

Transportation Management

Lesson 1

Introduction & Systems of Working

1.1 Introduction

- 1.101 Economic and industrial progress of a country depends to a great extent on the efficiency of the transportation sector. So far as our country is concerned most of the passenger and goods traffic is carried by rail and road. Other modes of transportation such as airways, waterways and coastal shipping carry a very small percentage of total traffic.

Importance of Railways

- 1.102 Railways in our country should play a more important role in the surface transport sector because they have the following advantages:
- (a) Railways are about six times more fuel efficient than roadways.
 - (b) Railways carry substantial quantum of traffic by electric traction, thereby saving precious oil resource.
 - (c) Railways make better land use.
 - (d) Railways cause less pollution.
- 1.103 The importance of proper development and efficient management of the Indian Railways to meet the future demands of traffic adequately and efficiently cannot, therefore, be overemphasized.

Role and Objectives of the Transportation Department

- 1.104 The role of the Transportation Department is to provide transportation efficiently by making best utilization of resources such as locomotives, coaches, wagons, track, signaling and communication equipments, fuel, electricity and staff.
- 1.105 Objectives of the Transportation Departments are:
- (i) Providing good quality of service to rail users and,
 - (ii) Ensuring high productivity of resources made available to it as stated earlier.

Important objectives in respect of passenger and freight traffic could be summarized as follows:

Passenger Operation:

- (a) Proper Time Tabling of passenger carrying trains.
- (b) Ensuring punctuality of trains.

- (c) Providing adequate number of passenger trains and accommodation as per requirement of traffic.
- (d) Optimizing utilization of coaching stock and locomotives.
- (e) Ensuring safety of passengers.

Goods Operation

- (a) Prompt and regular supply of wagons as required by trade and industry and maximizing loading.
- (b) Quick and assured transit of goods.
- (c) Optimizing utilization wagons and locomotives.
- (d) Safe transit of goods.

Organisation of the Transportation Department

- 1.106 Member, Traffic, in the Railway Board, is the head of Transportation and Commercial Departments of the Indian Railways. He is assisted by Additional Members, Executive Directors and other junior officers in the Board. He deals with policy matters and overall coordination and control of operation on the Zonal Railways.
- 1.107 Chief Operating Manager (COM) is the head of the Transportation Department at the zonal level. He is assisted by Chief Freight Traffic Managers (CFTMs), Chief passenger Traffic Manager (CPTM), Chief Traffic planning Manager (CTPM), Chief Motive Power Engineer, Running & Loco (CMPE\R&L). Chief Safety Officer (CSO) reports directly to the General Manager.
- 1.108 At Divisional level Senior Divisional Operating Manager (Sr DOM) is the head of Transportation Department. He is assisted by DOM/AOMs, Control Organisation, and Movement Inspectors. Safety aspect is coordinated by the SrDSO who is assisted by DSO, Safety Counsellors. Safety aspect of traffic department are looked after by DOM/G and Transportation Inspectors reporting to Sr DOM.. The Field Organisation includes Station Masters/Assistant Station Masters, Cabin ASMs, Switchmen, Leverman, Pointsmen etc. at stations and Area Managers, Chief Yard Masters/Yard masters, Asst. Yard Masters, shunting Masters, pointsmen, Skid porters, Box Boys, Badge Boys etc. in yards. Running staff of Transportation Department include Guards and Brakesmen.

1.2 Commission of Railways Safety

- 1.201 The Central Government have set up a Commission of Railway Safety, which as per section 6 of the Indian Railways Act 1989, carries out inspections of railway lines to determine whether they are fit to be opened for public carriage of passengers, of stations and rolling stock from safety point to view and also enquires into serious accidents when ordered by the Central Government as per provisions of the Indian Railways Act.

Ensuring Safety in Movements by Rail

1.202 Movement by railroads is different from by road, in that the passenger and goods trains as well as vehicles/wagons move on fixed railway tracks and their braking distances are mostly much more than the actual sighting distances. In view of this the railways have prescribed 'General and Subsidiary Rules' to ensure safety in railway working under the provisions of section 60 of the Indian Railway Act, 1989. While General Rules are applicable to the entire Indian Railways, Subsidiary Rules cater to the requirements of specific Railway/Railways, keeping in view any special conditions obtaining there. Subsidiary Rules on a Zonal Railway can be issued with the approval of the Commission of Railway Safety by the chief Safety Officer, who is designated as the 'Authorised Officer' under General and Subsidiary Rules.

Systems of Working

1.203 Systems of working have been prescribed in the 'General Rules' for ensuring safety in working for trains and vehicles/wagons. These systems ensure adequate "space interval" between trains and trains, and trains and vehicles/wagons etc. to prevent accidents such as collisions etc. Various systems of working prescribed in the General Rules are:-

- (i) Absolute Block System.
- (ii) Automatic Block System.
- (iii) Following Trains System.
- (iv) Pilot Guard System.
- (v) Train Staff and Ticket System.
- (vi) One Train Only System.

1.204 The system mostly followed is the 'Absolute Block System'. On very heavy density routes and suburban sections Automatic Block System is generally used. Other systems are followed on certain specified sections under Approved Special Instructions. 'Absolute Block System' and 'Automatic Block System' are described briefly later in this lesson.

Signals

1.205 Signalling systems have been provided to control movement of trains and shunting movements. Details of signaling and Inter-locking have been given in the Lesson Plan on this subject. However, some salient information is given here briefly.

Types of Signals

1.206 Following types of signals are used:-

- (i) Flare Signals.

- (ii) Detonating Signals.
 - (iii) Hand Signals.
 - (iv) Fixed Signals.
- 1.207 A 'Flare Signal' emits a bright red flame and is used in emergency to warn a driver of an approaching train of an obstruction.
- 1.208 Detonators when fixed on track explode with a loud report and warn the driver of train that there is some obstruction ahead or in case of thick and foggy weather, he is approaching a stop signal. These signals are also, therefore, known as fog signals.
- 1.209 Hand Signals are shown during day by using hands or red, green or white flags and during night red, green or white light.

Fixed Signals

- 1.210 Fixed signals include:-
- (a) Semaphore Signals.
 - (b) Colour Light Signals.
 - (c) Disc Signals.

Functional Nomenclature of Signals

- 1.211 The signals have also been designated according to their locations and functions as described below:-

Reception Signals

- 1.212 (i) **Outer Signal-** Where provide, it is the first stop signal of a station.
- (ii) **Home Signal-** It is the first stop signal at a station where outer signal has not been provide and second stop signal where outer signal has been provide.
- (iii) **Routing Signal-** It is used to indicate to a driver which of the two or more diverging routes is set for him.
- (iv) **Calling-on Signal-** This is provided below a stop signal and when taken 'OFF', calls on the driver to draw ahead with caution and be prepared to stop short of any obstruction.
- (v) **Co-acting Signal-** It is a duplicate signal fixed below an ordinary fixed signal when due to certain obstacle, the arm or light of the main signal is not in view of the Driver during the whole time when he is approaching it.
- (vi) **Repeater Signal-** A signal placed in the rear of a fixed signal for the purpose of repeating to the Driver of an approaching train, the aspects of a fixed signal in advance is called a Repeating signal.

Departure Signals

1.213 Departure signals are designated as-

- (i) Starter Signal.
- (ii) Advanced Starter Signal.

The last departure signal is known as the 'Last Stop Signal'. Where an Advanced Starter is provided, it is the 'Last Stop Signal'. Where there are no Advanced Starters, the starting signals are the 'Last Stop Signals'.

A Few Important Definitions

1.214 To understand the systems of Working, it is desirable to know the following terminologies.

(i) Authority to Proceed is an authority given to the driver of a train to enter a 'Block Section with his train.

On double line sections and on single line sections provided with tokenless working, taking 'off' of the last stop signal is the Authority to Proceed. On single line sections where tokenless working is not provided, a 'token' or a 'paper line clear ticket' is the Authority to Proceed. In special circumstances, there are other types of authorities provided under rules, such as 'Authority to Proceed without Line Clear'.

(ii) Block Station is a station at which the driver must obtain an 'Authority to Proceed' under the system of working to enter the Block Section with his train.

(iii) Block Section is that portion of running line between two block stations on to which no running train may enter unless line clear has been received from the Block Station at the other end of the Block Section.

Block Instruments

1.215 Block Stations are provided with Block Instruments which facilitate communication between adjacent Block Stations and Control on trains running.

These instruments have handles, which have normally the following three positions:-

On Single Line

- (i) Line Closed.
- (ii) Train Coming From.
- (iii) Train Going To.

On Double Line

- (i) Line Closed.
- (ii) Line Clear.
- (iii) Train on Line.

1.216 These instruments are used by the Station Masters at Block Stations to obtain 'line clear' from the station in advance, advise the station in advance that the train for which 'line clear' was obtained has started and entered the Block Section, and to close back the Block Section to normal after the train has arrived complete at the Block Station ahead. On single line sections where token working in force, a token comes out from the

Block Instrument only after line clear has been obtained from the station ahead. On Double line sections and single line sections with tokenless working, it is ensured by electrical interlocking that the 'Last Stop Signal' can be taken 'OFF' only after line clear has been obtained on the Block Instrument.

Absolute Block System

1.217 Essentials of 'Absolute Block System' as laid down in the 'General Rules' are reproduced below:-

1. Where trains are worked on the Absolute Block System-
 - (a) No train shall be allowed to leave a block station unless 'line clear' has been received from the Block Station in advance, and
 - (b) On double lines such 'line clear' shall not be given unless the line is clear not only upto the first stop signal at the block station where such line clear is given but also for an adequate distance beyond it;
 - (c) On single lines such line clear shall not be given unless the line is clear of trains running in the same direction, not only upto the first stop signal at the block station at which such line clear is given, but also for 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.
2. Unless otherwise directed by Approved Special Instructions, the adequate distance referred to above shall not be less than
 - (a) 400 metres in case of two-aspect lower quadrant signalling and,
 - (b) 180 metres in case of multiple-aspect signalling.

Block Overlap

1.218 Adequate distance referred to in 2 above is also often called as 'Block Overlap'. It is a safety margin to prevent collisions in case due to error of judgment the driver of a train overshoots the first stop signal in 'ON' position or a shunting move overshoots the 'Station Section'.

Conditions for Granting Permission to Approach (i.e. Line Clear)

1.219 The Station Master of a Block Station should personally ensure that the following conditions are satisfied before he grants line clear (on the Block Instrument) to the station in rear:-

- (i) The preceding train has arrived complete and (if it is still at the station) is standing clear of the fouling mark.
- (ii) The reception signals taken 'OFF' for the preceding train has been put back to the 'ON' position.

- (iii) The line is clear not only upto the First Stop Signal but for adequate distance beyond it. (see para 1.217).

Conditions to be satisfied for Reception of a Train

- 1.220. The Station Master of a Block Station should personally ensure that the following conditions are satisfied before he authorises taking ‘OFF’ of the reception signals for receiving a train at his station.
 - (i) All the facing points concerned are correctly set and locked for the reception of the train.
 - (ii) All the trailing points concerned are correctly set.
 - (iii) Reception line on which it is intended to receive the train is clear upto an adequate distance beyond the Starter signal (of the same direction) on the reception line, or beyond the trailing points if no Starter signal is provided.
- 1.221 The adequate distance referred to above should not be less than 180 metres in Two Aspect Lower Quadrant signaling and 120 metres in cases of Multiple Aspect signaling. This distance is also generally known as ‘signal Overlap’.

Classification of Stations

- 1.222 As per General Rules, all stations are classified in two categories:-
 - (a) Non-Block Stations:- These are stopping places which are situated between tow consecutive block stations and do not form the boundary of any block section.
 - (b) Block Stations:- At these stations the Driver must obtain an Authority to proceed under the System of Working to enter the Block Section with his train.
- 1.223 Block Stations have been classified in three categories viz. ‘A’, ‘B’ and ‘C’. These area described below in brief:

‘A’ Class Block Stations

- 1.224 Such stations are provided generally on Double Line Sections :- Minimum equipment of fixed signals at such an station will be Warner (or Distant), Home and Starter Signals in either direction. Provision of Advanced Starter Signals is optional.
- 1.225 Typical layout of such a station is given below:-
- 1.226 At such station ‘Line Clear’ for a train cannot be granted to the station in rear unless the line on which it is proposed to receive the train is clear

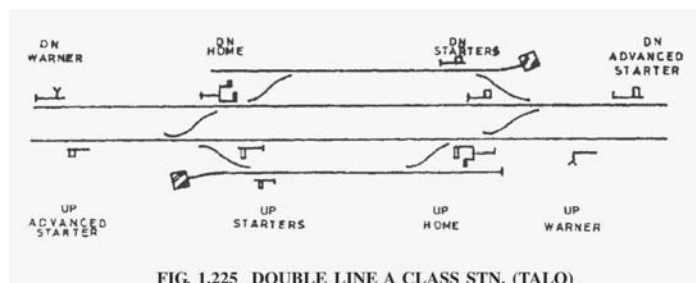


FIG. 1.225 DOUBLE LINE A CLASS STN. (TALQ)

upto the starter signal and all the facing points are correctly set and locked.

1.227 Advantages of 'A' class station:-

- (i) It is economical.
- (ii) It ensures faster movement of trains as the First Stop Signal (Home) is pre-warned.
- (iii) A train is not required to stop outside station limits i.e. far away from the station centre.

1.228 Disadvantages of 'A' Class Station:-

- (i) Line clear cannot be given unless a line is clear for the reception of the train.
- (ii) Once line clear is given, no shunting can be done.

'B' Class Stations

1.229 The Minimum equipment of fixed signals at such stations includes Outer and Home signals on single line sections and Outer, Home and Starter signals on Double Line sections. Such a station has 'Station Section' which is that portion of running lines within which shunting can be performed even after granting 'Line Clear' to the station in rear (provided the Reception signals are kept in the 'ON' position).

1.230 The typical layouts of 'B' class stations on Single line and double line sections are given below:-

Note : Thick line indicate BLOCK SECTION and thin lines S T A T I O N SECTION.

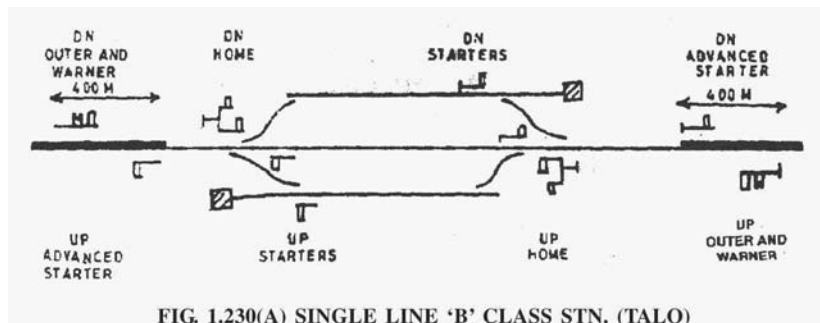


FIG. 1.230(A) SINGLE LINE 'B' CLASS STN. (TALQ)

1.231 At a 'B' class 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 station in rear.

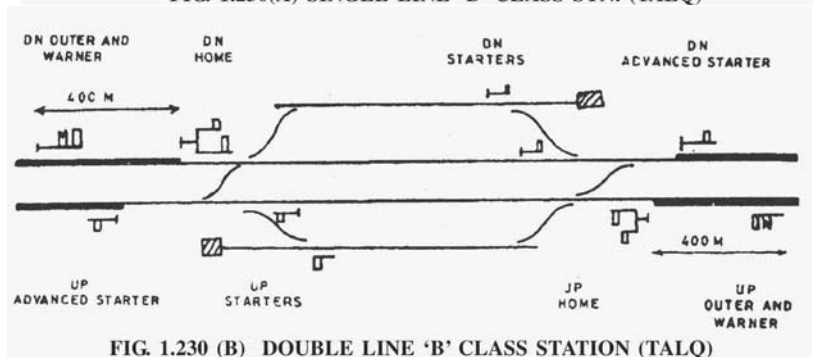


FIG. 1.230 (B) DOUBLE LINE 'B' CLASS STATION (TALQ)

1.232 Advantages of a 'B' class station

- (i) A reception line need not be kept clear while granting line clear to the station in rear.
- (ii) Shunting within Station Section can be carried on even after granting line clear to the station in rear.

1.233 Disadvantages of a 'B' class station

- (i) It is costlier than 'A' class station.
- (ii) In two Aspect Lower Quadrant (TALQ) signalling the Driver has to approach the first stop signal (i.e. Outer) without any prewarning.
- (iii) In case a reception line is not clear to receive a train, the train has to stop short of Outer Signal which is at a considerable distance from the centre of the station.

'C' Class Block Stations

1.234 'C' class stations are usually provided on Double line sections. The minimum equipment of signals is Warner (or Distant) and Home in either direction. No loop lines are provided and no trains are booked to stop at such stations. The purpose of such stations is to increase line capacity and to permit running of more number of trains.

1.235 The typical layout of a 'C' class station is given below:

1.236 Advantages of a 'C' class Station

- (i) It is cheap.
- (ii) It helps in faster movement of trains.
- (iii) It increases line capacity.

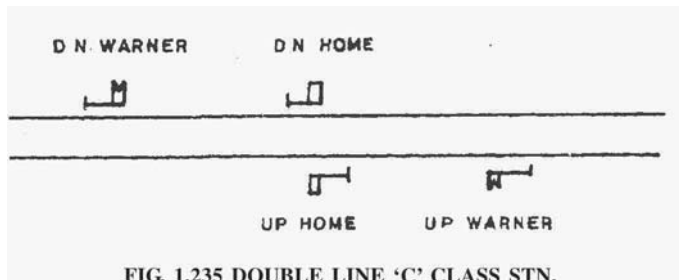


FIG. 1.235 DOUBLE LINE 'C' CLASS STN.

1.237 Disadvantages of a 'C' class Station

- (i) No shunting can be performed.
- (ii) Trains are not booked to stop.

The Automatic Block System

1.238 The Automatic Block System is followed mostly on suburban sections and very heavy density routes where a large number of trains have to follow in quick succession.

1.239 Following are the essentials of the Automatic Block System on double line sections:

- (a) The line is provided with continuous track circuiting or axle counters.
- (b) The line between two adjacent block sections may be divided into a series of automatic block signaling sections each of which is the portion of the running line

between two consequent stop signals and the entry into each of which is governed by a stop signal.

- (c) The track circuits or axle counters shall so control the stop signal governing the entry into the automatic lock signaling section that-
 - (i) the signal shall not assume an 'OFF' aspect unless the line is clear not only upto the next stop signal in advance but also for an adequate distance beyond it, and
 - (ii) the signal is automatically placed to 'ON' position as soon as it is passed by the train.

1.240 Unless otherwise directed by approved special instructions the adequate distance referred to above shall not be less than 120 metres.

Automatic Signals:

1.241 As indicated above in the essentials of automatic Block System, the aspects of an Automatic Stop Signal are controlled by the movement of trains over the block signaling sections ahead.

Kinds of Fixed Stop Signals in Automatic Block Territories:

1.242 Stop signals in Automatic Block territory are colour light signals and may be of the following types:-

- (a) An Automatic Stop Signal which is not dependent upon manual operation but is controlled automatically by the passage of a train into, through, and out of the automatic block signalling section.
- (b) A Semi-Automatic Signal which is capable of being operated either as an Automatic Stop Signal or as a Manual Stop Signal, as required;
 - (i) When a Semi-Automatic Stop signal works as an Automatic Stop Signal, it assumes 'on' and 'off' aspects automatically according to the condition of the automatic block signaling sections ahead;
 - (ii) When a Semi-Automatic Stop signal works as a Manual Stop Signal, it assumes 'on' aspect automatically on the occupation of the automatic block signalling section ahead, but assumes 'off' aspect when operated manually, provided the relevant automatic block signalling sections ahead are clear;
 - (iii) When a Semi-Automatic Stop Signal works as an Automatic Stop signal; the 'A' marker provide under the signals is illuminated. When the 'A' marker is extinguished, the signal shall be deemed to work as a manual Stop signal; and
- (c) A Manual Stop signal operated manually and which cannot work as an Automatic or a Semi-Automatic Stop Signal.

1.243 Duties of Driver and Guard when Automatic Stop Signal on double line is to be passé at 'on' position:-

- (i) When a Driver finds an Automatic Stop Signal with an 'A' marker at 'ON', he shall bring his train to a stop in the rear of the signal. After bringing his train to a stop in the rear of the signal, the driver shall wait there for one minute by day and two minutes by night. If after waiting for this period, the signal continues to remain at 'on', he shall give the prescribed code of whistle and exchange signals with the Guard and then proceed ahead, as far as the line is clear, towards the next stop signal in advance exercising great caution so as to stop short of any obstruction.
- (ii) The Guard shall show a stop hand signal towards the rear when the train has been so stopped at an Automatic Stop signal, except as provided for in sub-para (4) below.
- (iii) Where owing to the curvature of the line, fog, rain or dust storm, engine working the train pushing it, or other causes, the line ahead cannot be seen clearly, the driver shall proceed at a slow speed, which shall under no circumstances exceed 8 kilometres an hour. Under these circumstances, the driver, when not accompanied by a Fireman or an Assistant Driver, and if he considers necessary, may seek the assistance of the Guard by giving the prescribed code of whistle.
- (iv) When so sent for by the Driver, the Guard shall accompany him on the engine cab, to assist the driver in keeping a sharp look-out.
- (v) When an Automatic Stop signal has been passed at 'on' the Driver shall proceed with great caution until the next Stop signal is reached. Even if the signal is off, the Driver shall continue to lookout for any possible obstruction short of the same. He shall proceed cautiously upto that signal and shall act upon its indication only after he has reached it.

Other Systems of Working

1.244 Other than Absolute Block and Automatic Block Systems have been listed in para 1.203. These systems are generally followed under Approved Special Instructions on unimportant branch line sections. It is not considered necessary to describe them here. Details of these, however, can be studied from the General and Subsidiary Rules book.

Important Transportation Documents at a Block Station

1.245 Some of the important Transportation documents to be maintained at a Block Station are described below:

Station Working Orders (SWOs)

1.246 This is a very important document and copies of the same must be kept in SM/ASMs office and the Block Cabins in a properly bound cover. These include a 'Station Working Order Diagram' and instructions for reception and dispatch of trains at that station as well as rules for shunting operations. A list of safety equipment to be kept at the station is also given in the SWOs. Correction Slips to the SWOs should be serially numbered and kept in the file along with SWO.

Acknowledgement Register for SWOs (Assurance Register)

- 1.247 All Transportation staff at the station have to sign in the register certifying that they have read and understood the SWOs and the correction slips thereto. These have to be read and explained personally by the SM to the staff who cannot themselves read and understand the same.

Train Register

- 1.248 All entries regarding Block Operations giving train numbers and timings have to be entered serially in this register by the SM/ASM who does the Block Operations. Each entry should be supported by private numbers taken down from the Private Number Book supplied to each SM/ASM and received from the SM/ASM at the other end of the Block Section.

Caution Order Registers

- 1.249 As soon as a Caution Order Notice is received from a competent engineering official or through control, the same should be noted down verbatim and serially in the Caution Order Registers, generally maintained separately for Up and Down directions. All SM/ASMs while coming on duty must carefully see the Caution Order Registers and issue Caution Orders to the Drivers of trains accordingly.

Block Competency Certificate Register

- 1.250 All SMs/ASMs, Levermen and Pointsmen have to be issued Block Competency Certificates after duly testing their knowledge of rules. These certificates have to be renewed periodically. It is the duty of the Sr. DSO/DSO, TI and SM to ensure that their certificates are renewed in time and no staff works with expired Block Competency Certificate.

Medical Register- Vision Test Register

- 1.251 Transportation staff has to be tested medically for their vision test periodically. Record of the same is maintained in this register. It is the duty of the SM and Inspecting Officers to ensure that staff is sent for periodical medical test as per rules.

Accident and Unusual Occurrence Register

- 1.252 Particulars of all accidents and unusual occurrences that take place at the station and adjoining block sections must be recorded in this register.

Inspection Books

- 1.253 Separate Registers should be maintained for recording Inspection Notes of Officers and Inspectorial Staff. Action taken on the instructions/observations by the official concerned should be indicated against each entry.

Signal and Block Failure Register

- 1.254 Particulars of all Signals, Points and Block and Communication failures are recorded in this register. Time of the failure occurred and time rectified by maintenance staff must be

recorded.

- 1.255 A list of some other transportation registers/ records maintained at a station is given below:-
- (i) Detonators Register.
 - (ii) List showing Medical Facilities available nearby including list of Doctors and phone numbers. It should be displayed prominently with a red cross mark.
 - (iii) List of Staff trained in First Aid.
 - (iv) Register showing surprise night inspections of Cabins and Level Crossings by the SM.
 - (v) Refresher Course Register.
 - (vi) Register showing receipt and issues of important numbered books such as, paper line clear ticket books, Authorities to Pass Signal at Danger, Caution Order Books, Private Number Books etc.
 - (vii) General and Subsidiary Rules Books, Accident manual, Block Working Manual etc. With upto-date Correction Slips.
 - (viii) SMs/ASMs Diary:- Before signing 'Off' each Sm/ASM must record the work done during his shift in this diary, including any unusual occurrence. He should also record what follow up action, if any, has to be taken by his successor.