

# Chapter - 1

## Introduction

### 1.0 Overview of Indian Railways

Indian Railways (IR) is a great national asset, a single transport network, connecting far flung areas of the country. It is infrastructural backbone of Indian economy. With around 65000 RKms of track network & total traffic earnings of around Rs 1,39,838 crores, it is one of the largest transportation and logistics networks of the world which runs around 19,000 trains per day. It runs around 12,000 passenger carrying trains to carry over 23 million passengers per day, connecting about 8,000 stations spread across the sub-continent. It is equivalent to moving the entire population of Australia in a day. It runs more than 7,000 freight trains per day, carrying about 3 million tonnes of freight every day.

It has joined the select club of countries, comprising Chinese, Russian and United States Railways, with an originating freight loading of 1008.09 million tonnes (i.e. one billion plus) in the financial year 2012-13. During the year 2013-14, Indian Railways carried 1.05 billion tonnes of revenue earning freight traffic. Indian Railways, with around 1.307 million employees, is one of the largest commercial or utility employers of the world.

However, IR is passing through a challenging phase today. It is facing stiff competition from other segments of the transport sector of Indian economy. As shown in **Table 1.1** (Indian Railways- A White Paper, 2015), total share of

the transport sector in GDP of the India is around 6.7%. The share of IR in overall GDP has been static at 1% and has, in fact, gone down to 0.9% in 2012-13, against the corresponding share of road transport of 4.9% of GDP. With renewed focus on highway construction, the share of the road sector may further increase. This increase in the road sector share may occur at the expense of the IR.

**Table 1.1: Share of Transport Sector in Overall GDP (%)**

Financial Year ----	2008-09	2009-10	2010-11	2011-12	2012-13 (1 <sup>st</sup> RE)
Overall Transport	6.6	6.6	6.5	6.6	6.7
<i>of which</i>					
Railways	1.0	1.0	1.0	1.0	0.9
Road Transport	4.7	4.7	4.6	4.8	4.9
Water Transport	0.2	0.2	0.2	0.2	0.2
Air Transport	0.2	0.2	0.3	0.3	0.3
Services incidental to transport	0.4	0.4	0.4	0.4	0.4

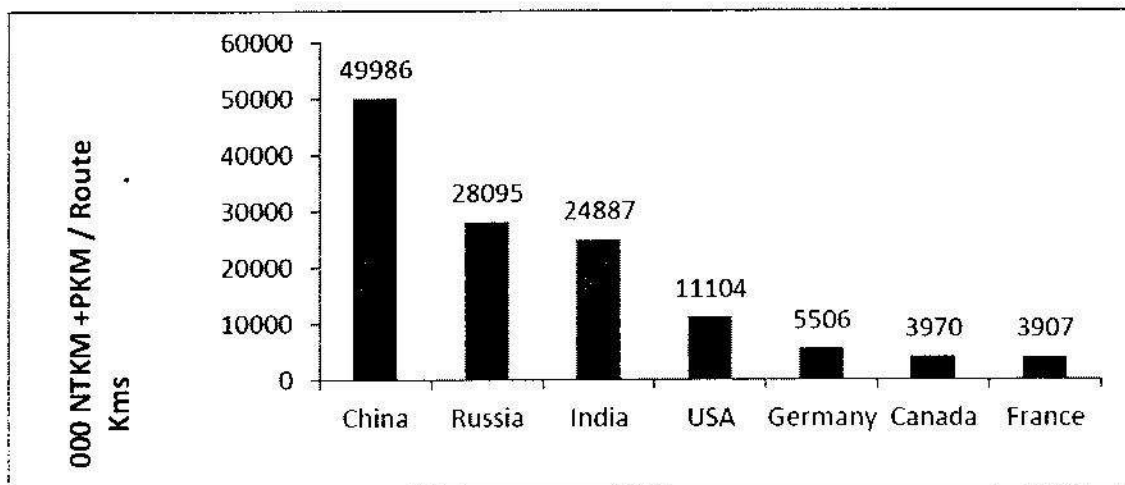
The growth story of Indian Railways, over the last 64 years, is captured below in **Table 1.2** (Indian Railways- A White Paper, 2015). In the last 64 years, the Route kilometers have grown by only 23%, from 53,596 Rkm in 1950-51 to 65,806 Rkm and Doubling & Multiple route length by only 289%, from 5,127 Kms to 19,887 Kms. The above growth pattern has resulted in large scale congestion of the system, affecting the speed of movement, something that impacts passenger satisfaction.

**Table 1.2: Key Parameters of IR**

Items	1950-51			2013-14			%Variation		
Route Kms (All Gauges)	53,596			65,806			23%		
	BG	MG	NG	BG	MG	NG	BG	MG	NG
	25258	24185	4153	58175	5334	229	(+)	(-)	(-)
Running Track Kms (All Gauges)	59,315			89,987			52%		
Total Track (Kms)	90,500 (1964-65)			1,14,907			27%		
Double & Multiple Route Length (Kms)	5,127			19,887			289%		
Freight Carried (Million Tonnes)	73			1,054			1344%		
Wagon Turn Round (Days)	11			5.13			(-)54%		
Wagon Capacity (Million Tonnes)	4.14			13.65			230%		
Passenger Originating (In Millions)	1.284			8.420			556%		
Passenger Kms (In Millions)	66,517			11,58,742			1642%		
No. of Passenger Trains Run Daily (Base Year 1982-83)	6,392			12,874			102%		
Seat/Berth Capacity (Suburban)	87,986			15,28,124			1637%		
Seat/Berth Capacity (Non-Suburban)	8,54,678			36,43,423			327%		

Although the Traffic Density on IR is quite high as per world standards, the growth of the network is not commensurate with the growth of the traffic as can be seen from the following graph in **Figure 1.1** (Indian Railways- A White Paper, 2015):

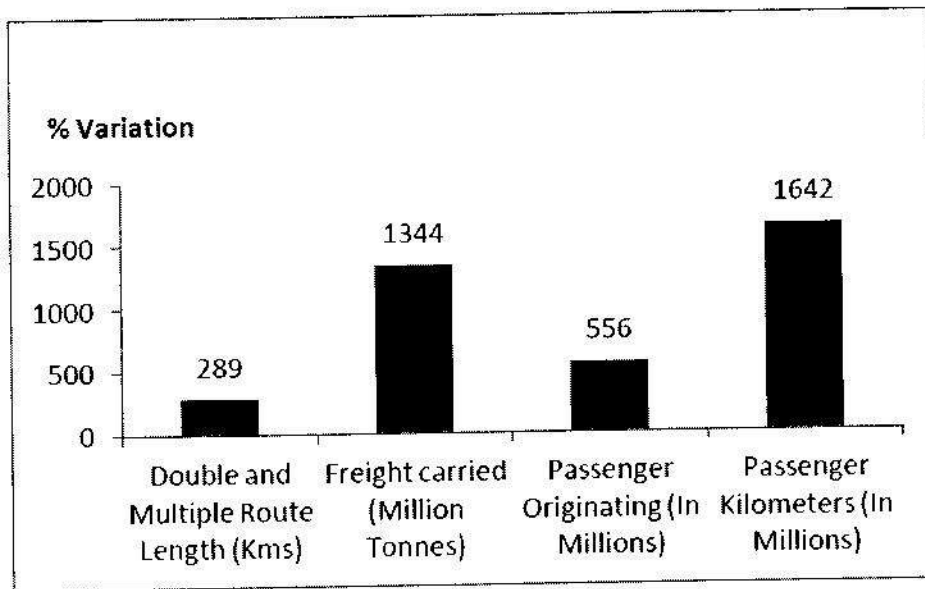
**Figure 1.1: Traffic Density**



Due to resource crunch, the expenditure on Railways, as a percentage of total transport expenditure, has been declining over last few decades. Railway expenditure, as percentage of transport sector expenditure, used to be about 56% in 7th Plan (1985-90). It has reduced to 30% in 11th Plan (2007-12). IR, in last two decades, has remained under-invested whereas the road sector has witnessed a surge in investments. In the last 64 years, as shown in **Figure 1.2** (Indian Railways- A White Paper, 2015), while the freight loading has grown by 1344% and passenger kilometres by 1642%, the Route kilometres have grown by only 23% and Doubling & Multiple route length by only 289%. The biggest challenge facing Indian Railways today, therefore, is its inability to meet the demands of its customers, both freight and passenger.

Indian Railways has suffered from chronic and significant under-investment as a result of which the network expansion and modernization has not happened at the requisite pace leading to an erosion of the share in national freight and passenger traffic. There is a clear recognition of the fact that for serving as the lifeline of the nation and making a contribution to the country's growth, the organization needs to become operationally and financially sound.

**Figure 1.2: Growth Pattern since Independence**



Indian Railways is striving to enhance its market share and improve the quality of service so as to ensure that rail travel is an experience beyond other modes of travel. This can be achieved by eliminating capacity bottlenecks which constrain growth, improve productivity of assets and efficiency of operations and optimal employment of its resources including human capital.

The high density networks of the Indian Railways are facing acute capacity constraints coupled with a low passenger fares thereby leading to increases in freight tariffs to cross subsidize passenger revenues. However, that only enables recovery of costs and does not leave enough resources for investment in network expansion and replacement of assets. **Table 1.3** (Indian Railways- A White Paper, 2015) shows the financing pattern of the Plan investment over the last few years.

**Table 1.3: Financing the Railway Plan**

	2009-10	2010-11	2011-12	% share	2012-13	% share	2013-14	% share	2014-15 (BE)	% share
Budgetary Support	16911	18385	20013	44%	24132	48%	27033	51%	30100	46%
Railway Safety Fund	805	1100	1323	3%	1578	3%	1983	4%	2200	3%
Internal Resources	12196	11528	8935	20%	9531	19%	9681	17%	15350	23%
Extra-budgetary resources	9760	9780	14790	33%	15142	30%	15085	28%	17795	27%
<b>Total</b>	<b>39672</b>	<b>40793</b>	<b>45061</b>		<b>50383</b>		<b>53782</b>		<b>65445</b>	

Investments in safety have also suffered on account of low internal generation of resources. Although the safety record of Indian Railways compares well with other European countries, the fact remains that there is considerable room for improvement. Unmanned level crossings are a major area of concern apart from accidents that arise on other accounts.

The productivity of Indian Railways does not match up with other countries. Select productivity indicators of Indian Railways vis a vis other Railway systems are shown in Tables 1.4, 1.5 and 1.6 (Indian Railways- A White Paper, 2015) below.

**Table 1.4: Passenger Service Yields in some Major Economies**

Country	Passenger Service Yield US Cents / Passenger-KM at nominal prices	Passenger Service Yield US Cents/Passenger-KM adjusted for PPP* (India=1)
India	0.6	1.0
China	2.4	2.7
Russia	5.2	6.7
Japan	19.0	9.4
Germany	12.6	6.2

Source: World Bank (2012): Railways International Overview: Issues for India (12<sup>th</sup> Plan document)

**Table 1.5: Freight Yields in some Major Economies**

Country	Freight Yield US Cents/ Total Tonne-KM at nominal prices	Freight Yield US Cents/Total Tonne-KM adjusted for PPP (India=1)
India	2.11	1.00
China	1.49	0.58
Russia	2.20	0.75
USA	2.28	0.51

Source: World Bank (2012): Railways International Overview: Issues for India (12<sup>th</sup> Plan document)

\*PPP: Purchasing Power Parity

**Table 1.6: Benchmarking Indian Railways with Chinese and Russian Railways**

Railways	Employee Productivity (Annual)		Network Productivity		Wagon Productivity (Annual)
	NTKM (million)/ Employee	PKM (million)/ Employee	NTKM (million)/ Network Length	PKM (million)/ Network Length	NTKM (million)/ Wagon holding
Russia	1.81	0.15	21.87	1.80	5.52
China	1.23	0.38	39.66	12.38	4.31
India	0.44	0.66	9.39	14.12	2.73

Source: UIC Statistics 2009-10 (12<sup>th</sup> Plan document)

Due to under-investment, there has been severe congestion on the network and has resulted in the inability of the system to accommodate more trains and increase the speed of trains. Therefore, the need of the hour is to undertake a massive infrastructure expansion and decongestion program coupled with upgradation of technology and judicious electrification of tracks along with enhancement of terminal capacity. It is evident that the real issue today is the lack of physical capacity over IR on key routes due to severe congestion and the incremental traffic is being offered on the saturated routes only. The consequential impact of the above arises in the areas

network expansion, customer satisfaction, project planning and implementation and safety.

## 2.0 Traffic Growth Scenario on IR

Railways traffic is a derived demand. It emanates from the requirement of the growing population of the country which has already reached 125 crore. This population generates the demand directly on the passenger side and indirectly on the freight side.

Indian Railways entered the Billion Club in freight loading in 2012-13 by achieving 1,008 million tonnes of originating loading. The XII<sup>th</sup> Plan projections of freight loading in the terminal year of the Plan (2016-17) are 1,405 million tonnes. Indian Railways carried 8,425.6 million passengers in 2013-14 which is about 1,430 million higher than the population of the world put together. The XII<sup>th</sup> Plan target is 11,710 million passengers in the terminal year of the Plan. The growth of the traffic over last 5 years is given in Table 7 (Indian Railways- A White Paper, 2015) below:



**Table 1.7: Trends in Traffic Growth on IR**

	2009-10	2010-11	2011-12	2012-13	2013-14
Freight Loading (Million Tonne)	887.79	921.73	969.05	1,008.09	1,053.54
<b>YoY growth</b>	6.53%	3.82%	5.13%	4.03%	4.51%
NTKM (million)	6,00,548	6,25,723	6,67,607	6,91,658	6,74,790
<b>YoY growth</b>	8.90%	4.19%	6.69%	3.60%	-2.44%
Originating Passengers (million)	7,246	7,651	8,224	8,421	8,425.6
<b>YoY growth</b>	4.71%	5.59%	7.49%	2.40%	0.05%
Passenger Kilometers (million)	9,03,465	9,78,508	10,46,522	10,98,103	11,10,000
<b>YoY growth</b>	7.81%	8.31%	6.95%	4.93%	1.08%

As the growth in the economy picks up in the years to come, IR will have a challenging task ahead because of line and terminal capacity constraints in transporting the incremental traffic. Therefore, there is need for significant investment in the network, especially the HDN routes and its feeder and other important routes. This would include prioritised capacity enhancement works such as doubling/tripling/quadrupling and traffic facility works like Intermediate Block Sections, bypasses, longer loops for running long haul trains. The Goods sheds along these routes would also need to be strengthened. The capacity of workshops needs to be enhanced to cater to larger volume of maintenance of wagons and coaches. Similarly prioritized electrification and signalling & telecom works are also of importance for reasons of safety and efficiency.

There is a large shelf of pending projects which is estimated at Rs. 4,91,510 crore on the basis of originally estimated costs. Of these, fund requirement for the prioritized works such as doubling, new lines, gauge conversion, traffic facilities, signal & telecom works, workshops and electrification is estimated at Rs 2,08,054 crore. Such prioritization of works as per developmental requirements can ensure a sustained flow of funds for such projects and focused attention can be given for early completion and commissioning of these works. These will have a direct bearing on the line capacity which in turn will ensure higher earnings and optimal utilization of assets.

Further, there are constant demands for new lines. From the point of view of remote area connectivity and meeting the demands of all for access to rail travel, construction of new lines also assumes importance. However, all of these demands do not translate into viable projects from the point of view of Railways. Hence, a large number of socially desirable projects have been sanctioned in the past creating huge throw-forward liability and thin spread of funds. In many cases, IR carries the burden of losses from operations in case such projects are undertaken.

Projects have been languishing for years on account of absence of assured funding. Delay in execution of projects leads to time overruns and cost overruns. This has an impact on the viability of the projects once they are completed. The available resources are normally spread out thinly over all sanctioned projects.

### 3.0 Infrastructure Congestion over IR

Across zones, the availability of line capacity on high density network & other important routes is illustrated below (492 out of total 1219 Sections i.e. 40% of Sections are running at 100% or above Line capacity) in Tables 1.8 & 1.9 (Indian Railways- A White Paper, 2015).

**Table 1.8: Line Capacity Utilisation on IR**

Railway	< 80%	80-00%	100-120%	120-150%	> 150%	OTOS*	Total
Central	34	9	11	12	7	1	74
East Coast	16	9	9	16	2	4	56
East Central	16	13	19	22	16	5	91
Eastern	22	22	41	1	--	3	89
North Central	11	3	7	22	2	1	46
North Eastern	12	6	12	6	6	--	42
North Frontier	18	10	4	14	3	11	60
Northern	70	26	29	23	10	4	162
North Western	39	7	6	3	1	4	60
South Central	20	32	23	8	9	--	92
South Eastern	24	13	14	17	1	2	71
South East Central	9	6	9	7	2	--	33
Southern	53	38	25	15	--	--	131
South Western	38	12	--	--	--	1	51
West Central	1	4	7	6	3	--	21
Western	32	18	17	21	4	48	140
<b>Total</b>	<b>415</b>	<b>228</b>	<b>233</b>	<b>193</b>	<b>66</b>	<b>84</b>	<b>1219</b>

\*OTOS : One Train only System

It would be seen that most of the Zonal Railways are in the range of optimal and higher than optimal utilization of line capacity.

**Table 1.9: Line Capacity Status of High Density Network on IR**

Railway	<80%	80-100%	100-120%	120-150%	>150%	Total
Central	12	4	7	12	5	40
East Coast	5	--	6	8	1	20
East Central	1	5	4	3	3	16
Eastern	--	3	7	--	--	10
North Central	--	1	5	19	1	26
North Eastern	1	3	6	1	3	14
North Frontier	--	3	--	5	1	9
Northern	3	4	5	7	2	21
South Central	--	14	2	2	2	20
South Eastern	2	2	6	6	--	16
South East Central	--	--	3	5	1	9
Southern	5	8	4	--	--	17
West Central	1	--	2	2	2	7
Western	--	9	2	9	2	22
Total	30	56	59	79	23	247

Further, 161 out of total 247 Sections i.e. 65% of the sections are running at 100% or above line capacity on High Density Network (HDN) routes. The detailed map of capacity constraints over IR gives a graphic description of the situation (Annexure-1).

#### 4.0 Need for Railway Network Expansion

As there is congestion on the high density network, its feeder routes and other important routes, decongestion and expansion of the rail network is required on these routes. Some works related to these areas are already sanctioned, while others are awaiting sanction. All these works may take over 7-10 years to complete at the current levels of funding. Many additional tripling/quadrupling line works are to be sanctioned along with Doubling on some sectors

The National Transport Development Policy Committee (NTDPC) estimated that Indian Railways should invest Rs. 900 billion in the 12th Plan, Rs. 1.9 trillion in the 13th Plan and Rs. 4.6 trillion in the 15th Plan to regain its lost share in the transport sector. There is need to focus on investments which are remunerative and yield returns to IR.

Arrangement of such huge resources for the above critically required network infrastructure is a big challenge for IR. This challenge for the speedy creation of the infrastructure is planned to be met by IR by requesting funding by state governments and other beneficiaries and execution of projects through Special Purpose Vehicles (SPVs).

## **5.0 IR Performance on Operational Safety Front**

### **5.1 Accident Statistics**

A comparison of accident statistics of Indian Railways for 2012-13 and 2013-14 with that of the whole of Europe for 2012 is shown in Table 1.10 (Indian Railways- A White Paper, 2015). To normalize the data due to variation in traffic density, Index of 'Accidents per million Train Kilometre' has been used.

It can be seen that the safety record of Indian Railways compares favourably with that of advanced systems of European Railways. The Accident rate per million Train Kilometres over Indian Railways is 0.201 for 2012-13 and 0.147 for 2013-14 compared to 0.210 over Europe as a whole for 2012. Fatalities per billion Passenger km of IR are 0.240 for 2012- 13 and 0.147 for 2013-14, which is also better than that of Europe (1.033). Although the number of accidents on IR is less compared to those over European Railways in terms of

per million Train Kilometers, still there are some causes of concern which need to be addressed, to make our system safer.

**Table 1.10: Comparison of Accident Statistics of IR & Complete Europe**

<b>Comparison of Statistics</b>						
	<b>No. of Accidents Indian Railways</b>		<b>No. of Accidents Europe</b>	<b>No. of Fatalities Indian Railways</b>		<b>No. of Fatalities Europe</b>
	<b>2013-14</b>	<b>2012-13</b>	<b>2012</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2012</b>
<b>Collision of Trains</b>	8	8	97	1	27	34
<b>Derailments of trains</b>	80	95	97	0	5	0
<b>Level Crossing Accidents</b>	61	73	573	112	179	372
<b>Fires in Rolling Stock</b>	8	14	14	35	31	0
<b>Other Accidents</b>	4	4	81	7	8	10
<b>TOTAL</b>	<b>161</b>	<b>194</b>	<b>862</b>	<b>161</b>	<b>250</b>	<b>416</b>
	<b>Million Train Kms. (Avg/year)</b>			<b>Billion Passenger Kms(per year)</b>		
	1096	964	4095	1098	1046	402.6
	<b>Accidents per million train Kms</b>			<b>Fatalities per billion pass. Kms.</b>		
	0.147	0.201	0.210	0.147	0.240	1.033

## 5.2 Main Causative Factors for Accidents

IR's network has 1,14,907 kms of total track length. Of this, 4500 km of track should be renewed annually. However, due to financial constraints, the progress in track renewals is constantly coming down over the last six years. As on 01.07.2014, 5300 km track length is due for renewal. The target for the current year is only 2100 km. Arrears of track renewal are accumulating which will result in disproportionately high maintenance effort. This will also result in reduced reliability of assets.

Highest numbers of fatalities over IR occur due to accidents at unmanned level crossings. They take place mainly due to the negligence of road vehicle

users in not observing the precautions laid down in the Motor Vehicles Act while negotiating unmanned level crossings. Railways, in conjunction with other stake holders such as State Governments, NHAI etc., are removing the unmanned level crossings by building Road Over Bridges and Low Height Subways in order to eliminate such accidents.

Accidents on account of running staff in terms of Signal Passing at Danger (SPAD) are a major cause of concern. The issue of the accidents on account of loco drivers' error is being addressed through technological intervention. Automatic Train Protection (ATP) systems mitigate the safety risk due to loco drivers' error or over speeding leading to collisions. On IR network, this safety area could not be given adequate priority/resource allocation and induction of ATP systems has been mostly limited to suburban sections. Train Protection & Warning System (TPWS) has been equipped on suburban section of Southern Railway and also on the Kolkata Metro covering all EMU rakes. TPWS has also been approved for 3300 Route Km Automatic Signaling Sections on IR network. There has been delay in commissioning TPWS for want of funds.

Lack of funds is also affecting much delayed upgradation of signaling and telecommunication system of IR which is vital for safety of the train operations. State of the art signaling and telecommunication systems being used by advanced world Railways to realize safety and capacity enhancements compared with signaling and communication systems adopted on IR are shown in Table 1.11 below (Indian Railways- A White Paper, 2015). It may be seen that in spite of having one of the highest traffic densities in the world, the

signaling & telecommunication system of IR is quite outdated and ill-equipped to deal with such high density traffic with zero tolerance for the accidents.

**Table 1.11: Benchmarking in Signalling & Telecommunications**

Signaling & Telecom Elements	Indian Railways	State-of-art / Railways abroad (Global benchmark)
Interlocking systems	<ul style="list-style-type: none"> <li>Relay based (72%)</li> <li>EI based (12%)</li> <li>Mechanical Lever frames (16%)</li> </ul>	<ul style="list-style-type: none"> <li>Electronic Interlocking (EI)</li> </ul>
Block Working systems	<ul style="list-style-type: none"> <li>Absolute block</li> <li>Automatic block signaling (2623 Rkm)</li> </ul>	<ul style="list-style-type: none"> <li>Track circuit block with Automatic signaling.</li> <li>Communication Based Train Control (CBTC) for Rapid Mass Transit.</li> </ul>
Train protection systems	<ul style="list-style-type: none"> <li>AWS ( 328 Rkm)</li> <li>ETCS L1(250 Rkm)</li> <li>Trials with TCAS</li> </ul>	<p>Automatic Train Protection:-</p> <p>USA (PTC): All main line tracks involving passenger &amp; commuter railroad and lines carrying toxic materials – implement by Dec'15.</p> <p>Europe (ETCS): mandated due to interoperability for conventional &amp; high speed trains.</p>
Signals and Movement Authority	<ul style="list-style-type: none"> <li>Line side Color Light LED Signals,</li> <li>No cab signaling.</li> </ul>	<ul style="list-style-type: none"> <li>Line side Signals</li> <li>Cab signaling (USA: Speed &gt; 80 mph, Japan: Speed &gt; 150 kmph-</li> </ul> <p>Europe: ETCS L2; Japan: ATACS; China: CTC; Australia: ATMS; USA: ITCS</p>
Command & Control systems	<ul style="list-style-type: none"> <li>Distributed, voice commands from train controller</li> <li>TMS at Mumbai suburban</li> </ul>	Centralized & Integrated control with automated tools.
Mobile Train Radio Communications (MTRC)	Unsecured, Short range communication system deployed.	Secure, fail-safe and reliable mobile communication system with Save-our- Souls (SoS) features.
Train detection systems	<ul style="list-style-type: none"> <li>DC track circuits</li> <li>Axle counters</li> <li>AFTC</li> </ul>	<ul style="list-style-type: none"> <li>DC track circuits (Relay based Fail Safe)</li> <li>Axle counters</li> <li>AFTC</li> </ul>



Signaling & Telecom Elements	Indian Railways	State-of-art / Railways abroad (Global benchmark)
Points operating equipment	<ul style="list-style-type: none"> <li>• High thrust point m/c.</li> <li>• Clamp lock beginning to be used</li> </ul>	<ul style="list-style-type: none"> <li>• In sleeper machines.</li> <li>• Clamp lock on high speed routes</li> </ul>
Level crossings control	Mostly manual control. warning is from a fixed distance	Mostly automatic control, warning is from fixed distance

As a consequence, the safety of the train operations is dependent, to a large extent, on individual skills of the station operations staff and the running staff. It is one of the main reasons for the high percentage of the accidents on account of human failures on IR.

A list of the operational safety related works that need to be taken up on priority is presented in Table 1.12 (Indian Railways- A White Paper, 2015).

**Table 1.12: List of Safety Related Works Required over IR**

List of Safety Related Works Required over IR
<p><b>Track</b> Track renewal, Renewal of over aged distressed bridges, provision of thick web switches and weld able CMS crossings, improved welding technology, vehicle borne ultrasonic flaw detectors and mechanized maintenance of track.</p>
<p><b>Signalling &amp; Telecommunication</b> Works for provision of isolation, replacement of over aged signaling gears, mobile train radio communication and train protection system.</p>
<p><b>Coaches &amp; wagons</b> Works of up gradation of mainline coaches with smoke and fire detection system, crash worthy buffers, up gradation of wagon and improvement in train examination facility and disaster management facilities.</p>
<p><b>Traction distribution &amp; Rolling Stock</b> Works of replacement of over aged traction distribution assets, masts/portals having critical implantation, fire safety in EMUs/locos, replacement of DG sets in power cars and mid-life rehabilitation of mainline coaches/ EMU.</p>
<p><b>Running Staff</b> Up gradation of training institutes, running rooms and crew lobbies.</p>

### **5.3 Requirement of Funds for improving operational safety**

Special Railway Safety Fund (SRSF) Phase-I which was implemented during the period 2003-2008, involved expenditure of Rs.16,318 crore for improving operational safety on Indian Railways. It involved primarily replacement of worn out assets relating to bridges, signalling systems, track and rolling stock.

A High Level Safety Review Committee under the Chairmanship of Shri Anil Kakodkar was set up in September 2011 and the report was submitted in February 2012 (Kakodkar A. , February, 2012). The Committee has estimated that for implementation of all its recommendations, primarily pertaining to rail safety, will require expenditure of a whopping amount of Rs.1, 03,110 crore in a period of 5 years, i.e. approx. Rs.20, 000 crore per annum for a 5 years period. Such a big amount is beyond the financial capacity of IR. Therefore, IR has been requesting Ministry of Finance for a grant for a second phase of Special Railway Safety Fund to undertake the works recommended by the Kakodkar Committee.

### **6.0 Indian Railway Customers**

Indian Railways deals with two types of customers, viz. passenger and freight. The major issues regarding passenger satisfaction are availability of train accommodation, transit time, punctuality, cleanliness at stations and in trains, catering services, reservation facilities etc. Similarly, major issues regarding freight customers are availability of suitable terminals for loading and unloading, availability of rolling stock and speedy and seamless transit

times of freight trains. The low recovery of costs on the passenger segment and high freight rates have led to an imbalance in the revenues from these two business segments.

### 6.1 Punctuality of Coaching Trains

Punctuality is the one of significant factors determining overall satisfaction of the passengers with the service provider. Indian Railways run 2558 Mail/Express train services, including daily and non-daily services (as on 31 December 2014). IT enabled Integrated Coaching Management System (ICMS) helps in online monitoring of the running of trains.

The punctuality of Mail/Express trains over the Indian Railways is about 80 percent. The average punctuality of Mail/Express trains achieved over the IR system on terminating basis in the last five years is depicted in Table 19 below (Indian Railways- A White Paper, 2015).

**Table 1.13: Average Punctuality of Mail/Exp Trains over IR**

Year	Punctuality Percentage	Avg. No. of Mail /Exp Trains Run Per Day
2010-11	69.00%	1266
2011-12	75.00%	1348
2012-13	79.00%	1430
2013-14	83.00%	1505

*(Source: Integrated Coaching Management System)*

On a daily basis, Indian Railways has now been running about 300 Mail/Express trains more as compared to those in 2010-11. The punctuality of

the trains is severely affected on the trunk routes due to over saturation of line capacity, apart from factors which are beyond the control of the Railways like fog during the December- February period, adverse law and order conditions, running of pilots ahead of Mail/Express trains in Left Wing Extremism (LWE) sensitive areas of East Central Railway etc. Due to over saturation of line capacity on such routes, any disturbance tends to have a cascading impact on punctuality of all trains. During 2013-14, the significant factors accounting for about 54% of punctuality loss of Mail/Express trains were capacity constraints, bad weather and law and order problems, traffic blocks for capacity enhancement /project implementation and up-gradation of existing assets.

For improving the punctuality on IR, developing additional infrastructure by way of signaling intervention, doubling, augmentation of terminals and development of additional terminals needs to be undertaken on priority. However, under the current scenario of overstretched infrastructure, over emphasis on the punctuality is putting avoidable pressure on the running staff. It is resulting in increased instances of human errors and use of unsafe short cut methods by the running staff.

## **6.2 Upgradation of Speed of Coaching Trains:**

inputs for upgrading New Delhi Agra Section to run trains at 160 kmph have been provided. Necessary approvals are being processed for obtaining Safety clearance from Commissioner of Railway Safety. Speed of a higher number of trains is proposed to be increased from 100/110 to 130 kmph. The sections targeted for speed upgradation include Virar- Godhara and Virar- Ahemdabad

section on Western Railway, New Delhi-Ambala, Ambala- Ludhiana sections on Northern Railway and Ghaziabad-Kanpur section on North Central Railway. All the above sections are high traffic density sections. Upgradation of the speed potential on these sections, without upgradation of the signaling system and without provision of the Train Protection & Warning System (TPWS), will make operation of these trains predominantly dependent on the individual skills of the running staff driving these trains. This will make the running staff more vulnerable to be stressed and prone to commit operational mistakes.

### **6.3 Analysis of Profitability of Coaching and Freight Operations of IR**

Analysis of the profitability of coaching services in 2013-14 revealed an overall loss of Rs 21,391 crore, to which net suburban losses in Chennai, Kolkata and Mumbai provided with EMU and Non-EMU services contributed Rs 2,852.32 crore. Excessive stoppages of the coaching trains also not only result in direct revenue losses but also eat into line capacity. The coaching operations are cross-subsidized heavily by the freight operations. It makes Railway freight fares less competitive as compared to road transportation sector. As a consequence, the Railways have been continuously losing the market share to its competitors, mainly from road transportation sector. Non-revision of the passenger tariffs for almost a decade on non-commercial reasons has further aggravated this imbalance. It has put severe constraints on the capacity of IR for undertaking the line capacity and terminal infrastructure upgradation measures from its own internal resources.

## **7.0 Financial Status of IR**

In 1923, IR's functioning was separated from that of the General Finance of India and the arrangement formalized by the Separation Convention of 1924 deemed that IR would be responsible for its own financials while contributing to the exchequer a dividend for the capital invested in it. IR has earned enough to be able to discharge its working expenses, debt servicing, dividend and all other liabilities including planning for investments and depreciation. Apart from that, IR has also carried a huge social burden which it faithfully discharges by either concessions or subsidized travel. However, of late, particularly after the Sixth Pay Commission, there has been a downside in the finances of IR, impinging upon its investment planning.

### **7.1 Structure of IR's finances:**

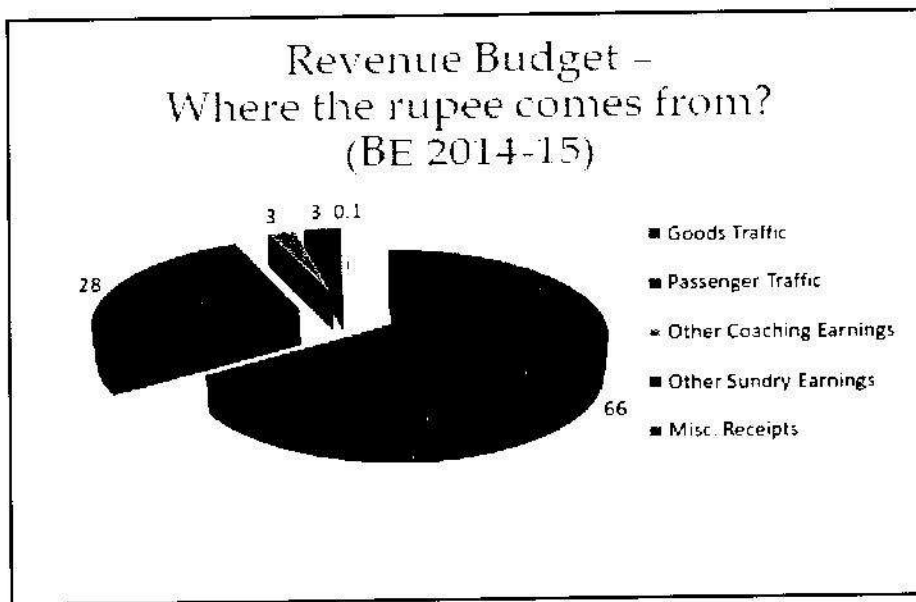
The structure of IR's finances is such that they are divided into revenue and capital expenditures. While revenue expenditure takes care of the day to day and operational working expenses, inclusive of debt servicing and dividend payment, capital expenditures take care of IR's investments inclusive those of repair and renewals. There are three streams that comprise capital expenditure; these are Gross Budgetary Support from the Ministry of Finance, internal generation of resources and leasing from IRFC.

#### **7.1.1 Revenue Expenditure**

The chart below (Indian Railways- A White Paper, 2015) indicates the flows into the revenue budget of IR (Gross revenue receipts in year 2013-14 of the

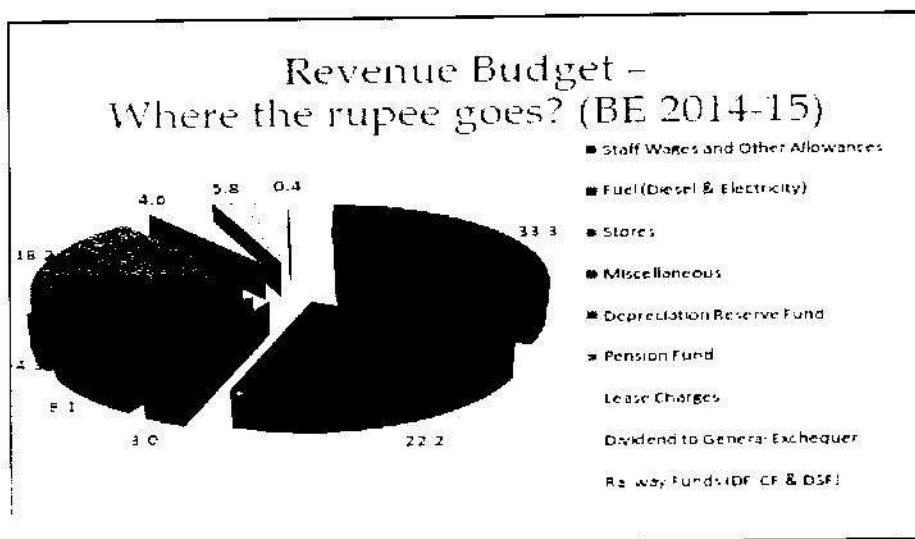
tune of Rs1,43,214 crores & gross traffic receipts of Rs 1,39,558 crores.) i.e. earnings from goods traffic, passenger traffic and receipts under other heads:

**Figure 1.3: In-flows of Revenue Budget of IR**



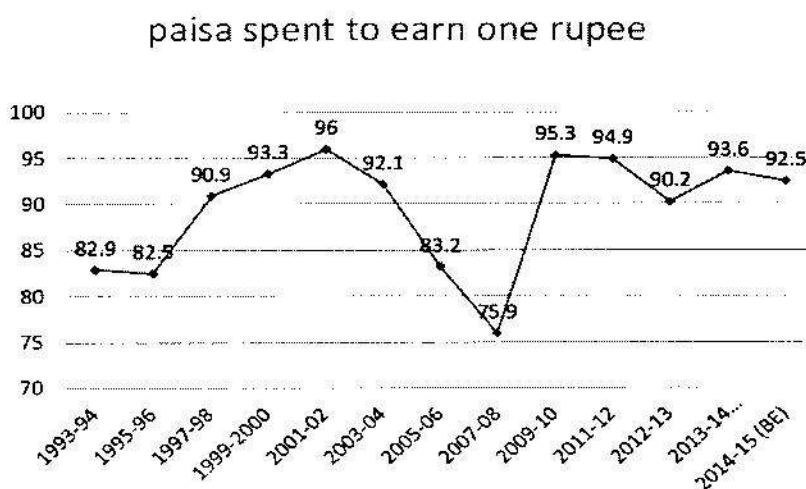
Similarly, the chart below (Indian Railways- A White Paper, 2015) indicates the flows out of the revenue budget of IR (Rs 1,31,465 crores in year 2013-14) i.e. expenditures on staff wages, fuel, stores and expenditures under other heads:

**Figure 1.4: Out-flows of Revenue Budget of IR**



**7.1.2 Operating Ratio of IR** – Operating Ratio is defined as the ratio of working expenses (excluding suspense but including Appropriation to Depreciation Reserve Fund and Pension Fund) to gross traffic earnings (excluding suspense). It is generally considered as the index of financial health of the organization. A graph, showing variation of the Operating Ratio over last few years, is shown in Figure 1.4 (Indian Railways- A White Paper, 2015).

**Figure 1.5: Operating Ratio of IR Over Years**



It may be seen that after the year 2009-10, the Operating Ratio has touched 90% only once i.e. in the year 2012-13, and that can be attributed to robust goods earnings. In 2007-08, the dip in the Operating Ratio was significant on account of continuing combined benefit of robust demand in the core sector of economy and iron-ore export that was compounded by higher axle load and carrying capacity on certain key routes with heavy traffic density. The spike since 2008-09 was due to the adverse impact of the 6th Pay Commission which was to the tune of Rs one lakh crore up to 2012-13. It is obvious that almost entire gross earnings of IR get consumed in meeting



with the requirements of the working expenses and very little is left to cater for long term investments for the infrastructure upgradation and the technological upgradation.

### **7.1.3 Staff Costs of IR:**

IR has 13.07 lakh employees on roll, spread over 280 categories of Group C and 10 cadres of Group A officers. Expenditure on staff wages constitutes a major portion of the IR expenditure. In the year 2013-14, gross revenue receipts were Rs 1,43,214 crores, with gross traffic receipts of Rs 1,39,558 crores. During this year, total expenses of IR were Rs 1,31,465 crores, with total working expenses of Rs 1,30,320 crores. The staff costs constituted 43% of the total working expenses and 34% of the gross traffic receipts. The pension outgo and the staff costs combinedly constituted 51.3% of the gross traffic receipts.

### **7.1.4 Social Service Obligations of IR :**

Indian Railways also bear social service obligation of around Rs 25,000 crore every year by carrying passenger and goods services below cost. Reimbursement of this cost has been considered by Government and a Committee of Secretaries had recommended that these be reimbursed to the Railways but still remains unresolved. Net Social Service Obligation borne by IR in 2013-14 is assessed at Rs 21,391 crore. This cost impinges upon the viability of IR system.

The main elements of "Social Service Obligation" of IR are losses relating to the following:

- i) Essential commodities carried below cost- essential commodities of mass consumption like fruits and vegetables, organic manures, paper, charcoal, bamboos, cotton raw pressed etc. are carried below cost of operation in order to contain their market prices.
- ii) Passenger and other coaching services including concessions, low tariff particularly in the second class all contribute to the losses.
- iii) Operation of uneconomic branch lines: Despite concerted efforts to enhance earnings on branch lines, most of these lines remain commercially unviable. The Railway Reforms Committee recommended closure of 40 such lines but due to stiff public resistance and opposition by the state governments towards withdrawal of such services, only 15 lines have been closed permanently by the Railways. A review of the financial results of existing 88 uneconomic branch lines for the year 2011-12 shows that, on an original investment on these lines of the order of Rs 1,719 crore, loss during the year 2011-12 amounted to Rs 1,366 crore.
- iv) New lines opened for traffic during the last 15 years have not become economically viable so far.

#### **7.1.4 Capital Expenditure**

Regarding capital expenditure, the inter-se share of various streams of funding as a percentage of the total is detailed as under:

**Table 1.14: Share of Fund Sources for capital expenditure over IR**

Year	General Budgetary Support	Internal Resources	Borrowing/Lease
2010-11	47.4%	28.7%	23.9%
2011-12	46.8%	20.4%	32.8%
2012-13	50.0%	20.0%	30.0%
2013-14	52.7%	19.0%	28.3%

It may be seen from the above table that the declining share of internal resources has meant increasing reliance on borrowings as well as "General Budgetary Support", both of which carry a cost which adversely impacts the expenditures.

It is evident that the generation of internal resources is insufficient to take care of the capital expenditure. The previous experiment with financing projects from IRFC borrowed resources was not entirely successful. Hence, other and alternate means of resources are required to be tapped for funding of bankable projects that can be executed in a short time-span.

## **7.2 Alternate Financing Options for Capital Investments over IR**

Efforts have been made in the past to involve private sector in creation of Rail infrastructure, but this has been met with limited success. Absence of any regulatory mechanism, no control over network & tariff, uncertainty of traffic materialization and delay in processes has not generated adequate confidence among the investors. Indian Railways would be required to lay down certain benchmarks for appraisal which would be acceptable to the market to enable the relevant projects to be financed.

Government of India in August, 2014 has permitted Foreign Direct Investment in construction, maintenance and operation of the identified areas in IR. Investments for creating rail infrastructure may be attracted through various models. Attempts are being made to adopt the Engineering, Procurement and Construction (EPC) mode of contracting for construction of Railway projects.

## **8.0 Road Ahead for IR**

In such a competitive environment with very little room for internal generation of resources for infrastructure and technical updation of the system, IR has to focus on continuously improving its operational efficiency, with optimal use of all its resources, especially human resource, so that the consequent generation of surpluses or internal resources could be maximized and used for building the capacity and making the organization more competitive. Loco running staff, comprising of loco pilots, traction loco controllers/power controllers and chief loco inspectors, constitute one of the most important and critical components of the human resource of IR. The loco pilots drive the trains and are responsible for safe and timely movement of the trains to their destinations. They are primarily responsible for safety and punctuality of the train operations.

Duty of a loco pilot is quite challenging. He does not have any regular and fixed working hours. Periods of duty at a stretch are around 10 hours and may exceed 10 hours, depending on the congestion of the traffic and spatial distribution of the crew changing points. Stressful driving conditions, lack of regular sleep cycles & fixed periodical rests take a toll on physical wellbeing of

the loco pilots. Most of the times, they are away from their headquarter stations, away from their families and friends. Inability of fulfilling their familial and social obligations also makes their lives more stressful. Rapid technological advancements in locomotive fields make their tasks further challenging. With reducing tolerances on safety and punctuality aspects of the train operations, norms of punitive action against loco pilots for any lapse have become quite severe. For example, minimum punishment recommended against a loco pilot for an act of SPAD (i.e. Signal Passing at Danger) is "Removal from Service". All these factors have been affecting the morale and motivation levels of the loco pilots quite adversely. It may have undesirable effects on their performances and consequently, on overall operational efficiency of IR. It may, therefore, be desirable to study the present motivation levels of the loco running staff in order to have a better understanding of their likely impact on competitiveness of the IR in the times to come.

## **9.0 Objectives of the Study**

Every organisation has to strive continuously for improving its operational efficiency in order to maximise its profits and achieve desired growth trajectory amid acut throat competition. It requires optimal use of all its resources, especially the human resource. Human resource is the most important and precious resource of any organisation. The performance of the human resource i.e. employees of any organisation, depends upon the motivation levels of the employees.

Motivation refers to the force within a person that affects his or her direction, ntensity and persistence of voluntary behaviour. Motivated employees are

...ing to exert a particular level of effort (i.e. intensity), for a certain amount of time (i.e. persistence), towards a particular goal (i.e. direction). Even when people have clear work objectives, the right skills and a supportive work environment, they must have sufficient motivation to work objectives.

Core business of IR is transportation of the goods and the passengers across the length and breadth of the country through the trains. The loco running staff, i.e. the loco pilots and the loco supervisors, is responsible for driving the trains and therefore, form one of the most critical components of train operations. Operational efficiency of the Indian Railways is, therefore, highly dependent on the performance of this critical segment of its human resource. Corner stone to the performance of the loco running staff is its motivation level.

Improvement of motivation level of this critically important segment of the human resource of the Indian Railways will translate into significant improvement in its operational efficiency.

Accordingly, the objectives of the proposed study are as follows:-

- i. To identify present levels of motivation of different grades and ranks of the loco running staff of Indian Railways, with a special focus on Delhi Division of Indian Railways.
- ii. To analyze trends of variations and deviations in the motivation levels of the loco running staff.
- iii. To identify reasons for such variations and deviations in the motivation levels of the loco running staff.

4. To suggest viable remedial measures to improve the motivation levels of the loco running staff.

## 10.0 Research Questions

Based on the review of the available literature on the subject, during the limited opportunities available so far during the 41st APPPA Course, following research questions have been formulated:-

1. What are the present levels of motivation of loco running staff of different grades and ranks of Indian Railways?
2. What are the trends of variations and deviations in the motivation levels of the loco running staff?
3. What are the viable measures that may be taken to bring about improvement in the motivation levels of the loco running staff?