffic becomes more, it requires smaller gauge

Que.39 The width of narrow gauge is same as that of metre gauge.

a) Right

b) Wrong

Que.39 The width of narrow gauge is same as that of metre gauge.

a) Right

b) Wrong

Que.40 the gauge representing the maximum width and height up to which a railway vehicle may be built, is known as

a) broad gauge

b) narrow gauge

c) loading gauge

d) all of these

Que.40 the gauge representing the maximum width and height up to which a railway vehicle may be built, is known as

a) broad gauge

b) narrow gauge

c) loading gauge

d) all of these

Que.41 In India, for broad gauge track, the maximum height of a loaded goods wagon is fixed as

a) 3.40 m

b) 4.72 m

c) 5.32 m

d) 5.87 m

Que.41 In India, for broad gauge track, the maximum height of a loaded goods wagon is fixed as

a) 3.40 m

b) 4.72 m

c) 5.32 m

d) 5.87 m

Loading Gauge

- **The gauge representing maximum width and height upto which a railway vehicle may be built**
- **For broad Gauge it is fixed as 4.72m and for metre gauge 3.43m**

Que.42 In India, for metre gauge track, the maximum height of a loaded goods wagon is fixed as

a) 3.43 m

b) 4.72 m

c) 5.32 m

d) 5.87 m

Que.42 In India, for metre gauge track, the maximum height of a loaded goods wagon is fixed as

a) 3.43 m

b) 4.72 m

c) 5.32 m

d) 5.87 m

Loading Gauge

- **The gauge representing maximum width and height upto which a railway vehicle may be built**
- **For broad Gauge it is fixed as 4.72m and for metre gauge 3.43m**

Que.43 The speed of a locomotive, in India, on broad gauge is restricted between

a) 60 and 75 km/h

b) 75 and 96 km/h

c) 96 and 120 km/h

d) 120 and 140 km/h

Que.43 The speed of a locomotive, in India, on broad gauge is restricted between

a) 60 and 75 km/h

b) 75 and 96 km/h

c) 96 and 120 km/h

d) 120 and 140 km/h

Que.44 The speed of a locomotive, in India, on metre gauge is restricted up to

a) 60 km/h

b) 80 km/h

c) 100 km/h

d) 120 km/h

Que.44 The speed of a locomotive, in India, on metre gauge is restricted up to

a) 60 km/h

b) 80 km/h

c) 100 km/h

d) 120 km/h

Que.45 The resistance of the train is due to

a) speed

b) gradient

c) curves

d) all of these

Que.45 The resistance of the train is due to

a) speed

b) gradient

c) curves

d) all of these

Que.46 The rail section, now-a-days, used in Indian railways is
a) double headed type
b) dumb-bell type
c) bull headed type
d) flat footed type

Que.46 The rail section, now-a-days, used in Indian railways is
a) double headed type
b) dumb-bell type
c) bull headed type
d) flat footed type

Que.47 The rail section first designed in Indian railways was
a) double headed type
b) bull headed type
c) flat footed type
d) none of these

Que.47 The rail section first designed in Indian railways was

a) double headed type

b) bull headed type

c) flat footed type

d) none of these

Que.48 The speed of the locomotives will be more if the gauge is wider.

a) Correct

b) Incorrect

Que.48 The speed of the locomotives will be more if the gauge is wider.

a) Correct

b) Incorrect

Que.49 Tractive force, due to which engine pulls the train, is ……… the resistance of train.

a) more than

b) equal to

c) less than

Que.49 Tractive force, due to which engine pulls the train, is ……… the resistance of train.

a) more than

b) equal to

c) less than

Que.50 The width of top portion of a flat – footed rail, is

a) 66.67 mm

b) 69.80 mm

c) 73.25 mm

d) 75.87 mm

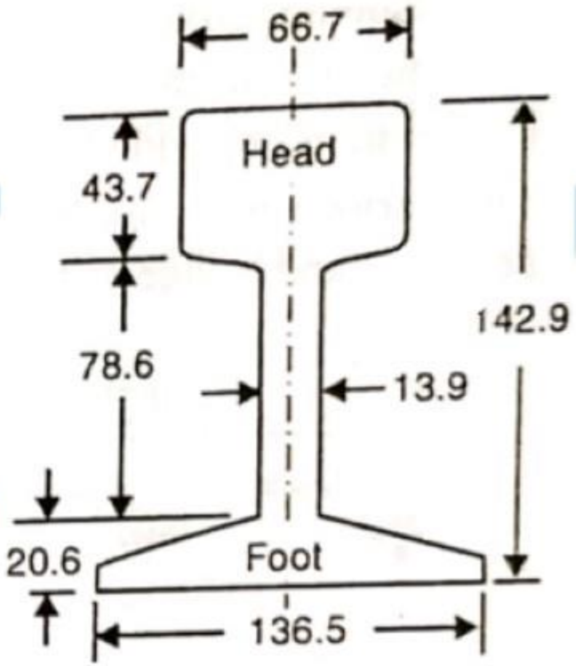
Que.50 The width of top portion of a flat – footed rail, is

a) 66.67 mm

b) 69.80 mm

c) 73.25 mm

d) 75.87 mm



Que.51 The bull headed rails are provided on points and crossings.

a) Yes

b) No

Que.51 The bull headed rails are provided on points and crossings.

a) Yes

b) No

Que.52 For broad gauge main lines with maximum traffic loads, the rail section provided should have

a) 29.77 to 37.25 kg/m

b) 44.7 to 56.8 kg/m

c) 49.8 to 52.3 kg/m

d) 49.8 to 56.8 kg/m

Que.52 For broad gauge main lines with maximum traffic loads, the rail section provided should have

a) 29.77 to 37.25 kg/m

b) 44.7 to 56.8 kg/m

c) 49.8 to 52.3 kg/m

d) 49.8 to 56.8 kg/m

Sr no	Type of Gauge	Type of Rail Section	Mass (kg/m)
1	Broad Gauge	55 R	55
2	Metre Gauge	45 R 35 R 30 R	45 35 30
3	Narrow Gauge	25 R	25

Que.53 For metre gauge, 49.8 to 52.3 kg/m rail section is used.
a) True
b) False

Que.53 For metre gauge, 49.8 to 52.3 kg/m rail section is used.

a) True

b) False

Sr no	Type of Gauge	Type of Rail Section	Mass (kg/m)
1	Broad Gauge	55 R	55
2	Metre Gauge	45 R 35 R 30 R	45 35 30
3	Narrow Gauge	25 R	25

Que.54 The rail section is designated by its

a) total length

b) total weight

c) cross – sectional area

d) weight per metre length

Que.54 The rail section is designated by its

a) total length

b) total weight

c) cross – sectional area

d) weight per metre length

Que.55 The largest dimension of a rail section is

a) head width

b) foot width

c) height

d) all of these

Que.55 The largest dimension of a rail section is

a) head width

b) foot width

c) height

d) all of these

Que.56 The rail section is divided on the basis of
a) type of rails
b) spacing of sleepers
c) gauge of the track
d) speed of trains

Que.56 The rail section is divided on the basis of

a) type of rails

b) spacing of sleepers

c) gauge of the track

d) speed of trains

Que.57 Generally, the rail section is designed by assuming that it can bear a load equal to ………… its own weight per metre length.

a) 100 times

b) 350 times

c) 460 times

d) 560 times

Que.57 Generally, the rail section is designed by assuming that it can bear a load equal to ………… its own weight per metre length.

a) 100 times

b) 350 times

c) 460 times

d) 560 times

Que.58 The flat – footed rail is mostly used in Indian railways because of its lateral rigidity.

a) Agree

b) Disagree

Que.58 The flat – footed rail is mostly used in Indian railways because of its lateral rigidity.

a) Agree

b) Disagree

Que.59 Charles Vignole invented .... Type of rail section.

a) double headed

b) bull headed

c) flat footed

Que.59 Charles Vignole invented ………. Type of rail section.

a) double headed

b) bull headed

c) flat footed

Que.60 Which of the following statement is correct?

a) Bull headed rails keep better alignment than flat footed rails due to chairs.

b) Flat footed rails are cheaper than bull headed rails.

c) Flat footed rails are stronger in every direction than the bull headed rails for the same cross-sectional area.

d) all of the above

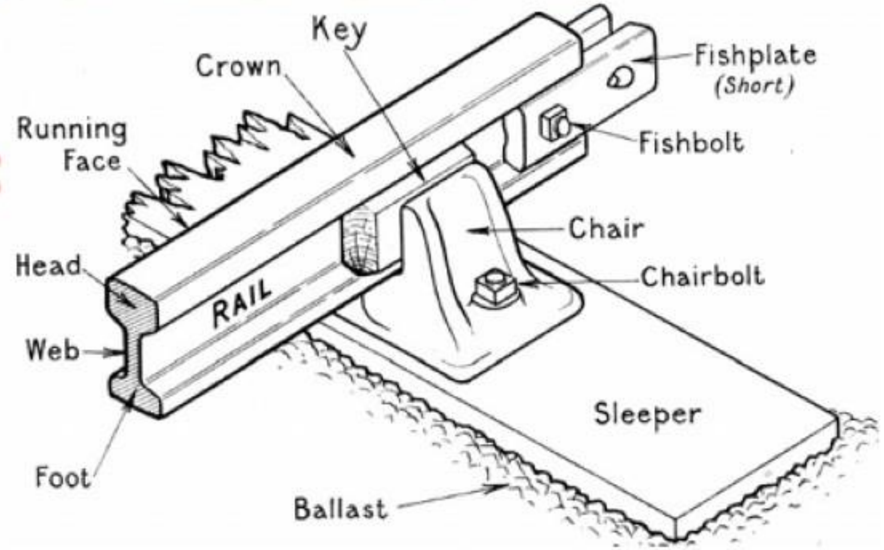
Que.60 Which of the following statement is correct?

a) Bull headed rails keep better alignment than flat footed rails due to chairs.

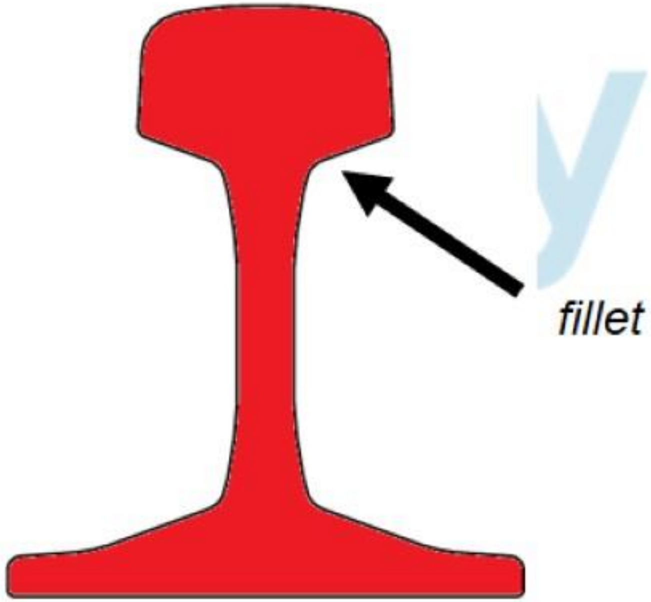
b) Flat footed rails are cheaper than bull headed rails.

c) Flat footed rails are stronger in every direction than the bull headed rails for the same cross-sectional area.

d) all of the above



Que.61 The fillet in a rail section is provided to
a) increase the vertical stiffness
b) increase the lateral strength
c) reduce wear
d) avoid stress concentration



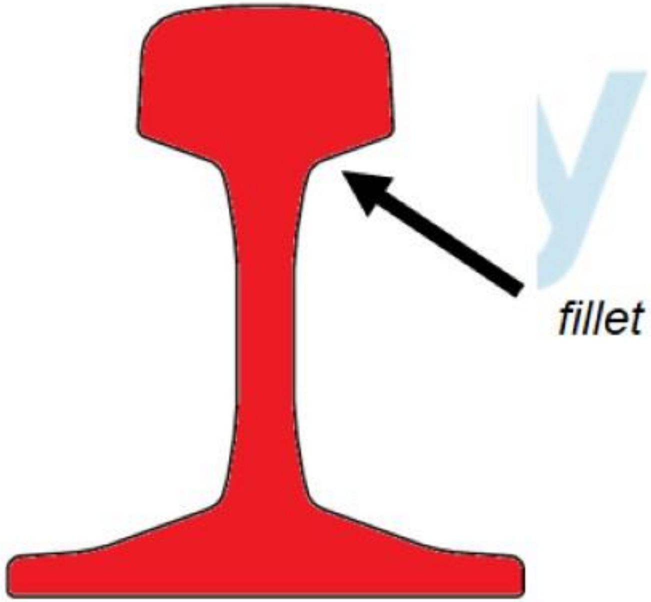
Que.61 The fillet in a rail section is provided to

a) increase the vertical stiffness

b) increase the lateral strength

c) reduce wear

d) avoid stress concentration



Que.62 For metre gauge track, in Indian railways, the standard length of the rail is

a) 10.06 m

b) 10.97 m

c) 11.89 m

d) 12.8 m

Que.62 For metre gauge track, in Indian railways, the standard length of the rail is

a) 10.06 m

b) 10.97 m

c) 11.89 m

d) 12.8 m

Que.63 For broad gauge track, in Indian railways, the standard length of the rail is
a) 10.06 m
b) 10.97 m
c) 11.89 m
d) 12.8 m

Que.63 For broad gauge track, in Indian railways, the standard length of the rail is

a) 10.06 m

b) 10.97 m

c) 11.89 m

d) 12.8 m

Que.64 The rail gauge is the distance between

a) outer faces of rails

b) running faces of rails

c) centre to centre of rails

d) none of these

Que.64 The rail gauge is the distance between

a) outer faces of rails

b) running faces of rails

c) centre to centre of rails

d) none of these

Que.65 The choice of gauge depends upon

a) volume and nature of traffic

b) speed of train

c) physical features of the country

d) all of these

Que.65 The choice of gauge depends upon

a) volume and nature of traffic

b) speed of train

c) physical features of the country

<u>d) all of these</u>

Que.66 A standard rail point should

a) be as strong as the other portion of the track

b) have just enough rail gap between two rails

c) have the same elasticity as the other portion of the track

d) all of the above

Que.66 A standard rail point should

a) be as strong as the other portion of the track

b) have just enough rail gap between two rails

c) have the same elasticity as the other portion of the track

d) all of the above

Que.67 In U.S.A., rails used are ………. Long.

a) 20 m

b) 30 m

c) 40 m

d) 50 m

Que.67 In U.S.A., rails used are ………. Long.

a) 20 m

b) 30 m

c) 40 m

d) 50 m

Que.68 The joint generally not used on Indian railways is
a) supported joint
b) suspended joint
c) base joint
d) bridge joint

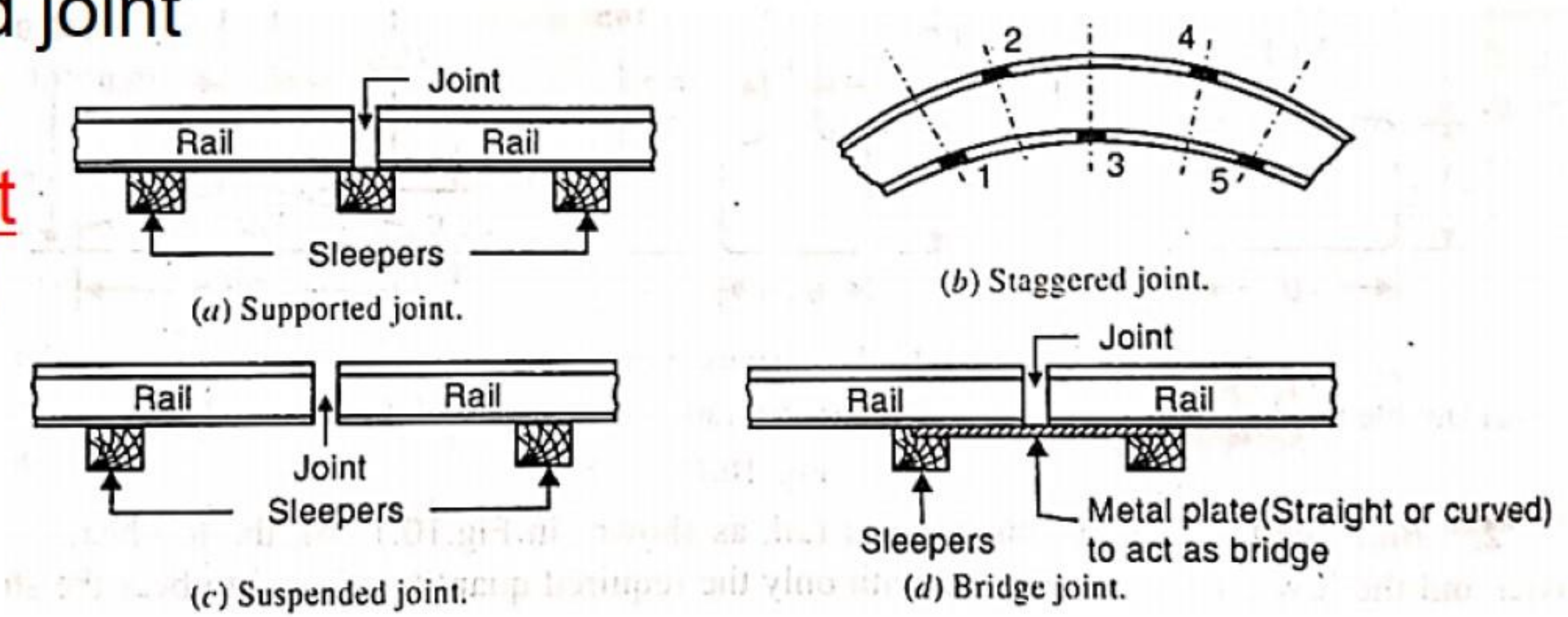
Que.68 The joint generally not used on Indian railways is

a) supported joint

b) suspended joint

c) base joint

d) bridge joint



Que.69 Staggered rail joints are generally provided on curves.

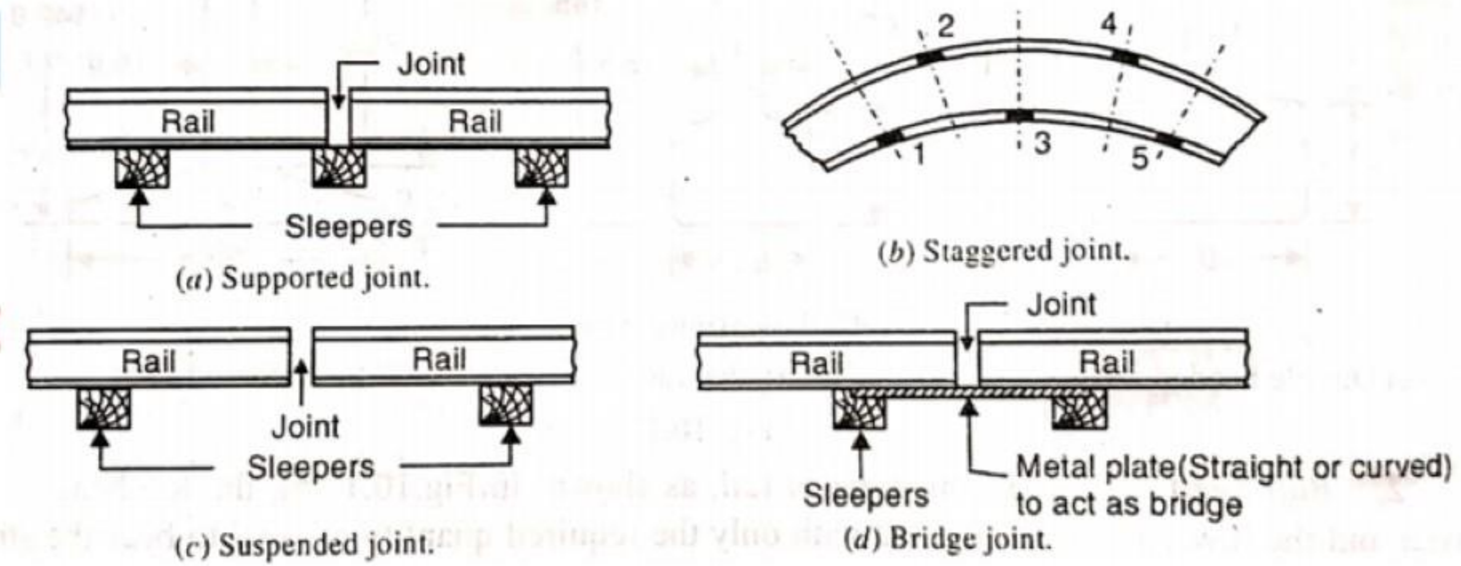
a) Correct

b) Incorrect

Que.69 Staggered rail joints are generally provided on curves.

a) Correct

b) Incorrect



Que.70 In supported rail joint, both the ends of adjoining rails are supported on a

a) single sleeper

b) single fish plate

c) double sleeper

d) none of these

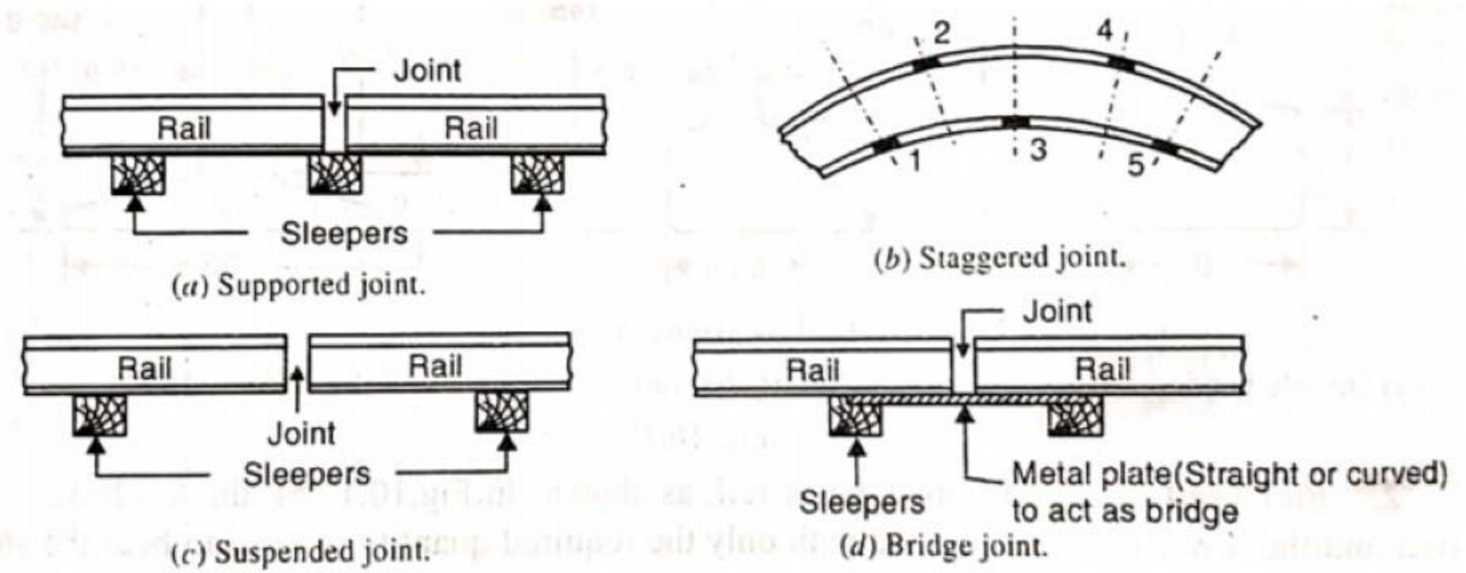
Que.70 In supported rail joint, both the ends of adjoining rails are supported on a

a) single sleeper

b) single fish plate

c) double sleeper

d) none of these



Que.71 Between two rails, a gap of ……… Is provided for free expansion of the rails due to rise in temperature.

a) 1.5 mm to 3 mm

b) 3 mm to 6 mm

c) 6 mm to 9 mm

d) 9 mm to 12 mm

Que.71 Between two rails, a gap of ……… Is provided for free expansion of the rails due to rise in temperature.

a) 1.5 mm to 3 mm

b) 3 mm to 6 mm

c) 6 mm to 9 mm

d) 9 mm to 12 mm

Que.72 Two fish plates are fixed at each rail joint with eight fish bolts.

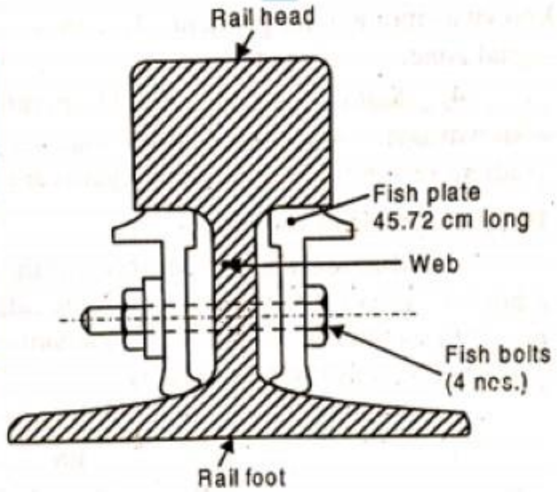
a) Right

b) Wrong

Que.72 Two fish plates are fixed at each rail joint with eight fish bolts.

a) Right

b) Wrong



Que.73 No sleeper is placed just below the rail joint, as it will cause

a) more impact

b) discomfort to passengers

c) either (a) or (b)

d) both (a) and (b)

Que.73 No sleeper is placed just below the rail joint, as it will cause

a) more impact

b) discomfort to passengers

c) either (a) or (b)

d) both (a) and (b)

Que.74 The main purpose of welding rails is to

a) build up the worn – out parts of points and crossing

b) build up the battered or worn heads of rail ends

c) to rebuild those portions of rail ends, which are burnt due to slipping of wheels at the time of applying brakes

d) all of the above

Que.74 The main purpose of welding rails is to
a) build up the worn – out parts of points and crossing
b) build up the battered or worn heads of rail ends
c) to rebuild those portions of rail ends, which are burnt due to slipping of wheels at the time of applying brakes
d) all of the above

Que.75 A welded rail joint is generally

a) supported on a sleeper

b) suspended

c) supported on a metal plate

d) none of these

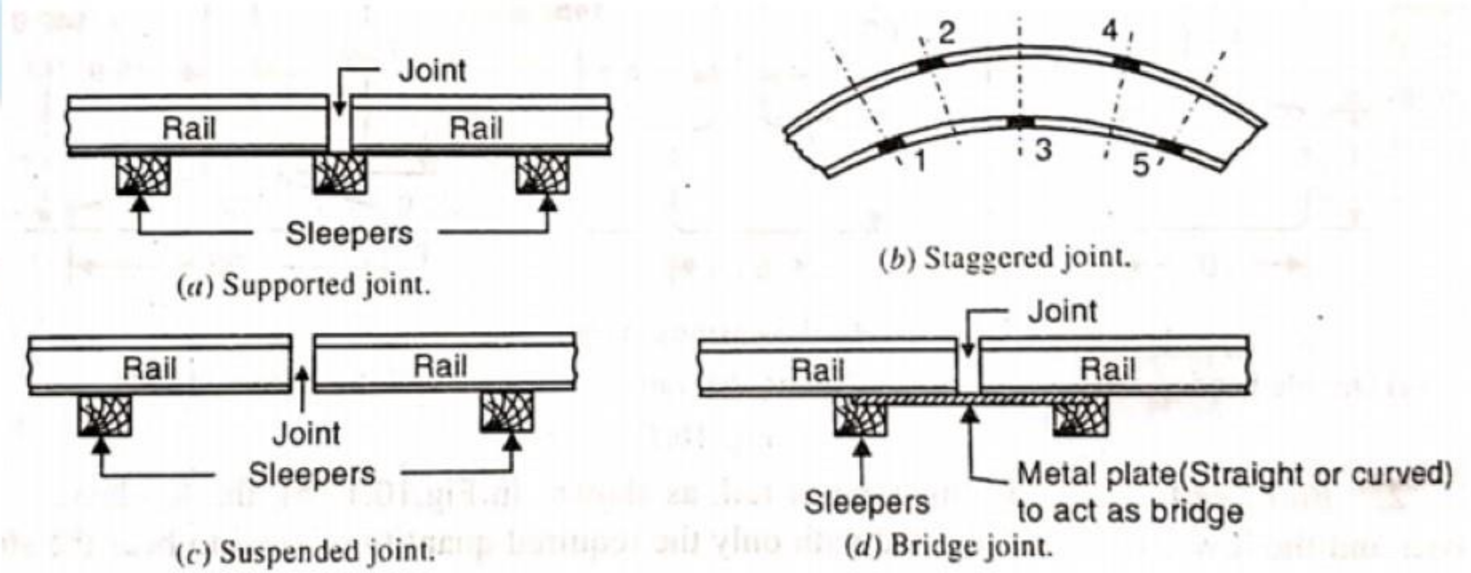
Que.75 A welded rail joint is generally

a) supported on a sleeper

b) suspended

c) supported on a metal plate

d) none of these



Que.76 To reduce the wearing of rails, the rails are placed at an

a) inward slope of 1 in 20

b) outward slope of 1 in 20

c) inward slope of 1 in 30

d) outward slope of 1 in 30

Que.76 To reduce the wearing of rails, the rails are placed at an

a) ***inward slope of 1 in 20***

b) outward slope of 1 in 20

c) inward slope of 1 in 30

d) outward slope of 1 in 30

Que.77 The coning of wheels is made to prevent the
a) lateral movement of the axle
b) lateral movement of the wheels
c) damage of the inside edges of rails
d) all of these

Que.77 The coning of wheels is made to prevent the
a) lateral movement of the axle
b) lateral movement of the wheels
c) damage of the inside edges of rails
d) all of these

Que.78 To prevent the flanges of wheels from rubbing the inside face of the rail, the distance between the inside edges of flanges is kept .... the gauge.

a) equal to

b) less than

c) more than

d) Can not comment

Que.78 To prevent the flanges of wheels from rubbing the inside face of the rail, the distance between the inside edges of flanges is kept ………. the gauge.

a) equal to

b) less than

c) more than

d) Can not comment

Que.79 In coning of wheels, the wheels are given a slope of
a) 1 in 20
b) 1 in 25
c) 1 in 30
d) 1 in 40

Que.79 In coning of wheels, the wheels are given a slope of

a) 1 in 20

b) 1 in 25

c) 1 in 30

d) 1 in 40

Que.80 Due to the coning of wheels, the pressure of wheels is always near the ……….. edge of rail.

a) inner

b) outer

Que.80 Due to the coning of wheels, the pressure of wheels is always near the ……….. edge of rail.

a) inner

b) outer

Que.81 Which of the following statement is wrong?

a) The coning of wheels is provided for smooth running of trains.

b) The coning of wheel prevents the wear of the inner faces of rails.

c) If the axle moves laterally towards one rail, the diameter of wheel rim increases on that rail.

d) On curves, the outer wheel has to travel lesser distance than the inner wheel.

Que.81 Which of the following statement is wrong?

a) The coning of wheels is provided for smooth running of trains.

b) The coning of wheel prevents the wear of the inner faces of rails.

c) If the axle moves laterally towards one rail, the diameter of wheel rim increases on that rail.

d) **On curves, the outer wheel has to travel lesser distance than the inner wheel.**

Que.82 the rails are laid without bending, at flat curves, where the degree of curve is

a) less than 3°

b) equal to 3°

c) more than 3°

Que.82 the rails are laid without bending, at flat curves, where the degree of curve is

a) less than 3°

b) equal to 3°

c) more than 3°

Que. 83 The distance between two adjoining axles fixed in a rigid frame is knows as

a) gauge

b) wheel base distance

c) creep

d) none of these

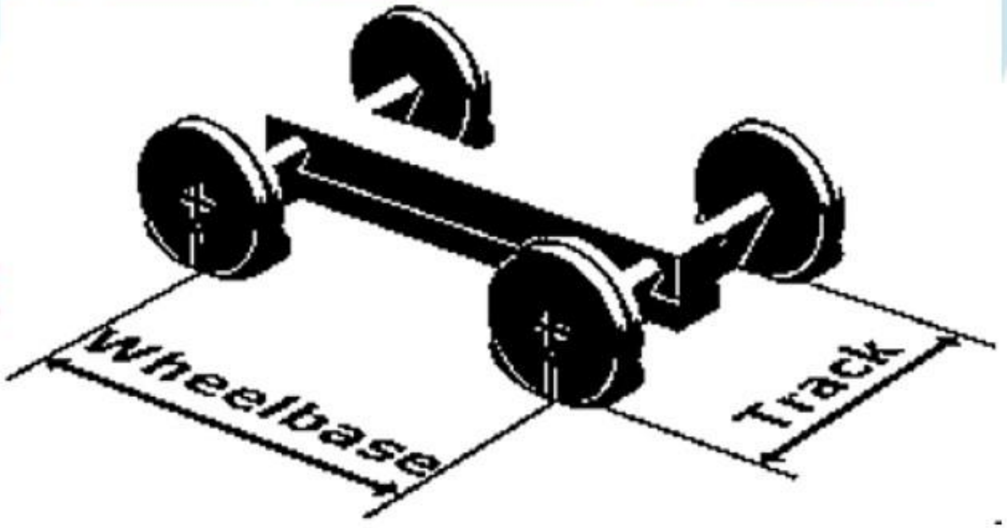
Que. 83 The distance between two adjoining axles fixed in a rigid frame is knows as

a) gauge

b) wheel base distance

c) creep

d) none of these



Que. 84 Creep is the ………… movement of rail.

a) longitudinal

b) lateral

c) vertical

Que. 84 Creep is the ………… movement of rail.

a) longitudinal

b) lateral

c) vertical

Que. 85 Creep is greater

a) on curves

b) in new rails than in old rails

c) both (a) and (b)

d) none of these

Que. 85 Creep is greater

a) on curves

b) in new rails than in old rails

c) both (a) and (b)

d) none of these

Que. 86 When the degree of curves is more than 3°, the rails are bent to the correct curvature before fixing them on to the sleepers.

a) Yes

b) No

Que. 86 When the degree of curves is more than 3°, the rails are bent to the correct curvature before fixing them on to the sleepers.

a) Yes

b) No

Que. 87 The versine (h) for the curves is given by

a) $h = l^2/r$

b) $h = l^2/2r$

c) $h = l^2/4r$

d) $h = l^2/8r$

Where l =Length of rail on curve portion, and r = radius of curve.

Que. 87 The versine (h) for the curves is given by

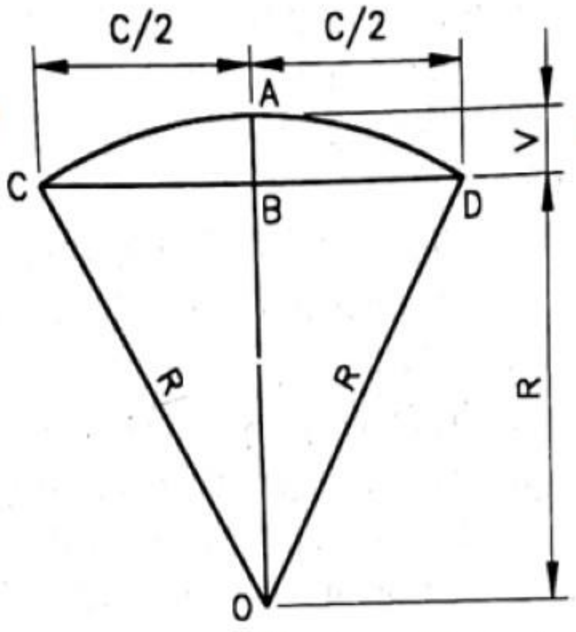
a) $h = l^2/r$

b) $h = l^2/2r$

c) $h = l^2/4r$

d) $h = l^2/8r$

Where l =Length of rail on curve portion, and r = radius of curve.



Civil Engineering by Sandeep Jyani

Que. 88 Creep causes

a) opening of rail joints

b) distortion of points and crossings

c) buckling of track

d) all of these

Que. 88 Creep causes

a) opening of rail joints

b) distortion of points and crossings

c) buckling of track

d) all of these

Que. 89 In Indian railways, the maximum wheel base distance on broad gauges is 4.058 m.

a) True

b) False

Que. 89 In Indian railways, the maximum wheel base distance on broad gauges is 4.058 m.

a) True

b) False

Que. 90 The gauge is widened on curves of ……. $4\frac{1}{2}°$ curvature.

a) equal to

b) less than

c) more than

Que. 90 The gauge is widened on curves of ……. $4\frac{1}{2}°$ curvature.

a) equal to

b) less than

c) more than

Que. 91 The gauge should be ……. slack for curves of more than 438 m.

a) 6 mm

b) 12 mm

c) 20 mm

d) 30 mm

Que. 91 The gauge should be ……. slack for curves of more than 438 m.

a) 6 mm

b) 12 mm

c) 20 mm

d) 30 mm

Que. 92 Match the correct answer from Group B for the statements given in Group A.

Group A	Group B
(a) Distance between two adjoining axles is called	(A) gauge
(b) Clear horizontal distance between inner faces of rails near tops is called	(B) rail wear
(c) Longitudinal movement of rails in a track is called	(C) wheel base distance
(d) Flow of rail metal due to abnormally heavy loads is called	(D) rail creep

Que. 92 Match the correct answer from Group B for the statements given in Group A.

Group A	Group B
(a) Distance between two adjoining axles is called	(A) gauge
(b) Clear horizontal distance between inner faces of rails near tops is called	(B) rail wear
(c) Longitudinal movement of rails in a track is called	(C) wheel base distance
(d) Flow of rail metal due to abnormally heavy loads is called	(D) rail creep

Que. 93 The longitudinal movement of the rails in a track is technically known as

a) buckling

b) hogging

c) creeping

d) none of these

Que. 93 The longitudinal movement of the rails in a track is technically known as

a) buckling

b) hogging

c) creeping

d) none of these

Que. 94 The impact of the rail wheel ahead of the joint gives rise to the creep of the rail. This statement is according to

a) wave theory

b) percussion theory

c) drag theory

d) none of these

Que. 94 The impact of the rail wheel ahead of the joint gives rise to the creep of the rail. This statement is according to

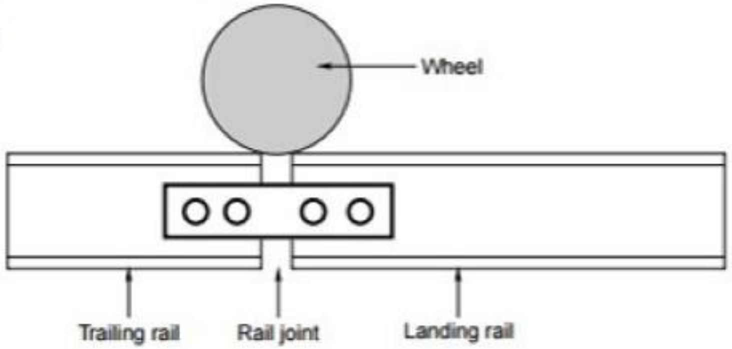
a) wave theory

b) percussion theory

c) drag theory

d) none of these

According to percussion theory, creep is developed due to the impact of wheels at the rail end ahead of a joint. As the wheels of the moving train leave the trailing rail at the joint, the rail gets pushed, forward causing it to move longitudinally in the direction of traffic, and that is how creep develops. Though the impact of a single wheel may be nominal, the continuous movement of several of wheels passing over thc joint pushes the facing or landing rail forward, thereby causing creep



According to **drag theory**, the backward thrust of the driving wheels of a locomotive has the tendency to push the rail backwards, while the thrust of the other wheels of the locomotive pushes the rail in the direction in which the locomotive is moving. This results in the longitudinal movement of the rail in the direction of traffic, thereby causing creep.

According to **wave motion theory**, wave motion is set up in the resilient track because of moving loads, causing a deflection in the rail under the load. The portion of the rail immediately under the wheel gets slightly depressed due to the wheel load. Therefore, the rails generally have a wavy formation. As the wheels of the train move forward, the depressions also move with them and the previously depressed portion springs back to the original level. This wave motion tends to move the rail forward with the train. The ironing effect of the moving wheels on the wave formed in the rail causes a longitudinal movement of the rail in the direction of traffic resulting in the creep of the rail

Que. 95 In hogging

a) the rail ends get bent down and deflected due to loose packing under the joints

b) the rails get out of their original positions due to insufficient expansion joint gap

c) the longitudinal movement of the rails in track takes place

d) all of the above

Que. 95 In hogging

a) the rail ends get bent down and deflected due to loose packing under the joints

b) the rails get out of their original positions due to insufficient expansion joint gap

c) the longitudinal movement of the rails in track takes place

d) all of the above

Que. 96 When the rails get out of their original position due to insufficient expansion joint gap, the phenomenon is known as buckling.

a) Agree

b) disagree

Que. 96 When the rails get out of their original position due to insufficient expansion joint gap, the phenomenon is known as buckling.

a) Agree

b) disagree

Que. 97 Which of the following statement is correct?

a) When wheel passes over a rail joint, it cause creep.

b) Insufficient and defective packing of ballast causes creep.

c) Train wheels cause slight depression on the table of the rails due to their own weight

d) all of the above

Que. 97 Which of the following statement is correct?

a) When wheel passes over a rail joint, it cause creep.

b) Insufficient and defective packing of ballast causes creep.

c) Train wheels cause slight depression on the table of the rails due to their own weight

d) all of the above

Que. 98 The adjustment of rails is usually needed when creep exceeds

a) 50 mm

b) 100 mm

c) 150 mm

d) none of these

Que. 98 The adjustment of rails is usually needed when creep exceeds

a) 50 mm

b) 100 mm

c) 150 mm

d) none of these

Que. 99 The flow of rail metal due to abnormally heavy loads is called

a) hogging

b) buckling

c) wear of rails

d) creeping

Que. 99 The flow of rail metal due to abnormally heavy loads is called

a) hogging

b) buckling

c) wear of rails

d) creeping

Que. 100 In India permissible limit of rail wear is ……….. by weight.

a) 5%

b) 10%

c) 25%

d) 30%

Que. 100 In India permissible limit of rail wear is ……….. by weight.

a) 5%

b) 10%

c) 25%

d) 30%

Que.101 When a train passes on curves which have no superelevation, it will give thrust on the

a) inner rail

b) outer rail

c) inner side of inner rail

d) inner side of outer rail

Que.101 When a train passes on curves which have no superelevation, it will give thrust on the

a) inner rail

b) outer rail

c) inner side of inner rail

d) inner side of outer rail

Que.102 When the train moves on the rail, it causes constant reversal of stresses.

a) Right

b) Wrong

Que.102 When the train moves on the rail, it causes constant reversal of stresses.

a) Right

b) Wrong

Que.103 A good sleeper should be such that

a) the rails can be easily fixed and taken out from the sleeper without moving them

b) it can provide sufficient bearing area for the rail

c) it can provided sufficient effective bearing area on the ballast

d) all of the above

Que.103 A good sleeper should be such that

a) the rails can be easily fixed and taken out from the sleeper without moving them

b) it can provide sufficient bearing area for the rail

c) it can provided sufficient effective bearing area on the ballast

d) all of the above

Que.104 The chief function of sleepers is to
a) support the rails
b) keep the two rails at correct gauge
c) distributed the load coming on rails to the ballast
d) all of the above

Que.104 The chief function of sleepers is to

a) support the rails

b) keep the two rails at correct gauge

c) distributed the load coming on rails to the ballast

d) all of the above

Que.105 The wooden sleepers are the ideal sleepers.

a) Yes

b) No

Que.105 The wooden sleepers are the ideal sleepers.

a) Yes

b) No

Que.106 Sleepers which satisfy all of the requirements and are only suitable for track circuiting are

a) wooden sleepers

b) steel sleepers

c) cast iron sleepers

d) R. C.C. sleepers

Que.106 Sleepers which satisfy all of the requirements and are only suitable for track circuiting are

a) wooden sleepers

b) steel sleepers

c) cast iron sleepers

d) R. C.C. sleepers

Que.107 The life of wooden sleepers depends upon
a) quality of the timber used
b) ability to wear decay
c) resistance to white ants
d) all of these

Que.107 The life of wooden sleepers depends upon

a) quality of the timber used

b) ability to wear decay

c) resistance to white ants

d) all of these

Que.108 Which of the following sleeper provided best elasticity of track?

a) Wooden sleeper

b) Cast iron sleeper

c) Steel sleeper

d) R.C.C. sleeper

Que.108 Which of the following sleeper provided best elasticity of track?

a) Wooden sleeper

b) Cast iron sleeper

c) Steel sleeper

d) R.C.C. sleeper

Que.109. The number of sleepers used for rail varies from

a) $(n + 1)$ to $(n + 4)$

b) $(n + 3)$ to $(n + 6)$

c) $(n + 2)$ to $(n + 7)$

d) $(n + 4)$ to $(n + 8)$

where $n =$ Length of rail in metres.

Que.109. The number of sleepers used for rail varies from

a) $(n + 1)$ to $(n + 4)$

b) $(n + 3)$ to $(n + 6)$

c) $(n + 2)$ to $(n + 7)$

d) $(n + 4)$ to $(n + 8)$

where $n =$ Length of rail in metres.

Que.110 The railway sleepers should act as elastic medium between the rails and the ballast.

a) Correct

b) Incorrect

Que.110 The railway sleepers should act as elastic medium between the rails and the ballast.

a) Correct

b) Incorrect

Que.111 Minimum packing space provided between two sleepers is

a) 250 to 300 mm
b) 300 to 350 mm
c) 350 to 400 mm
d) 400 to 450 mm

Que.111 Minimum packing space provided between two sleepers is

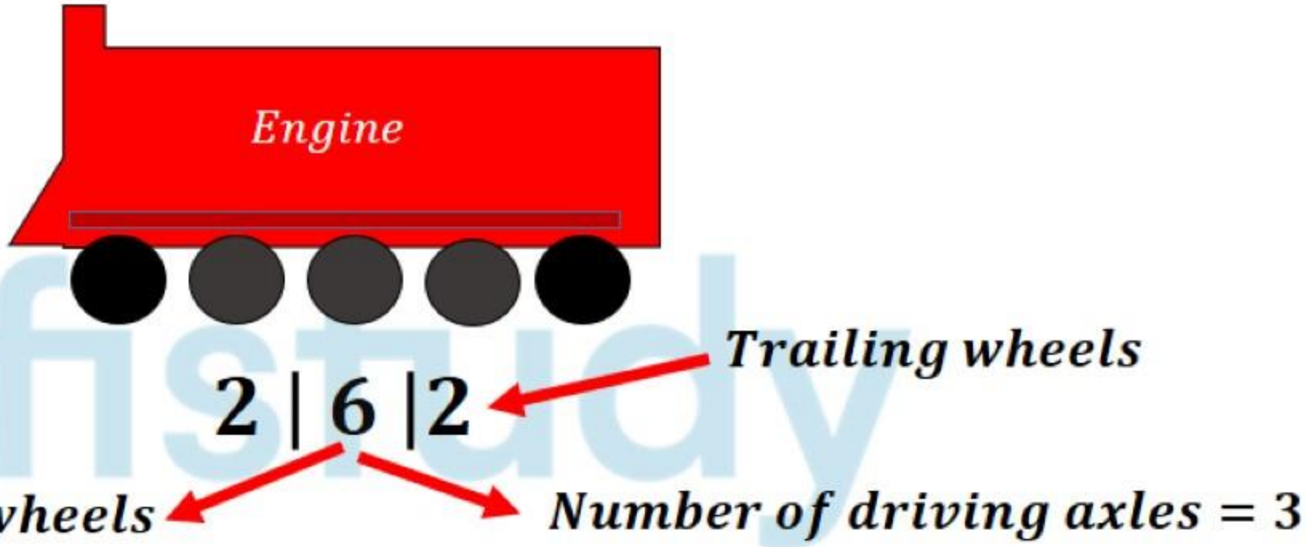
a) 250 to 300 mm

b) 300 to 350 mm

c) 350 to 400 mm

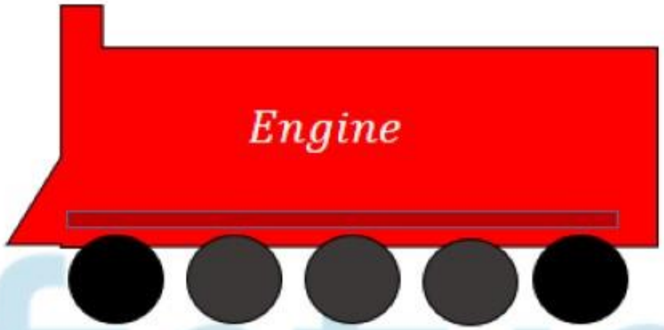
d) 400 to 450 mm

Traction and Tractive Effort



- Tractive Effort: It is the power applied by engine on the driving wheel

Traction and Tractive Effort



$\mathbf{2\,|\,6\,|2}$

number of driving wheels ***Number of driving axles = 3***

- <u>Hauling Capacity:</u> It is the maximum load which can be pulled by the engine or it is the maximum frictional force developed between driving wheel and track

$$\boxed{\boldsymbol{Hauling\ Capacity = \mu \times n \times w}}$$

$\boldsymbol{\mu = frictional\ coefficent\ 0.1\ to\ 0.3\ or\ take\ 0.2}$

$\boldsymbol{n = number\ of\ axle}$

$\boldsymbol{w = weight\ on\ each\ axle}$

Que 126. A train is hauled by 2-8-2 locomotive with 22.5 tonnes and on each driving axle. Assuming the coefficient of rail-wheel friction to be 0.25, what would be the hauling capacity of the locomotive?

a) 15.0 tonnes

b) 22.5 tonnes

c) 45.0 tonnes

d) 90.0 tonnes

Que 126. A train is hauled by 2-8-2 locomotive with 22.5 tonnes and on each driving axle. Assuming the coefficient of rail-wheel friction to be 0.25, what would be the hauling capacity of the locomotive?

a) 15.0 tonnes

b) 22.5 tonnes

c) 45.0 tonnes

d) 90.0 tonnes

$$\boxed{\boldsymbol{Hauling\ Capacity = \mu \times n \times w}}$$

$$= \mathbf{0.25 \times 4 \times 22.5}$$

$$= \mathbf{22.5\ \boldsymbol{tonnes}}$$

Que 127. The load on each axle of a locomotive is 22 tonnes. If the coefficient of friction is 0.2, then the hauling capacity due to 3 pairs of driving wheels will be

a) 26.41

b) 19.81

c) 13.21

d) 6.61

Que 127. The load on each axle of a locomotive is 22 tonnes. If the coefficient of friction is 0.2, then the hauling capacity due to 3 pairs of driving wheels will be

a) 26.41

b) 19.81

c) 13.21

d) 6.61

$$\boxed{\boldsymbol{Hauling\ Capacity = \mu \times n \times w}}$$

$$= \mathbf{0.2 \times 3 \times 22}$$

$$= \mathbf{13.2\ \boldsymbol{tonnes}}$$

Que.112 The spacing of sleepers is kept

a) closer near the joints

b) closer at the middle of rails

c) same throughout the length of rail

d) none of these

Que.112 The spacing of sleepers is kept

a) closer near the joints

b) closer at the middle of rails

c) same throughout the length of rail

d) none of these

Que.113 The type of sleeper used, depends upon
a) initial and maintenance cost
b) easy fixing and removal of rails
c) provision for sufficient bearing area for rail
d) all of the above

Que.113 The type of sleeper used, depends upon

a) initial and maintenance cost

b) easy fixing and removal of rails

c) provision for sufficient bearing area for rail

d) all of the above

Que.114 The standard size of wooden sleepers on metre gauge railway track is

a) 1.52 m × 15 cm × 10 cm

b) 1.83 m × 20 cm × 11 cm

c) 2.74 m × 25 cm × 13 cm

d) any one of these

Que.114 The standard size of wooden sleepers on metre gauge railway track is

a) 1.52 m × 15 cm × 10 cm

b) 1.83 m × 20 cm × 11 cm

c) 2.74 m × 25 cm × 13 cm

d) any one of these

Que.115 the standard size of wooden sleepers on broad gauge railway track is

a) 1.52 m × 15 cm × 10 cm

b) 1.83 m × 20 cm × 11 cm

c) 2.74 m × 25 cm × 13 cm

d) any one of these

Que.115 the standard size of wooden sleepers on broad gauge railway track is

a) 1.52 m × 15 cm × 10 cm

b) 1.83 m × 20 cm × 11 cm

c) 2.74 m × 25 cm × 13 cm

d) any one of these

Que.116 The standard size of timber sleeper sin railway tracks of metre gauge and narrow gauge is same.

a) Yes

b) No

Que.116 The standard size of timber sleeper sin railway tracks of metre gauge and narrow gauge is same.

a) Yes

b) No

Que.117 The best wood for sleepers is

a) sal

b) deodar

c) teak

d) chir

Que.117 The best wood for sleepers is

a) sal

b) deodar

c) teak

d) chir

Que.118 Adzing is done in the sleepers to give a slope of

a) 1 in 10

b) 1 in 20

c) 1 in 30

d) 1 in 40

Que.118 Adzing is done in the sleepers to give a slope of

a) 1 in 10

b) 1 in 20

c) 1 in 30

d) 1 in 40

Que.119 The composite sleeper index is the index of
a) strength and hardness
b) strength and toughness
c) hardness and wear resistance
d) toughness and wear resistance

Que.119 The composite sleeper index is the index of

a) strength and hardness

b) strength and toughness

c) hardness and wear resistance

d) toughness and wear resistance

Que.120 The composite sleeper index determines the
a) suitability of the wooden sleepers
b) number of sleepers per rail length
c) permissible stresses in the steel sleepers
d) all of these

Que.120 The composite sleeper index determines the

a) suitability of the wooden sleepers

b) number of sleepers per rail length

c) permissible stresses in the steel sleepers

d) all of these

Que.121 The minimum composite sleeper index for wooden sleepers used over bridge girders, is

a) 1352

b) 1455

c) 1555

d) 1652

Que.121 The minimum composite sleeper index for wooden sleepers used over bridge girders, is

a) 1352

b) 1455

c) 1555

d) 1652

Que.122 The minimum composite sleeper index for wooden sleepers used over cross-overs, is

a) 1352

b) 1455

c) 1555

d) 1652

Que.122 The minimum composite sleeper index for wooden sleepers used over cross-overs, is

a) 1352

b) 1455

c) 1555

d) 1652

Que.123 To prevent the change in gauge and creep, the steel sleepers are fixed by clips, bolts and

a) one key

b) two keys

c) three keys

d) four keys

Que.123 To prevent the change in gauge and creep, the steel sleepers are fixed by clips, bolts and

a) one key

b) two keys

c) three keys

d) four keys

Que.124 Steel sleepers consist of steel troughs made out of about 6 mm thick steel sheets, with

a) its both ends bent down

b) its both ends bent up

c) its one end bent up and another bent down

d) any one of these

Que.124 Steel sleepers consist of steel troughs made out of about 6 mm thick steel sheets, with

a) its both ends bent down

b) its both ends bent up

c) its one end bent up and another bent down

d) any one of these

Que.125 At the time of pressing the steel sleepers, a cant of 1 in 20 is provided towards the centre.

a) True

b) False

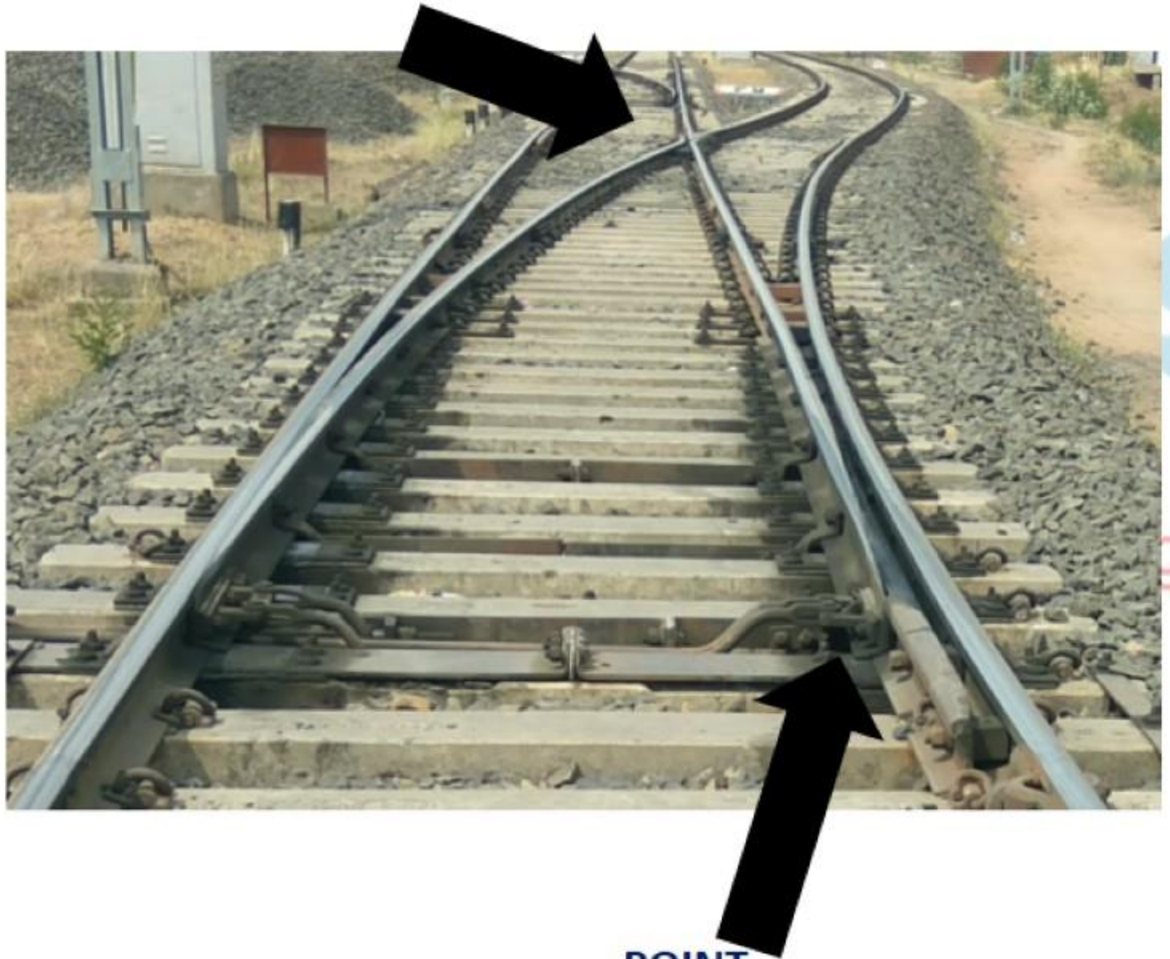
Que.125 At the time of pressing the steel sleepers, a cant of 1 in 20 is provided towards the centre.

a) True

b) False

POINTS AND CROSSINGS

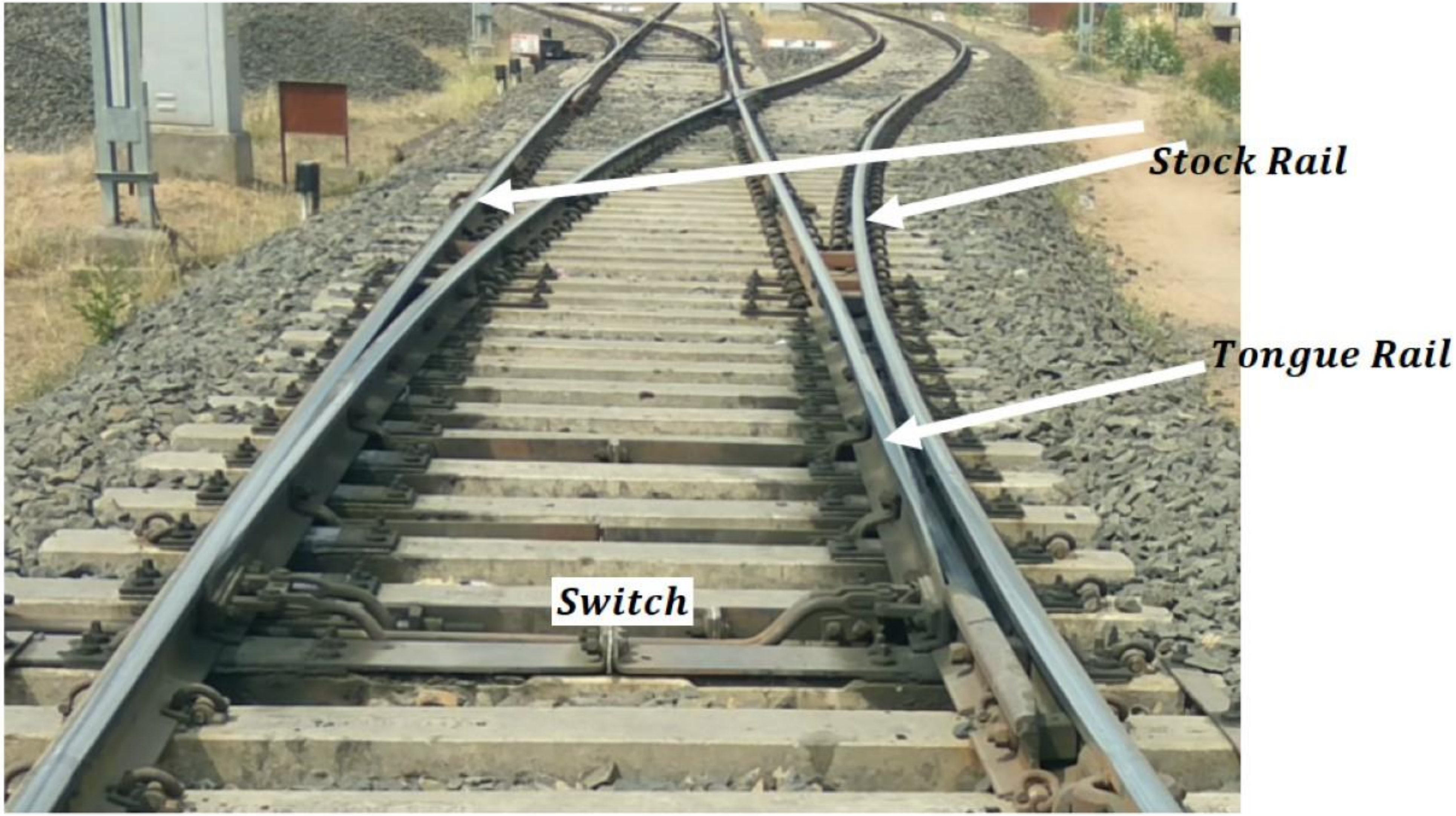
POINT

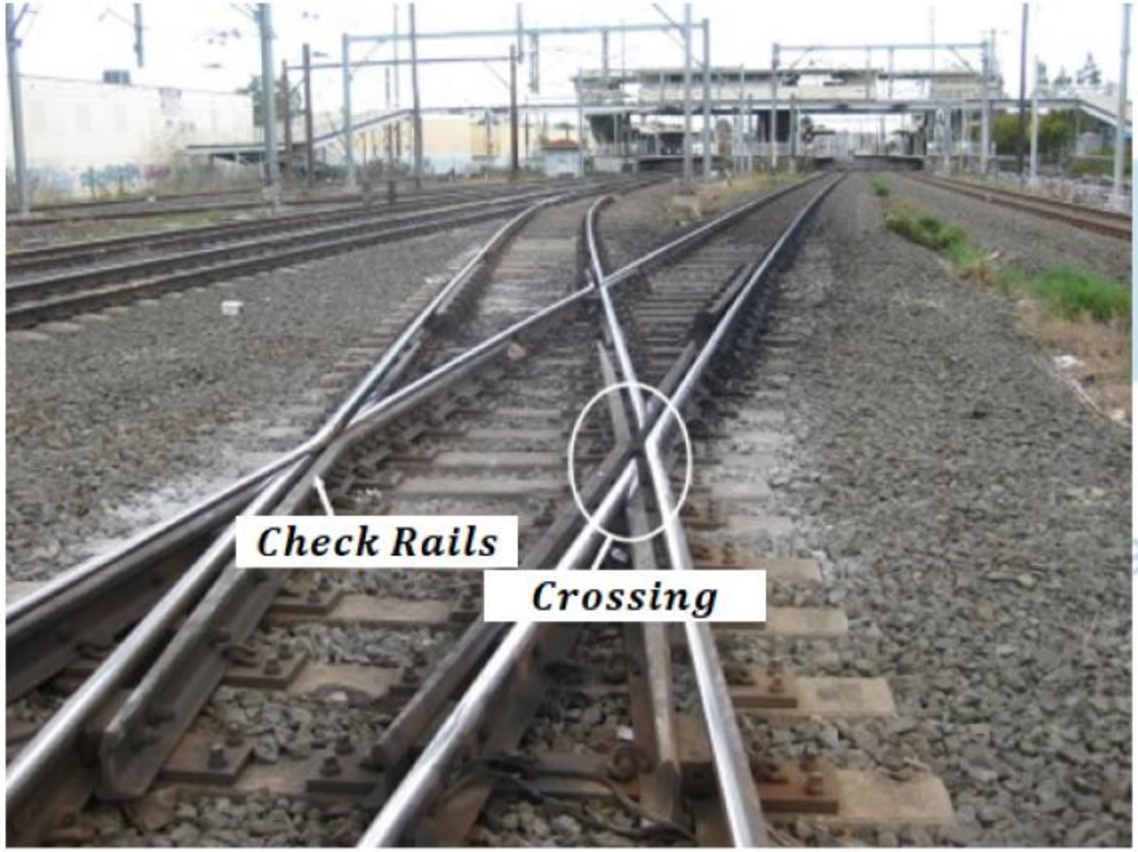


POINT

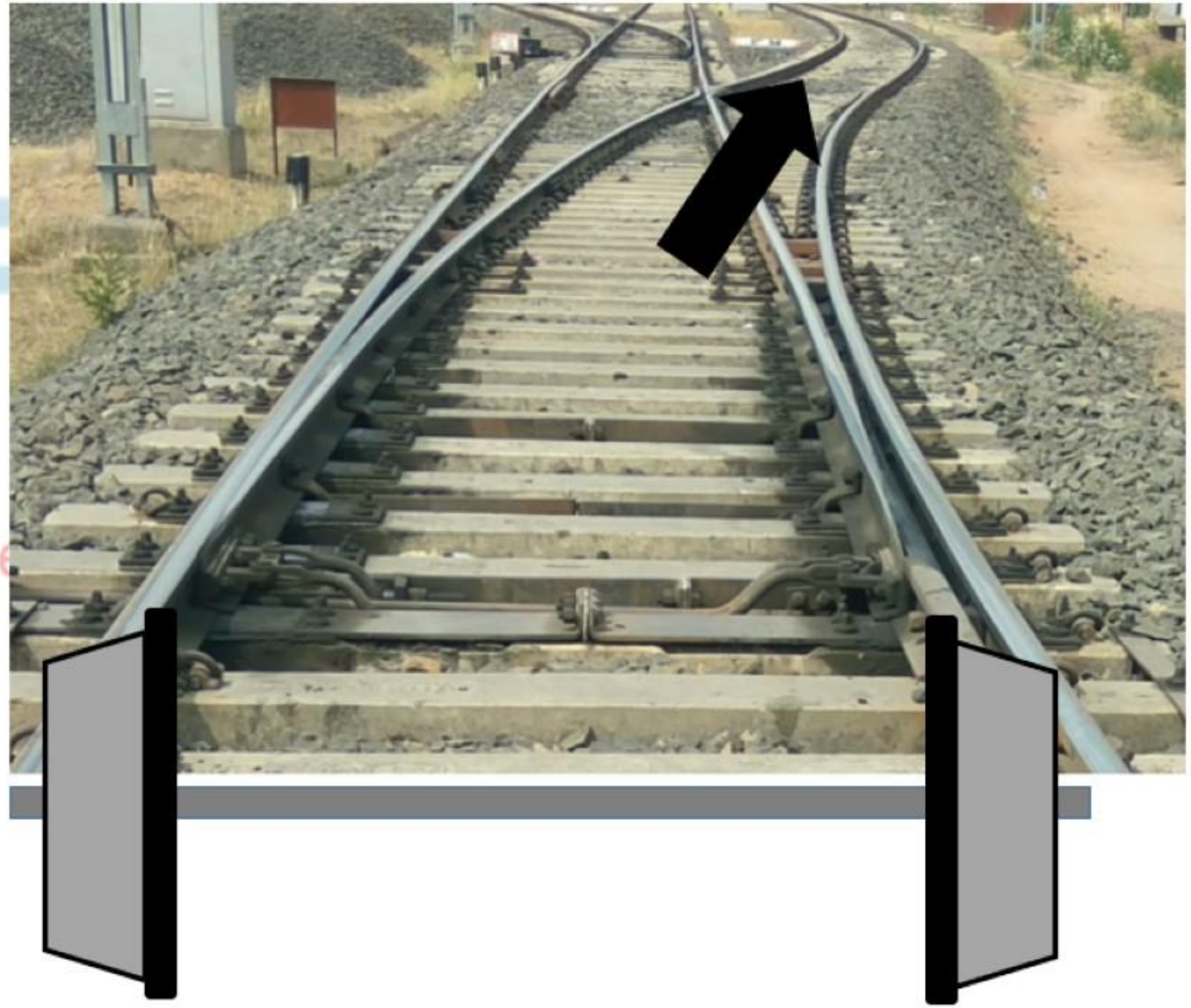
CROSSOVER

POINTS AND CROSSINGS

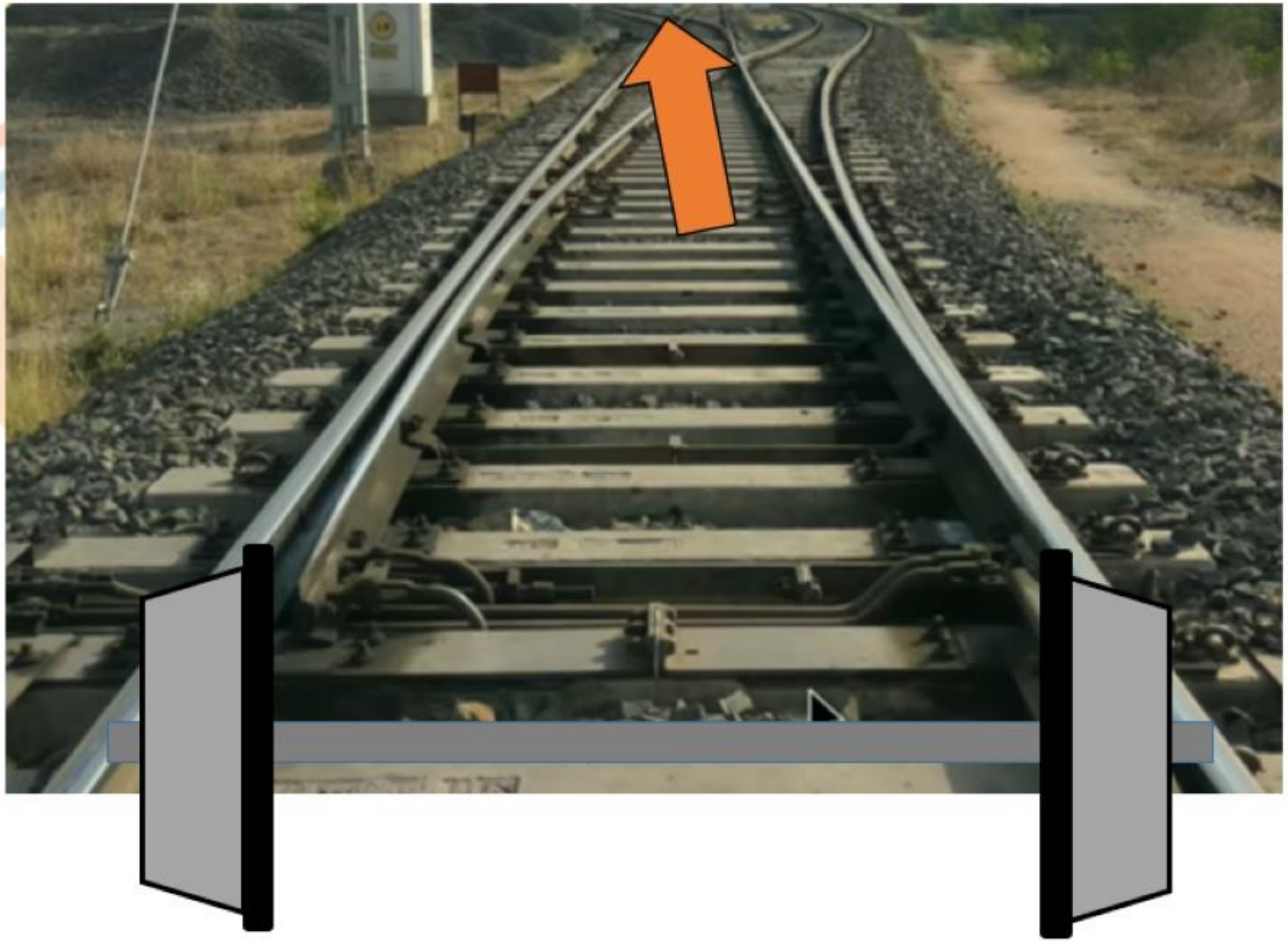



Check Rails
Crossing

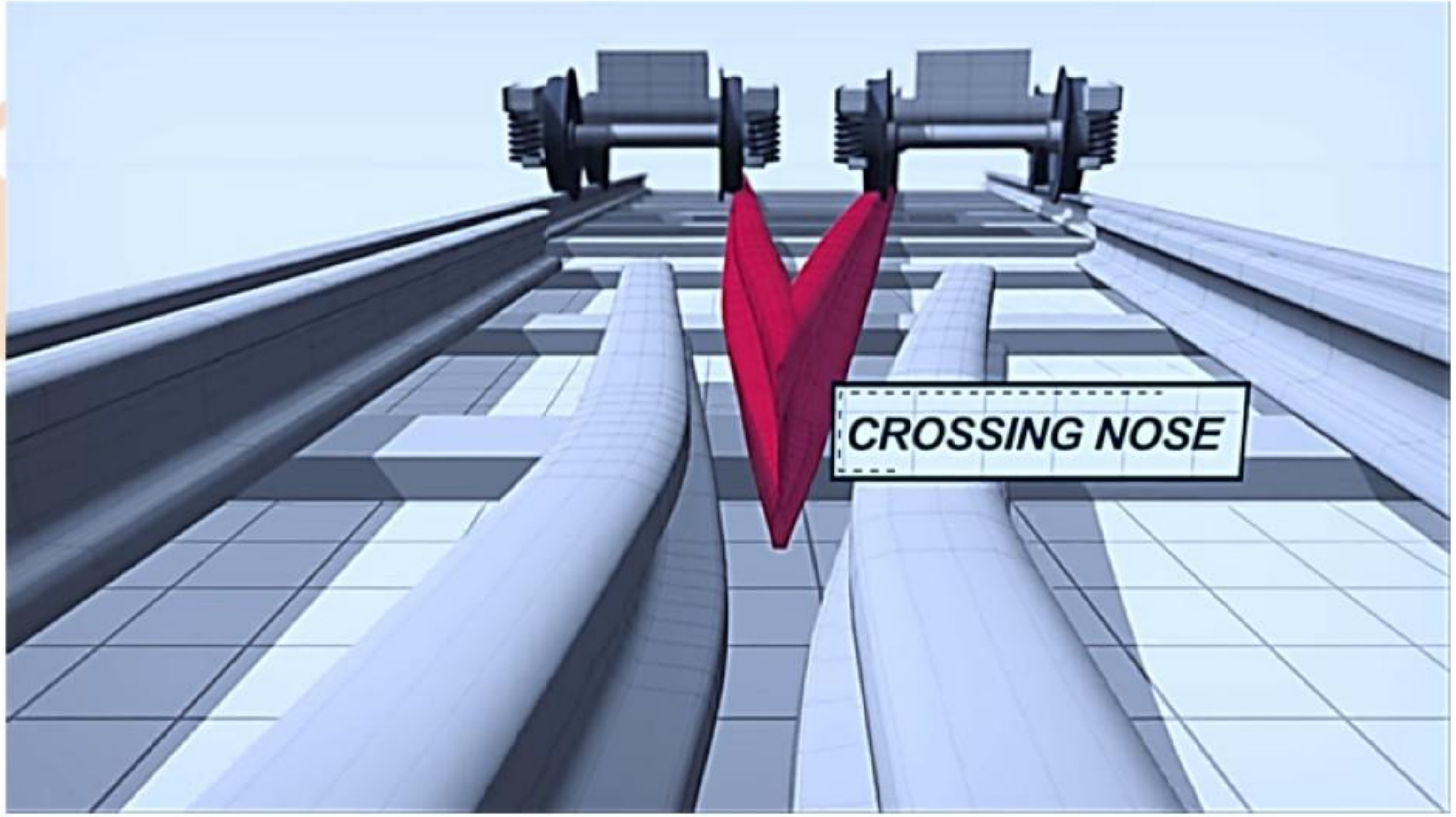
POINTS AND CROSSINGS



POINTS AND CROSSINGS

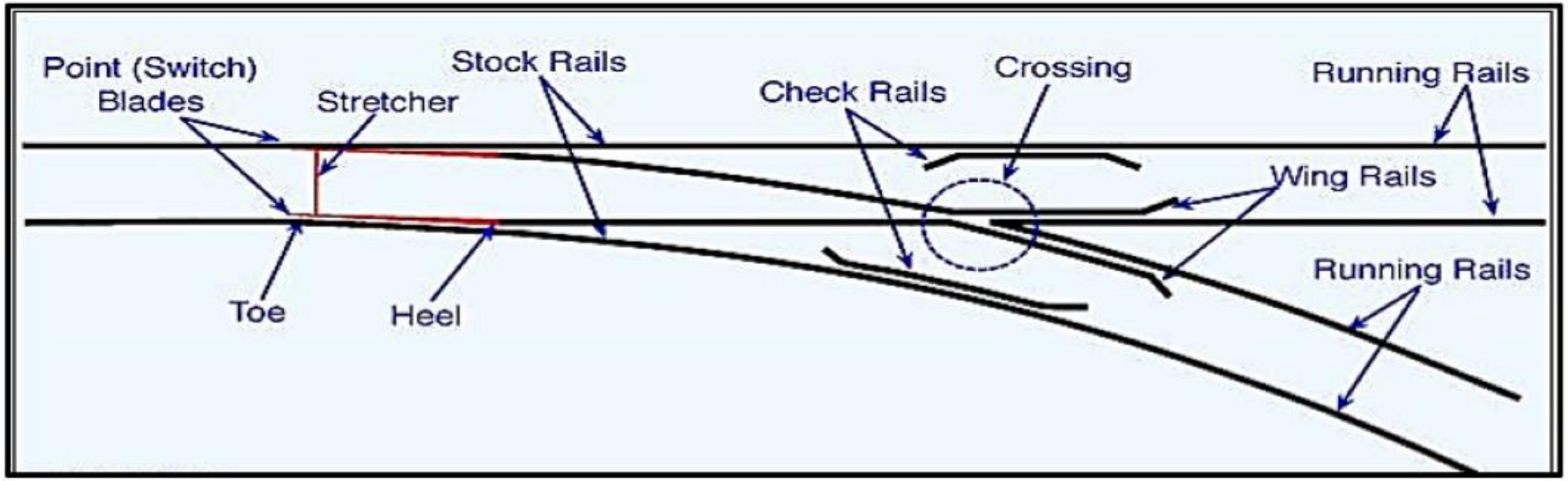


CROSSING



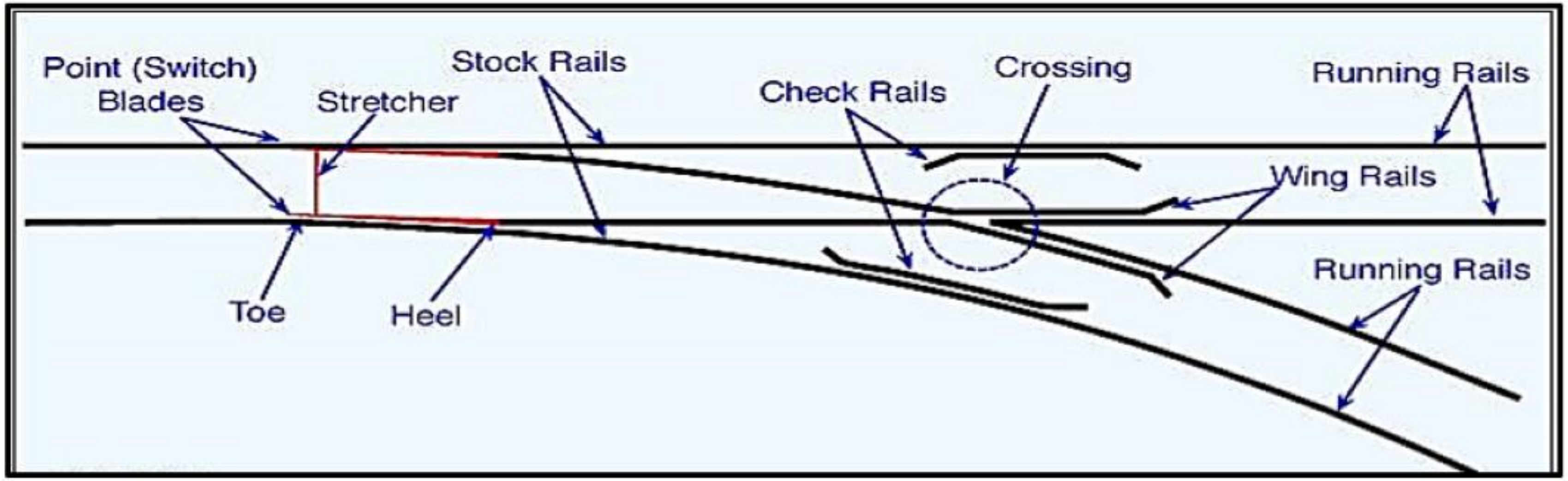
POINTS AND CROSSINGS

- **The arrangements which are made for directing the trains from the main lines to branch lines or to cross over from one track to another without any obstruction are called *points and crossings.***
- **The points are operated for diverting trains from one track to another while the crossings provide required gap between the rails to be crossed to enable wheel flanges to pass through the gaps.**
- **The combination of points and crossings that enable the trains to be diverted from one track to another is known as *turn out*.**
- **The track from which the train diverts is called a *main line*.**



POINTS AND CROSSINGS

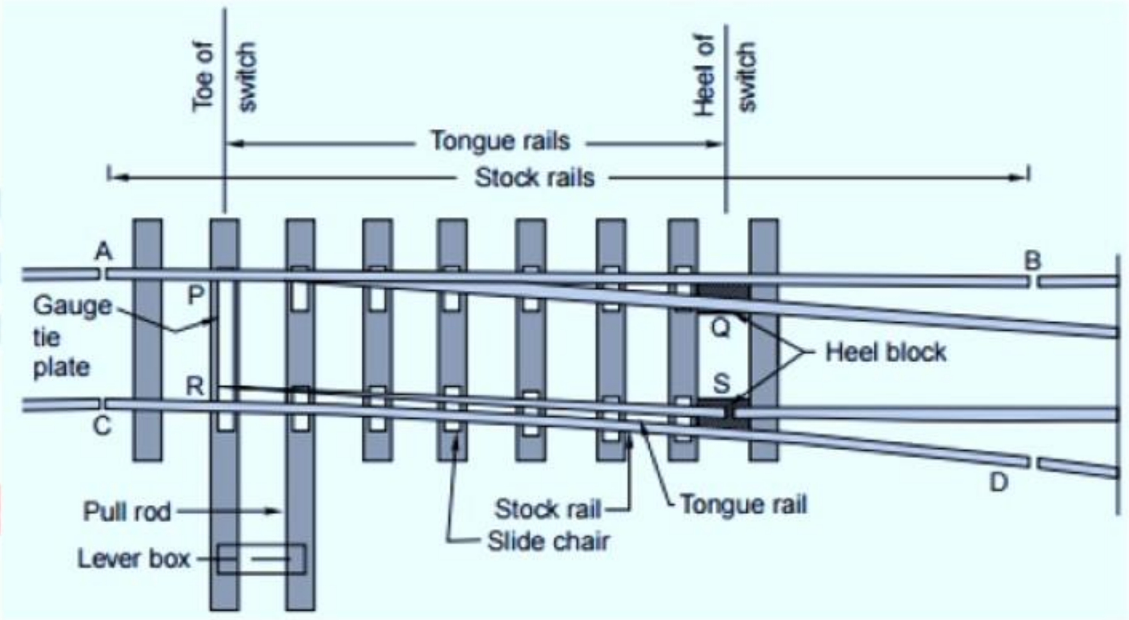
- **Stock rail:** They are the fixed rails of the track against which a tongue rails fit.
- **Tongue rail:** They are the tapered rails which moves and fit snugly against their respective stock rails. They are also called *switch rails* or *point rails.*
- **Switch angle:** The angle subtended between the gauge faces of the stock rail and the tongue rail.



- **Throw of switch:** The distance between the running face of the stock rail and the toe of the tongue rail. For Indian Railways, it is specified as 95mm for B.G and 89mm for M.G tracks.

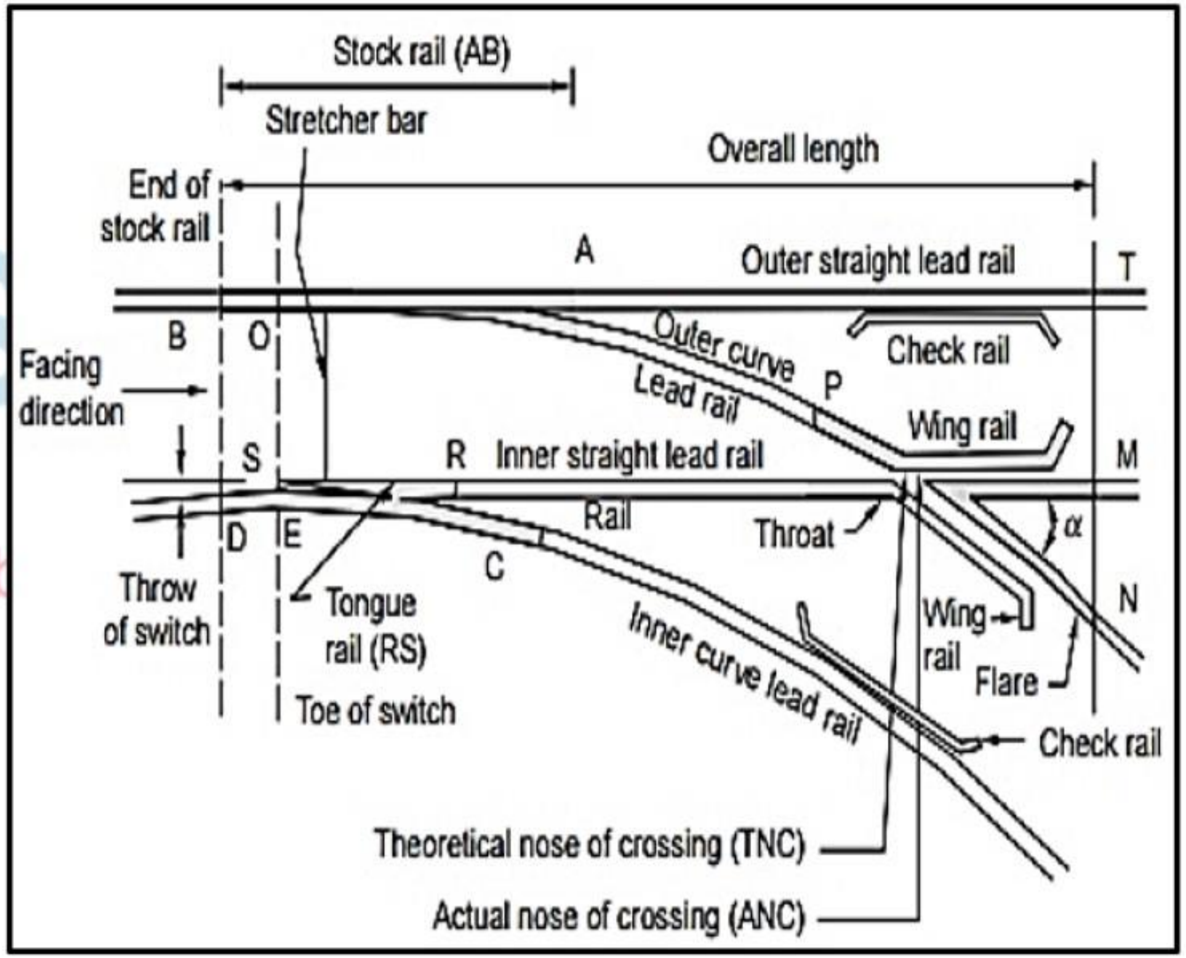
POINTS AND CROSSINGS

- **Heel block:** It is a cast iron block to which the tongue rails and lead rails both are bolted to their respective stock rail.
- **Heel clearance/Heel divergence:** It is the distance between the running edge of the stock rail and the switch rail at the switch heel. It is always measured perpendicular to the stock rail. For Indian Railways, it is specified as 137-133mm for B.G tracks and 117-121mm.
- **Flange way clearance:** It is the distance between the adjacent faces of the stock rail and check rail. Its minimum value is 60mm.
- **Check rail:** These are the rails which are provided to guide the wheel flanges, while the opposite wheel is jumping over the gap in front of the nose and thus prevents sideways movement.



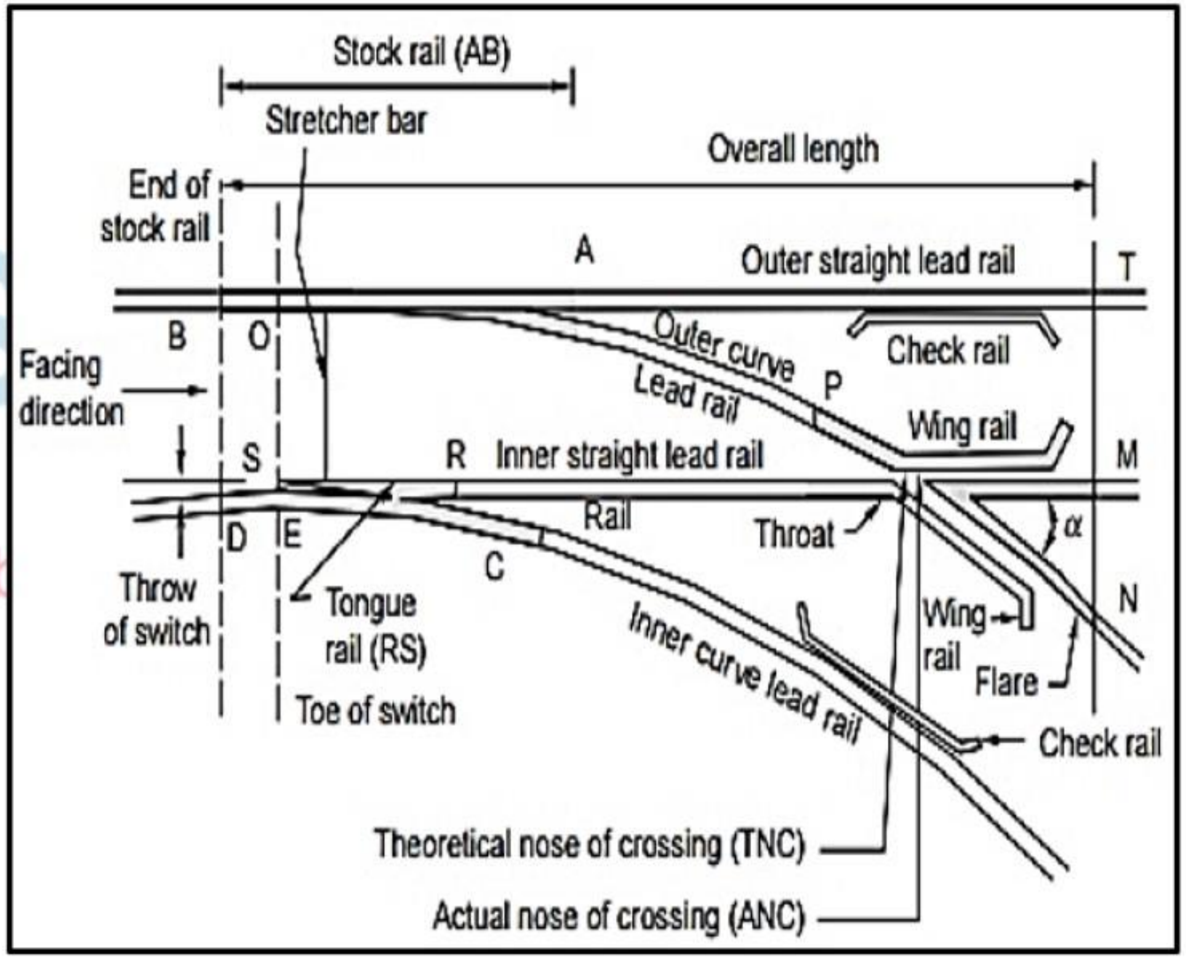
POINTS AND CROSSINGS

- **Lead rail:** They lead the train from the heels of the tongue rail to the toe of crossing.
- **Point rail:** The rail of the main track which forms the one side of nose of crossing.
- **Nose of crossing:** It is the point of intersection of the running faces of the splice rail and point rail.
- **Splice rail:** The rail of the branch line which meets the point rail at the nose of crossing.
- **Angle of crossing:** It is the angle between the point rail and splice rail of a crossing.
- **Wing rail:** It is the bent up length of the rails in front of the nose of crossing, which are provided for channelizing the wheel flanges to their proper routes.



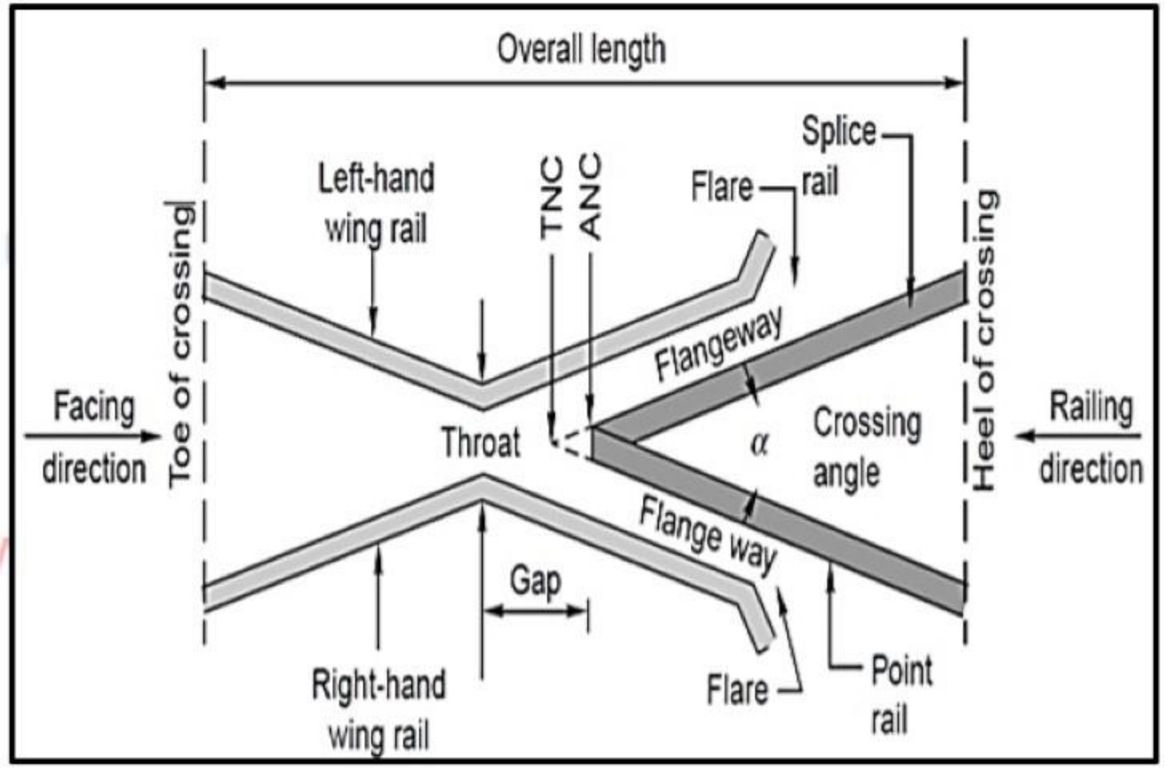
POINTS AND CROSSINGS

- **Facing points:** These are such points the train pass over the switches and then over crossings.
- **Trailing points:** These are such points the train pass over the crossings and then over switches.
- **Flare:** It is the gradual widening of the flange way formed by bending the ends of the check rail or wing rail away from the running faces of the adjacent rails.



CROSSINGS

- A crossing is a device introduced at the junction where two rails cross each other to permit the wheel flange of a railway vehicle to pass from one track to another.
- The crossing is designated by the number which is the ratio of the spread at the leg of the crossing to the length of the crossings from its theoretical nose.
- In Indian Railways, the crossing number used for goods is $8\frac{1}{2}$ and for passenger turnouts is 12.
- ANC – Actual Nose of Crossing is the toe of the blunt face nose.
- TNC – Theoretical Nose of Crossing is the theoretical point where the gauge faces from both the sides intersect.



CROSSINGS

- TYPES OF CROSSINGS:
  1. Acute angle or V- crossing:
     - The crossing in which the right hand rail of one track crosses the left hand rail of another track at an acute angle.
  2. Obtuse angle or Diamond crossing:
     - The crossing in which a track crosses another track of same or different gauge at an obtuse angle.
  3. Square crossing:
     - The crossing in which one track crosses another track of same or different gauge at an right angle.

Acute angle crossing

Obtuse angle crossing

Square crossing

TRACK JUNCTIONS

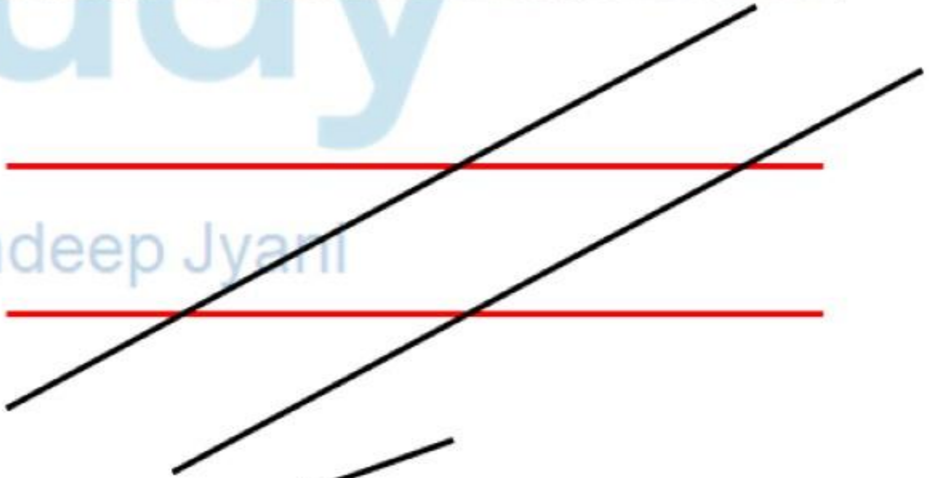
- The track junction is formed by the combination of points and crossings for diverting trains from one track to another.
- Classification:
  1. Turnouts
  2. Double turnout or Tandem
  3. Diamond crossing
  4. Symmetrical split
  5. Three throw switch
  6. Double junction
  7. Single slip and Double slip
  8. Cross over
  9. Scissor Cross over
  10. Gauntlet track

CLASSIFICATION OF TRACK JUNCTIONS

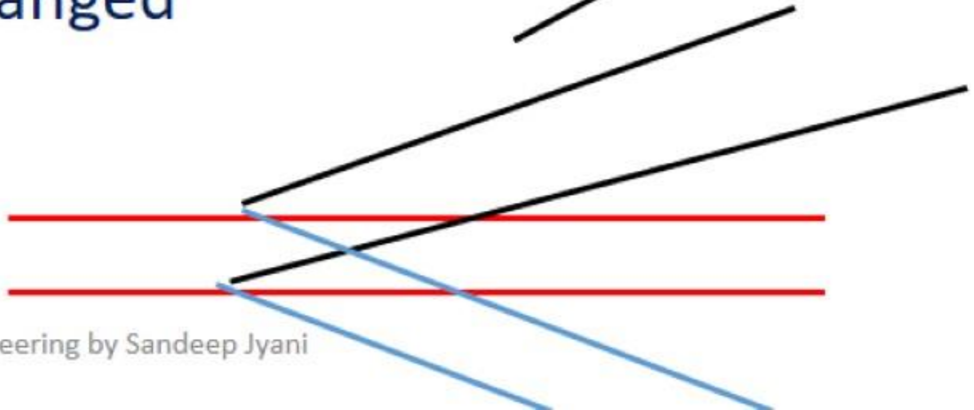
1. **Turnouts:** It enables the train to be diverted from one track to another.
2. **Double turnouts:** The arrangement of two turnouts taking off from the main track for different directions.
3. **Diamond Crossing:** When a track crosses another track of same or different gauge at any angle.
4. **Symmetrical split:** When a straight track splits up in two different directions at equal radii.
5. **Three throw switch:** When two turnouts take off from the same point of the main straight track. It requires two sets of switches and three crossings.

CLASSIFICATION OF TRACK JUNCTIONS

6. **Double junction:** The arrangement made for two parallel tracks to diverge from two parallel tracks.



7. **Single slip and Double slip:** A slip in which the track can be changed from one direction only is *single slip* and a slip in which the track can be changed in two directions is *double slip*.



CLASSIFICATION OF TRACK JUNCTIONS

9. **Cross over:** The arrangement made to divert a train from one track to another parallel track. It requires two sets of switches and two crossings.

10. **Scissors cross over:** When two cross overs are laid between two tracks. It enables the trains from opposite directions to change the track.

11. **Gauntlet track:** When one track is superimposed on the another track such as on rivers , bridges.

Que 128. On a single rail track, goods trains loaded with heavy iron material run starting from
A to B and then empty wagons run from B to A. The amount of creep in the rails.

a) will be more in the direction of B to A
b) will be more in the direction of A to B
c) will be maximum at the middle of A and B
d) cannot be determined from the given data.

Que 128. On a single rail track, goods trains loaded with heavy iron material run starting from
A to B and then empty wagons run from B to A. The amount of creep in the rails.

a) will be more in the direction of B to A

b) will be more in the direction of A to B

c) will be maximum at the middle of A and B

d) cannot be determined from the given data.

STATION

A railway station is provided for one or more of the following purposes.

(a) To entrain or detrain passengers

(b) To load or unload goods or parcels

(c) To control the movement of trains

(d) To enable trains to cross each other in the case of a single-line section

(e) To enable faster trains to overtake slower ones

(f) To enable locomotives to refuel, whether it be diesel, water, or coal

(g) To attach or detach coaches or wagons to trains

(h) To collect food and water for passengers

(j) To enable sorting out of wagons and bogies to form new trains

(k) To provide facilities and give shelter to passengers in the case of emergencies such as floods and accidents, which disrupt traffic.

SELECTION OF SITE FOR STATION

The following factors are considered when selecting a site for a railway station.

1. **Adequate land**
2. **Level area with good drainage**
   - **In India, the maximum permissible gradient adopted is 1 in 400, but a gradient of 1 in 1000 is desirable.**
3. **Alignment**
4. **Easy accessibility**
5. **Water supply arrangement**

CLASSIFICATION OF RAILWAY STATION

- **Railway station can broadly be classified on the basis of two main considerations**
  1. **Operational considerations**
     1. **Block station**
        1. **A class**
        2. **B class**
        3. **C class**
     2. **Non block station or D class**
  2. **Functional characteristics**
     1. **Halt station**
     2. **Flag station**
     3. **Crossing station**
     4. **Junction station**
     5. **Terminal station**

CLASSIFICATION OF RAILWAY STATION

1. **Block station:**
   - A block station is a station at which the driver has to obtain an 'authority to proceed' in order to enter the next block section.
   - In a railway system that is inclusive of block stations, the entire railway line is divided into convenient block sections of 5 to 10 km and a block station is provided at the end of each block.
   - There are three types of block stations:
     1. A class:
        - A class stations are normally provided on double-line sections.
        - A class stations are suitable for sections where traffic passes rapidly
        - Outer signal is provided at a distance of 540m for broad gauge and 400m for meter gauge
     2. B class
        - This is the most common type of station and is provided on single-line as well as double-line sections.
     3. C class
        - The C class station is only a block hut where no booking of passengers is done.
        - It is basically provided to split a long block section so that the interval between successive trains is reduced.
        - No train normally stops at these station

2. **Non block station:**
   - D class or non-block stations are located between two block stations and do not form the boundary of any block section.
   - No signals are provided at D class stations.

CLASSIFICATION OF RAILWAY STATION

1. **Halt:**
   - A halt usually has only a rail level platform with a name board at either end.
   - Sometimes a small waiting shed is also provided, which also serves as a booking office.
   - There is no yard or station building or staff provided for such types of stations.

2. **Flag station:**
   - It is more important as a stop-over for trains than a halt and is provided with a station building and staff.
   - A flag station is usually provided with a small waiting hall and booking office, platforms and benches, and arrangements for drinking water.
3. **Way side station/Crossing station:**
   - A crossing station has arrangements for controlling the movement of trains on block sections.

4. **Junction station:**
   - A junction station is the meeting point of three or more lines emerging from different directions.
   - Normally at junctions, trains arrive on branch lines and return to the same station from where they started or proceed to other stations from where they again return to their originating stations
5. **Terminal station:**
   - The station at which a railway line or one of its branches terminates is known as a terminal station.

Platforms

- There are two types of platforms:
  1. Passenger Platforms
  2. Goods platform

1. Passenger Platform
   - Height of passenger platform above the rail surface should be
     - Broad Gauge 76.2cm to 83.8cm
     - Metre Gauge 30.5cm to 40cm
     - Narrow Gauge 22.9cm to 40.6cm
   - Distance between centre line of track and the platform should not be less than
     - 1.676 metres for Broad gauge
     - 1.343 metres for Meter Gauge
     - 1.219 metres for Narrow Gauge

Platforms

1. Passenger Platform
    - Width of Platform, under no circumstances should be less than 4 metres
    - Length of the platform
        - Should be more than the longest train which is moving on that section
        - It should not be less than 300 m for broad gauge
        - Gorakhpur railway station, Uttar Pradesh, India:1,366.33 m (4,483 ft) (longest in the world)
2. Goods Platform
    - Used for Loading/unloading of goods from the wagons
    - The heights of goods platform above the rail surface should be
        - Broad Gauge 107cm
        - Metre Gauge 69cm
        - Narrow Gauge 61cm

Platforms

- Minimum Horizontal Distance between the centre line of the track and any structure or building (in metres) for passenger and goods platform are :

Platform	Broad Gauge	Metre Gauge	Narrow Gauge
Passenger	5.33	5.0	4.88
Goods	4.72	3.18	3.05

YARDS

- **A yard is a system of tracks laid out to deal with the passenger as well as goods traffic being handled by the railways.**
- **This includes receipt and dispatch of trains apart from stabling, sorting, marshalling etc.**
- **Classification of yards:**
    1. **Coaching yard**
    2. **Goods yard**
    3. **Marshalling yard**
    4. **Locomotive yard**
    5. **Sick line yard**

CLASSIFICATION OF YARDS

1. **Coaching yard:**
    - The main function of a coaching yard is to deal with the reception and dispatch of passenger trains.
2. **Goods yard:**
    - A goods yard provides facilities for the reception, stabling, loading, unloading, and dispatch of goods wagons.
    - Most goods yards deal with a full train load of wagons.
3. **Marshalling yard**
    - The marshalling yard is a yard where goods trains are received and sorted out, and new trains are formed and finally dispatched to various destinations.
    - A marshalling yard serves the following functions at the specified locations within the yard itself.
        a) Reception of trains
        b) Sorting of trains
        c) Departure of trains
4. **Locomotive yard:**
    - This is the yard which houses the locomotive.
    - Facilities for watering, fuelling, examining locomotives, repairing, etc., are provided in this yard
5. **Sick line yard:**
    - Whenever a wagon or coach becomes defective, it is marked 'sick' and taken to sick lines. This yard deals with such sick wagons.

TRACK MAINTENANCE

- **Railway tracks can be maintained either conventionally by manual labour or by the application of modern methods of track maintenance such as mechanical tamping or measured shovel packing.**
- **NEED OF TRACK MAINTENANCE:**

  (a) Due to the constant movement of heavy and high-speed trains, the packing under the sleepers becomes loose and track geometry gets disturbed. The gauge, alignment, and longitudinal as well as cross levels of the track thus get affected adversely and the safety of the track is jeopardized.

  (b) Due to the vibrations and impact of high-speed trains, the fittings of the track come undone and there is heavy wear and tear of the track and its components.

  (c) The track and its components get worn out as a result of the weathering effect of rain, sun, and sand.

TRACK MAINTENANCE

- **ADVANTAGES OF TRACK MAINTENANCE:**
  - (a) If the track is suitably maintained, the life of the track as well as that of the rolling stock increases since there is lesser wear and tear of their components.
  - (b) Regular track maintenance helps in reducing operating costs and fuel consumption.
  - (c) Small maintenance jobs done at the appropriate time such as tightening a bolt or key, hammering the dog spike, etc., helps in avoiding loss of the concerned fitting and thus saving on the associated expenditure.
  - (d) When track maintenance is neglected for a long time, it may render the track beyond repair, calling for heavy track renewals that entail huge expenses.

TRACK MAINTENANCE

- **In India, maintaining tracks has traditionally been a manual activity and the 'calendar system of maintenance' has been taken.**
- **In this system, a timetable that outlines the track maintenance work to be done by the gangs in the course of a year is drawn out and generally followed.**
- **As per the timetable or calendar, the 12-month cycle of maintenance consists of the following operations.**
  - **(a) Through packing**
  - **(b) Systematic overhauling**
  - **(c) Picking up slacks**

THROUGH PACKING

1. Opening of road

- The ballast is dug out on either side of the rail seat for a depth of 50 mm (2") below the bottom of the sleeper.
- On the outside, the width of the opening should extend up to the end of the sleeper.
- On the inside, it should extend from the rail seat to a distance of
  - 450 mm (18") in the case of BG
  - 350 mm (14") in the case of MG
  - 250 mm (10") in the case of NG.

2. Examination of rails, sleepers, and fastenings

- The rails, sleepers, and fastenings to be used are thoroughly examined.
- Defective sleepers are removed and loose fastenings are tightened.
- Any kinks in the rails are removed.

3. Squaring of sleepers

- The sleepers get out of square quite frequently resulting in gauge variations and kinks. To avoid this, one of the rails is taken as the sighting rail and the correct sleeper spacing is marked on it.

THROUGH PACKING

4. Aligning the track

- The alignment of the track is normally checked visually, wherein the rail is visually assessed from a distance of about four rail lengths or so.
- It is checked for a distance of 25-30metres.

5. Gauging

- The gauge should be checked and an attempt should be made to provide a uniform gauge within permissible tolerance limits.
- For B.G. – 1676mm
- For M.G. – 1000mm
- For N.G. – 762mm

6. Packing of sleepers

- The sleepers are then packed by applying the scissors packing method.
- It is done with respect of one fixed sleeper to others.
- Each sleeper should be packed at a time by 4 members.
- After packing they will be blown, and a hollow sound will indicate defective packing.

SYSTEMATIC OVERHAULING

- **The track should be overhauled periodically with the object of ensuring that the best possible standards of track conditions are met and maintained.**
- **The systematic overhauling of the track should normally commence after the completion of one cycle of through packing. It involves the following operations in sequence.**
    - **(a) Shallow screening and making up of ballast section**
    - **(b) Replacement of damaged or broken fittings**
    - **(c) All items included in through packing**
    - **(d) Making up the cess**
- **The frequency of overhauling depends upon a number of factors such as**
    - **a) the type and age of track structure**
    - **b) the maximum permissible speed and volume of traffic**
    - **c) the mode of traffic**
    - **d) the mode of traction**
    - **e) the rate of track deterioration**
    - **f) the amount of rainfall in the region.**

PICKING UP SLACKS

- **Slacks are those points in the track where the running of trains is faulty or substandard.**
- **Slacks generally occur in the following cases:**
  - Stretches of yielding formation
  - Poorly maintained sections that have loose packing, bad alignment, and improper longitudinal and cross levels
  - Improperly aligned curves
  - Approaches to level crossings, girder bridges, etc., particularly in sags
  - Portions of track with poor drainage
  - Sections with an inadequate or unclean ballast cushion
  - Other miscellaneous reasons

Some Important Terms

- Triangle: A device used for changing direction of engine
- Turn Table: Used for changing the direction of engine
- Traverser: Used to shift the position of wagons, coaches and locomotives sideways from one track to a parallel track

Some Important Terms

- Buffer Stop: It is provided to prevent the vehicles from moving beyond the end of the rails at terminal or sliding

- Scotch Block and Sand Hump: These are used for preventing the movement of vehicles beyond dead end sidings

Que 129. Two important constituents in the com-position of steel used for rail are

a) carbon and silicon

b) manganese and phosphorous

c) carbon and manganese

d) carbon and sulfur

Que 129. Two important constituents in the com-position of steel used for rail are

a) carbon and silicon

b) manganese and phosphorous

c) carbon and manganese

d) carbon and sulfur

Que 130. Largest percentage of material in the rail is in its
a) head
b) web
c) foot
d) head and foot both

Que 130. Largest percentage of material in the rail is in its

a) head

b) web

c) foot

d) head and foot both

Que 131. Tensile strength of steel used in rails should not be less than

a) 450 MPa

b) 500 MPa

c) 700 MPa

d) 850 MPa

Que 131. Tensile strength of steel used in rails should not be less than

a) 450 MPa

b) 500 MPa

c) 700 MPa

d) 850 MPa

Que 132. Ordinary rails are made of
a) mild steel
b) cast iron
c) wrought iron
d) high carbon steel

Que 132. Ordinary rails are made of

a) mild steel

b) cast iron

c) wrought iron

d) high carbon steel

Que 133. The main function of a fish plate is
a) to join the two rails together
b) to join rails with the sleeper
c) to allow rail to expand and contract freely
d) none of the above

Que 133. The main function of a fish plate is

a) to join the two rails together

b) to join rails with the sleeper

c) to allow rail to expand and contract freely

d) none of the above

Que 134. Gauge is the distance between
a) center to center of rails
b) running faces of rails
c) outer faces of rails
d) none of the above

Que 134. Gauge is the distance between

a) center to center of rails

<u>b) running faces of rails</u>

c) outer faces of rails

d) none of the above

Que 135. Due to battering action of wheels over the end of the rails, the rails get bent down and are deflected at ends. These rails are called

a) roaring rails

b) hogged rails

c) corrugated rails

d) buckled rails

Que 135. Due to battering action of wheels over the end of the rails, the rails get bent down and are deflected at ends. These rails are called

a) roaring rails

b) hogged rails

c) corrugated rails

d) buckled rails

Que 136. The slipping of driving wheels of locomotives on the rail surface causes

a) wheel burns

b) hogging of rails

c) scabbing of rails

d) corrugation of rails

Que 136. The slipping of driving wheels of locomotives on the rail surface causes

a) wheel burns

b) hogging of rails

c) scabbing of rails

d) corrugation of rails

Que 137. The formation width for a single line meter gauge track in embankment as adopted on Indian Railways is

a) 4.27 m

b) 4.88 m

c) 5.49 m

d) 6.10 m

Que 137. The formation width for a single line meter gauge track in embankment as adopted on Indian Railways is

a) 4.27 m

b) 4.88 m

c) 5.49 m

d) 6.10 m

Que 138. The formation width for a double line Broad Gauge track in cutting (excluding drains) as adopted on Indian Railways is

a) 6.10 m

b) 8.84 m

c) 10.21m

d) 10.82 m

Que 138. The formation width for a double line Broad Gauge track in cutting (excluding drains) as adopted on Indian Railways is

a) 6.10 m

b) 8.84 m

c) 10.21m

d) 10.82 m

Que 139. Width of ballast section for Broad Gauge is

a) 1.83 m

b) 2.25 m

c) 3.35 m

d) 4.30 m

Que 139. Width of ballast section for Broad Gauge is

a) 1.83 m

b) 2.25 m

c) 3.35 m

d) 4.30 m

Que 140. The limiting value of cant excess for Broad Gauge is

a) 55 mm

b) 65 mm

c) 75 mm

d) l00 mm

Que 140. The limiting value of cant excess for Broad Gauge is

a) 55 mm

b) 65 mm

c) 75 mm

d) l00 mm

Que 141. The limiting value of cant gradient for all gauges is
a) 1 in 360
b) 1 in 720
c) 1 in 1000
d) 1 in 1200

Que 141. The limiting value of cant gradient for all gauges is

a) 1 in 360

b) 1 in 720

c) 1 in 1000

d) 1 in 1200

Que 142. Normally the limiting value of cant is

a) G/8

b) G/10

c) G/12

d) G/15

where G is the gauge.

Que 142. Normally the limiting value of cant is

a) G/8

b) G/10

c) G/12

d) G/15

where G is the gauge.

Que 143. To provide cant in rails, wooden sleepers are cut too a slope at rail seat, which is known as

a) Coning

b) Cutting

c) Boxing

d) Adzing

Que 143. To provide cant in rails, wooden sleepers are cut too a slope at rail seat, which is known as

a) Coning

b) Cutting

c) Boxing

d) **<u>Adzing</u>**

Que 144. Where R is the radius of curve in metres, D is the degree of curve in degrees, and length of the chord is 30m, then the relation between R and D is

a) $\boldsymbol{R = \frac{5400}{D}}$

b) $\boldsymbol{R = \frac{1520}{D}}$

c) $\boldsymbol{R = \frac{1720}{D}}$

d) $\boldsymbol{R = \frac{4500}{D}}$

Que 144. Where R is the radius of curve in metres, D is the degree of curve in degrees, and length of the chord is 30m, then the relation between R and D is

a) $\boldsymbol{R = \frac{5400}{D}}$

b) $\boldsymbol{R = \frac{1520}{D}}$

c) $\boldsymbol{R = \frac{1720}{D}}$

d) $\boldsymbol{R = \frac{4500}{D}}$

Que 145. The magnitude of superelevation provided in Indian Railways on broad gauge is (in cm)

a) $1.315 \frac{V^2}{R}$

b) $1.676 \frac{V^2}{R}$

c) $0.81 \frac{V^2}{R}$

d) $0.415 \frac{V^2}{R}$

Que 145. The magnitude of superelevation provided in Indian Railways on broad gauge is (in cm)

a) **$1.315 \frac{V^2}{R}$**

b) $1.676 \frac{V^2}{R}$

c) $0.81 \frac{V^2}{R}$

d) $0.415 \frac{V^2}{R}$

Que 146. The shift of the transition curve of radius 300m and length 48m is...

a) 0.32 m

b) 0.42 m

c) 0.52 m

d) 0.62 m

Que 146. The shift of the transition curve of radius 300m and length 48m is…

a) 0.32 m
b) 0.42 m
c) 0.52 m
d) 0.62 m

Que 147. Due to slipping of the wheels, the rail forms

a) Crushed head
b) Battered head
c) Split head
d) Horizontal Fissure

Que 147. Due to slipping of the wheels, the rail forms

a) **Crushed head**

b) Battered head

c) Split head

d) Horizontal Fissure

Que 150. What does the gauge of a railway line define?

a) Thickness of steel plates used
b) Distance between two parallel rails of a track
c) Instrument to measure pressure
d) Pressure that a railway track can stand

Que 150. What does the gauge of a railway line define?

a) Thickness of steel plates used

b) **Distance between two parallel rails of a track**

c) Instrument to measure pressure

d) Pressure that a railway track can stand

Que 151. Widening of curve is provided if degree of the curve is

a) 3° or less

b) 3° to 4.5°

c) More than 4.5°

d) None of these

Que 151. Widening of curve is provided if degree of the curve is

a) 3° or less

b) 3° to 4.5°

c) **More than 4.5°**

d) None of these

Que 152. If n is the length of rail in meters, the number of sleepers per rail length generally varies from

a) n to (n+2)

b) (n+2)(n+4)

c) (n+3)(n+6)

d) (n+4)(n+5)

Que 152. If n is the length of rail in meters, the number of sleepers per rail length generally varies from

a) n to (n+2)

b) (n+2)(n+4)

c) **(n+3)(n+6)**

d) (n+4)(n+5)

Que 153. Calculate the design rate of super elevation on a 3 degree horizontal curve for narrow gauge track, if design velocity on the curve is 70kmph.

a) 0.051

b) 0.07

c) 0.067

d) 0.112

Que 153. Calculate the design rate of super elevation on a 3 degree horizontal curve for narrow gauge track, if design velocity on the curve is 70kmph.

a) 0.051

b) 0.07

c) 0.067

d) 0.112

Que 154. What will be the cant deficiency (cm), if maximum safe speed on a 5 degree curve of a broad gauge track is 110kmph and average speed of train is 85kmph?

a) 6.3

b) 10

c) 12.6

d) 18.7

Que 154. What will be the cant deficiency (cm), if maximum safe speed on a 5 degree curve of a broad gauge track is 110kmph and average speed of train is 85kmph?

a) 6.3

b) 10

c) 12.6

d) 18.7

Que 155. Calculate the number of sleepers required for 1 km railway track, if sleeper density is (n+4) for broad gauge and the length of one rail for a broad gauge is 13m

a) 437

b) 678

c) 1308

d) 17000

Que 155. Calculate the number of sleepers required for 1 km railway track, if sleeper density is (n+4) for broad gauge and the length of one rail for a broad gauge is 13m

a) 437

b) 678

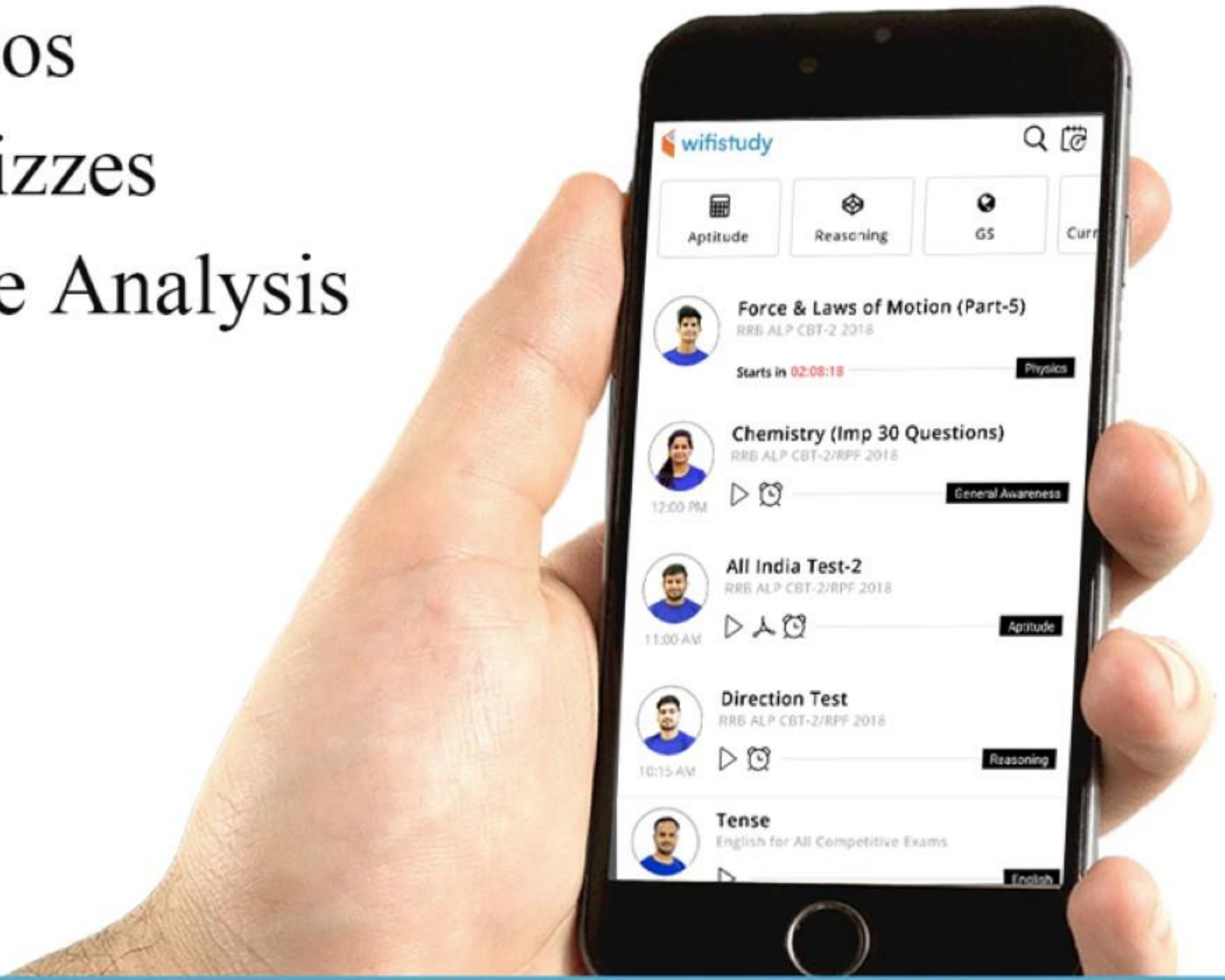
c) **1308**

d) 17000

- Watch Videos
- Practise Quizzes
- Performance Analysis

GET IT ON
Google Play

Available on the
App Store



www.wifistudy.com