RAILWAY OPERATION

Presentation by
Ranjan K. Jain

SYSTEMS OF WORKING

- Ensure safety in working of trains, wagons/vehicles
- Ensure adequate “space interval” between trains and trains and trains and vehicles/wagons etc. to prevent accidents such as collisions.

SYSTEMS OF WORKING

- Absolute Block System
- Automatic Block System
- Following Train System
- Pilot Guard System
- Train Staff And Ticket System
- One Train Only System

Absolute Block System

- Essentials of Absolute Block System are
  - No train shall be allowed to leave a block station unless “line clear” has been received from the Block Station in advance, and
  - On double line such “line clear” shall not be given unless the line is clear not only up to the first stop signal at the block station where such line clear is given but also an adequate distance beyond it.

Absolute Block System

- On single lines such line clear shall not be given unless the line is clear of trains running in the same direction, not only up to the first stop signal at the block station at which such line clear is given but also an adequate distance beyond it and is clear of trains running in the direction towards the block station to which such line clear is given.

Absolute Block System

- Unless otherwise directed by approved special instructions, the adequate distance referred to shall not be less than
  - 400 m in case of two aspect lower quadrant signalling and
  - 180 m in case of multiple aspect signalling
- **Block Overlap** Adequate distance referred to above is also called as “block overlap”. It is a safety margin to prevent collision in case of error of judgment on the part of the driver.

Condition for Granting Permission to Approach

- The preceding train has arrived complete ansd if it is still at the station is standing clear of the fouling mark
- The reception signals taken “OFF” for the preceding train have been put back to the “ON” position
- The line is clear not only upto the first stop signal but for an adequate distance beyond it.

Condition to be satisfied for reception of a train

- All the facing points concerned are correctly set locked for the reception of the train
- All the trailing point concerned are correctly set
- Reception line on which it is intended to receive the train is clear up to an adequate distance beyond the starter signal on the reception line.

Condition to be satisfied for reception of a train

- The adequate distance referred to above should not be less than 180 m in two aspect lower quadrant signalling and 120 m in cases of multiple aspect signalling. This distance is also generally known as “**signal overlap**”.

Types of signals

- Flare signal
- Detonating signal
- Hand signal
- **Fixed Signal**
  - **Semaphore signal**
  - **Colour light signal**
  - **Disc Signal**

Functional Signals

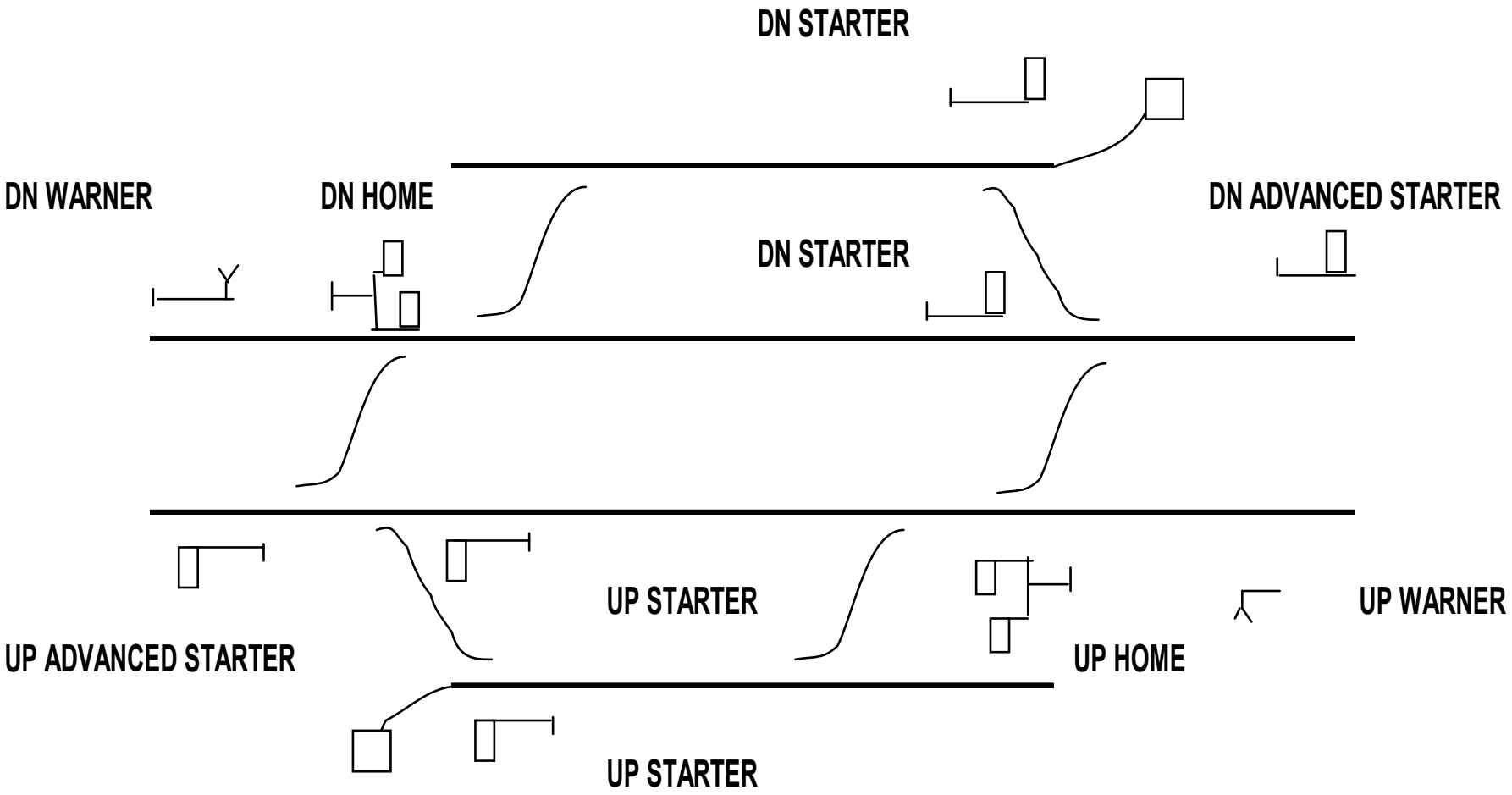
- Reception Signals
  - Outer Signal
  - Home Signal
  - Routing Signal
  - Calling-On Signal
  - Co-acting Signal
  - Repeater Signal

Departure Signals

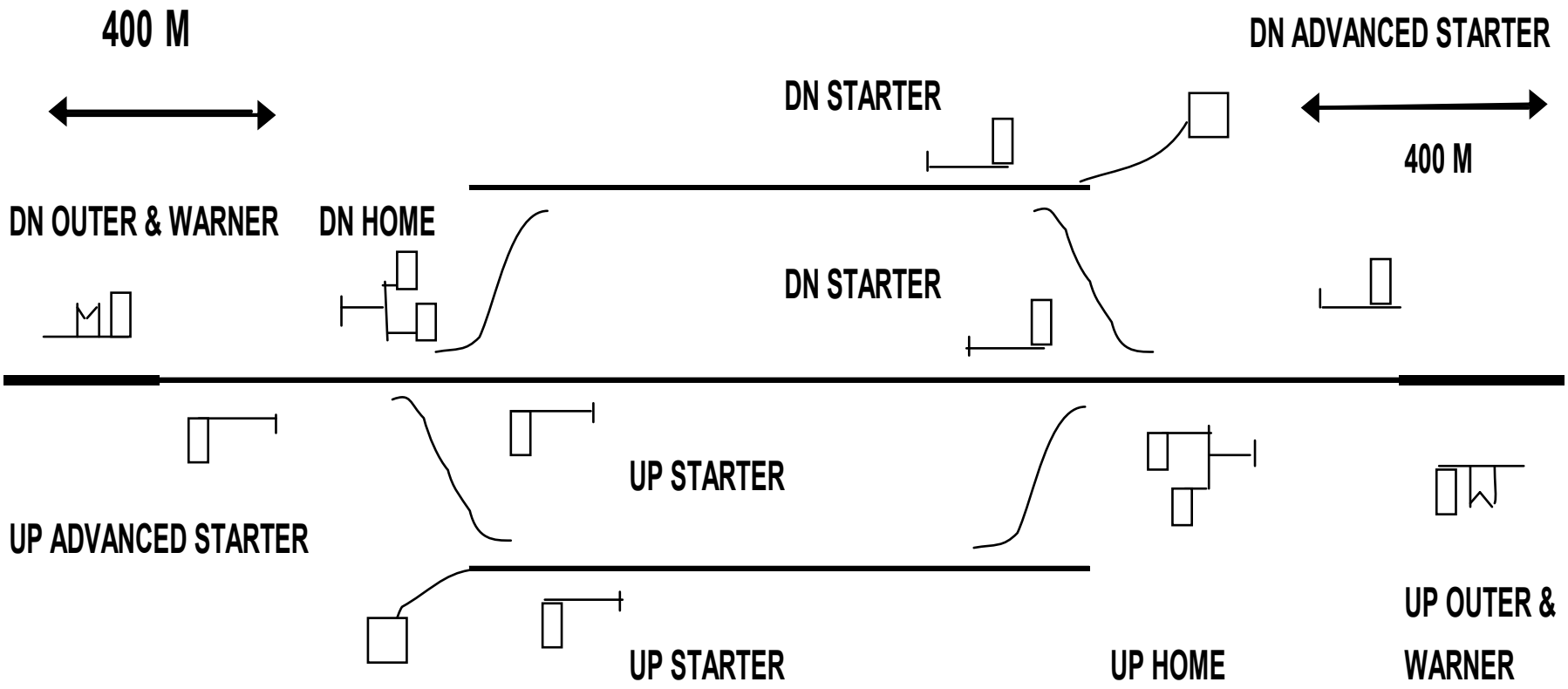
- Starter Signal
- Advance Starter Signal/ Last Stop Signal

Classification of Stations

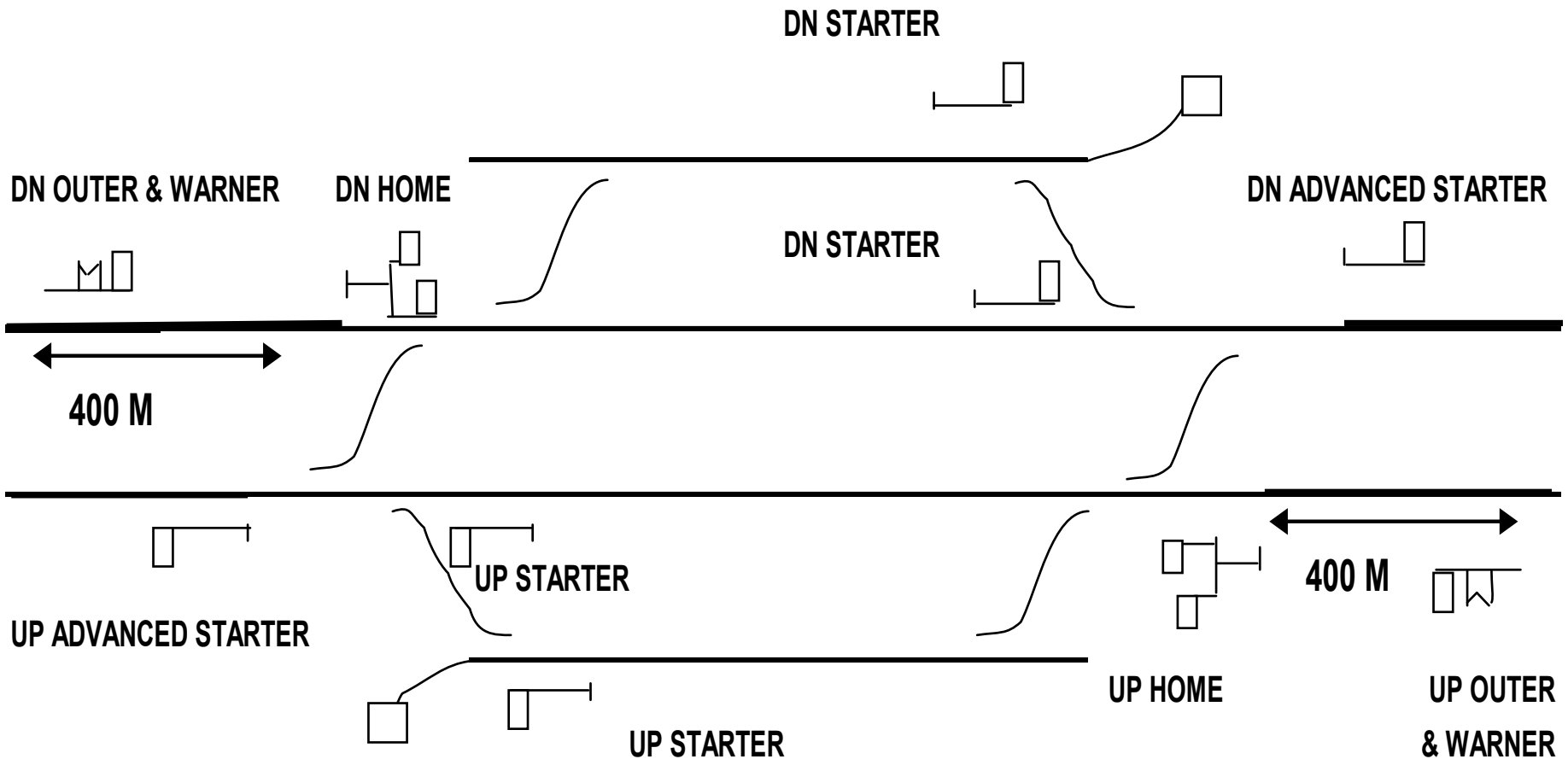
- **‘A’ class** At such station ‘line clear’ for train cannot be granted to the station in rear unless the line on which it is proposed to receive the train is clear upto the starter signal and all the facing points are correctly set and locked
- **‘B’ class** At such station line clear can be granted for a train to approach from the station in rear even if the station section is not clear. Hence shunting can be carried on within the station section even after granting line clear to the section in rear.



DOUBLE LINE " A " CLASS

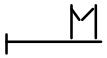


SINGLE LINE " B " CLASS

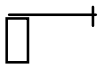


DOUBLE LINE " B " CLASS STATION

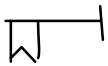
DN WARNER



DN HOME



UP HOME



UP WARNER

DOUBLE LINE " C " CLASS STATION

Classification of Stations

- **C Class** is provided on double line. No loop lines are provided and no trains are booked to stop at such stations. The purpose is to increase the line capacity.

Automatic Block System

- The line is provided with continuous track circuiting or axle counters.
- The line between two adjacent block sections may be divided into a series of automatic signalling sections each of which is the portion of running line between two consequent stop signallings and the entry into which is governed by a stop signal.

Automatic Block System

- The track circuits or axle counters shall so control the stop signal governing the entry into the automatic lock signaling section that:
  - The signal shall not assume an ‘OFF’ aspect unless the line is clear not only upto first stop signal in advance but also for an adequate distance beyond it,
  - The signal is automatically placed to ‘ON’ position as soon as it is passed by the train
- The adequate distance shall not be less than 120 m

Time Tabling

- Requirement of passengers
  - Suburban passengers
  - Medium distance passengers
  - Long distance passengers
  - Other requirements
- Service Requirements
  - Booked Speed
  - Maximum Speed
  - Time allowances for crossing & precedences

Time Tabling

- Platform facilities
- Engineering Allowances
- Time required for shunting
- Time required for fuelling of locomotives
- Time required for watering/cleaning
- Meal halt
- Loading/unloading of parcels
- Traffic recovery time

Freight Trains

- Departmental trains
- Shunting Trains
- Pilots
- Through Goods trains
  - Block trains
  - Point load
  - Unit trains
  - Freightliners
  - speed link

Other methods

- Charting Method
- Computer Simulation
- Measure to increase capacity
  - Reducing T
  - Reducing t
  - Increasing E

Line Capacity

- The number of trains which can be run on a given section in 24 hours
- Scott's Formula
  - C=1440*E/(T+t)
  - C= Section Capacity
  - T= Time taken in minutes by the slowest train to cover the 'critical block section'
  - t= Block operation time
  - E= Efficiency Factor

Throughput

- Throughput per of a given section is defined as the total quantum of traffic that can be carried on the section in 24 hrs
- It can be measured in terms of
  - Number of wagons
  - GTKM
  - NTKM

Increasing Throughput

- Running more no of trains
- Increasing load per train
  - Using more powerful loco
  - Using high capacity wagons
  - Strengthening track
  - Increasing loop capacity

Operating Statistics

- Wagon turnround
- Wagon Km/ Wagon day
- NTKM/ Wagon Day
- Loco Utilisation
- Track Utilisation
- Operating Ratio

Modern Trends

- High Speed Freight Train
- Multimodal Container Train
- High speed intercity Shatabdi train
- Rajdhani train
- Jan Shatabdi Train
- EMU Train
- Private Parcel Train

THANK YOU