Hot Axle Box Detectors and Single Line Control

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Overview:

- **Part I**, Hot Axle Box Detectors: The hunt for faulty bearings.
- **Part II**, Single Line Control: How to deal with a single bi-directional piece of track.
Part I: Hot Axle Box Detectors
Why are Hot Axles a Problem?

Prior to the 1960s trains carried relatively light loads, travelled at lower speeds.

The axle system at this time was such that it required constant maintenance and inspection.

Better lubricants and axle materials reduced the need for maintenance and inspection.

- **Problem:** How do we know whether an axle or bearing is faulty?
- **Solution:** Check the axle temperature.
How Do We Detect Them?

The *Hot Axle Box Detector (HABD)* system comprises of several pieces of trackside equipment

- Scanners
- Transducers
- Processors

The combined system logs if an axle is running hot and raises an alarm.
Bearing Detection

Infrared scanners are used to check the temperature of passing axles.

Different types of rolling stock have to be scanned from different positions

**Outside look**  Scanner is positioned to scan the bearing housing.

**Inside look**  Scans the axle journal between the bearing housing and the wheel disc.

**Vertical look**  Scans the underside of the bearing.
Originally outside look was used to scan the rear of the bearing housing.

To allow for many wheel sizes the vertical look is now used.

There are two types of bearing used on the railway, these are *plain bearings* and *roller bearings*.

These both have their own thermal ”finger print”.
Transducers

*Transducers* are used to detect trains approaching the system. They also turn the heat sensors on and off. They consist of a magnet and coil. The positioning of the transducers is critical as they ensure only the bearings are detected.
Processors are housed transide in the *Directional Data Control Unit*.

**Input**: Scanners, Transducers

**Output**: Scanners, Interlocking and Control System

No matter the train the bearings on one axle are always the same. The DDCU raises an alarm if there is a temperature difference.
Directional Data Control Unit

L.H. HEAT SENSOR (SCANNER) → PULSE PROCESSOR

X1
A
B
C
D
X2

DIRECTONAL DATA CONTROL UNIT

ALARM MONITORS → TRANSMITTER (MODEM)

R.H. HEAT SENSOR (SCANNER) → PULSE PROCESSOR
Readout System

Diagram showing the Readout System with components such as Receiver (MODEM), COUNTER/ALARM UNIT, Printer, and Alarms.
Choosing the right site for a HABD is based on the following requirements:

- The HABD should be positioned near a siding or yard
- There should be road access
- Awkward and Dangerous siting must be avoided, e.g. tunnels
- Must respect signalling
- Trains should not stop while moving over a HABD
- Trains should be operating for 30 minutes before reaching
Part II: Single Line Control
The Single Line Problem

It is common especially in remote areas to have a long single line of track with trains moving in both directions.

This presents some problems:

- How do we tell whether the track is occupied?
- What direction are the trains currently travelling on the track?
- When is it safe for a train to proceed down the track?

There are a variety of methods to solve this. We will now discuss a few of them.
Electric Token System

*Tokens* are special physical or in this case electric keys uniquely configured for a given line.

*Token instruments* are located in the signal box are at the end of each line.

Once a token is taken out of one instruments the system locks preventing any further tokens being released.

The train is then allowed to proceed along the track. When the token is replace in an instrument further tokens can be released.
Track Circuit Block System

Makes use of a *direction lever* to indicate which direction the track is operating in.

Track circuits and axle counters are used to detect trains.

The Interlocking provides safety.
Radio Electronic Block System

Allows for a track which contains loops or sidings.

Tokens are provided by an electronic system for a section of track.

Trains can exchange tokens for track sections electronically via radio.
This talk covered two topics.

**Hot Axle Box Detectors:**
- Basic equipment: scanners, transducers, processors
- Directional data control unit and readouts
- Siting requirements

**Single Line Control:**
- The problem of controlling a single line
- Electric token system
- Track circuit block system
- Radio electronic block system