GEOMETRIC DESIGN

Horizontal Profile

- Circular Curves
- Super elevation
- Transition Curves
- Widening of Track

Vertical Profile

- Gradients
- Grade compensation
- Vertical curves
- Speed on track

DERAILMENT OF TRAIN DUE TO TRACK DEFECTS ON STRAIGHT TRACK

- Defective cross-levels
- Defective alignment
- Defective gauge
- Low joints

DERAILMENT OF TRAIN DUE TO TRACK DEFECTS ON CURVED TRACK

• Improper super elevation

• Improper radius of the curve

• Improper speed

• Unequal distribution of loads on two rails

DERAILMENT OF TRAIN DUE TO TRACK DEFECTS OVER TURN-OUTS & CROSSINGS

- Gaping points
- Lifting of toe of switch due to inadequate fittings
- Improper assembly of crossing
- Excessive wear in switches
- Tight gauge & defective check clearances at the nose of crossing.

GEOMETRIC DESIGN – NECESSITY

Smooth and safe running of trains

- Maximum speed
- Carrying heavy axle loads
- Avoid accidents and derailments

Less maintenance efforts Ø Good aesthetic value.

GRADIENT

Any departure of the track from the level is known as GRADE or GRADIENT.

Gradient is measured either by –

- The extent of rise/fall in 100 units horizontal distance or
- The horizontal distance travelled for a rise/fall in 1 unit

GRADIENT

Reasons for providing gradients on the tracks

- ❖ To provide a uniform rate of rise or fall as far as possible.
- ❖ To reach the various stations located at different elevations, and
- ❖ To reduce the cost of earth work.

GRADIENT

Various gradients used on tracks can be classified as: -

- Ruling Gradient Ø Momentum Gradient
- Pusher or Helper Gradient

Gradients at station yards.

RULING GRADIENT

Ruling Gradient on a section is defined as the gradient which determines the maximum load that the engine can haul on the section. or It is the maximum gradient allowed on the track section. The ruling gradient depends upon the additional power of the locomotive which shall be able to pull up its train load along the gradient.

RULING GRADIENT

The extra pull required = W x gradient

In plain terrain = 1 in 150 to 1 in 200

In hilly regions = 1 in 100 to 1 in 150

GRADE COMPENSATION ON CURVES

To avoid resistances beyond the allowable limits, the gradients are reduced on curves and this reduction in gradients is known as grade compensation for curves.

In India, compensation for curvature is given at 0.04% per degree of curve for B.G 0.03% per degree of curve for M.G 0.02% per degree of curve for N.G

PROBLEM: If the ruling gradient is 1 in 150 on a particular section of BG and at the same time a curve of 4 degree is situated on this ruling gradient, what should be the allowable ruling gradient?

Solution:

Grade compensation of B.G is 0.04% per degree of curve Compensation for 4°curve = 0.04 * 4 = 0.16%

Now, ruling gradient is 1 in 150 = 1 150 × 100 = 0.67%

So maximum allowable gradient or actual gradient to be provided = 0.67-0.16=0.51% or 0.51 100

i. e. 1 *in* 196.

Points and crossings

Points and crossings in railways are special track assemblies that allow a train to move from one track to another by creating gaps for wheel flanges to pass. A set of points (switches) and a crossing make up a turnout, which enables trains to divert for purposes like switching platforms or entering sidings.

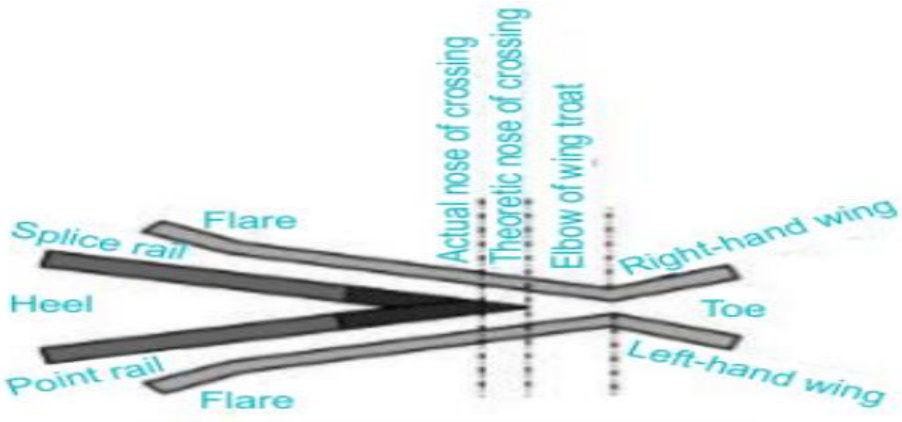

Fig 1: Crossing

Points and crossings are provided to facilitate the transfer of trains from one track to another. The tracks may go in the same direction, in different directions, or meet in the middle. Points and crossings are provided because the wheels of railway vehicles have inside flanges. Because of these flanges, they need a special arrangement for movement along the tracks. The "points" or "switches" help the diversion of the rail vehicles, and the "crossings" provide certain spaces in the rails to allow the rolling of flanged wheels over them.

A set of points and crossings and the lead rails together form a turnout.

Component Parts of Points and Crossings

1. **Switch Rails:** Movable rails guiding trains between tracks.
2. **Stock Rails:** Fixed mainline rails connecting to switch rails.
3. **Frog:** Diamond-shaped component at rail intersection.
4. **Check Rails:** Side rails guiding train wheels at crossings.
5. **Switch Drive Mechanism:** Operates points and moves switch rails.
6. **Switch Lever:** Controls switch rail position manually.
7. **Tie Plates and Fasteners:** Secure rails to sleepers (ties).
8. **Crossings and Crossing Nose**: Allow trains to cross tracks safely.

Necessity of Points and Crossings

- The wheels of rolling stock have flanges on the inside of the rails to prevent the lateral movement of the trains.
- When trains are diverted along different tracks, these flanges may cause hindrance. Due to this, points and crossings are necessitated to facilitate the transfer and uninterrupted movement of trains when moving from one track to another.
- Some of the major functions of Points and Crossings are:

1. They facilitate in receiving the trains that approach the railway station.
2. Facilitating shunting operations and marshalling of trains.
3. Connecting the dispatched train to the designated route.