

DI04006071: Railway, Harbour & Tunnel Engineering

Lecture 3.16: Function and necessity of Points and Crossing

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Civil Engineering

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Introduction to Points and Crossings I

Points and crossings are specialized arrangements in permanent way layout that enable trains to be diverted from one track to another. They are essential components of railway junctions and station yards. The points (or switches) guide the wheels, while crossings provide gaps for wheel flanges to cross intersecting rails.

Key Points

- Enable track changing
- Essential for junctions and yards
- Consist of points (switches) and crossings

Necessity of Points and Crossings I

Trains have flanged wheels, meaning they cannot change directions freely like road vehicles. A physical track manipulation is strictly necessary to guide the flanged wheels to an alternate route. Points and crossings fulfill this necessity by providing a continuous, guided path for trains diverging or converging on different tracks, avoiding derailment.

Key Points

- Rigid steering due to flanged wheels
- Divergence and convergence of traffic
- Allows overtaking and crossing of trains
- Essential for marshalling yards

Basic Components of a Turnout I

A complete set of points and crossings is known as a turnout. It primarily comprises three parts: a set of switches (points), a crossing assembly, and the lead rails which connect the switches to the crossing. Other components include switch ties, stretcher bars, gauge tie plates, and crossing check rails.

Key Points

- Switches (Points)
- Crossing assembly
- Lead rails connecting points to crossing
- Ancillary components: tie plates, check rails

Diagram of a Right-hand Turnout I

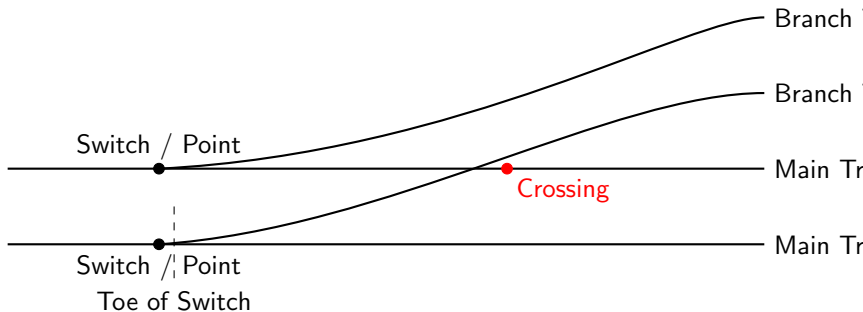


Diagram of a Right-hand Turnout II

Key Points

- Main Track
- Branch Track
- Switch/Points at the diverging point
- Crossing where rails intersect

Functions of Switches (Points) I

The switch, consisting of a pair of tongue rails and stock rails, is the movable part of the turnout. Its primary function is to laterally deflect the wheel flanges, guiding them from the main track onto the diverging track or vice versa. The tongue rails are machined to a fine edge at the toe and are moved simultaneously using a stretcher bar.

Key Points

- Deflect wheel flanges laterally
- Consists of stock rails and tongue rails
- Moved by mechanical or electrical means
- Determines the route of the train

Types of Switches I

Feature	Stub Switch	Split Switch	Operation
Moves entire main line rails to align with branch	Uses tapered tongue rails against fixed stock rails		
Safety	Unsafe at high speeds, requires square joints	Highly safe, standard for modern railways	
Application	Obsolete, historically used	Universally used in modern track layouts	
Rigidity	Lacks rigidity	Very rigid and stable	

Key Points

- Comparison of Stub and Split Switches
- Split switches are the modern standard
- Stub switches are obsolete due to safety concerns

Functions of Crossings I

A crossing or frog is an assembly situated at the intersection of two rails. Its function is to permit the wheel flange of a railway vehicle to cross the intersecting rail safely. Without a crossing, the flange would collide with the rail, causing derailment. It incorporates a gap and a nose to ensure a smooth transition.

Key Points

- Allows wheel flanges to cross intersecting rails
- Prevents derailment at intersections
- Consists of point rail, splice rail, and wing rails
- Check rails are used to guide the opposite wheel

Diagram of a Crossing I

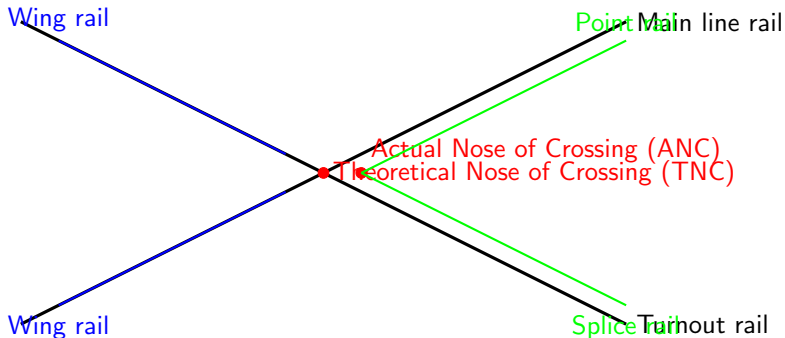


Diagram of a Crossing II

Key Points

- Nose of Crossing (Actual and Theoretical)
- Wing rails guide the wheels through the gap
- Point and splice rails form the nose

Types of Crossings I

Crossings are classified based on the angle of intersection and their structural arrangement. Based on the angle, there are Acute Angle Crossings (V-crossings), Obtuse Angle Crossings (Diamond crossings), and Square Crossings. Based on structure, they can be Built-up crossings, Cast steel crossings, or CMS (Cast Manganese Steel) crossings, which are highly durable.

Key Points

- Acute Angle (V-crossing) - standard turnout
- Obtuse Angle - used in diamond crossings
- Square Crossing - tracks crossing at 90 degrees
- CMS Crossings offer superior wear resistance

Safety Measures and Maintenance I

Points and crossings are the weakest links in track structure and experience severe impact loads. Proper maintenance is critical for safety. This includes regular inspection of wear on switches and crossings, checking track gauge, lubricating sliding surfaces, and ensuring the integrity of stretcher bars and locking mechanisms to prevent accidental switching under a moving train.

Key Points

- Regular inspection for wear and tear
- Lubrication of slide chairs
- Maintenance of exact gauge and cross-level
- Verification of locking mechanisms (facing point locks)

Summary I

In summary, points and crossings are indispensable components that overcome the rigid steering of trains by allowing route changes. Switches guide the direction, while crossings safely negotiate intersecting rails. Their proper design, installation, and meticulous maintenance are paramount for the safe and efficient operation of railway networks.

Key Points

- Points enable directional change
- Crossings allow intersecting routes
- Essential for network flexibility
- Require high maintenance for safety