



# CHAPTER 1

## Basic Terms of Railway Operation

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# **Unit 2 Basic Signal Arrangements**

- **Basic Type of Fixed Signals**
- **Block Signal**
- **Interlocking Signal**
- **Interlocking Signal Limits**
- **Station Limits**
- **Home Signal Limits**

## 2.1 Basic Type of Fixed Signals

- **Fixed signals indicate** if a movement may enter the section of track behind the signal.
  - ◆ On railways where **train movements** are strongly separated from **shunting movements**, there are also different kinds of signals for these kinds of movements.
  - ◆ On these railways **main signals** indicate if a train may enter a **track section**.
  - ◆ This is typical for almost all railways **outside of** North America.
  - ◆ In a **fixed block territory** with a signal-controlled operation, train movements are **authorized by signal indications**.
  - ◆ Except for lines with low speed, a signal that authorizes a train movement requires an **approach indication** at the **braking** distance in approach to the signal because the stopping distance is generally longer than the **range of vision**.

## 2.1 Basic Type of Fixed Signals

- The **approach indication** is necessary for a safe braking when approaching a **stop signal**.
  - ◆ In a territory where the distance between signals does not **exceed** the braking distance very much, the approach indication is usually provided by the signal **in rear**.
  - ◆ In a territory with very long distances between main signals, special **distant signals** are placed at the braking distance in approach indication for the signal ahead but it cannot show a **stop aspect**.
- **Shunt signals** are used to authorize shunting movements and to protect train routes against shunting movements.
  - ◆ In a territory where shunting movements may enter main tracks, a shunt aspect is also **integrated** in the main signals, so that shunting movements may be authorized to pass main signals in stop position.
  - ◆ For shunt signals an approach indication is not provided because shunting movements are **carried out** at a very low speed that allows to stop short of any vehicle or obstruction.

## 2.1 Basic Type of Fixed Signals

### ■ Note:

- ◆ On North American railways there is no differentiation between main and shunt signals because of different operating rules for shunting movements.
  - ◆ But at some places a signal may show a special aspect that is only used for shunting movements.
- A signal is usually **mounted** on a high **signal post** directly beside the track it **governs**.
- ◆ If there is not sufficient space between parallel tracks to place signal posts between them, the signal heads may also be mounted on **signal cantilevers** or **signal bridges**.
  - ◆ On some railways signals on show speed tracks may be constructed as **dwarf signal**.
  - ◆ Shunt signals are usually dwarf signals.

## 2.1 Basic Type of Fixed Signals

- Concerning the control principle, signals may be divided three classes:
  - ◆ Controlled signals.
    - A controlled signal is **locally** or **remotely** controlled by an operator.
  - ◆ Automatic signals.
    - The working of an automatic signal is automatically affected by the trains moving along the line.
  - ◆ Semi-automatic signals.
    - A semi-automatics signal is a controlled signal that can be switched into an automatic mode.

## 2.2 Block Signal

- ◆ In a territory with a fixed block system, main tracks are divided in **block sections** for the purpose of safe train separation. A train must generally not enter a block section until it has been **cleared** by the train ahead.
- ◆ In a territory with **lineside** signals, block sections are limited by signals which govern train movements. A signal which limits a block section is called a **block signal** (Fig.2.1).



Fig. 2. 1 Block signal

## 2.3 Interlocking Signal

### ■ Interlocking

- ◆ An **interlocking** is an arrangement of points and signals **interconnected** in a way that each movement follows the other in a proper and safe sequence.
- ◆ **Signaled routes** for trains on main tracks are usually interlocked.

### ■ Interlocking Signals

- ◆ The signals which govern train movements through an interlocking are called **interlocking signals**.
- ◆ An interlocking signal can also be a block signal.

### ■ Interlocking Machine

- ◆ The points and signals within interlocking limits are operated by an **interlocking machine**.
- ◆ In order installations, the interlocking machine is located in a **staffed interlocking tower** (in Britain called “signal box” or “signal cabin”).



## 2.3 Interlocking Signal

### ■ Note:

- ◆ Modern interlocking are usually remote controlled by a control center.
- ◆ The block signals between controlled interlocking are often called **intermediate block signals**. In Britain, this term is only used for a block signal that is controlled from the signal box in rear.

## 2.4 Interlocking Signal Limits (North American Practice)

- On North American railways the tracks between the **outer opposing** interlocking signals of an interlocking are called “**interlocking limits**”.
  - ◆ The **trackage** within interlocking limits is also called an “**interlocking plant**”.
  - ◆ At each track which leads into interlocking limits is placed a signal that may authorize train movements, even at tracks which are not used for regular train movements (this is an essential difference from European signaling). These signals are called **home signals**.
  - ◆ Thus, on North American railways the interlocking limits usually equal home signal limits.
  - ◆ Home signals which are not used for regular train movements are often dwarf signals.
  - ◆ Special shunt signals are not typical for North American railway.
  - ◆ Inside the interlocking limits there are usually no successive interlocking signals for the same direction, but there are some exceptions in large interlocking.
  - ◆ There may be different logical interlocking limits inside the control area of one interlocking tower.

## 2.5 Station Limits (British Practice)

- In older British interlocking systems there are designated “**Station limits**”.
  - ◆ Station limits are limited by the home signal and the last signal of the same direction controlled from the same signal box (British term for interlocking tower).
- The signal that governs train movements to leave the station limits into the following block section is called a **section signal** (formerly called a **Starter Signal**).
  - ◆ There are different station limits for each direction.
  - ◆ In most British **installations** this signal is placed behind the last points of the interlocking (then also called an advance signal or formerly an advanced starter signal), thus usually requiring additional interlocking signals before the points.

## 2.5 Station Limits (British Practice)

- The **track sections** between signals inside the station limits are not referred to as block sections.
  - ◆ In a track layout that is controlled by more than one signal box, each signal box has its own station limits.
  - ◆ Station limits are not **designated** in modern interlocking with a continuous track clear detection.

## 2.6 Home Signal Limits (German Practice)

- On German railways a track layout with at least one turnout where trains may begin, end, pass, overtake and turn is limited by opposing home signals (Fig.2.2).
  - ◆ In German these **home signal limits** are called a “Bahnhof” (there is no suitable English translation).
  - ◆ The main tracks outside the home signal limits are called the “**open line**”.



Fig. 2. 2 Home signal

## 2.6 Home Signal Limits (German Practice)

- ◆ The signals which govern train movements to leave the home signal limits to the open lines are called **exit signals**.
- ◆ Interlocking signals inside of home signal limits which are neither home nor exit signals are called **intermediate interlocking signals**.
- ◆ The track sections between interlocking signals inside the home signal limits are not referred to as block sections.
- ◆ The operator who is responsible for authorizing all train movements is called **train director**. The train director may work in a local interlocking tower or in a remote control center.

## 2.6 Home Signal Limits (German Practice)

- ◆ When the track layout inside the home signal limits is controlled by more than one interlocking tower there is usually one command tower where the train director works. The other towers are **dependent towers**. To clear a signal for a train movement in a dependent tower it has to be electrically unlocked by the command tower.
- ◆ Interlocking at junctions and crossovers outside the home signal limits belong to the open line. The signals at these junctions and crossovers are referred to as **blocks signals** but not as home signals, in difference to junctions and crossovers inside of home signal limits.
- ◆ An interlocking on the open line is called a **junction station** or **crossover station**.

# Homework

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