Transportation Engineering II: Highway Design & Railways

Lecture 5
RAILS

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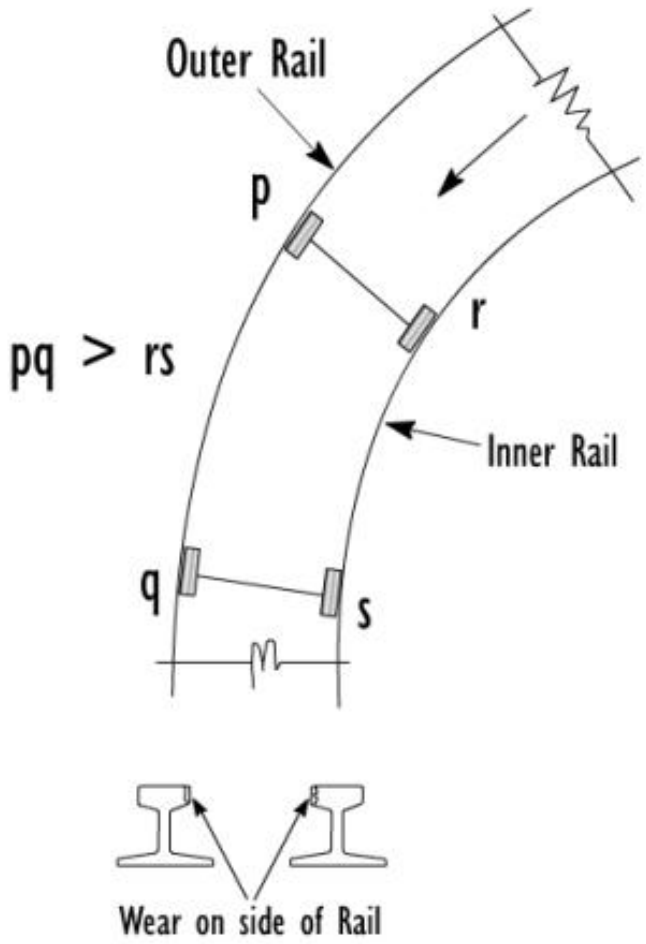
Methods to Reduce Wear

- Better maintenance of track
- Reduction of number of joints
- Use of heavier rails and special steel alloys
- Lubricating the gauge face of the outer rail in curves
- Providing check rails in sharp curves
- Interchanging inner and outer rails
- Coning of wheels and tilting of rails



- Outer wheel covers longer distance (pq>rs)
- Wheels are connected with rigid connections (pr=qs)
- Inner wheel tends to slip over inner rail causing wear of head of inner side of inner rail

Check Rails

- Rails parallel to the inner rail on sharp curves to prevent the wheel flange from mounting the outer rail
- Functions
  - Prevents derailment
  - Reduces lateral wear on the outer rail and
- Generally worn out rails used as check rails

Check Rail

Coning of Wheels

- If the wheels have flat flanges they will easily slide
  - The flanges of wheels are therefore never made flat
- They are made in the shape of a cone with a slope of about 1 in 20

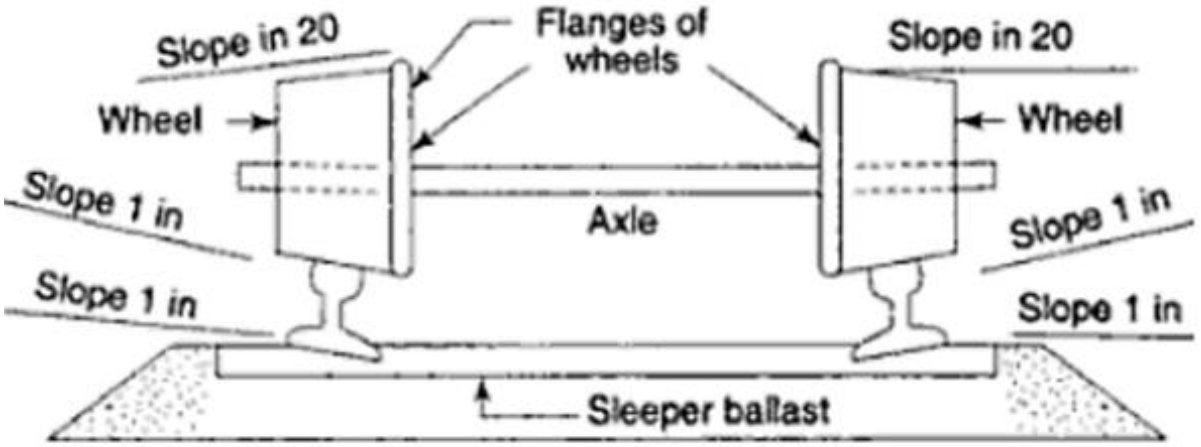
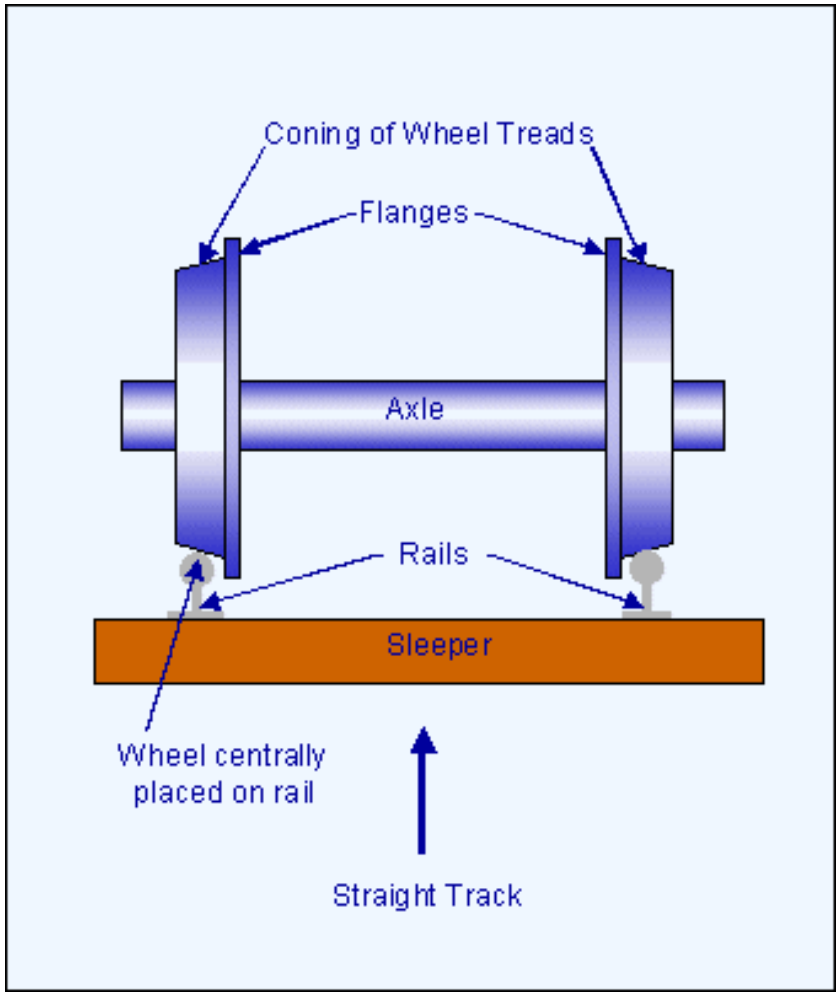
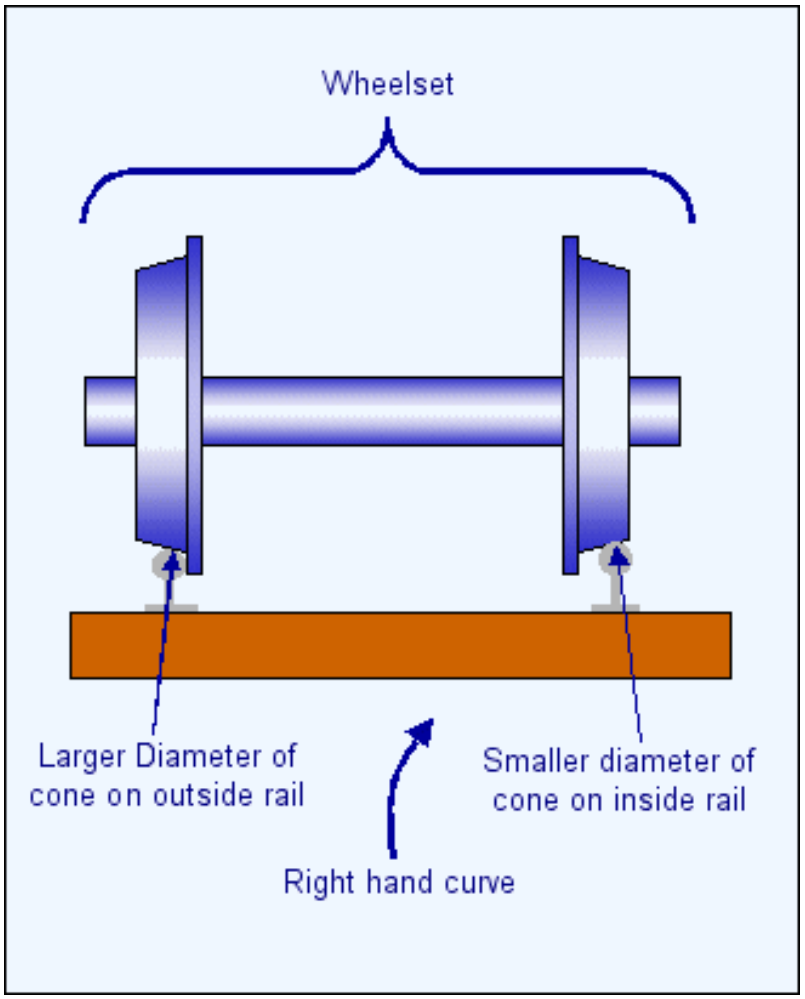


Figure: 2 Coning of Rails.

Source: Railway Track Engineering By Mundrey (Page Number: 14).

Coning of Wheels





Coning

- Advantages
  - Helps in negotiation of curves
    - Displacement/slip = $\frac{2\pi\theta}{360}G$

      θ= angle at center of curve in degree

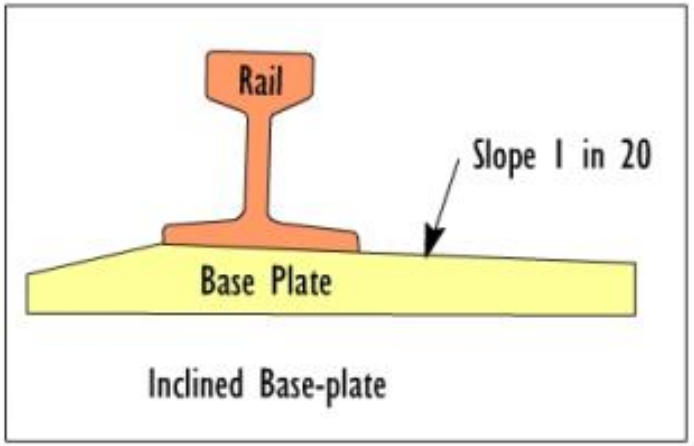
      G= gauge of rail
  - Provides a smoother ride
  - Reduces wear and tear
- Disadvantage
  - Causes stress concentration at contact point between wheel and rail

Tilting of Rail

Tilting of Rails

In order to minimize the above-mentioned disadvantages, tilting of rails is done, which means that the rails are not laid flat, but they are **tilted inwards.** The most common method adopted for tilting of rails is **to use inclined base-plates**.

The slope of the base-plate is 1 in 20 which is also the slope of the wheel-flange.



Causes of Rail Failure

- Inherent defects
- Defects due to fault of rolling stock and abnormal traffic
- Excessive corrosion
- Badly maintained joints
- Defects in welded joints
- Improper maintenance
- Derailments

Rail Flaw Detection

- Visual examination
  - Joint opened
  - Cleaned using kerosene
  - Examined with magnifying glass and white chalk
- Ultrasonic detectors

Sleepers

- Functions

Desirable Properties

Types of Sleepers