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**ESE , GATE, BEST** Y KW , / E E
D/E/D D W @

**1.** KE E /E / **2.** E /E /
D , E /E / **4.** / E /E /
/E D E /KE E /E / **6.** KD /

## ,GATE , TEST @

- –W / & D /
- **GATE**

➢ E **- ALL** E /E / E

➢ **ALL** s W / **YEAR** Y /KE W @

## W / /K K -

**EASY ,** ,**ACE** ,**KREATRYX ,GATE** /, ,**GK**
, **YADAV, KD** D , &K E /KE , **–GRAW** , D ,W KE...K **S**
/ K @

| | | | |
|---|---|---|---|
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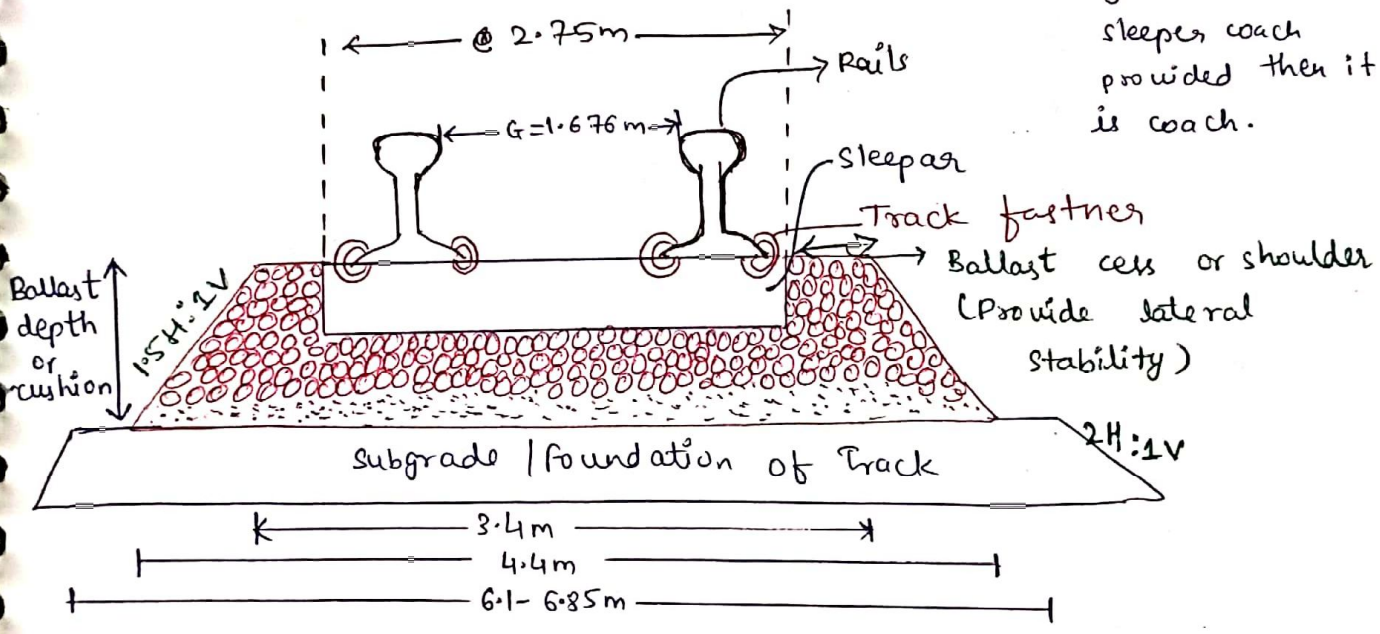
# RAILWAY AND AIRPORT

* Railway is very huge, reliable and rapid transportation medium.
* To run the Indian Railways, lot of undertakings like DFCCIL, IRCON, IRCTC, CRIS, RVNL, CONCOR, RITES, KONKAN RAILWAYS, etc are working.

* Boggie - Sirf Bottom part. jo Ex- Ja o truck ya kuch bada samaan leke jata h uska bottom part.
* Wagon - If any cover provide over boggie then it is wagon.
* Coach - If separate AC coach general coach, sleeper coach provided then it is coach.

## Railway Track




* Rails - Allow movement of Train
* Sleeper - Holding the rails in correct gauge
* Track fastner - making connection between rail & sleeper
* Ballast Depth or cushion - ① Distribute load upto larger area
② Facilitate Drainage

- Sub ballast Layer- ① Prepared by fine grained soil, like Murrom soil.
  ② It resist percolation of water.
- Subgrade — • Prepared by compacting cohesionless soil at OMC.
- In order to increase durability, stabilisation technique can be used (lime, cement, chemical).

★ Gauge Distance – It is the inner to inner face distance between rail.

- Which gauge is to be provided depends on type of train to be served, topography and cost available.
- Gauge distance affects land cost, does not affect operational cost.
- uniformity in gauge reduces delay, labour cost, tranship hazard, fear of theft and increases utilization of full capacity of locomotive.

Different type of gauge are as follows.

| | | | |
|---|---|---|---|
| Broad Gauge | – 1.676m | Feder gauge | – 0.692 m |
| Meter Gauge | – 1.000m | Standard gauge | – 1.435 m |
| Narrow Gauge | – 0.762m | Cape Gauge | – 1.067 m |

## Survey to be done before laying track

(2marks)

Red line, Yellow line, Blue line } Broad Gauge

① Traffic survey- Type of train, frequency of train, type of industry & population to be ~~ser~~ serve.

② Reconnance survey- It is a rough survey of area regarding topography, nearby ~~wa~~ water body, road connectivity, approximate route, approx. no. of location of station, map study, type of soil, etc.

③ Preliminary survey - It is a the instrumental analysis of reccoinnance survey.

* Approx. estimate is prepared before starting construction.

④ Final location survey - final work allocation, final estimate, establishment of center line of railway track.

## Rails

$$\frac{\text{weight of rail}}{\text{axial load of locomotive}} = \frac{1}{580}$$

→ allows movement of train.

→ Rails are levelled, Parallel, Continuous girder.

- levelled ↙ Top surface should not have undulation
- Parallel ↓ maintain gauge distance
- Continuous girder ↓ Beam which takes moving load
- ↙ support of number of sleeper

→ Rails are strongest and smooth (Negligible friction)

C > Mn > Si > P > S ← ↳ contact area of wheel & Rail head is a point contact { very less w.r.t dia}

⇒ Rails converts moving load into point load at any cls.

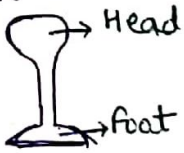
### Types of Rails

① Double headed Rail - Purpose was to use it from both side but couldn't happen because of indentation marks at foot.

Foot & Head are same

② Bull Headed Rail - * Head is bigger than foot.

* Chances of overturn ↑
* less lateral stability



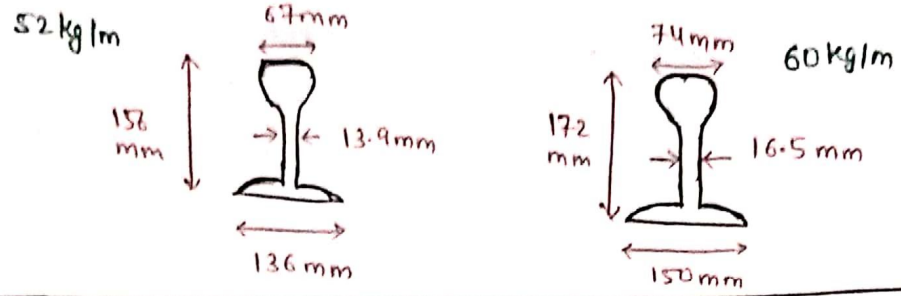

③ Flat Footed Rail


Head - enough thick to impart vertical stiffness.

Web - enough thick to impart flexure rigidity in Horizontal plane.

foot - Flat foot Resist overturning

Flat foot reduce stress intensity.




| | Gross area ($mm^2$) | UTS (MPa) | Speed (kmph) | GMT (Gross million tonn/yr/m) |
|---|---|---|---|---|
| 52 kg/m | 6615 | 710 | 130 | 20-25 |
| 60 kg/m | 7686 | 880 | 160 | >35 |

* Distribution of material and manufacturing of rail should be done in such a way that load should pass from CG of rail section in order to avoid Bending stresses.

$L_{BG} = 12.8\ m \approx 13m$

$L_{MG} = 11.89\ m \approx 12m$

* Rail Tounge - To hold Rail

Tongue

Note:- ① Rail Tounge - is used to hold Rails.

(i) ② Sleeper Tounge - is used to hold sleeper.

Tongue

③ JIM CROW - is used to bend or break rail.

④ VISER MIR - is used to check level of rail.

Note -(ii) Tup Test & falling weight Test should be carried out over Rail.

Note (iii)

IRS - 52 - 710 - SAIL - X11 - 20 - OH

- IRS → Indian Rail section
- 52 → 52 kg/m
- 710 → UTS
- SAIL → manufacturer name
- X11 → Date of manufacturing
- 20 → Year of manufacturing
- OH → Process of Manufacturing
  - Basic Bessemers
  - open Hearth
  - Duplex

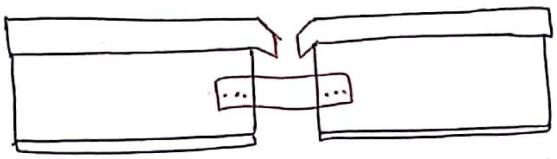
## Defects in Rail

① Corrugation in Rail (Roaring rails)

* Due to abnormal loading, sudden application of break, the top surface of rails get some undulation which are

spreading in nature, known as corrugation in Rails.
* When wheels moves over these depression, it creats noise ~~heeee~~ hence also known as Rooing rails.

② Hogging in Rails - Due to loose joint if expansion gap increases, the rails ~~on~~ end get depressed as shown in figure due to continuous movement of train over loose joint known as hogging of rail.



③ Kinking in Rails - Due to loose joint & loose packing of ballast, the rails get misaligned known as kinking in rail It creates jerk during train movement.

④ Buckling in Rails - Due to extra-ordinary rigidity bolts, due to insufficient expansion gap, rails gets deflected in lateral direction under the continuous temperature changes. known as buckling in Rails.

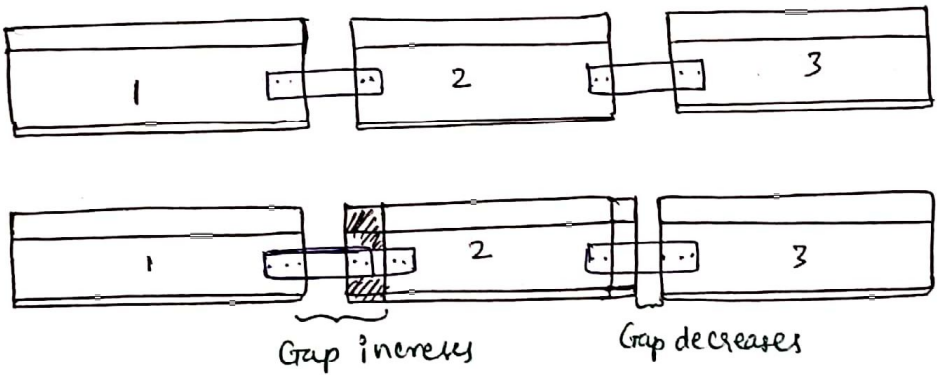
* Buckling results in irregular widening of gauge which may increase the chances of derailment.
* Due to number of supports in terms of sleeper rails will not depress in downward direction.

## Creep in Rails (रेंगना)

* Due to loose joint if rails moves in the direction of traffic with respect to sleeper known as creep.
* Creep can be identified by closing of gap at one end and opening of gap at another end.
* closing of gap may increase the chances of buckling and opening of gap may increase the chances of hogging kinking, forging of ballast and breaking of fish plate.

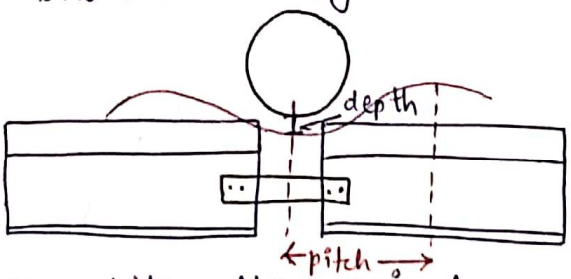
* Hence creep is known as dangerous localised phenomena which is to be taken care of atleast once in 3 months with the help of creep indicator.
* Maximum permissible creep is 150 mm or 6 adjoining rails are allow for subjected to creep.
* Creep occurs more in downward gradient, in old rails and in double ~~track~~ lane traffic.
* Creep can be reduced by pulling back the rails, by using anti creepers, anchors or by using steel sleepers.

Note:- * very loose packing of ballast allow the ballast to accumulate between the rails known as forging of ballast.




## Theories of creep

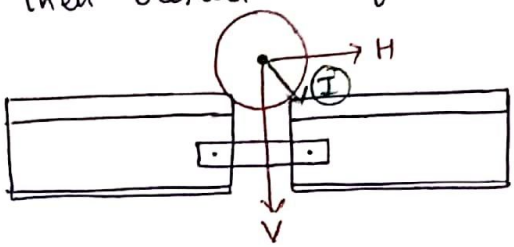
① Wave Theory - As per wave theory when wheel moves over rail, an imaginary reverse curves or wave forms as shown in fig.



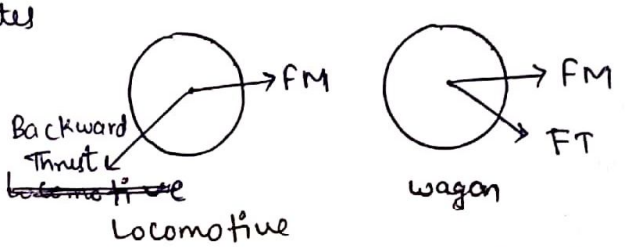

* wheel actually hits the raised part of wave which cause creep.
* The pitch & depth of wave can be controlled

by stability of foundation, stiffness of track & Track Modulus.

② Percussion Theory - As per percussion theory when wheel moves over loose joint then resultant force creates the impact over the rail end which causes creep as shown in figure.




③ Drag Theory - As per drag theory wheel of locomotive creates backward thrust for its forward movement and wheel of wagon creates forward thrust for its forward movement due to law of inertia.




* whichever thrust is more creep will occur in that direction (generally forward thrust is higher than for train).

## Wear in Rail

* Due to abnormal load, high speed if stresses becomes more than yield stress over rail, metal of rail starts flowing, known as wear in rails.

* Top → due to vertical load
  → due to corrugation, corrossion, etc.
  → due to sliding & skidding of wheel.

* Side → due to strike of flange.
  End → due to creep, Hogging, etc.

Top wear ≯ 25%

Total wear ≯ 5% {max^m upto 8%}

## Rail Joint

* Rail joint are most weakest position in railway track hence it should be avoided at level crossing, at entry and exit of bridges, in short bridges.

* Welding in rails eliminate the joints hence eliminate the chances of creep, hogging etc.
* welding in rails also reduces man power required for maintenance.
* As welding closes all the expansion joint hence the chances of buckling increases.
* welding in rail impose such a restrain at the ends of rail so that fasteners can work properly.
* Due to closed expansion joint whatever the temperature will develop will be taken care by combination of sleepers and fastner. Hence we can say succes of welding depends on resisting capacity of fastners.
* Two different sections of welded rail separated by switch expansion joint.
* The end position of welded rail which is allowed for expansion is known as breathing length.
* In short welded rail (SWR) welding is done for 3, 5 and 10 rails, for long welded rail (LWR) welding is done upto 1 kilometers, continuous welded rail is (CWR) is welding more than 1km or station to station.
* Breathing length can be calculated as follows.