Transportation Engineering II: Highway Design & Railways

Lecture 12

MAINTENANCE, STATION & YARDS

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Essentials of Maintenance

- Formation:
  - No difference in cross-levels except in curves
  - Uniform longitudinal levels
- Ballast is adequate and track drainage is good
- Sleepers are well packed and in place
- Rail
  - No excessive wear and tear
  - Fastenings are in place
  - Gauge correct within certain limits
  - Alignment is straight and kink free

Fastenings

- Purpose
  - To hold rails in proper positions
  - To join adjacent rails
  - To join rail with sleepers

Requirements of Ideal Fastening

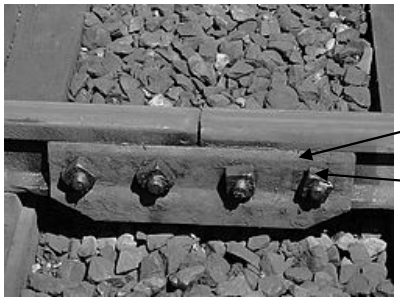
- Good shock and vibration resistance
- Capability to secure correct gauge
- Good electric insulation (for electrifies sections)
- Capability to resist creep
- Consist of a small number of components
  - Less maintenance cost
- Difficult to remove without special tools
  - Anti-theft

Types

Purpose	Examples
Joining Rail to Rail	Fish plates, Fish bolts
Joining Rail with Wooden Sleepers	Dog spikes, Screw spikes, Bearing Plates
Joining Rail with Concrete Sleepers	Jaws, Keys
Joining Rail with Wooden, Concrete, Steel Sleepers (for high speed rail)	Pandrol Clip, Elastic Rail Clip

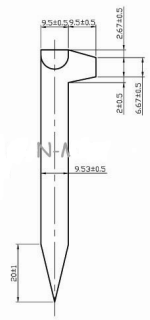
1. Fish plates

- Purpose: Join successive rails to constitute a continuous track and hold them together in horizontal and vertical planes



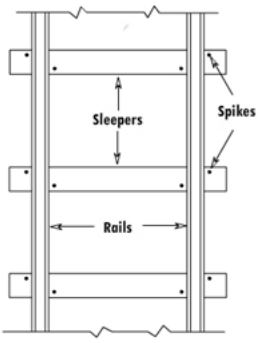
2a. Spikes

- Hold wooden sleepers with rails
  - Dog spike: Top end has shape of dog's head
  - Screw spike: Almost double holding power
- Often used with bearing plates



Arrangement of Spikes

- Staggered
  - To avoid splitting of wooden sleeper
  - Direction of staggering opposite for two rails
- Numbers
  - Straight: 2 (1 on each side)
  - Curve: 3 (2 outer, 1 inner)
  - Bridges: 4 (2 outer, 2 inner)



2b. Bearing Plates

- Advantages
  - Increase bearing area and ease of avoid stress concentrations
    - Prevents rail-cutting
    - Prevents soil-cutting (on curves)
  - Increases stability by group action of spikes
  - Reduces wear of spike
  - Reduces maintenance cost

3. Elastic Fastenings

- Required for high speed rails
- Requires least maintenance

Maintenance

- Manual method
  - Calendar system of maintenance
- Modern methods
  - Mechanical tamping
  - Measured shovel packing

Calendar System

- To be done cyclically throughout the year
- Typical steps
  - Through packing
  - Lubricating moving elements
  - Picking up slacks
  - Fixing loose fastenings
  - Systematic over-hauling

Modern Maintenance

Identifies flaws
+ Repairs

Yards

- System of tracks for receipt and dispatch of passenger and freight trains
- Types and functions
  - Coaching yard: Receipt and dispatch of passenger trains
    - Fueling, washing, recharging batteries, watering etc.
  - Marshalling yard: Receipt and dispatch of freight trains
    - Receiving freight trains, sorting wagons of different destinations, forming trains, dispatch trains
  - Locomotive yard: Stabling (parking) and regular maintenance
  - Sick yard: Repair 'sick' engines, wagons and coaches

Station

- Functions:
  - Passenger boarding alighting
  - Freight loading unloading
  - Enable faster trains to overtake slower trains in the same direction in single track lines
  - Refueling
  - Marshalling
  - Provide facilities for changing crew and staff
  - Provide passenger waiting facilities
  - Collecting food and water for passengers

Criteria for Site Selection

- Adequate land
- Level area with good drainage
- Straight alignment
- Ease of accessibility
- Availability of utilities

Types of Station

- Halt station
- Flag station
- Wayside/crossing station
- Junction station
- Terminal station

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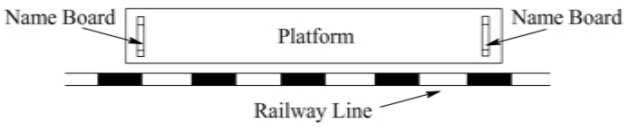
Halt Station

A halt is a **stopping place** on a railway line of the simplest kind. Halt has usually a rail level platform only with a name board at either end. A small waiting shed is also provided sometimes, which also serves as a booking office. There is **no yard or station building or staff** provided for such types of stations. Some selected trains are given stoppage of a minute or two at such stations to enable passengers to entrain or detrain.



Layout of Halt Station

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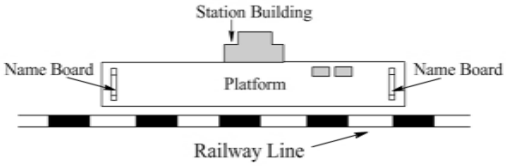
Flag Station

A flag station is a more important stopping place than a halt and **has station building and staff**. On controlled sections, a flag station has got either a Morse telegraph or a control phone connected to one of the stations on either side for easy communication. A flag station is usually provided with a small waiting hall and booking office, platforms with benches and with drinking water arrangements. Sometimes a **siding is also provided** for a flag station for stabling wagons booked for that station.



Layout of Flag Station

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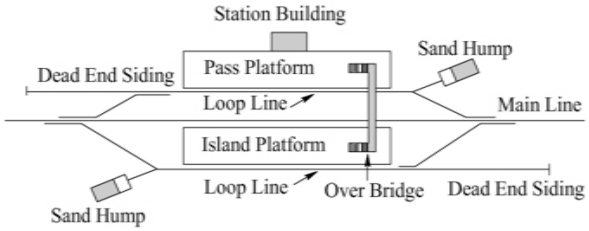
Way Side or Crossing Station

In case of crossing station, this forms a limit of block section and movement of trains is also controlled. The idea of a crossing station was initially conceived on a **single line** section for **crossing of trains** going in opposite direction so that movements of train may be accelerated.



Layout of Way Side or Crossing Station on Single Line Section

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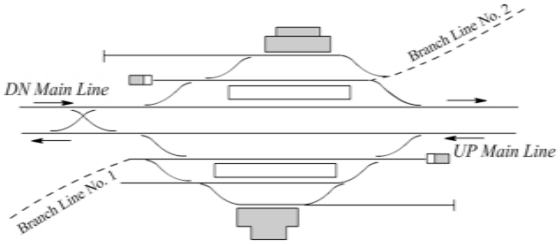
Junction Stations

At a junction station, **lines from three or more directions** meet. Normally at these junctions, trains from branch lines arrive and return to the same station or proceed to other stations from where they again return. A typical layout of a junction station with single main line and single branch line is shown in the following Figure.



Layout of Junction Station with Double Main Lines & Two Branch Lines

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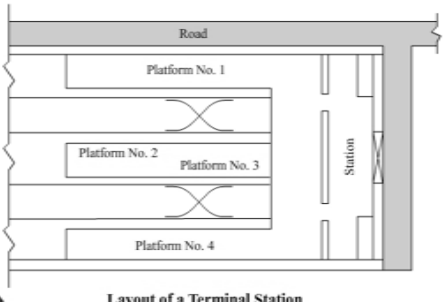
Terminal Station

The station at which a railway line or one of its branches terminates or ends is known as terminal station or terminal. In such a station, the reception line terminates in a **dead end** and there is a provision for the engine of an incoming train to **run round** and move from the front to the rear of a train.



Layout of a Terminal Station