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, signalling 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) Optimising 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) Optimising 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 Gurads 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 railways 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 area 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	**On Double Line**
(i) Line Closed.	(i) Line Closed.
(ii) Train Coming From.	(ii) Line Clear.
(iii) Train Going To.	(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 quardrant 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 Odverlap'. It is a safety margin to prevent collisions in case due to error of judgement 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 have 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 refered 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 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 Doble 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 STATION SECTION.

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.

1.232 Advantages of a 'B' class station

(i) A reception line need not be deptclear 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 area 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.

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 adequatae 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 Automtic 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 Systsems 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 Operataions. Each entry should be supported by private numbers taken down form 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 Regissters

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 have 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 are sent for periodical medical test as per rules.

Accident and Unusual Occurance Register

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

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 off 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 prominentlywith 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 Registser.

(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 occurance. He should also record what follow up action, if any, has to be taken by his successor.

Transportation Management

Lesson 2

Passenger Operation

INTRODUCTION

2.101 The importance of passenger traffic could be easily appreciated from the fact that Indian Railway carried about 4971 million originating passengers during the year 2002-03, which is more than four times the total population of the country. The growth of passenger traffic on the Indian Railways has been phenomenal as can be seen from the table below:-

Number of Passenger Originating (IN MILLION)*

Year	Suburban All classsess	Upper Class	Non-suburban Second class			Total Non-sub-urban	Grand Total
			Mail/Exp.	Ordinary	Total		
1950-51	412	25	52	795	847	872	1,284
1960-61	680	15	96	803	899	914	1,594
1970-71	1,219	16	155	1,041	1,196	1,212	2,431
1980-81	2,000	11	260	1,342	1,602	1,613	3,613
1990-91	2,259	19	357	1,223	1,580	1,599	3,858

1995-96	2,484	27	380	1,127	1,507	1,534	4,018
1996-97	2,578	27	403	1,145	1,548	1,575	4,153
1997-98	2,657	29	446	1,126	1,662	1,691	4,348
1998-99	2,668	30	461	1,252	1,713	1,743	4,411
1999-00	2,771	38	445	1,331	1,776	1,814	4,585
2000-01	2,861	40	472	1,460	1,932	1,972	4,833
2001-02	2,999	41	496	1,557	2,053	2,094	5,093
2002-03	2,934	42	513	1,482	1,995	2,037	4,971
2005-06	3,329	50	668	1,678	2,346	2,396	5,725
2006-07	3,514	58	713	1,934	2,647	2,705	6,219
2007-08	3,689	66	776	1,993	2,769	2,835	6,524
2008-09	3,802	76	895	2,147	3,042	3,118	6,920

(*Source: Indian Railways Year Book 2008-09)

2.102 Passenger kms during the same period i.e. from 1950-51 to 2008-2009 increased from 66,517 million to 838,032 million.

2.103 During the year 2008-09 a total of 10,673 (2007-08 a total of 10368) passenger trains were run which included (4634 EMU 2007-08) 4851 EMU suburban trains. Of the total number of passengers carried in 2008-09, 54.94% were suburban and 45.06% non-suburban. Of the total traffic passenger kms for non-suburban passengers, about 29.12% travelled in ordinary second class and (49.98% in 2007-08) 50.08% in second class Mail/Express. Only (5.32% in 2007-08) 5.9% of non–suburban passengers travelled in upper classes, while (15.56% 2007-08) 14.9% was an account of non-suburban passenger of all classes.

2.104 It will be seen from the passengers' statistics given above that the Indian Railways are carrying vast volumes of passengers everyday and the goodwill of the Railways depends to a very large extent upon the quality of service rendered to these passengers. The various aspects of passenger operation to be looked afater by the Transportation Department, are discussed hereafter.

Time Tabling of Passengers Carrying Trains

2.201 Time Tabling of passengers carrying trains is a very intricate process. It has to take into account passengers requirement and preferences as well as other aspects of the railway operation. It is dynamic process and the Time Tables need revision at least once a year for following reasons:-

(a) Increasing demands of passengers due to a developing economy and increasing population Every year a number of additional regular passenger trains are introduced.

(b) Due to technological advancement, the trains are speeded up through deiselisation, electrification and signalling improvements.

2.202 Presently revised time table are issued once a year on every Ist July.

Factors taken into account for Time Tabling

2.203 These factors could be grouped into two categories viz:-

(i) Requirements of passengers.

(ii) Service requirements by Railways.

Passengers' Requirements & Preferences

2.204 (i) Suburban & Suburban like passengers:- Trains should reach the Metropolitan (CBD) and other big towns in the morning hours and leave back after office hours.

(ii) Medium Distance (300 to 500kms) Inter-city passengers:- Superfast day time trains such as Shatabadi Express trains between New Delhi –Kanpur-Lucknow or New Delhi-Chandigarh etc.

(iii) Long Distance passengers:- Overnight Journey without wasting a working day is preferred. That is why Rajdhani Express trains between New Delhi & Bombay and New Delhi and Calcutta are so popular. Very long distances passengers would naturally prefer fast trains with fewer halts.

(iv) Other requirements of passengers would include:-

(a) Convenient arrivals and departures at terminals and important intermediate stations.
(b) Appropriate meal halts.
(c) Proper connections with branch line trains at junction stations.
(d) Adequate halts at intermediate stations for entraining and detraining.

Service Requirements:

2.205 These will include:-

(i) Realistic running times between stations: These timings are now generally being determined through computer simulatiaon in the RDSO Lucknow. For departmental use, Minimum and Normal Running times are stipulated for each block section for each train. Minimum Running Time (MRT) is calculated at 'Maximum permissible Speed'. While Normal Running Time (NRT) is calculated at 'Booked Speed' which is generally 90% of the Maximum permissible Speed. Due allowance is made in MRT and NRT for permanent speed restrictions. When a train is running late the driver can make up time equal to (NRT-MRT), except in thick & foggy weather & cautious driving.

(ii) Time Allowances for crossings and precedence : These are calculated by preparing Master Charts which are time distance graphs indicating the paths of all passenger carrying trains & nominated important freight trains.

(iii) Platform facilities at terminals and other important stations.

(iv) Engineering Allowances for maintenance of track.

(v) Time allowances for shunting, if required for attaching/detaching locomotives or slip coaches etc.

(vi) Time required for crew changing.

(vii) Time required for fuelling of locomotives at nominated stations.

(viii) Time required for carriage watering/cleaning.

(ix) Meal halts.

(x) Time required for loading/unloading of parcels/luggage.

(xi) Recovery time: These are provided short of important junction stations and terminals to make up time in case of any unforeseen delays.

Process of Preparing Time Tables

2.206 Suggestions received from members of Divisional Railway Users' Consultative Committees (DRUCUs), Passenger Associations and other rial-users, as well as departmental requirements are first examined at Divisional Levels. Suggestions received from the divisions are examined at the zonal headquarters level and are coordinated by the Chief Passenger Traffic Managers (CPTMs).

Inter-Railway Time Table Coordination Meeting is then convened by the Executive Director (Coaching), Railway Board. Suggestions including those for introducing additional trains are considered in depth and the Time tables are finalized by the month of June. New Time Tables come in force from Ist of July every year.

Types of Time Tables

2.207 The following types of time-tables are published:-

(a) **Zonal Time Table: -** Each zone publishes its detailed time table. These not only give detailed time table of each train but also give detailed information regarding bookings, reservations, refunds, retiring room facilities, catering facilities etc. for use of passengers.

(b) **Trains at a Glance :-** This is an all-India publication and it gives abstract time-tables for Mail/Express trins.

(c) **Sheet time Tables:-** These also give abstract timings of trains and are pasted at prominent places at stations.

(d) **Working Time Tables :-** These are meant for departmental use by railway staff only. These include detailed information for staff including sectional running times, speed restrictions, bread-down and other facilities available at various stations etc.

Punctuality of Passengers Carrying Trains

2.301 As has been mentioned earlier more than 10 million passengers travel in over 7500 trains per day on the Indian Railways. Any late running of trains not only results in colossal waste of time of the passengers but also causes great loss of goodwill of the Railways. Punctual running of trains is, therefore, one of the most important aspect of railway operation.

Factors Affecting Punctuality

2.302 Timely running of trains can only be ensured by proper performance of an coordination between various departments. The factors which affect punctual running of trains can, therefore, be summarised department wise as discussed below.

Transportation Department

2.303 (i) Adequate facilities for berthing of rakes and reception and dispatch of trains at terminals and important intermediate stations : Lack of such facilities result in detention to trains short of terminals and important stations and also late starts.

(ii) Proper time Tabling : Time tables should be realistic making due provision for engineering allowances and recovery times.

(iii) Proper education, training and motivation of operating staff so that they have punctuality consciousness and work efficiently.

Station Masters should grant line clear and set the route and take 'off' signals in time. They should ensure proper maintenance and lighting up of signals and see that shunting operations, if any, area done efficiently. Warner or Distant signals should be taken 'off' when train is passing through main line, except in case of cautious driving.

Similarly, Guards should appear on duty in time display 'All Right' signal to the Driver to start the train as per rules without delay and make up 'Traffic Time' at stations, when the train is running late, ensures expeditious loading/unloading of parcels/ luggage, and take prompt action in case of any Alarm Chain pulling.

Section Controllers must arrange judicious crossings/precedence having regard to the priority and importance of trains. They should keep in touch with Station Masters to ensure that there are no delays at stations due to various reasons. They may also send messages to the Drivers motivating them to make up time when running late. Stabling of goods trains, if necessary, should be done judiciously.

Commercial Department

2.304 (i) Reservation charts should be pasted in time and there should not be any mistakes in the same.

(ii) Meals should be served without causing any detention to train.

(iii) Loading/unloading of parcels/luggage should be completed within allowed time.

(v) Special checks should be conducted to eradicate Alarm Chain pulling.

Mechanical Department

2.305 (i) Proper maintenance of locos so that there are no detentions due to locomotive failures. In case of steam locomotives, it should be ensured that proper grade of coal is loaded.

(ii) Locomotives should be turned out punctually from the loco-sheds.

(iii) Drivers should be suitably trained, monitored and motivated to ensusre they do not lose time and make up time as per rules when running late.

(iv) Proper maintenance of coaches so that they are not marked sick at the starting station or en-route. Vacuum or Air-brake system, as the case may be, should be maintained efficiently.

(v) Carriage and Wagon examination and carriage watering whereever required, must be done within allowed time.

Electrical Department

2.306 (i) proper maintenance of electric locos.

(ii) Proper maintenance of train lighting.

(iii) proper maintenance of air conditioned coaches.

(iv) Proper maintenance of overhead Equipment (OHE) on electrified sections.

(v) Ensuring assured power supply.

Signal and Telecommunication Department

2.307 (i) Proper maintenance of points and signals.

(ii) Proper maintenance of telecommunication facilities including Block Instruments.

(iii) Prompt action in case there is any failure of telecommunication or points or signals.

Civil Engineering Department

2.308 (i) To ensure minimum speed restrictions and cautions driving. Time loss on this account should not exceed total 'Engineering Allowance' time provided in the time table.

(ii) Whenever 'engineering blocks' are taken for track repair/maintenance, the work should be completed within allotted time.

(iii) Working of dip-lorries in the face of fast mail/express trains should be avoided.

(iv) For speeding up trains, long term measures should be taken to remove permanent speed restrictions as far as possible.

(v) It should be ensured that caution orders are issued to Drivers only when required. It sometimes happens that caution orders continue to be issued even after speed restrictions has been removed due to lack of communication between engineering officials and station staff.

Action by Administration to Maintain Punctuality

2.309 A coordinated effort by all departments concerned led by the Divisional Railway Manager (DRM) himself is imperative to maintain punctuality.

2.310 Proper information system

(a) A punctuality register is maintained in the control office wherein particulars of detentions to passenger carrying trains are recorded daily. Departmental Executive officers must make it a point to scrutinise this register in the morning and take up cases of loss of time due to any shortcomings on the part of their department.

(b) In addition each departmental head must set up his own channel of communication to get information in real time for any serious detentions pertaining to his department. Section or Deputy Controllers should also inform telephonically bad cases to the officers concerned even if it happens at odd hours.

(c) DRM generally has a visual indication board in his chamber which indicates how the mail express trains are running. If a train is running late the DRM may order the control to issue message from him to the Driver/Guard and station staff concerned to make up time.

DRM's Meeting with Departmental Officers

2.311 Every day the DRM generally holds a meeting attended by all departmental officers concerned to discuss reasons for detention to trains the previous day and remedial action taken. DRM may also hold a monthlymeeting with officers where detailed causewise analysis of detentions is done and medium and long term remedial measures are decided upon.

Control Charts/Drivers & Guards' Journals

2.312 Transporation & Power officers must scrutinize a few control charts and journals to get better insight into trains running.

Foot Plate Inspections

2.313 Foot plates inspections by DRM/ADRM & Transportation, Mechanical, S&T & Engineering officers are very important not only from punctuality but also from safety point of view. It creates punctuality and safety consciousness amongst staff and gives a personal touch for motivating staff. Such inspections also help to pinpoint signals which need improvement in sighting or lighting/focusing.

Punctuality Awards

2.314 Good performance by Drivers/Guards, station staff and staff of other departments should not go unnoticed. For good performances in making up time and maintaining punctuality cash awards should be given liberally and the same should be publicized through circulars, fortnightly gazettes etc.

Punctuality Drives

2.315 Occasionally punctuality drive may be organisesd during which all trains should be monitored through footplate inspections and deputing officers round the clock in shift duties in the control office.

Zonal Headquarters level

2.316 Chief passenger Traffic Manger (CPTM) Coordinates and monitors passenger operation on the zone. He takes up cases of detentions to trains every day with the Divisional officers concerned.

General Manger or Additional General Manager generally hold meetings everyday with the departmental heads to discuss bad cases and remedial measures taken.

Information about passenger trains operation is collected round the clock by Emergency Cell on each Zonal Hqrs.

Railway Board's level

2.317 Executive Director (Coaching) coordinates and monitors passenger train operations at the Railway Board's level. A 'Punctuality Cell' functions in the Railway Board's office round the clock. Detentions to important trains are scrutinised. Very bad cases may be discussed with Additional Member (Transportation) or Member Traffic himself.

Some selected and very important trains maybe designated as ' Ministers' Trains' and these have to be especially monitored. Minister for Railways may himself call for action taken in bad cases.

RAKE COMPOSITIONS, RAKE LINKS AND UTILISATION OF COACHING STOCK

INTRODUCTION

2.401 Rake composition of passenger carrying trains depends upon the following considerations:-

(a) Passengers' requirements.
(b) Availability of various types of coaches.
(c) Type of train viz. ordinary passenger or Mail/Express, or Superfast or Rajdhani/Shatabdi Express trains.
(d) Lengths of Platforms.
(e) Rake maintenance facilities.

Passenger's Requirement

2.402 The various passenger classes for travel on the Indian Railways could be criefly summarized as follows:-

Non-Airconditioned

(a) Second (ordinary)
(b) Second Sleeper-3tier.
(c) Second Sleeper-2tier.
(d) First class (sleeping accommodation)
(e) First class-Chair car

Air-Conditioned

(a) AC Chair Car
(b) AC Sleeper-2 tier
(c) AC 3 tier.
(d) AC Firsts Class.

Rake Composition

2.403 Rake composition will include-

(a) Type of coaches on the train.
(b) Total Number of coaches on the train.
-Normal Composition
-Maximum permissible load.

Types of Coaches to be provided

2.404 The types of coaches have to be provided keeping in view the passengers requirements and relative importance of trains. Ordinary short distance passenger trains may have only Second (ordinary) coaches with sitting accommodation. Medium and long distance ordinary passenger trains may be provided with II Sleeper coaches and also a First class coach.

Mail/Express trains will normally consist of Second Ordinary, Second Sleeper, Ist Class and Ac two and three tier coaches. More important trains may have AC Ist class in addition. Rajdhani and Shatabdi Express trains area fully air conditioned. Intercity shatabdi Express trains have Air conditioned sitting accommodation while Rajdhani Express trains have AC I class, AC-two tier, Ac-3 tier and AC Chair Cars.

All trains must have a brake van in front and one in rear. Generator car are provide on Air conditioned trains and other specified trains equipped with end-on generation.

In Mail and Express trains area is also provided with postal vans as per requirements of the postal department.

Dinning or pantry cars are also normally provided on long distance trains.

A few important codes used for indicating the types of coaching stock are listed below:

Code	Stands for
G	Self generating.
W	Vestibuled.
L	Luggage Compts.
R	Brake van
Y	(Suffix) Ladies
Y	(Prefix) Suburban
AC	Airconditioned
S	Second Class
F	First Class
FC	First Class with coupe
GSCN	Self Generating Second Class 3 tier (Sleeper)
WAC	First ACC
WACCN	AC Sleeper (3 tier)

WGACCW	AC Sleeper (2 tier)
GSCZAC	Vestibuled second class AC Chair Car.
WGFCZAC	Vestibuled First Class AC Chair Car
VP	Bogie parcel van
PP	Full Postal unit.
PPH	Half postal unit

Lengths of Trains

2.405 Trains on Main line/Trunk route are generally overcrowded and still there is often demand for more accommodation. Additional demands for more accommodation are being met by introducing additional passenger trains and also by increasing lengths of the trains. With diesel and electric traction it has been possible to increases the composition of trains to 24 bogies on the B.G. In the long run the Indian railways have plans to run 26 bogies trains on selected trunk routes.

2.406 Maximum length of a train depends on:-

(a) Hauling power of the locomotive
(b) Maximum speed at which the train is required to be run.
(c) Lengths of platforms at terminals and intermediate stopping stations.
(d) Strength of the couplings.
(e) Brake power available.
(f) Signalling system.

Marshalling of Coaches on a Train

2.4.07 While marshalling the coaches on a train, the following precautions should be observed:-

(a) Marshalling should conform to Anti-telescopic Marshalling orders.
(b) One brake-van should be provided in the front and one in rear. Passenger carrying coaches should normally not be attached outside brake-vans. However, if it is necessary to do so, it should conform to instructions contained in General and Subsidiary Rules. In any cases not more than two coaches should be attached outside the rear brake-van.
(c) Same class of coaches should normally be grouped together.
(d) Dining Car/Pantry Car should normally be in the middle.

Rake Links

2.408 Rake links are chalked out for time tabling the movement of rakes of passenger carrying trains on a regular schedule. While making these schedules the requirements of maintenance of rakes are duly taken into account. This will include 'Primary' and 'Secondary' maintenance of rakes.

Primary Maintenance

2.409 Primary maintenance is carried out by the Zonal railway to which the rake belongs. All scheduled repairs such as repacking of axle-boxes, cylinder overhauling, clappet valve testing, water tank wash out are carried out during primary maintenance in addition to washing, cleaning and safe-to-run examination. Normally six hours are provided for such maintenance at the homing depot of the rake.

Secondary Maintenance

2.410 Only cleaning and safe to-run examination as well as minor repairs are carried out during Secondary maintenance. For this also six hours are normally provided.

Booklet showing rake links, composition etc. of Passenger Carrying Trains :-

2.411 Each Zonal railway publishes such a book for guidance of staff. This booklet gives the following information for all passenger carrying trains:-

(i) Rake Links.
(ii) Normal Composition of rakes.
(iii) Marshalling order of each rake.

(iv) Permissible loads.
(v) Maintenance stations.

2.412 A typical example of a rake link covering 2403/2404 and 2413/2414 Super Fast Express trains on the Northern Railway is given below:-

It will be seen from above that two daily Superfast trains, one between JAT and DLI and other between Delhi and Jaipur, are covered by this rake link. It will also be seen that the number of rakes required is equal to the total turn round time in days. In this case it is two days and two rakes.

Utilisation of Pasenger Coaches

2.413 As on 31.3.2009, Indian Railways had 6241 EMU coaches and 50,282 conventional passenger coaches. Efficient management and utilization of this large number of coaches is an important aspect of passenger operation.

Information system for controlling usage of Passenger Coaches

2.414 Control of coaching stock is exercised at Zonal HQs level. Earlier 'Cardex' system was used wherein there was a distinctive card for each vehicle in the Coaching Cabinet section of the COM's office. Now railways have installed computers for this purpose.

2.415 Every day all interchange points convey the out-reports of trains interchanged to the Zonal HQs. In addition Divisional Control conveys 18.00hrs. daily coaching stock position which gives the details of spare coaches, programmed bogies, coaches attached and detached etc. Zonal HQs feeds the information in the HQs computers and obtains requisite outputs for exercising proper control on the movements of coaching stock.

2.416 Important aspects to be looked after by the HQs office include the following:-

(a) Rake compositions of trains as per prescribed marshalling and trains are not running under load.

(b) Coaches are sent for POH to workshops as per schedule.

(c) Percentage of ineffective coaches is within prescribed limit. Coaches marked sick out of course are repaired expeditiously.

(d) Spare coaches are not held in excess of the target.

(e) Foreign railways' coaches are returned to the owning railways expeditiously. Also chasing the foreign railways to return own railways coaches expeditiously.

(f) Steps are taken to accept maximum movement of programmed bogies and seasonal traffic within existing resources.

Improving Utilistion of Coaching Stock

2.417 The following steps help to improve utilisation of coaching stock:-

(a) Having an efficient information system for control of coaching stock:-

(b) Careful planning of Rake Links with mini mum required lie-over periods at terminals. For example in the rake link no 25 of the N.Rly given in para 2,412, the coaching stock utilsation is only 598 Kms per day. while for 2419/2420 Lucknow-New delhi stock Gomti Express trains the utilisatiion is as high as 1014 Kms per day. standardisation of rake compositions can help us to prepare Rake Links combining several trains minimising lie over periods at terminals and improving utilisation of stock.

(c) Reducing ineffective percentage of coaches by better maintenance.

(d) Not holding stock in excess of necessary requirements.

(e) Quick repairs and retrievals of coaches marked sick out of course.

2.5 PASSENGER STATIONS

Categories of Passenger Stations

2.501 Passaesnger stations could be broadly divided into the following categories:-

(a) 'D' class non-block stations.

(b) Roadside small and medium size block stations.

(c) Major stations including Junction stations.

(d) Passenger terminals.

(e) 'D' Class Non-block Stations

2.502 In the General Rules, 'D' class non-block stations have been defined as places which area situated between two consescutive block stations and do not from the boundary of any block station.

2.503 A 'D' class station which serves an outlying siding is called 'DK' station. The siding takes off through a cross over at such a station and the cross-over can be operated only with the help of a key released by inserting the line clear Token in a box provided for the purpose. The Token gets locked in the box and can be released onlyn when the points are set and locked in the normal position for the main line. The key also gets locked back in the box.

2.504 A 'D' class station which serves no siding is called a 'Halt' or 'Flag' station. A halt has normally a rail-level platform and no railway staff is posted to man the station. Passengers at such stations area booked by the Travelling Ticket Examiners or the Guard of the train. Halt may also be operated for booking of passengers etc. through a contractor. It is known as 'Contractor operated Halt'.

2.505 A 'Flag' station has a station building including booking office and waiting hall. Commercial staff area posted there for booking of passengers and parcels.

2.506 Normally only slow moving passenger trains are booked to stop at 'Halt' or 'Flag' stations.

(b) Roadside block stations

2.507 Roadside block stations are small intermediate stations where only slow moving passenger trains are booked to stop. As the small booking of goods traffic has been discontinued since Dec. 94 and piecemeal wagonload goods traffic is not begin generally accepted, most of the roadside stations have been closed for goods booking. Such stations now deal with passenger and parcel traffic only. Main operating work at such stations includes arranging of trains passing, crossings, precedence and dealing with stopping passenger trains.

2.508 For operation of points and signals at such stations, there may be either a central abin or there may be two cabins, one at either end of the station. Block instruments may be provided either in the cabins or in the Station Master's office. When the Block working is done from cabins, the cabins are manned by Cabin ASMs or Switchmen. However, Station Master controls the operation of reception and dispatch signals through 'slides control' provided in his office. Reception and dispatch of trains and shunting movements, if any, are done strictly according to the instructions laid done in the 'Station Working Orders'.

2.509 When a train runs through, the Station Master in proper uniform should stand opposite his office and exchange 'all right' signals with the Driver and Guard of the train. He should carefully watch the running train and, if there are any unusual conditions, such as hot-box etc. he should advise station in advance through the block instrument to stop and

examine the train and/or take such action as prescribed in the General and Subsidiary Rules.

Layouts of Roadside Satiations

2.510 Some of the typical track layouts of roadside stations are illustrated in the diagrams below (without showing signals):-

2.511 ***Notes*** (1) On an Island platform two stopping trains can be dealt with simultaneously. Also, if a goods train has to be stabled at such a station, it can be accommodated on the loop line of the Island platform, thus keeping the main line free for run through trains. (2) It is desirable to provide 'Attaching and Detaching Sidings' at either end to accommodate Vehicles/wagons, such as marked sick from running trains.
(3) Foot over bridges should be provided at stations with high level platforms.
(4) On less important routes only one loop line may be provided in addition to the main line.
(5) In case of Ghat type stations, while arranging crossing of trains, the train negotiating the up gradient (up train in this case) should not be stopped at the Home signal and must be received directly on the lie by Siding, detaining the other direction train at the Home signal, if necessary.

2.512 Note: In the above layout the following aspects are worth noting:-

(a) Attaching/Detaching sidings are provided in each direction

(b) Island platform helps in dealing with more than one train in each direction. Also if necessary,

a goods train can be stabled on the loop line of the Island platform keeping main line free for stopping passenger trains and all run through trains.

(c) Main station building has direct approach for passengers. Apart from convenience to passengers, this facilitates provision of a nice front elevation for the station building.

(d) Main platform loop line has facility for reception of both Up and Dn trains. Hence more important stopping trains can be received on the main platform line.

(e) Facing and trailing cross-overs are provided in either direction. In case of accidents etc. if temporary signal line working has to be adopted, there will be no need of backing a train from one line to the other in such layout.

Junction Stations

2.513 A station where lines meet from more than two directions is called a Junction station. A few examples are Itarsi, Moghalsarai, Lucknow, Ghaziabad, Kazipet, Muri, and Bangalore. The following aspects may be kept in view while designing layouts of junction stations:-

(i) It should be possible to receive trains simultaneously from various directions.

(ii) Adequate number of platform lines should be provided so that trains are not detained for reception at the station.

(iii) In case connection is to be provided with a branch line train, an Island platform maybe so designed that the passengers may transship from one train to another using the same platform.

Typical layout of a junction station maybe as given in the diagram below:

Passenger Terminal Stations

2.514 A few examples of such terminals are, Mumbai CST, Mumbai Central, Churchgate, Howrah, Sealdah, Dehradun, and Kalka. A few important aspects in the layouts of such stations are given below:-

(a) Reception and dispatch of trains should be easy. Adequate number of Platforms should be provided keeping in view the requirements of reception, despatach and berthing of trains. Major Stations should have route relay interlocking and all Points and Signals should be centrally operated from a Route Relay Cabin.

(b) Interlocking should permit maximum simultaneous movements both for reception and dispatch of trains as well as shunting. Diesel shunting engines should be provided as per requirements.

(c) Approach and dispersal of passengers should be easy. At a suburban terminal platforms may be provided at either end of a track as has been done at Churchgate station of the Western Railway.

(d) Adequate facilities such as washing lines and sick lines should be provided for cleaning and maintenance of rakes of passenger trains.

(e) If possible, an approach road may be provided between two important platforms where passengers may get their cars, as is the case at Howrah station.

(f) The front elevation of the station may be designed beautifully.

(g) The drainage should be designed carefully so that there is no stagnation of water. Washable aprons should be provided so that cleaning of tracks is easy. Examples of two different types of layouts of terminal stations are given below (only reception lines and passenger concourse are shown):

Passenger Terminal Statiaons

(Ancillary facilities such as washing lines, sick lines, stabling lines, loco shed, other sidings etc. not shown for simplicity)

Note : *(1) In the above layout locomotive of an incoming train can be released immediataely on the arrival of the train through the engine run-round (ERR) line. However, it involves lot of additional space and expenditure for this purpose.*

(2) Hydraulic buffers are provided at the dead ends of Reception lines

Note: *In this type of layout the locomotive of an incoming train gets locked up till the rake is released and backed. A rake should normally be released in 15mts to ½ hour sand as such it is not a serious constraint, but it saves previous space of the terminal station.*

Facilities At Major Stations

2.515 Facilities at major stations should include the following:-

(a) Adequate number of platform lines.
(b) Adequate number of washing and sick repair lines.
(c) Extra lines to accommodate spare coaches.
(d) Engine movement and run round lines.
(e) Special platform facilities for tourist and programmed bogies.
(f) Saloon sidling with platforms for Inspection Carriages.
(g) Layout should permit easy shunting movements and simultaneous reception and dispatch facilities.

(h) Sufficiently wide foot over bridges or sub-ways.
(i) Offices for the officials of various departments.
(j) Running Room facilities for train crews as well as TTEs
(k) Proper shelter and basic facilities for licensed porters.

Commercial facilities will include

2.516 (i) Proper enquiry, reservation and booking offices.
(ii) Sufficiently large parcel office and facilities for stacking and movement of parcels and luggage.
(iii) Proper approach, including adequate area for parking of road vehicles.
(iv) Waiting Rooms, Waiting Halls, Retiring Rooms.
(v) Adequate and convenient drinking water and catering facilities, including refreshment rooms and stalls.
(vi) Public address and announcements system.
(vii) Public Telephone booth.
(viii) Public conveniences (Toilets etc.)

Transportation Management

Lesson 3

Freight (Goods) Operation

INTRODUCTION

3.101 Transportation of goods from one place to other is a basic necessity for the economic and industrial progress of a country. Railways play a vital role in the surface transport and caarry bulk of essential commodities from producing to cosuming areas. Without rail transport the thermal power houses, steel plants, oil refineries, cement and fertilizer plants and pratically all other industries will come to a grinding halt. Also the transportation of agricultural products from surplus to deficit areas will become extremely difficult. Hence, the Indian Railways constitute a very vital basic infra-structure for fulfilling the objective of having a prosperous and social welfare state.

Growth of Freight Traffic on the Indian Railway

3.102 The growth of freight traffic on the Indian Railways has been spectacular as will be seen from table 3.102 given below:-

Table 3.102

Revenue Earning Traffic on the Indian Railways

Year	Tonnes (Millions)	Index (1950-51 =100)	Net tonne kms (Million)	Index (1950-51 =100)	lead (kms.)	Index (1950-51) =100)
1950-51	73.20	100.0	37,565	100.0	513	100.0
1960-61	119.80	163.7	72,333	192.6	603	117.6
1970-71	167.90	229.4	110,696	294.7	659	128.5
1980-81	195.90	267.6	147,652	393.1	754	147.0
1990-91	318.40	435.0	235,785	627.7	741	144.4
1995-96	390.69	533.7	270,489	720.1	692	134.9
1996-97	409.02	558.8	277,567	738.9	679	132.4
1997-98	429.38	586.6	284,249	756.7	662	129.0

1998-99	420.92	575.0	281,513	749.4	669	130.4
1999-00	456.42	623.5	305,201	812.5	669	130.4
2000-01	473.50	646.9	312,371	831.5	660	128.7
2001-02	492.50	672.8	333,228	887.1	677	132.0
2002-03	518.74	708.7	353,194	940.2	681	132.7
2005-06	666.51	910.5	439,596	1,170.2	660	128.7
2006-07	727.75	994.2	480,993	1,280.4	661	128.8
2007-08	793.89	1,084.5	521,371	1,387.9	657	128.1
2008-2009	833.39	1,138.5	551,448	1,468.0	662	129.0

(Source:Indian Railways Year Book 2008-09)

Main Commodities Carried

3.103 Essential commodities constitute bulk of freight traffic on the Indian Railways as will be seen from table 3.103

Table 3.103

Commodity-wise Tonnagae of revenue Traffic loaded in 2008-09

Commodity	Tonnes Loaded (in millions)		Veriation over last year	
	2007-08	2008-09	Absolute	Percentage
Coal	336.83	369.63	3.78	4.71
Raw Materials to Steel Plants	11.18	10.85	-0.33	0.19
Pig Iron and finished Steel				
i) From Steel Plants	20.75	21.96	1.21	2.64
ii) From other points	5.04	6.62	1.58	0.79
Total	25.79	28.58	2.79	3.43
Iron ore				
i) for export	53.74	45.75	-7.99	5.49
ii) for steel plants	43.61	42.90	-0.71	5.15
iii) for other domestic user	39.34	41.93	2.59	5.03
Total	136.69	130.58	-6.11	15.67
Cement	78.99	86.24	7.25	10.35
Foodgrains	38.23	35.51	-2.72	4.26
Fertilisers	35.83	41.35	5.52	4.96
POL (Mineral Oils)	35.88	38.08	2.2	4.57
Container Service				
i) Domestic containers	3.74	7.05	3.31	0.85
ii) EXIM containers	17.39	23.29	5.9	2.79
Total	73.34	62.23	-11.11	7.47
Balance other goods	21.13	30.34	9.21	3.64
TOTAL	793.89	833.39	39.5	100.00

Railway, a Superior Mode of Surface Transport

3.104 Railways are a superior mode of surface transport as compared to road transport, especially for bulk commodities in train-loads, for the following reasons:

(a) Railways are more energy efficient:-
Railways can carry six times the traffic with the same diesel oil as compared to road vehicles. Also during 2008-09; 56.5% of gross tonne-kms were carried by electric traction saving huge quantity of precious diesel oil.

(b) Railways causes less pollution.

(c) Railways make better land use.

Investments for Developing Transport Capacity of Indian Railways

3.105 It is, therefore, in overall interest of the country that the railways carry maximum quantum of freight traffic which is economical to be carried by rail. Hence it will be in the national interest to make necessary investments in increasing transportation capacity of railways to meet the growing demands of freight traffic adequately.

Changing Pattern of Freight Traffic

3.106 Earlier the percentage of general goods traffic was appreciable, and considerable quantum of freight traffic was carried in piecemeal wagon loads. Even small traffic, i.e. less than wagon load traffic carried by rail was substantial. Booking and transport of smalls, and piecemeal wagon load traffic was not economical for the railways. Hence with progressive growth of freight traffic, railways are now carrying most of the freight traffic in point-to-point train loads. Bulk commodities viz. Coal, Iron Ore and other Ores, Iron and Steel, cement, POL, Fertilisers, Limesstone and Dolomite, Stones, Foodgrains, Salt and Sugar constituted 91.12% of total tonnes-originating traffic during 2008-09 (Source : Indian Railways year Book 2008-09). So far as smalls traffic is concerned, Indian Railways have completely discontinued booking of the same since December 1994.

3.107 Even the quantum of piecemeal wagon-load traffic has come down drastically. Collection, movement and distribution of such traffic meant lot of shunting operations at loading/unloading points and at intermediate goods marshalling yards. These wagons suffered lot of detentions in yards which were also nicknamed as graveyard of wagons. Railways are, therefore, now concentrating more and more on moving the freight traffic in point-to-point train loads needing no shunting at intermediate yards. The importance of goods marshalling yards has very much come down during the recent past years and many of such yards have already been closed down.

Areas of Freight Operation

3.108 The main areas of management of freight operation on a rail-road system are:-

(a) Loading/unloading points.

(b) Sections where the trains are run.

(c) Intermediate yards.

(d) Control organization

The management of these areas is discussed hereafter.

3.2 UNITS OF LOADING AND KINDS OF GOODS TRAINS.

3.201 Railways now accept goods traffic for booking in the following modes:-

(a) In wagon loads.

(b) In train loads.

(c) In Domestic and ISO containers

As has been mentioned earlier, prior to Dec. 1994, Indian Railways were also accepting booking of smalls (less than wagon_load traffic). This being very cumbersome and uneconomical for the railways has since been discontinued.

Freight Forwarders

3.202 Railways appoint Freight Forwarders who can collect goods traffic from such merchants who are not in a position to offer full wagon load or train load traffic. The Freight Forwarders can then group such traffic into full wagon or train loads. Railways provide suitable monetary incentives to the Freight Forwarders to organize such traffic. This helps the railways to convert piecemeal traffic in wagon loads and train-loads traffic which is more economical for railways to carry.

Kinds of Goods Trains

3.203 The various types of goods trains are indicated in the chart 3.203 below:

3.204 Trains carrying goods traffic are described here briefly:-

(a) **Shunting Trains/ Diesel Jugglers :** Earlier, when smalls were allowed to be booked from roadside stations, they were cleared by Smalls Quick Transit (SQT) trains. These trains were also called 'Section and Trainship' trains. As booking of smalls has now been discontinued wagons from intermediate stations are now cleared by diesel loco operated shunting trains which are know as diesel jugglers. These trains also clear any sick/hot axle wagons detached from through goods trains at roadside stations.

(b) **Pilots :** These are trains which supply or clear a string of wagons to and from sidings to the nearest goods yard. It may be a purely shunting move if no block working is involved.

(c) **Through Goods Trains :** These are goods trains which do not require any shunting at intermediate stations between terminals or yards. These can be further classified as follows:-

(1) **Block Trains :** Such a train by – passes one or more marshalling yards without any shunting.

(2) **Point Load :** In this case the entire train is booked for unloading at a particular point, such as a coal train to a power house.

(3) **Speedlink and Freight Forwarder Trains :-** Such trains consolidate piecemeal wagon load traffic into full train loads between specified pair of stations.Through such trains railways can attract high rated wagon load traffic which would otherwise be moved by road.

(4) **Unit Trains :-** Such trains are quite popular in U.S. Railroads. Here the railways enter into agreement with major bulk users who are required to offer a minimum guaranteed traffic between a pair of points. Railways clear such traffic by trains which run to a fixed schedule between the pair of points. The wagons may be of special type and may be owned by the rail user himself. The railways charge the rail user a special rate mutually agreed upon for haulage of such traffic. Loading/unloading at both terminals is mechanized. The wagon utilisation on such trains is very high and as such cost of transportation as well as inventory carrying costs by rail users are minimized. In case of Integral trains, even the locomotives are the integral part of such trains.

(5) **Freightliners :-** These are trains which carry only container traffic between Inland container Depots and ports. They can also be run from port to port. These are important trains for export and import traffic in ISO containers.

3.3 LINE OR SECTION CAPACITY

3.301 With progressive growth of traffic the railways are required to run more and more number of trains on various sections. However, there is a limit to the number of trains that could be run on a given section, i.e. a given section has capacity to run only a limited number of trains and we call this as the section or Line Capacity of the given section. Formal definition of the Line/Section Capacity is, however, given below:-

Definition of Line or Section Capacity

3.302 Line capacity is defined as “the number of trains which can be run on a given section in 24 hours”.

Calculation of Line Capacity

3.303 A section for which we calculate the line capacity is a portion of railway route between two yards or major terminals. A section will, therefore, have several block stations and block sections between its two ends. The intermediate block sections may vary in lengths and grades and may, therefore, have varying running times for the same train. The intermediate block section which the trains take maximum (longest) time to cover (negotiate or pass) is known as the ‘Critical Block Section’.

Scott’s Formula

3.304 Scott’s Formula, which is the simplest and perhaps the oldest for calculating the line capacity, is given below:

$$C =$$

Here, C = Section Capacity of the given section.
T = Time taken in minutes by the slowest train to cover the ‘Critical Block Section’
t = Block operation time.

E = Efficiency Factor

3.3.05 On Single Line sections E is normally taken as 70% and the capacity C by the above formula gives total number of trains that can be run in 24 hrs. over the given section taking the sum of both Up and Down direction trains.

3.306 On Double line section, E is taken as 80% and C gives number of trains that can be run in each direction separately.

3.307 There are other mathematical formulae such as Ex-GIP formula, Steinback Formula etc. which could be used for calculating line capacity. However, for practical purposes none of these formulae are normally used and in practice the line capacity is calculated by 'Charting Method'.

Charting Method for Calculating Line Capacity

3.308 According to the Charting Method, the Scheduled Mail/Express and Passenger trains are first plotted on a Time-Distance graph by experienced controllers for the section concerned. After that as many goods train paths are inserted as possible. Paths which may take unduly long time and may be very uneconomical are not considered for inclusion.Time allowances and tolerances for various operations involved in trains working are duly taken into account while charting these paths. However, as per Railway Board's directive the line capacity arrived at by charting method should not be less than calculated by the simple Scott's formula.

Computer Simulation

3.309 The RDSO has evolved Computer Simulation method for calculating line capacity of a given section. In the long run this should provide us good guidance for determining line capacities for various sections on the Indian Railways. Computer Simulation methods are now being used all over the world, specially for planning purposes.

Measures for Increasing Line Capacity

3.310 We can easily observe from the Scott's Formula that the line capacityof a given section could be increased by:-

(a) Reducing 'T'
(b) Reducing 't'
(c) Increasing 'E'

Reducing 'T'

3.311 'T' is the running line of slowest train over the Critical Block Section. It can be reduced by following measures:-

(a) Increasing speeds of trains by dieselization, electrification and by improvements in track and signalling.
(b) Reducing running time by providing additional crossing stations on single line and by providing 'C' class stations on Double line. In case the Critical Block Section is located on a track which is having continuous gradient, a crossing station with ghat type layout may be provided, as given in the diagram below:-

A Ghat-type Crossing Station

Reducing 't'

3.312 't' is the block operation time. This can be reduced by the following measures:-

(a) Providing token

less block working.

(b) Providing Panel interlocking.

(c) Providing Centralised Traffic Control.

(d) Providing Automatic Signalling.

Increasing 'E'

3.313 'E' is the efficiency factor. This can be improved by the following measures:-

(a) Improving efficiency of staff by better training, better leadership and management.

(b) Bringing about time table improvements such as cutting out loose timings, grouping of similar speed trains.

(c) Improving station layouts and providing additional loop lines wherever required.

Saturated Sections

3.314 When the utilization of section capacity of over 80%, the section should be considered as saturated as any further increase in the number of trains results in drastic drop in average speeds, and there area frequent congestions.

3.315 On a single line section when measures described above have already been taken and the traffic is still increasing, we then have to go for patch-doubling or full doubling of the section.

3.316 Investments on increasing line capacity may often be quite high and, therefore, before embarking upon such an expenditure, a careful financial appraisal must be done and the alternative which gives best returns in the long run should be adopted.

3.317 It is desirable to adopt following sequence in taking measurses to increase line capacity:-

(i) Bringing about organizational improvements.

(ii) Bringing about signalling and interlocking improvements such as standard III interlocking, token-less working, panel interlocking etc.

(iii Providing additional crossing stations.

(iv) Patch-doubling or full doubling.

3.4 Throughput

3.401 In a developing economy railways are required to handle progressively increasing quantum of traffic. This could be achieved by running more and more number of trains and also by increasing the 'load per train'. Often huge investments on line capacity works can be avoided by running longer and heavier trains. In simple words we are not concerned merely with the number of trains but with the total quantum of traffic which we carry on a given section.

Definition of Throughput

3.402 Throughput (per day) of a given section is defined as the total quantum of traffic that can be carried on the section in 24 hours. The through put of goods traffic could be measured in terms of :-

(i) Number of wagons (4 wheelers equivalent)

(ii) Gross tonne-Kms.

(iii) Net tonne-Kms.

3.403 For day to day working we normally talk in terms of number of wagons. However, as a commercial undertaking our emphasis is on net-tonne kms. Of freight traffic.

3.404 Passenger traffic through put may be expressed in terms of number of passengers or in terms of passenger-Kms. Carried over the section in 24 hours.

Increasing Throughput

3.405 Throughput of a given section can be increased by:-

(a) Running more number of trains.

(b) Increasing load per train.

We have already discussed (a) earlier when dealing with line capacity. Here we will discuss increasing load per train.

Increasing Load per Train

3.406 Load per train could be increased by:-

(a) Using more powerful locomotives or multiple locomotives.

(b) Using high capacity wagons.

(c) Strengthening track.

(d) Increasing loop capacities.

Using Powerful/Multiple locomotives

3.407 Freight traffic on Indian Railways now entirely being hauled by diesel or electric traction. Diesel traction which, accounted for 43.5% of gross tonne-kms in 2008-09 uses WDM_2 & WDG4 locomotives. The Horse power of WDM_2 Loco is 2600 and of WDM4 is 4000 HP. Inbetween other WDG locos have 3100 HP.

3.408 WAG_4, WAG_5, WAG7 & WAG 9 are most widely used electric locomotives on the Indian Railways. Their horse powers are 3150, 4000, 5000 & 6000 respectively.

3.409 Very heavy train loads can be carried by multiple operation of diesel or electric locomotives, but the constraints are loop capacities, strength of couplings, braking and signalling systems and the communications between the drivers.

Using High Capacity Wagons

3.410 There has been tremendous progress on the Indian Railways in improving the wagon designs. We are now producing high capacity wagons with CBC couplings and air braking systems. A train with box 'N' Mark II or BOBR-Mark II can carry as much as 5400 t gross load within the standard loop capacity of 686 metres in flat territory and loop capacity of 715 m in graded sections. BOX 'N' (open), BCN (Covered), BOBR and other new type of Wagons are equipped with CBC and air brakes and have helped greatly in increasing the throughput on important routes. Now BOXN HL wagons are designed for 25 tonnes axle load and carry 5900 tonnes trailing load in a train. They are presently used for transportation of iron ore.

Strengthening the Track

3.411 Track improvements will include the following:-

(a) Increasing Axle load restrictions from 20.3t to 22.9t on very heavy density routes. For running rolling stock with 22.9t axle loads at 80 Km per hour speed we require the track to be laid with minimum 60 Kg rails (LWR) with sleeper density of 1660/Km. These can help us to design and run still higher capacity wagons on heavy density routes. Most of high density routes are laid with such track design.

(b) **Track loading capacity:-** Presently on BG main routes the track loading density is restricted to 7.67t per metre. High capacity wagons such as BOX 'N' and BOB 'R' have been designed to conform to this. This will increase to 8.25 tonnes/meter for 25 tonnes axle load.

(c) Easing gradients can also help in running heavier loads.

(d) The bridges have also to be strengthened for taking heavier loads at maximum permissible speeds.

(e) Liberalising standard moving dimensions.

Increasing Loop Capacities

3.412 Presently, on the BG, we are having 686m as the standard loop CSR. We can run longer trains if the loop capacities could be increased. However, this will need extensive remodeling of stations and yards all over the railway system which will involve massive investments. We have, perhaps, to live with this constraint for quite some time to come.

Conclusion

3.413 Considerable savings on line capacity words could be achieved by running heavier train loads. Indian Railways have done good work in designing high capacity wagons and going in for more powerful locomotives. There is, however, considerable scope for going further in this direction.

3.5 Goods Marshalling Yards

What is a Goods Marshalling Yard (Definition)

3.501 A Goods Marshalling Yard is a place where goods trains are received, sorted out, reformed and dispatched.

3.502 Example of a few bigger yards on the Indian Railways are Moghul Sarai, Andal, Bhusaval, Itarsi, New Katni, Tughlakabad, Bondamunda, Bhilai, Vijayawada etc. However with running of unit trains most of these yards have been closed.

Declining Importance of Goods marshalling Yards

3.503 In the past when substantial quantum of freight traffic was being carried in piecemeal wagon loads, such yards played very important role in sorting and reforming goods trains carrying wagons for different destinations. However, now the railways are carrying most of the traffic in point-to-point train loads which do not require any sorting or marshalling enroute. Hence most of the yards have since been closed down.

Types of Goods Yards

3.504 Goods yards may be classified as:-

(a) Flat Yards.
(b) Hump yards.
(c) Gravity yards.

3.505 In flat yards sorting is done by pull and push method. On the metre gauge such yards are common. In hump yards, a hump having suitable profile, is provided. For sorting of wagons on a train, a shunting locomotive pushes the train over the hump from where the wagons roll down on the nominated sorting lines with the force of gravity.

3.506 Gravity yards area yards having natural slope and sorting could be done by gravity itself.

Functions of a Marashalling Yard

3.507 The following functions are carried out in a goods yard:-

(a) Reception of incoming trains or pilots.
(b) Sorting of wagons destination or direction wise.
(c) Reformation of outgoing trains.
(d) Despatch of trains.
(e) Reception and despatch of through Block trains.
(f) Formation of section trains.

Reception of Trains

3.508 Trains are received in the yard following the procedure laid down in the 'Station Working Order' for the yard. If it is not a bypass block load, the train engine is released and the Number Taking Staff (TNCs) note down the tally of wagons destination wise. The Train Examiners (TXRs) carryout inspection of wagons and note down repairs required, if any.

Sorting of Trains

3.509 In case mixed loads, a shunting memo is prepared which indicates the sorting line number for each wagon or group of wagons, including sick wagons. Wagons are then uncoupled accordingly and a shunting loco then pushes the load over the hump at a slow regulated speed as per signals shown to him (In flat yards push and pull method is adopted).

3.510 The uncoupled wagons roll down the hump. Appropriate route is set for each cut so that the same rolls down on the sorting line nominated for it as per the shunting memo. Speed on the sorting lines is checked with the help of skids and hand brakes. In mechanised marshalling yards mechanical retarders are used to check the speed suitably as the wagons roll down the hump.

Reformation of Outgoing Trains

3.511 Wagons collected on the nominataed sorting lines are coupled up. Outgoing train's formation is completed according to prescribed marshalling orders and a goods brake-van is attached in the rear. If there is a separate departure yard the load is pulled to a vacant departure line.

Despatch of Reformed Trains

3.512 Trains are dispatched as per Trains Notice given by the control and following activities are involved:-

(a) Number taking of wagons and preparation of outgoing 'Vehicle Guidance' by the Trains Clerks (TNCs).

(b) Carriage and Wagon examination by TXR Staff. This will include ensuring minimum prescribed brake power on train. Vacuum exhausters are generally provided on the departure lines for this purpose.

(c) Attaching the outgoing locomotive on the load and creating minimum prescribed vacuum. Checking the continuity of vacuum.

(d) Taking charge of the train by the outgoing crew viz. the Driver and the Guard including loading of their boxes on the train.

(e) Obtaining line clear and starting the train following the procedure prescribed in the Station Working Orders.

Reception and Despatch of Through Block Trains:-

3.513 As mentioned earlier, most of the goods traffic on Indian Railways is now moving in point-to-point train loads. Such trains do not require any shunting at intermediate yarads. Also if the load has been examined intensively at the starting point, no carriage and wagon examination need normally be done at an intermediate yard. The only activities for such trains at intermediate yards may include change of train crew, changing of locomotive, if required, or reuelling of diesel loco.

Placement and Removal of Local Wagons

3.514 Local wagons will include sick wagons, load adjustment wagons, goods-shed or tranship shed wagons, wagons for sidings served by the yard etc. Such wagons are generally collected on nominated sorting line or lines and if required sorting is carried out in a seperate grid yard, if provided. It is desirable to havbae a proper time table for placement and removal of local wagons.

Formation of Section Trains

3.515 Hardly any section trains are run now because loading of piecemeal wagons has been curtailed drastically. However, diesel jugglers are required to be run for clearing off sick

wagons or some stray special type wagons from intermediate stations, and for supply of empty wagons, if required for transhipment of sick detached wagons. Earlier section trains used to be formed according to the geographical order of stations on a section. However, in view of reduced quantum of such traffic such marshalling is not in practice now.

Area Control

3.516 Major yards on Indian Railways have been provided with 'Area Control' organisation. Area control is generally located on the top floor of the central building in the marshalling yard. One can have the bird's eye view of the entire yard from the 'Area Control' office. That is why sometimes its location is also called as the 'Crow nest'.

3.517 Area controllers in the Area Control office are connected telephonically to adjacent section control lines as well as on the administrative truck line to officers on the Division and HQs office. Local telephone net work connects them to other local officers, e.g. sick lines, loco shed etc.

3.518 Main job of Area Controllers is to keep a close laison with adjoining control boards, Deputy Controllers, Yard Masters and loco-shed etc. for reception and despatch of trains, connecting locomotives and ordering trains including train crews.

Layouts of Goods Marshalling Yards

3.519 As mentioned earlier, most of the smaller yards have since been closed. However, major yards are still functional, though with reduced work. The various constituents of the layout of major marshalling yards are described below.

Reception Yard

3.520 The yard may have common Reception lines for reception of mixed as well as through loads. Or it may have a separate bypass (or through) yards for reception and dispatch of through loads. Number of reception lines to be provided depends on the average number of trains received in 24 hours, catering for 4 to 6 hours occupation of a line per train. An engine run–round line is generally provided or nominated for movement of shunting locomotive. Length (CSR) of a reception line should be about 7% more than the CSR of loop lines on the sections. Reception lines are generally provided with Stop Boards as the yards are treated as terminal yards. In such a case line is to be kept clear upto the 'Stop Board' of the reception line while receiving a train on it.

Hump and Sorting Lines

3.521 A major yard dealing with more than 500 wagons per day on the BG, is generally provided with a hump. It is desirable to have reception lines, hump and sorting lines in longitudinal alignment so that the sorting could be done by forward movement only. Height of the hump is such that even the worst rolling wagon could roll down upto the trailing points of the sorting lines.

3.522 Number of sorting lines provided and used depends on the number of direction wises grouping of wagons required as well as on the requirement of local and sick wagons.

Departure Yard

3.523 It is desirable to have a separate departure yard in a major marshalling yard. After formation of a full train load on a sorting line the same can be pulled on to a departure line thus giving relief to the sorting lines. Outward number taking and C & W examination could also be done more safely and properly on separate departure lines. Number of departure lines will again depend on the average number of trains per day to be dispatched from the departure yard. Normally 4 to 6 hours occupation of a line per train should be enough.

Grid Yard

3.524 A separate Grid Yard may be provided in a major marshalling yard to sort out local wagons including sick wagons. Such a yard is generally provided at the trailing end of the sorting lines.

Single vis-à-vis Double Yards

3.525 A goods marshalling yard may have either separate Up and Down Yards or a single yard dealing both Up and Dn. traffic. It is more economical to have a single yard. Apart from economy in layout and operation, a single yard also avoids the problem of dealing with cross traffic between Up and Dn. yards.

Bypass or Through Yard

3.526 With the preponderance of intensively examined through block loads, the importance of bypass or through yards has increased substantially. It is desirable to provide fuelling facility for diesel locos on all the lines in a bypass yard. A spur for detaching sick wagons is also desirable.

Typical Layout of a Single Yard

5.527 The layout of a typical Single Yard is given in the diagram 3.528 below:-

Notes: *(i) Ancillary lines such as engine lines, hump by-pass line, sick lines etc. have not been shown for simplicity.*

(iii) Reception lines, Sorting lines, Departure lines & Through yard etc. are common for Up and Down Directions. Hence it is called a single yard, and is more economical than separate Up and Dn yards.

Mechanisation of Marshalling Yards

3.528 Mughal Sarai, Andal, Bhilai and Bondamunda are amongst the mechanised yard on the Indian Railways. Mechanization of Marshalling yards generally includes the following facilities:-

(a) Automatic route setting for sorting of trains:-
The cut-list is prepared on a perforated tape which is fed into the controlling device. The route for each shunt is set accordingly through power operated points as the cuts roll down the hump.

(b) Wagon Speed Control The speed of wagons rolling down the hump is controlled by mechanical retarders. Speed of heavy and good rolling wagons is so retarded that they do not enter the sorting lines at excessive speed.

(c) Automatic speed control of humping locomotive:-
This is not provided on the Indian Railways.

3.6 DIVISIONAL CONTROL ORGANISATION

INTRODUCTION

3.601 Divisional Control Organisation is the 'Nerve Centre' of Railway operation on a Division. Divisional Control office has extensive telecommunication network. There are various telecommunication channels which fix the control office to all officers on the

Division, other Divisions, HQS Office, all stations, yards, loco-sheds and other significant places on the Division. Apart from Railway administrative and other telephones, the Control office is also provided with P & T telephone facilities.

Location of Divisional Control Office

3.602 Main Divisional Control office is located in the premises of the Divisional Railway Manager's office. Sometimes outlying control offices are also provided on bigger Divisions, e.g. Agra Control on Jhansi Division, Tundla Control on Allahabad Division. Entire division is divided in manageable areas and each area is controlled by a separate 'Control Board'.

3.603 The set up of Allahabad Division Control Offices given below as an example.

Functions of Divisional Control Organisataion

3.604 The main functions of Divisional Control Organisation are listed below:-

(a) Train Control
(b) Traffic Control
(c) Power and Crew Control.
(d) Traction loco and Power Control
(e) TXR Control.
(f) Material Trains/Engineering Control.
(g) Commerical Control
(h) Security Control
(i) Safety Control

3.605 These functions are described briefly in subsequent paras.

Control Organisation

3.606 The typical organisational set up for performing the above functions on a Division is given in the chart below:

(a) Train Control

3.607 As stated earlier, the entire Division is divided into manageable control boards. Each control board is manned round the clock by Section Controllers (SCORs) in shift duties.

3.608 A SCOR sits in a sound proof cubicle with glass fronted door. He is connected to all stations, yard cabins and other important locations under his jurisdiction on a 'Omnibus' control phone circuit. He can call a station Master of Area Controller etc. by giving the corresponding ring. However, a Station Master can just lift his control phone and talk on the same. Only one person must talk at a time to avoid confusion. An SCOR has the priority to speak and he can direct which person should speak first.

3.609 The Station Masters are required to inform the SCOR the exact timings of arrivals, departures and passing through of trains soon after their occurrences. SCOR plots the movement of trains on his section on a time-distance graph based on timings repeated by the Station Masters. He also has a Master Chart displayed in front which gives the scheduled paths of all Mail, Express, Passenger and important goods trains. With the help of these charts a Section Controller plans in advance as to at what stations crossings and precedence of trains must be arranged according to their relative priority and at the same time ensuring minimum detention to trains. He issues instructions to the Station Masters accordingly sufficiently in advance for ensuring smooth working.

3.610 Apart from arranging crossing and precedence, the SCOR also takes suitable action in cases of emergencies such as unusual occurrences, accidents, agitations, engine failures, hot axle wagons, relief of train crew, etc.

3.611 An SCOR is a vital link between the administration and the field staff he can achieve better punctuality of passenger carrying trains and higher average speeds or goods trains through efficient and intelligent planning and control.

3.612 The Control Charts plotted by the SCORs are test checked by Dy. Chief Controller (Punctuality). A few charts of difficult sections area also checked by operating officers. Shortcomings, if any, on the part of SCORs are brought to their notice for their education and improvement. Punctuality of Mail/Express and Passenger trains is a very important aspect to be kept in view by the SCORs and the operating officers.

Traffic Control

3.613 'Traffic Control' is in fact the main aspect of control of freight operation on a Division. The salient features of Traffic Control are described below:-

(1) Loading on the Division

3.614 As has been explained earlier, maximizing loading of goods traffic is the main objective of freight operation. 'Smalls' booking has since been discontinued and piecemeal wagon loading is also not much encouraged in the new pattern of traffic. Hence most of the loading is now done in rake loads of BOX, BOX, 'N', BCN, BCX and CRT wagons. Conventional wagons such as 'C', 'K','CA' etc. have become quite old and as they are having brass bearing (and not roller bearings) they are normally not fit for loading of long distance traffic. Also they have screw couplings and cannot, therefore, be mixed with newer type CBC coupling wagons. Therefore, such wagons area being used in separate rakes, known as 'CC' rakes which are used for short distance closed circuit movements. Such conventional wagons which do not get formed in 'CC' rakes are used for piecemeal wagon loads.

Allotment and Supply of Wagons for loading

3.615 The rail users place their indents for loading of their goods in wagons with the SMs of the stations concerned. The control office receives the particulars of these indents every day through 16.00 hrs. 'Stock Reports' from the stations concerned. Allotment and supply of wagons has to be arranged by the Control. Keeping in view the oldest dates of registration as well as the priority of traffic as given in the 'Preferential Schedule' issued every six months by the Central Government to ensure supply of wagons to vital and essential traffic. 'Preferential Schedule' lists priority of traffic in five categories viz. A, B, C, D, and E. Priority traffic (A,B,C&D) includes important goods such as Military traffic, Government sponsored foodgrains movement, Iodised salt, seeds to State Governments, coal from collieries and per programme given by Goal Controller, POL traffic, levy sugar, cement, fertilisers etc.Traffic not covered by categories A, B, C and D is called non-priority traffic 'E'.

3.616 As most of the traffic now moves in train loads, the control office keeps a close watch on the indents for full train loads and the availability of empty rakes for loading of such traffic. A close liaison is kept with the Zonal HQs as well as adjoining divisions to keep a track on incoming rakes so as to supply the rakes for loading as expeditiously as possible. Supply of wagons for loading piecemeal traffic 'E' is now done mostly on nominated days, maybe once a week.

(2) Ordering Goods Trains

3.617 Timely ordering of goods trains is an important duty of Traffic Control. For ordering a goods train the Dy. Chief Controller ensures the availability of-

(a) Load,
(b) Power (i.e. locomotive),
(c) Crew, and
(d) Path

3.618 He then issues a 'Train Notice' to the Station/Yard concerned, normally 3 to 4 hours in advance of scheduled departure time so that all activities such as sending call book to the train crews, proper formation offload, outgoing train examination, preparation of outgoing vehicle guidance, attaching of loco on the train, creation of required vacuum etc. could be done in time.

(3) Unloading of Traffic on the Division

3.619 Dy. Chief Controller (Tfc) must keep a close watch on the inward loaded wagons which have to be unloaded on the Division. For train loads position has to be watched almost on an hourly basis. For piecemeal wagon loads daily report is received from unloading points indicating opening balance, fresh wagons placed for unloading, wagons unloaded and balance wagons to be unloaded. If left over balance is high special efforts have to be made and the matter may have to be tackled at Sr. DOM and Sr. DCM level. Special watch has to be kept on crane consignments, over dimensioned consignments and wagons requiring transshipment.

3.620 Daily 'in-sight' figures for loaded wagons expected to arrive on the Division within next one to three or more days must be checked from HQs office and if the inflow is expected to be more than the capacity for unloading, assistance should be sought from the HQs office to regulate, divert or restrict the traffic as considered desirable for smooth flow of traffic.

3.621 Released empty wagons/rakes must be worked out expeditiously as per pattern of traffic and the directions of the HQs and Sr. DOM.

(4) Working of Transhipment Point

3.622 If there is a break of gauge transhipment point on the Division, the Traffic Control must ensure supply of matching empties as required. Close watch must be kept to ensure that the wagons are transshipped as required utilizing full capacity of the Tranship Shed. Placements and removals must be done in time and special watch should be dept on crane consignments.

(5) Interchange of Traffic

3.623 Interchange of goods traffic at inter-railway and local interchange points as per quotas fixed by the Railway Board and the Zonal HQs is very important for mobility (smooth flow) of traffic. Keeping in view the pattern of traffic the Railway Board lays down quotas of empty and loaded wagons to be interchanged (handed over and taken over) at the various inter railway interchange points. The Railway Board also lays down the targets of average wagon holding (empties and loaded separately) for the various Zonal Railways. Each Zonal HQs in turn lays down, target average Divisional Wagon Balance (DWB) for each division.

3.624 If the total wagons received on a division in a day is equal to number of wagons dispatched to adjoining divisions the DWB remains same. However, if the dispatches are less than receipts the DWB will increase. A reasonable variation of DWB from the target DWB may not cause concern. But if the DWB is comparatively much more than the target, without appreciable increase in loading on the Division, it is a cause for concern. Because in such a case the wagon utilization on the division will deteriorate and other divisions may run short of wagons for their loadings.

3.625 For smooth flow of traffic and for making the requisite number of wagons available for loading on the various Zonal Railways/Divisions, it is important that the Divisions ensure interchange offloaded and empty wagons at the various interchange points as per targets laid down. This is a very important aspect of Traffic control.

(c) Power and Crew Control

3.626 Locomotives are very precious assets of the Railways. Any shortage or inbalance of locomotives may result in hold ups and impediments to smooth flow of traffic. Power control, therefore, includes the following aspects:-

(i) Making the locos available for ordering of trains and movement of traffic without detention.
(ii) Making optimum utilization of locomotives without causing them undue detentions.
(iii) Ensuring proper maintenance of locos and avoiding locomotives failures.
(iv) Sending locomotives for their repairs and maintenance to homing sheds as per schedules.
(v) Ensuring locomotives carry maximum loads as per their (tractive efforts) capacity.
(vi) Light running locos to be avoided as far as possible.

3.627 Working of train crews is governed by Hours of Employment Regulations (HER). The Dy. Chief and Power Controllers must ensure the following:-

(i) Crews are provided home and outstation rests as per HER.
(ii) Overtime working of crew is minimized, preferably reduced to zero.
(iii) Crews are relieved in time as per rules.
(iv) The incidence of train crews working over 10 hrs. at a stretch is kept to the very minimum.
(v) Trains do not have late starts due to late booking of train crews.

(d) Traction Loco and Power Control

3.628 So far as electric locos are concerned, the same aspects as described above have to be watched. In addition, Traction power has also to efficiently manage the supply and use of electricity to the overhead equipment (OHE) on electrified sections. Proper coordination has to be ensured with OHE maintenance staff and power blocks arranged as per their requirements.

(e) TXR Control

3.629 TXR controllers are posted in the control office for the following duties:-

(i) Ensuring quick repairs and clearance of wagons marked sick at roadside stations.
(ii) Ensuring timely placements and removal of wagons in sick lines.
(iii) Ensuring sick lines carry out repairs as per their capacity and left over sick wagons are not excessive.
(iv) Wagons are sent to workshops for POH as due.

(f) Material Trains/Engineering Control

3.630 Ballast Controllers posted in the control office maintain a close liaison with Deputy/Section Controllers are field officials of the Engineering Department for the following:-

(i) Ballast trains run as per requirements of engineering department.
(ii) Engineering Blocks for maintenance and repairs to tracks are organized as required.
(iii) Caution orders are recorded and issued at Notice stations properly.

(iv) Detentions to trains on engineering account are closely watched and enquired into.

(v) Utilisation of mechanised track maintenance machines is properly coordinated & monitored.

(vi) Engineering labour is organised by field officials in time.

(g) Commercial Control

3.631 Commercial Controllers look into following aspects:-

(a) Detention to trains on commercial account are closely watached and enquired into.

(b) Coordination of surprise ticket checking raids.

(c) Arranging unloading of loaded sick wagons detached at roadside stations, if asked for by the C&W staff.

(e) Keep a watch on detentions in unloading of wagons at goods-sheds, goods terminals and transhipment points.

(f) Ensuring adequate stock of money value books and tickets stock at stations and helping stations in case of any emergencies.

(g) Security Control

3.632 The security control ensures proper coordination between Security Officers in the Divisional office and field staff to guard vital installations and preventing thefts of railway materials and consignments. They also coordinate with commercial department in case of surprise ticket checking and alarm chain pulling raids. They maintain a close liason with the Govt. Rly Police for ensuring proper law & order on trains & stations premises.

(i) Safety Control

3.633 This is of recent origin. Safety Controllers keep a close liaison with field staff and officers in case of unusual occurances and accidents. They also keep a watch over supply of safety equipments and medical relief arrangements at stations.

3.7 SALIENT FEATURES OF CONTROL OF FREIGHT (GOODS) OPERATIONS AT ZONAL HQS AND RAILWAY BOARD LEVEL

ZONAL HQS

3.701 Chief Operating Manager (COM) assisted by other operating officers as mentioned in lesson 1, is overall in-charge of railway operations of the zone. The important aspects for coordination and control of good operation at Zonal HQs level includes the following:-

(i) Ensuring that loading of rakes/wagons on the divisions is according to the programmed targets and outstanding indents.
The supply of empty rakes for loading is monitored and close liaison is maintained with other zonal railways and Railway Board for the purpose. Expeditious loading and clearance of train loads is closely monitored.

(ii) A close watch is kept on the receipt and unloading of inward loaded rakes. In case there is likelihood of excessive receipt of inward wagons or there are certain unusual circumstances such as accidents etc. which may lead to congestions, close coordination has to be maintained with the Railway Board and other Zonal Railways to regulate the traffic suitably.

(iii) A close watch is kept to see that inter-railway and inter-divisional intercharge of traffic is smooth and as per targets. Divisional Wagon Balances should normally be as per targets. In case any division is holding excessive DWB, reasons should be analysed and the Division should be assisted to improve the situation.

(iv) It should be watched that average hourly holding of Diesel/Electric locomotives on the Divisions is as per targets and balancing of locomotives is done as required. Locomotive utilization figures, including average speeds of goods trains, should be closely monitored.

(v) Similarly wagon utilization indices such as wagon Turn Round, Wagon Kms per Wagon Day etc. should be closely monitored division-wise.

(vi) Expeditious clearance for movement of over-Dimensional Consignments (ODCs) should be given, taking approval/sanction of other zonal railways and ACRS as required under the rules.

(vii) Planning for additional line-capacity words and additional rolling stock be done carefully to meet the future demands of traffic efficiently. The same should be pursued with the Railway Board for inclusion in the Words Programmes.

Railway Board's Level

3.702 As mentioned in Lesson 1, Member (Traffic), assisted by Additional Member (Transporation) and other officers is in overall charge of Railway Operation on the Indian Railways. Important aspects to be looked after at Railway Board's level include the following:-

(1) Fixing loading targets commodity arise for the various zonal railways. A close interaction with other ministries and major industries is maintained to fix realistic targets and origin-destination linkages.

(2) Prescribing zone-wise targets of average holding of wagons according to the pattern of traffic and loading requirements.

(3) Prescribing target holding of average hourly outage of diesel and electric locomotives on the various zonal railways.

(4) Monitoring loading/unloading and interchange of traffic zone-wises. A close watch is kept on supply of rakes for loading/unloading and their clearance. Regulating loading and flow of traffic in case of congestions or anticipated congestion.

(5) Monitoring locomotive and wagon-utilisation figures zone wise vis-a-vis the prescribed targets.

(6) Allotment of new locomotives/wagons to various zones as per traffic plan and requirements.

(7) Planning for additional capacity including additional rolling stock for meeting future demands of traffic efficiency.

3.8 BROAD GAUGE WOAGON POOL

Classification of Wagons

3.801 For the purpose of inter-railway movement of traffic, the wagon fleet on Indian Railways is classified in the following categories:-

(1) **Local loading wagons :** These should move within the prescribed local limits only i.e. within a division or within a zone. These wagons are stenciled (LL).

(2) **Non-pooled wagons :** These are generally special type wagons, such as POL wagons, well-trucks etc. Mark (NP) is stenciled on such wagons and they have to be returned to the owning Railways after unloading.

(3) **Pooled wagons:** These wagons can be loaded freely and can have interzonal movements without any impediments.

Owning Railways

3.802 Each wagon is owned by a particular Zonal railway and the name of the owning railway is stenciled on each wagon. Cost of the wagon is borne by the owning railway. Timely POH of the wagons is also the responsibility of the owning railway.

Credit and Debit Balances

3.803 The difference between the number of wagons owned and the average daily number of wagons actually held on a Zone is known as its Credit or Debit balance. If the number held is less than number owned, it is credit (+) balance and if it is more it is debit (-) balance.

3.804 The Railway Board fixes target credit/debit balances zone wise keeping in view the loading requirements and the pattern of traffic. The Zonal railways are expected to adhere to theses targets.

Wagon Hire charges

3.805 The Railway Board computer receives the particulars of daily interchange of wagons between various zonal railways. After duly checking and requisite adjustments, monthly credit and debit balances are worked out zone wise in terms of four wheeler units. The zonal railways with debit balances have to pay hire charges of extra wagons held to the railways having credit balances.

These statements are sent monthly to the Director of Wagon Intercharge, Indian Railways Conference Association (IRCA), who works out total wagon hire charge to be credited/debited to the zonal railways as per prescribed rates.

3.9 OPERATING STATISTICS

3.901 Operating Statistics helps us to quantify the work done and assess the efficiency of our performance.

3.902 Statistical Units

(a) Primary Units : Units of distance, time, weight, money etc. e.g. Km, day, tonne, Rs.etc.

(b) Fundamental Units : Products of two primary units which gives us quantum of input or out-put e.g. wagon-days, tonne-Kms, Passenger-Kms, Train-Kms, Engine-Hours etc.

(c) Derived Units : It is the ratio; of two primary or fundamental units and gives us the idea or our efficiency of performance or productivity of resources e.g. Wagon km per wagon day, Train Kms per train Engine Hour (Average speed of trains) Net-tonne Kms per wagon day etc.

3.903 Productivity of Resources

Productivity of resources is defined as the ratio of output to input. The units for measuring productivity of various resources of the railways are described below.

(a) **Wagon Utilisation:** The derived units for measuring the efficiency of wagon utilization include the following :-

(b) Wagon Turn Round.

(c) Wagon Kms per Wagon Day.

(d) Net tonne Kms per Wagon Day.

(e) Net tones Kms per Tonne of Wagon capacity.

Wagon Turn Round is defined as average time interval in days between two successive utilization of wagon. It is, however, statistically calculated by the following formula,

WTR =

Where B = Effective Average wagon balance
L = Average daily number of wagon loaded.
R = Average daily number of loaded wagons received.

(b) Engine (Loco) Utilisation :

(i) Engine Kms per Engine day on line.

(ii) Engine Kms per Engine day in use.
(iii) Net Tone Kms per Engine Hour.
(iv) Average speed of goods trains.
(v) Average train load.

(c) Track Utilisation

(i) Net-tonne Kms per Route Km.
(ii) Passenger-Kms per Route Kms.
(iii) Gross tonne-Kms per Route Kms.

Operating Ratio

Operating Ratio helps us to assess our financial performance. It is defined as, the percentage of gross working expenses to the gross revenue recipts.

Operating Ratio =

3.904 Improving (Efficiency) Productivity of various resources:
The various resources of the Railways include rolling stock, track, fuel, staff etc. The measures for improving their productivity are listed below.

(a) Wagon Utilisation:

The most comprehensive indices for measuring productivity of wagons are Net-tonne Kms per wagon-day and Net-tonne Kms carried per tonne of wagon capacity. Measures for improving the same include-

(i) Running train loads of traffic by passing intermediate yards.
(ii) Reducing detentions to wagons at loading/unloading terminals, and yards and transhipment points.
(iii) Increasing average speeds of goods trains.
(iv) Reducing percentage of ineffective wagons.
(v) Using high capacity wagons.
(vi) Increasing average load per wagon.
(vi) Reducing percentage of empty wagaon-Kms to loaded wagon-Kms.

(b) Locomotive Utilisation

Most comprehensive unit for measuring loco-utilisation is Net-tonne Kms per Engine Hour on Line. The steps to improve the same include-

(i) Running of full load trains.
(ii) Increasing average speed of goods trains.
(iii) Reducing detentions to locomotives at various points.
(iv) Minimising percentage flight engine Kms to total engine kms.
(v) Reducing percentage of ineffective locomotives.
(vi) Minimising locomotive failures.
(vii) Designing wagons with maximum pay load to tare ratio.

(c) Fuel Utilisation

(i) Educating and encouraging drivers to economise in fuel consumption.
(ii) Better maintenance of locomotives.
(iii) Eradicating theft of coal & fuel oil.
(iv) Designing locomotives with Engine fuel efficiency.
(v) Avoiding idle running of locos.
(vi) Running trains evenly on electrified sections to minimize peak loads.

(d) Track Utilisation

Track utilization is best measured in terms of net-tonne kms plus passenger-Kms per route km per annum. Measures for improving the same will include the following:-

(i) Maximising throughput by running maximum number of trins.
(ii) Maximising average net load per train.
(iii) Strengthening track and bridges to take heavier axle loads (say upto 25t on BG)
(iv) Improving track to increase maximum load per metre of track (from 7.67 tonne per metre on B.G. as at present).
(v) Removing permanent speed restrictions.
(vi) Using high speed turn outs.
(vii) Carry out remodeling of fixed structures to permit increase in maximum moving dimensions.

(e) Staff Utilisation

Net tonne Kms plus passenger kms per employee on the Indian Railways is quite low as compared to developed countries. This could be improved by the following measures:-

(i) Proper education and training of officers and staff and developing required skills.
(ii) Adopting modern management techniques to motivate staff to give in their best. Such as encouraging, team spirit, creating a sense of belonging to the organization and sense of pride of being a railway man.
(iii) Adopting work-study and industrial engineering methods to improve productivity.
(iv) Identifying surplus staff and retraining them for absorbing in alternative jobs.
(v) Enlarging the scope of welfare measures for staff.
(vi) Streamlining the working of Personnel Department to sort our staff grievauces expeditiously.
(vii) Close coordination with recognized trade unions to improve the working conditions of staff etc.

Employees are the most precious resource of an organization. The above list gives only a few important aspects. There are many other areas which could be tackled to improve productivity of staff.

(f) Operating Ratio:

As defined earlier operating Ratio is the percentage of Gross Working Expenses to Gross Revenue Recepits.

Gross earnings could be increase by

(i) Maximising quantum of passenger and good traffic.
(ii) Adopting a rational tariff policy and minimizing losses on social burdens.

Working expenses could be reduced by-

(i) Improving productivity of resources.
(ii) Exercising economy in every aspect of railway working.

3.905 Conclusion :

Statistics is an important managerial tool. If used intelligently and properly it can help us greatly in identifying our areas of weaknesses and indicating what steps should be taken to improve our quality of service and productivity of resources.

Transportation Management

Lesson 4

Modren Trends in Transport Management

4 FREIGHT OPERATION

4.1 Unit Train :

Unit Train is a freight train, which contains all the wagons for a single destination. The full train is either loaded by a single consignor or multi-consignors from a station to a single point- Such a train movement is also known as "point-to-point" movement. The advantage of Unit Train movement accrues in terms of elimination of marshalling of trains in inmarshalling yard, elimination of wagaon detention in the marshalling yard, improved wagon turn round, improved wagon-usage, improved efficiency, quick transit time etc. The disadvantages are: (i) a very large unit of transport, requiring availability of large quantity of goods for movement, (ii) high mobilization efforts in terms of labour and transportation from godowns.

Indian Railways have resorted to Unit Train movement in 1980 to tide over the capacity shortage problem.They are normally not loading wagons in piecemeal or goods less than wagon load.

4.2 Heavy Haul Trains :

Heavy haul trains are longer trains carrying large number of wagons in one train. Currently, the heaviest train on Indian Railways consists of 59 BOXN wagons. The trailing load of the train is about 5400 tonnes. Heavy haul trains, comprising two trains of 58 BOXN each having a trailing load of 9400 tonnes, have also been run during the 1980s and 1990s on experimental basis between Eastern and Northern Railway Coal Circuits. However, longer trains pose problem due to inadequacy of length of loop lines at stations. The standard loop length is 686 metre, which is normally extended to 715/730 meters in graded sections to accommodate for multiple loco running.

4.3 High Speed Freight Trains

The normal speed of a freight train with air-brake BOXN/BCN stock is 75 kmph in the loaded direction and 80 kmph in the empty direction. However, to increases the line capacity and improve the transit time, Indian Railways have embarked upon the strategy of running freight trains at 100 kmph. The container trains between Delhi and Mumbai and rakes of coal trains between Eastern and Northern Railway are running at 100 kmph. The transit time of container trains has been reduced to half by running them at 100 kmph.

4.4 Multimodal Container Trains

With globalisation economy and trade, export and import traffic is growing, at very fast pace. Gradually the international traffic has been shifting to the container. This required focused attention on container movement. Indian Railways have formed a separate company, named CONCOR. To deal with container business, both international and domestic. Railways as facing stiff competition from 'road', which is resulting in diversion of traffic from rail to road mode of transport. Moreover, with increased share of 'manufacturing sector' in the GDP, aggregation of consignments to form a train load has become essential. Diversion of this traffic from road to rail requires provision of total logistic solution and containerization of the traffic for multimodal movement. CONCOR is successfully increasing its share in the domestic multimodal traffic, using the container route.

PASSENGER OPERATION

4.5 High Speed Intercity Shatabdi Trains

To cater to the requirement of business travellers covering a distance of 300 to 500 kms., high-speed fully air-conditioned Shatabdi-type trains have been introduced on Indian Railways. These trains have AC Chair Car and Ac Executive Chair Car accommodation. They provide for

the normal travel requirement of business travellers and are very popular. The maximum speed of these trains varies from 120 to 140 kmph.

4.6 High Speed Rajdhani Trains

These set of trains connect state capitals with Delhi, which is the Capital of the country. These are fully air-conditioned trains, having Ist Ac, 2-tier AC and 3-tier AC sleeping accommodation. They normally cover the distance of the state capitals as overnight journey. Meals and other bed roll requirements, etc. are fully met. The maximum speed of Rajdhani trains normally in the range of 120 kmph.

4.7 Jan Shatabdi Trains

These are newly-introduced trains during the 150th year of Railways, existence. These are second-class high-speed intercity trains, catering to the not-so-affluent travellers' requirement.

4.8 EMU Trains

In the suburban section, for fast travel of daily commuters, Electrical Multiple Units (EMUs) type of trains area run. These trains have fast acceleration and deceleration, wide doors and area run on sections which have high level platforms, which normally flush with the floor of the coach. This provides for a service with small stoppages at short and frequent intervals. High acceleration and deceleration helps in tiding over the loss of time in frequent stoppages. Wide doors help in entraining and detraining of passengers in short halts. High level of platform avoids need of steps in the coach and help in quick entraining/detraining.

4.9 Duranto Trains

These trains were introduced in 2009. They run nonstop between originating and terminating stations.

PARCEL OPERATION

4.9 Private Parcel Trains

Indian Railways are running millennium parcel express trains, which are leased to private operators. These trains are dedicated to private operators and are run between two set of points. The private operator fixes its own tariff and fills the train. He pays a fixed rate per kilogram to the Railways.